

# Design Driven. Forward Thinking.

**Contemporary Issues in the Fashion Industry**

BUF 4700 -OL85

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# Abstract

This paper aims to identify problems within the fashion industry and investigate what solutions and innovations are available through new technologies. Covering topics such as social and environmental responsibility, globalization, and technology. Starting with manufactory and social responsibility, fair trade, and how globalization impacted the garment industry. How sweatshops came to be and why the lack of labor laws enforcement in foreign countries had sweatshops move from the US to a global problem. Then we move to large retailers' social and environmental current practices, and what are they doing to contribute to a better world, Levi's was the chosen study case because they are revolutionizing one of the most pollutant textiles, the denim industry. Ending with the latest trends and new technologies in the textile industry. Covering the difference between active smart, passive smart, and very smart technologies. The paper is separated into chapter 1, "Fair Trade and Ethics", chapter 2 "Sustainability", and chapter 3 "Smart Textiles". The goal is to learn the impact of garment production and to identify its latest trends.

Keywords: Social Responsibility, Ethics, Environmental responsibility, Fair Trade, Smart Textiles, Sweatshops.

# Outline

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# Introduction

What's the connection between the immigrant condition and sweatshops?

The existence of sweatshops is attached throughout history to the abuse of vulnerable people, children immigrants, and farm people seeking a better life in the city, and the lack and enforcement of labor laws. The following text also analyzes the origins of the terms Fair Trade and Sweatshop. Then it's questioned the supply chain responsibility, and a new SB62 law that envisions a new solution for the environmental issue.

Which brands are taking environmental and social issues seriously? Levi's is finding solutions through new technologies to minimize the environmental impact of jeans production. Patagonia is sourcing responsibly, using recycled materials, and educating clients. Stella McCartney is the number one sustainable luxury brand, using the latest materials and innovation in the creation of lux designs. There are so many fashion new eco or ethical fashion brands using natural fibers but how accessible are new technological textiles? Let's also look into what challenges small eco businesses face to scale a sustainable brand.

Where is fashion going and Are the boundaries between clothes and technologies being broken? There are currently smart textiles in use, and some are being created to interact with humans on another level, the very smart textiles seem to be able to adapt to the environment itself. Another way is through the Web 3 technologies such as cryptocurrencies and NFTs, fashion brands such as Louis Vuitton are incorporating these new technologies and creating new approaches to how fashion is consumed. Let's take a deeper look into the industry's best practices and latest technologies.

# 1. The Sweatshop



Figure 1. *Lewis Wickes Hine. A Small Girl Bringing Homework to her Tenement Home, 1912. Photograph. NYPL (b12326668)*

Sweatshops and the immigrant condition are quite shocking, as an immigrant myself I can picture the position of vulnerability. Hine's picture above shows a child carrying a bundle of clothing, working at this age is quite unacceptable and shocking now but it is still happening in sweatshops overseas. Historically, the US garment industry has improved, there are currently labor laws in place, meaning children are not allowed to work and there are hourly minimum wage rates between other improvements but sweatshops still exist. To keep profits high and low-cost production, the garment industry has moved overseas,

to places that are not protected by the US labor laws, making it harder to control the existence of sweatshops. Even in the US, there are still sweatshops but because of protection laws it's criminal to run one and the owner can be prosecuted.

Piece work is when workers are paid per piece produced and not per hour, it's an abusive practice as no matter how many hours it takes to make the piece the worker still receives the same. Piece work is a common practice from sweatshops where vulnerable people are overworked and live in slavery-like conditions. The larger issue in the article "**California Just Passed a Landmark Bill to Protect Garment Workers—Here's What It Means for the Entire Fashion Industry**" by Emilie Farra is that brands are not being held responsible for sweatshops conditions because they hire third-party companies to do the job and don't enforce codes of conduct created, the low prices of fast fashion drive these conditions.

The SB62 bill will probably resolve sweatshop issues within California but while people are seeking low-cost products someone will be paying the price. The new bill introduces accountability for designers and brands that is previously unheard of. It's an important step in fashion. The prices of goods may rise but people will eventually adjust to the new prices, what makes prices not competitive is the availability of cheap goods, if they no longer exist for purchase, new standards will be created making it possible to make a change in the industry. This is only if the government forbids and enforces sweatshop products to be sold in the US.

## II. Social Responsibility- Global Outsourcing and Sweatshops

Sweatshop is a term that defines a workplace, usually a factory where apparel is produced under unsafe work conditions and where labor laws are not enforced. Workers are paid below the per hour minimum salary and sometimes paid by piece produced, no matter how long it takes to finish, in some cases children are employed. Sweatshops give room to abusive conditions where immigrants or other socially vulnerable groups of people have no other option but to work. The term came to life with the Industrial Revolution as factories emerged with no labor laws in place and they became widespread as World War I required the quick production of uniforms for soldiers. The industry consisted mostly of women, who were paid less than men for the same work. So when in 1911, the Triangle ShirtWaist Factory got on fire in New York, 145 workers died, 125 being women and girls. The incident set a precedent and led to the creation of the International Ladies' Garment Workers' Union (ILGWU), the union that protected the worker's rights, so they could have health care, fair wages, paid leave, and safe work environments (Rosen, 2002, p.1). After the ILGWU things got better in the US but with the end of WW2, and the beginning of free trade sweatshops expanded overseas.

The United States and the Allied forces won the war and the United States' strategy to maintain peace and its position as a world power was to rebuild the countries destroyed in the war, which meant rebuilding their economies too. For the first time, the United States set new free trade policies reducing tariffs and quotas. Some countries did they advantage of the opportunities and became first-world countries, like South Korea, Japan, and Taiwan. Some others, ridden by corruption and poverty were unable to trade at the same level that a dollar country. The industries that were most affected by these new free trade policies

were the labor-intensive ones like the apparel industries. The new free trade policies, The General Agreement of Tariffs and Trade (GATT) ruled from 1947 to 1994 (Rosen, 2002, p.14), and helped the US to remain in power as a leading nation and helped to contain Communism by introducing Capitalism ideals. The consequences were widespread sweatshops that make apparel for profit-driven global corporations.

The Fair Trade concept appeared in 1946 when a woman named Edna Ruth Byler had the idea to import needlecraft from impoverished Puerto Rico. The concept was later brought to Europe where the first Fair Trade Fair took place in the UK during the 1950s (Jiminez, Guillermo C., and Elizabeth Pulos, 2016). Fair Trade is a concept that includes social responsibility when sourcing, which means fair pay, and fair work conditions for the people involved a condition that might support more environmentally friendly production methods. Worker Rights are covered by Fair Trade organizations, and the term remains an emerging trend that more brands look to be associated with. Worker Rights are currently protected by the law, companies in the United States need to pay minimum wages and offer safe work conditions, but sweatshops still exist in the US and overseas, once in a while a scandal broke out of a big corporation using sweatshop labor, as an example a sweatshop scandal almost killed Nike during the 90s. Institutions like the Fair Labor Association (FLA) offer a label to be used by companies who follow fair labor standards, labels like this help consumers to make more informed decisions when shopping, as the consumers can be sure that with the label it's a guarantee of a product produced following labor laws.

The pros and cons of Global Outsourcing and Sweatshops are many. As a retailer, you can drive higher profits producing in developing countries where labor is cheap. The disadvantage is that it's also harder to control what is happening in the manufacturing sites. A study from the University of Nevada Master's Program, reveals an example of why companies outsource is "You



outsource because you can get the best talent in a highly specialized area and not have to carry them on your payroll” and the study continues “Companies outsource for a reduction in labor costs or efficiency” (Smith, 2012). Some manufacturers produce guide books with conduct rules for the overseas factories but rarely send people to make sure the rules are being enforced. Labor laws in overseas countries are also different than in the US and it is something that should be taken into consideration when producing overseas as the retailer's reputation is at risk.



Figure 2. Sweatshop conditions in China. Daily Mail, 2016.(<https://www.dailymail.co.uk/news/article-3960264/Shocking-video-shows-underage-workers-young-13-forced-work-19-hours-day-Chinese-sweatshops.html>)

Manufacturers on the other hand also have to offer competitive prices and still turn a profit, to be attractive to overseas customers, manufacturers charge the least possible, but profit should never come before people and basic human

rights, manufacturers who provide safe working conditions, and fair pay are on the way to the long run as more and more people are concerned with how products are made. Consumers are willing to pay more for responsibly made products if they can afford of course. Once we have the basics we start to question things, and from here to the future, luxury will be more and more associated with responsibly made products. Consumers are concerned about getting the best product at the lowest price, the pro of buying overseas outsourced products is the wide variety, and lower price, and the con is the lack of knowledge of how they were made. A great quote by Alexis M. Herman (1997) that exemplifies how many sweatshops should exist is the following “there is no definitive source on how many sweatshops operate in this country. But we know this: One is one too many” (National Museum of American History). It’s generally known that as people get more educated they tend to search and care for labels that display better products and more responsible products.

Whether worker rights follow the labor laws of the apparel company’s country, or that of the factory location is a complex question since it would be hard to enforce another country’s laws other than its territory but the correct action would be for retailers to stop purchasing from manufacturers who don’t follow U.S. standards, that’s actually how to create the standard as the manufacturer who wants to sell and have to adapt. American Labor standards are exemplified in the following quote “To foster, promote and develop the welfare of the wage earners, job seekers, and retirees of the United States; improve working conditions, advance opportunities for profitable employment; and assure work-related benefits and right” (U.S. Department of Labor, 2012). These are basic workers’ rights; we are not even getting into the details of paid vacations, maternity and paternity leave, 401(k), and more benefits that we have the luxury of having in the United States, the very basic standard like work safety and fair pay it’s the minimum that retailers should take in consideration when hiring a manufacturer.

Overseas factories and Retailers should both be held responsible in case of factory disasters, the consumer trusts that the retailer is ensuring safety conditions in the manufacturer's locations. And by that, I mean Retailers that have sales over 2 million dollars because they set the standard and in reality, a small business like myself doesn't have the budget or the power to travel to China and ensure these conditions. Large corporations have a social responsibility and should use what they do not only because they believe it and it's the right thing to do but also because it's a great marketing strategy, it's a win-win situation and who is not seeing is soon going to be left behind. I believe we are living through a chance to adapt our businesses before they are ridden by a scandal, if everyone demands overseas factories to hold certain standards things will change. Consumers do hold the ultimate power as it might be impossible to produce such cheap items if not in sweatshops but people who can't afford them are just going to buy the cheapest, so we can't blame them. The government should enforce regulations, the consumers who can afford should purchase smartly as it's already happening, and the factories should be aware that there is an urgency to adjust to better conditions, retailers are not going to work with factories that may jeopardize their image. One of the questions raised by Ellen Israel Rosen in her book *Making Sweatshops* is if free trade and globalization were bad or good, and I would say it's always good if the government takes the opportunity to develop the local economy while enforcing labor laws. In my opinion, Global Outsourcing is good and inevitable, it can help to spread the wealth between countries as it happened with Japan after the war, we just need to create more global agreements and cooperations between countries to enforce labor laws, generate more wealth and world development, that would also maintain world peace and maybe avoid a third World War. More realistically, Retailers should care about their reputations sending people regularly to train and enforce US standards, customer acquisition is too expensive to waste on a scandal.



Figure 3. Man works in battery recycling factory in China. New York Times, 2008.  
([https:// www.nytimes.com/2008/01/05/business/worldbusiness/  
05sweatshop.html](https://www.nytimes.com/2008/01/05/business/worldbusiness/05sweatshop.html))

## 2. I. LEVI'S® Sustainable Practices

The need for sustainability is obvious as we will be stuck on the planet with the leftovers. Most of the sustainable fashion brands are selling sports or casual minimalist-style clothing that use natural or new technology recycled fibers, that's why it is interesting to see what Levi's, one of the world's oldest jeans brands are doing in terms of sustainability. The fashion industry is the second largest polluter in the globe (Sustain Your Style, 2022) and jeans are usually on the top list of garment polluters. The cotton dying process is quite toxic, and it takes a lot of water to make a single pair of jeans "To make just one pair of denim jeans, 10,000 liters of water is required to just grow the one kilo of cotton needed for the pair of jeans. In comparison, one person would take 10 years to drink 10,000 liters of water (United Nations, 2018). In 1873, Levi Strauss and Jacob Davis patented the blue jeans (History.com, 2009), since then the brand has kept up to date with market trends by becoming more conscious and introducing sustainable practices. Levi's is labeled as sustainable because they are thinking full circle, Levi's is designing with recycled plastic materials, the brand is also cleaning up the water before it ends in nature and it's creating new processes to make jeans without the use of water, the Water<Less® technology. The brand is concerned to create durable products and even offers repairing, reimaging, and recycling at their tailor shops, according to Levi's website they stopped using PFCs and PFAS, "Prolonged exposure to and unsafe handling of PFCs and PFAS has been linked to severe human and environmental health impacts, including cancer, but they're still used in a wide range of everyday items, from kitchen appliances to apparel" (Levi's, 2022). The California brand, present in over one hundred countries is committed to sustainability, they are also thinking of ethical production and sourcing and ways to give back to the community. Quite incredible achievements for a brand to have while maintaining prices affordable. I

will definitely consider this information next time I'm shopping for a new pair of jeans.

The main garment industry problem is how to scale a business and be profitable while also being sustainable, that is a question that only technology can solve. Having felt the challenge while trying to turn my own business into more sustainable practices, the most frequent challenge faced while sourcing from sustainable business is the amount of time you need to plan ahead and count that everything still might change along the way, sustainable is the opposite of Fast Fashion, sustainable takes time, handmade crafts take long, sometimes one piece takes a month, that's why is usually so much more expensive and it's even known as Slow Fashion. But a few brands managed and more people doing sustainably means it becomes more viable, cheaper, and sustainable becoming a mainstream trend is important as all brands work towards the goal of educating the prospective customers.

## II.Sustainability in Fashion

Sustainable fiber sources are the ones that complete the full cycle of going back to nature, biodegradable, or recycled. Natural fibers that are biodegradable come from limited resources or animals, which makes them not sustainable. Innovative fibers are coming from the most unlikely sources, mushroom leather, orange fiber, pineapple fiber, fermented wine fabric, and even milk fabric the variety is incredible and the lab seems to be the place where they are all coming from, another common thing is that the fibers are coming from food sources, an example of what could possibly happen is the current Ukrainian-Russian war and the fact that the world is facing a possible food shortage crisis, our resources are more limited than we notice. It's hard to sustain the natural fibers because a lot of water and space is needed to keep the plants or animals. According to the Victoria and Albert Museum (2018) video "The future of fashion: Bolt Threads"

there are only 31 types of fibers in the world, and a lot of room for innovation, new technology efforts include the creation of fibers such as the bolt Thread technology use lab-grown yeast to create sustainable threads. There are also experimental processes where clothes made of mushroom fiber have a second function besides aesthetics. Clothes that clean the air, fabrics that can suck Carbon Dioxide, an incredible innovation, imagine cleaning the carbon footprint as we walk. The issue we run into is the scalability of the idea. How to democratize sustainable fashion to leave the museum to everyday life. How can we find enough mushrooms to dress everybody? Well, we all say it is impossible until it's done.

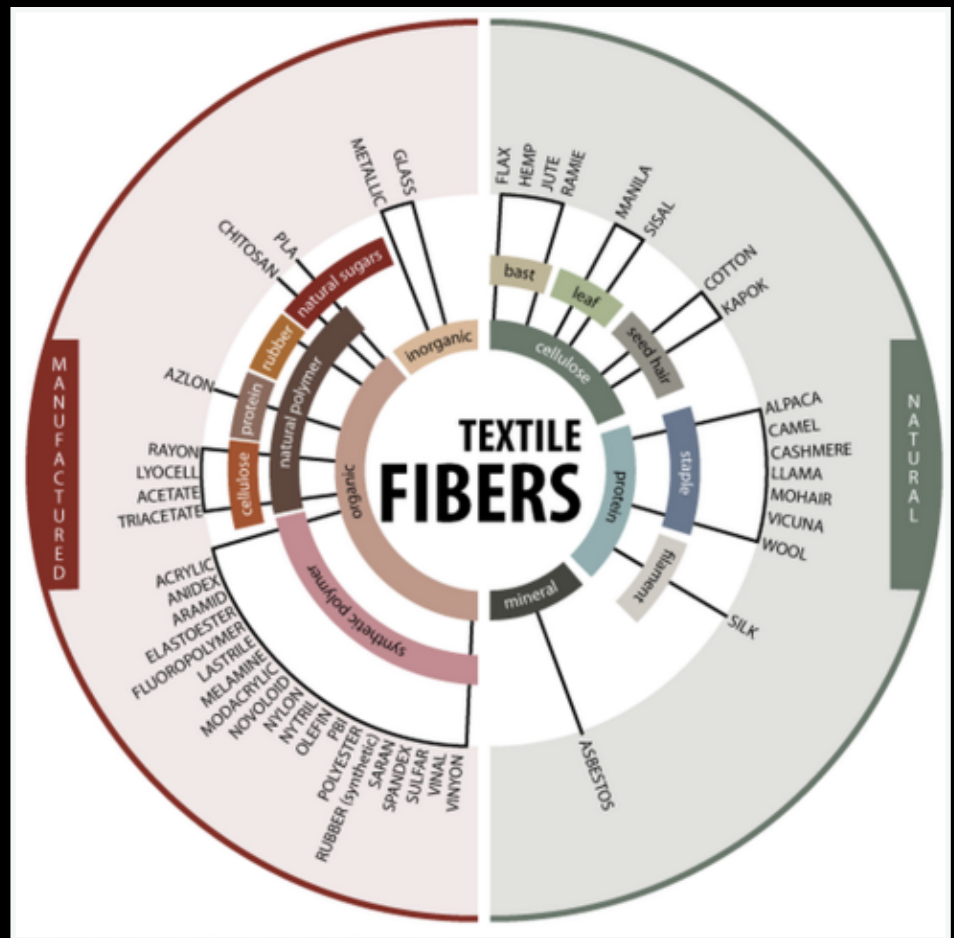


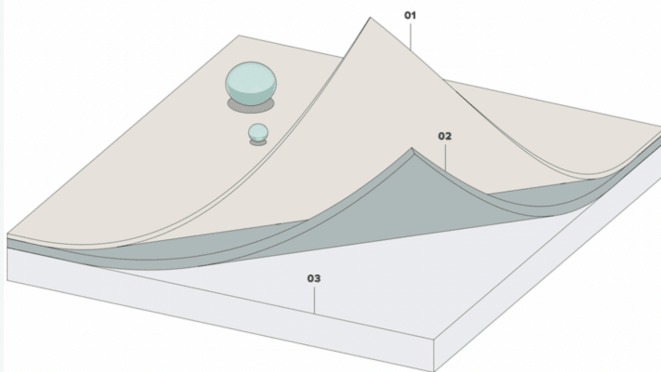
Figure 4. Types of Fibers. <https://www.close-the-loop.be/en/phase/3/end-of-life>

In the luxury market, Stella McCartney is the most known sustainable brand that uses many of the most innovative materials in the market, the above-mentioned Bolt Threads and the vegan Technik Leather, "Created from recycled fibers and plants, Technik-Leather is our 100% animal-free performance fabric that captures the essence of premium leather" (Vonholzhausen, n.d.), the



Figure 2. A Mycotex dress and jacket by Neffa, made from mycelium, and a carbon-negative bioplastic mac, made using algae by designer Charlotte McCurdy. <https://www.theguardian.com/environment/2020/feb/08/fashion-living-garments-suck-carbon-from-air>

## technik-leather



01. A proprietary additive allows our material to biodegrade in a landfill.
02. A plant-based top surface makes Technik-Leather stain resistant, water resistant, and scratch resistant for ultimate durability.
03. A microfiber layer made from recycled plastic water bottles (PET) mimics the supple quality of leather without the negative impact.

Figure 3. Technik Leather Layers. <https://vonholzhausen.com/pages/technik-leather?irclidid=RmqS3GWeFxyITGRVas1XzXzuUkGQmx0SS3xzxU0&irgwc=1> material is



known for its durable performance, low carbon footprint, being lightweight, water scratch and stain resistant, also saving water and conserving land. It's one of the most sophisticated sustainable materials out there, but it does come with a heavy price tag that not everyone can afford. A bag from Vonholzhausen is on average \$495 while a McCartney mini-bag using the same material can cost \$1800. Stella McCartney also uses Recycled Nylon and Polyester, recycled Cashmere, and sustainably sourced Cotton, Viscose, and Silk. Stella McCartney(n.d.) explains why it's important to source sustainably:

Viscose, also known as rayon, starts its life as a tree. Every year, 150 million trees are cut down to create fabric. Some come from sustainably managed forests, like that Stella McCartney uses, though a significant amount of the global viscose supply still originates from ancient and endangered forests.

*environmental impacts*

	Energy use	Water use	Greenhouse gases	Waste water	Direct land use
Decreasing environmental impact ↓	Acrylic	Cotton	Nylon	Wool	Wool
	Nylon	Silk	<i>Synthetic</i>	<i>Regen.</i>	Ramie
	Polyester/PTT	Nylon	Polyester	<i>cellulosic</i>	Cotton
	<i>Regen. cellulosic (viscose, Modal)</i>	<i>Regen. cellulosic</i>	Lyocell	<i>Natural bast fibres</i>	Flax
	PLA/Cotton/Lyocel	Acrylic	Viscose	Nylon	Hemp
	Wool	Hemp	Modal	Polyester	Viscose and Modal
	<i>Natural bast fibres</i> <sup>1</sup> (nettle, hemp, flax)	Wool	Cotton		Jute
		<i>Natural bast fibres</i>	<i>Natural bast fibres</i>		PLA
		Polyester	Wool		Lyocell ( <i>Synthetic</i> )

Source [Defra 2010]

Figure 4. Environmental Impacts. <https://www.semanticscholar.org/paper/Mistra-Future-Fashion---Review-of-Life-Cycle-of-21-Chapman-Hollins/739893062680c631c755391f334901c7239f8c5c>

So it doesn't mean that comes from nature is a good material option because that material might be depleting our environment of much-needed forests. Below is a tab of the ranking of textiles by different environmental impacts:

A sustainable mid-range brand, Patagonia is an example of a mainstream brand that successfully implemented sustainable and ethical practices. The brand uses organic certified cotton and recycled materials like Recycled Spandex, NetPlus® Recycled Fishnets, NetPlus® material is made from 100% recycled discarded fishing nets collected in fishing communities in South America” (Patagonia, n.d.), Recycled Cotton is "made from scraps gathered from the fabric floors" (Patagonia, n.d.) producing Cotton takes a lot of water so this a sustainable practice. Patagonia has a variety of sustainable materials, the brand also works with Recycled Polyurethane, Recycled Nylon, Recycled Wool, Recycled Cashmere, Recycled Polyester, Recycled Tencel, and the innovative Advanced Denim that uses less energy, less water, and emit less CO2 in the dying process that is done using sulfur dyes to bond instead of the traditional jean synthetic indigo dying process. A Patagonia long sleeve surf top costs \$49 and a one-piece swimming suit \$159 putting the brand in the mid-range affordability section.

Patagonia stopped using synthetic indigo because of the amount of water and energy that requires. Synthetic indigo also requires a large amount of petroleum, cyanide, and formaldehyde which are toxic and can turn rivers into non-potable water sources, also killing its wildlife. Turning back to the original Indigo derived from plants seems like a good idea, the reason why the synthetic indigo was developed is the difficulty to fix indigo to the fabric but people are looking to innovate the original Indigo techniques with technologies like the Advanced Denim and Tinctorium, another new technology. Tinctorium uses genetically modified bacteria to mirror the original indigo brand and bond the color to the fabric in the same way. While Tinctorium uses bacteria to create

indigo, Colorifix cast genes to create microbes that turn into a variety of colors. Colorifix also uses a sugar-based fermentation process to create pigment. So while there is sugar there is pigment. Without the help of technology, it's very hard to make natural dyes, it takes 1.5 kilos of flowers to color naturally one page of paper red as seen in the Victoria and Albert Museum (2018) video "In Search of Forgotten Colors: Sachio Yoshioka and the Art of Natural Dyeing", so technology is making it possible to look at past techniques and enhance them with more consciousness and care for the environment.

After having discussed the latest technologies by large brands, we discuss the most affordable sustainable options. Of the 33 brands listed in the Good Trade (2021) article "35 Ethical And Sustainable Clothing Brands Betting Against Fast Fashion", none had been classified as a budget brand the most affordable would go from \$ to \$\$, that it was Kotn a sustainable Canadian brand that sells Cotton products. The third sustainable brand discussed in this essay includes products that start at \$11 for socks and \$26 for cotton t-shirts. Kotn (n.d.) uses non-toxic dyes on cotton. It's very rare to see other materials besides lycra and cotton being used on affordable sustainable brands, that's why the main challenge of this industry is how to run a competitive and profitable sustainable business because the technologies are being constantly developed but it is usually expensive. After so much research on the latest innovation, I come to the conclusion that upcycling and recycling are the most sustainable option because it's using what's already been created instead of creating more products that use more energy, land, water and in terms of scaling a sustainable business it seems the most affordable would be to use cotton and recycled lycra. Textile is a field that didn't see radical innovation since the last invention of the petroleum made Nylon during WWII. As the awareness of sustainability become more mainstream more money is available for new technologies to be developed, things are moving fast and we expect to see many new fibers in the next few years.



Figure 5. What's Sustainable Fashion? <https://thevou.com/fashion/sustainable-fashion/>

### 3. I.Virtual Fashion

Virtual Fashion is the uprising technology that allows us to experience fashion expression online. There are multiple ways to experience virtual fashion and it's a field that just started to be mainstream with major brands doing collaborations with games, NFTs, influencers and etc.

Louis Vuitton is exploring the gaming market through League of Legends, the smartest collaboration example in the video with a complete merge between reality and virtual reality. It's exciting and strange but definitely not irrelevant as millions are being invested in the development of these new technologies.

NFTs were not mentioned in the video but as of now, I think it's the most popular technology in a virtual fashion. An example is the Louis Vuitton game that is used for collecting NFTs, "The adventure featured 30 hidden NFTs with 10 NFTs in collaboration with "Beeple", a popular NFT artist"(Zipmex, 2022).

Virtual fashion as real fashion, an extension of real life, one will not erase the other it's a continuation.

## II.Smart Textiles

Smart textiles are the future of fashion; in one single generation we became completely addicted to technology and it seems hard to stay away from our phones, the next thing is weaving interactiveness into clothing, wearable

technology means adding functions to clothes. The first thing that comes to mind is a huge breakthrough in fashion since no major scalable inventions happened since Nylon was invented right before WWII in 1938. Now there is a race for this scalable smart textile collaboration between scientists and major brands are many. What concerns is the use of more oil in clothes with added conductive energy touching the skin on a daily basis. Usually, something is invented, and it takes a while until we learn the health costs of such conveniences. More people are looking for sustainable and organic fabrics these days but on the other hand, the technology use is increasing. Whoever invents a sustainable organic smart textile will probably become very wealthy. Some smart textiles are already commonly used. An example is the antimicrobial fabrics that became quite popular towards the end of the COVID pandemic, also LED clothes that are used for artistic performances, and sports shoes that track information like miles and calories spent. Smart textiles are divided into Passive Smart, Active Smart, and Very Smart.

## **Passive Smart**

Passive Smart means that textiles are made to react a certain way, it's not adaptable to the user's control, and "provide the same function no matter of the environment is doing" (Kettlely, 2016). Passive smart textile has an extra function but doesn't need the use of the internet for example. An example would be antimicrobial clothes. The antimicrobial fabrics work similarly to the way soap and hand sanitizers do, they attack the pathogen on the cellular level to prevent their growth" (Apexmills, n.d.), in the U.S. government regulations control antimicrobial fabrics by demanding it to also be nontoxic to be considered antimicrobial. This textile technology is very useful in the hospital for dressing wounds and for scrubs, it's also used in furniture textile, automotive, and fashion activewear. It's a very current widespread technology. Another common passive smart feature on

textiles is UV protection. Airbrush is an ALO yoga fabric that is antimicrobial another passive function is the control of moisture.



**AIRBRUSH**

**WHY WE MADE IT**  
We wanted a multifunctional fabric that would perform great in yoga, hug and compress for a perfect fit and feel, and sculpt and contour for a lifted look. Airbrush is our ultimate leggings performance knit and the foundation for all our core leggings.

**HOW TO WEAR IT**  
Available year-round in high-waist and regular-waist leggings in staple colors and regular, 7/8, capri, and short lengths. Updated in new colors and designs each season. Pair with our bras, tops and coverups, with an alo it slide or sneakers.

**WHAT IT DOES**  
Lifts, sculpts, contours, smooths. 4-way stretch for a moves-with-you feel. Flat-locked seaming for comfort. Lined panel between legs for a smooth fit. Moisture-wicking. **Antimicrobial.**

**DRY WICKING**   **ANTI MICROBIAL**   **4-WAY STRETCH**

Figure 1. Alo Fabric technology. [https://www.aloyogab2b.com/img//ALO\\_FABRIC\\_GUIDE.pdf](https://www.aloyogab2b.com/img//ALO_FABRIC_GUIDE.pdf)

## Active Smart

Active Smart textiles include some level of interactions like buttons or a panel, “they do something as a result of the sensed environment” (Kettley, 2016). An example would be heated textiles such as Loomia heated jackets. Active Smart textiles usually use electricity to change “form, store and regulate heat” (Loomia, n.d.). Loomia is a patented active smart fabric that can be washed. The fabric controls heat, includes a touch sensor, and it has a panel that lights up. It’s flexible and foldable like a normal fabric but with the added functionalities that can be used for safety and comfort purposes. It’s sewable and bondable making it perfect for apparel and furniture use. How does it work? Loomia is a soft circuit called e-textile, used when standard PCBs can’t be used. The technology was

developed in Stanford's labs. This type of technology is not widespread yet but it's already a reality as the company is able to produce 20000 pieces per month.

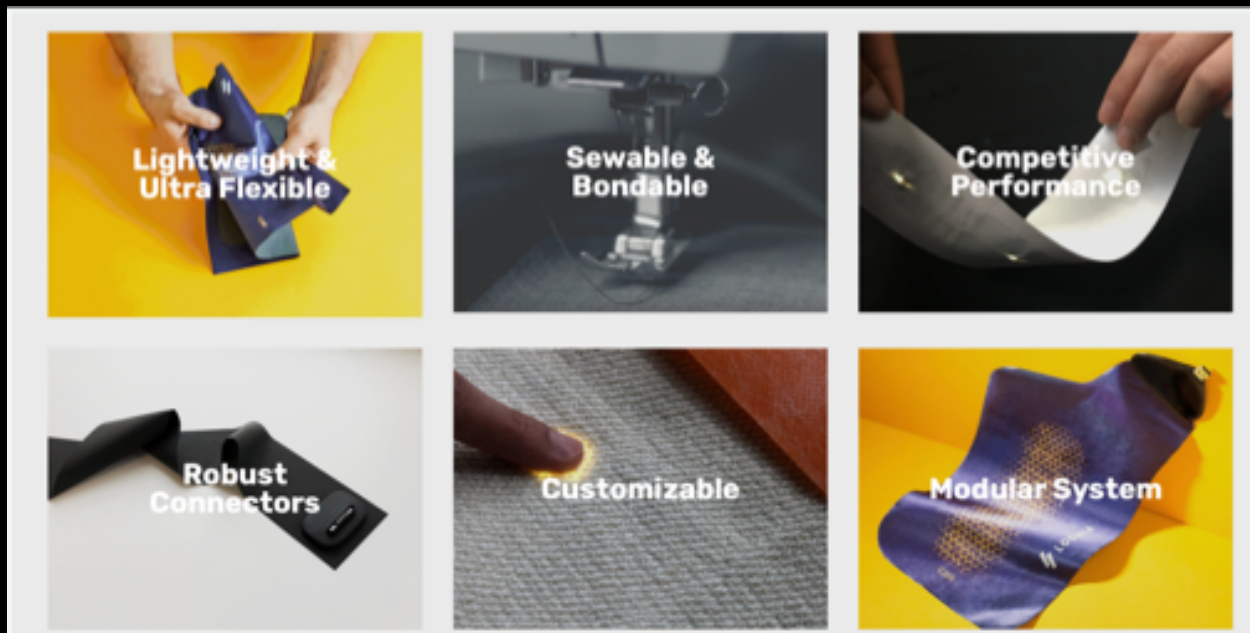


Figure 2. Active smart fabric Loomia. <https://www.loomia.com/our-technology>

## Very Smart

Much more complex systems are weaved into fabrics or adaptive wearable technologies that have "a range of behaviors that sense themselves and the external environment" (Kettley, 2016). An example would be IDTechX Chromorphous color-changing fabric, a technology developed by the CREOL, The College of Optics & Photonics at UFC, University of Central Florida, that allows the fabric pattern or color to be changed by a smartphone. The new technology works by adapting to temperature changes in the body that are sensed by the microwires that are woven into the fabric (Chromorphous, n.d.). For the first time, the user can control these changes in color and pattern. The



fabric can be washed, cut, and sewn. The technology is scalable but the patent is pending approval. So it's something that can become a reality in a near future.

In the future, it's clear the ultimate fashion luxuries will be related to the added functions in textile manufactory. Exclusivity related to technology is easier to patent than only a fast rotating design with a branded logo so it seems like a great investment for major brands that will set small businesses and large businesses even more apart.



Figure 3. Color-changing fabric. <http://www.chromorphous.com>

# Conclusion

Technology is the future of fashion, integrated and woven into the clothes or the way we experience fashion on the web. There is no other point to reference in history where we have been consuming more, more connected, and more aware of the damage that we are doing to the environment. All at the same time.

Technology seems to be the solution to keep our levels of comfort while consuming responsibly. And as technology goes into the mainstream it becomes more affordable. Prices may rise initially but if cheap competition is eliminated by laws everyone will have to adjust. The problem is the availability of cheaply made goods that enter the country without fiscalization of where it ends if items are not sold or how were they made. That is the price of free trade and globalization; sweatshops, and pollution. For people to start asking the bigger questions and care about the environment, their basic needs must be fulfilled. So the first step is in the US government's hands to enforce laws that make it mandatory for retailers to purchase responsibly and take care of items that are not sold, coming full circle. It's in the foreign government's hands to enforce labor laws in their countries. The question is do we have that time to adapt? I hope so; natural disasters seem to be the Earth expelling the human cancer out of the beautiful planet that we help to pollute.

## References Chapter 1

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