Sustainability Innovation

Chain Refreshment Of Fast Fashion For Sustainability

Mengxi Lyu, App-Ark

Yanfei Zhu, App-Ark

Siye Chen, App-Ark

Lianbo Xia, App-Ark

Yunqing Chen, App-Ark

Zhen Yao, App-Ark

Summary

The idea of the sustainability innovation of the chain of fast fashion industry was come up due to its close relation to too many people in the urban society. The purpose of the project is to solve the problems on both the environment and the society caused by the fast fashion industry. This problem is solved by improving each step of this industry chain and focused on the impact of the dear price. The improvements are taken place in the following sectors: use of materials, product design, transportation, manufacture, sales, and consumption. After the collaborative work for months, we designed a model of the improvement in the chain of fast fashion as our prototype. Because this is a large project that involves many separated industries, it is not actually used in the real life situation, but according to the deep interview with our potential users, we are confident in the feasibility of the project. We hope one day it can be used in the real world to benefit both the environment and the society.

Choose the Topic

Identify the Challenges

Pesticides and fertilizers

Due to fast fashion, people tend to buy clothes and dump them more frequently. Consequently, the production of cotton increases in response to the increasing number of clothes. Unlike fossil fuel, cotton is a natural product, but cotton production still damages the environment because of the overuse of agricultural chemicals.

One problem is pesticides. There are many pests that pose a threat to cotton products such as the American bollworm. There are three kinds of pesticides: herbicide, insecticide, and fungicide. The pesticides used on cotton are mostly insecticides. Nearly 40% of the total insecticide in the USA is used for cotton. It is identified as the world's largest consumer of insecticide. (Ali & Abdulai, 2010) Overuse of pesticides is a big environmental problem in the entire field of agriculture since very little of it actually reaches its target. (Pimentel & Levitan, 1986) Overuse of insecticides also leads to insecticides resistance of some pests which will lead to increasing use of insecticides.

Chemical components of some pesticides are so stable that it takes years for them to degrade. Most of the pesticides go into the environment and negatively affecting innocent organisms. Water contaminated by pesticides spread toxins further throughout the water system, killing fishes and plants. Pesticides also evaporate into the air. Although pesticides on cotton won’ t cause direct damage to humans as vegetables or crops do since cotton is not food, they still harm humans indirectly by biomagnification. Biomagnification, according to Wikipedia, is any concentration of a toxin, such as pesticides, in the tissues of tolerant organisms at successively higher levels in a food chain. For example, when pesticides that contain mercury leak into the water. They will first be ingested by zooplankton. Then, zooplankton will be eaten by smaller fish which will be eaten by bigger ones. Since the rate of degradation of pesticides is low, they will accumulate in organisms’ bodies and be passed on to their predators. The toxins are increasingly concentrated as they move up the food chain. Finally, we humans consume the bigger fishes with a high concentration of toxins.

Deprivation of worker’ s human rights

In 2013, the Rana Plaza building in Dhaka, Bangladesh collapsed, resulting in the death of 1,129 workers and more injured. Back to several hours before the tragedy, the workers noticed some cracks on the wall of the building and notified their managers. Though these managers were given an evacuation order, they forced the workers to go back to the assembly line by ignoring it. This accident seems to be

attributed to the negligence of the managers; However, the real culprit is the exploitation of workers in fast fashion industries. In that collapsed building, various brands of fast fashion set their garment factories inside, with thousands of workers caged for 14 hours a day with no escape. According to data collected, as of 2016, the minimum wage is 67 dollars each month, which is far less than fair compensation for the labor of these workers, especially in such poor conditions. (Reid, 2018) This has violated the United Nation's Universal Declaration of Human Rights (UDHR) that the workers should have "just and favorable remuneration ensuring for himself and his family an existence worthy of human dignity." This situation seems to be a common problem in the fast fashion industry, especially in Asian countries. Companies in developed countries have increasingly chosen to outsource their labor to developing countries with lax labor laws, where they can pay less for the work that is necessary for clothing production. (Reid, 2018) Garment workers in these regions work for long hours and are often paid low wages that just meet the legal minimum, which is far below the living wage. Moreover, workers are often forced to work for a long time beyond the legal working limits with little compensation, though factories alleging that all overtime work is voluntary. A report found that 94% of Cambodian factories investigated violated overtime regulations and that a factory dismissed 40 workers for refusing to do overtime work. (Muscati, 2014) More astonishingly, this kind of circumstances even occurred in some developed countries like England. A factory in Leicester that manufactures clothes for the brand Boohoo was revealed that its workers were paid only £3.50 per hour while the UK national living wage is £8.72. Furthermore, some factories even recruit child laborers for massive production. There are more instances of abuse and exploitation in fast fashion industries, which are more cruel and inhumane. While we buy fast-fashion clothes at rock-bottom prices, somewhere in the world workers are living a dark life in a garment factory. Ruthless managers squeeze the workers' human rights out of them for lower cost when manufacturing the clothes.

The Overuse of Water and Water Contamination

As the second-largest consumer of the world's water supply, the fast fashion industry has created a complicated dilemma for water resources. During the manufacturing process, water is largely used to wash away the chemicals, which renders a huge quantity of water and leaves pollutants in the water in the meantime. As an estimate, it takes 200 tons of water to produce 1 ton of dyed fabric. This requires sourcing fresh water and releasing water that is tainted, rendered toxic, undrinkable, or otherwise polluted back into the ecosystem. Moreover, wastewater produced during the manufacturing process is often discharged directly into rivers and waterways, meaning it should comply with discharge regulations to avoid polluting the environment and causing irreparable damage. However, this is often not the case. These chemicals are still present in wastewater, even in trace levels, when they are discharged into the environment, which has been proven to cause lasting damage. The overuse of water and

contaminated water produced by the fast fashion industry is an urgent and worrisome issue and should be considered seriously.

Problems of Recycle

We are in an extremely inefficient chain of recycling, in which around 85% of all textiles thrown away in the US--roughly 13 million tones in 2017-are either dumped into landfills or burned.

However, only 13.6% of clothes in the US are being recycled-with the average American throws away 37 kg of clothes every year. Globally, just 12% of the material used for clothing ends by being recycled.

Problems with many types of fabrics

Synthetic Fabrics make up more than 60 percent of today's clothing. This number is estimated to go up to 98 percent by 2025. All synthetic materials shed off micro-plastics, poor quality cheap synthetic clothing. Micro-plastics then enter water sources, absorbs toxins, and end up consumed by organisms and the human. Additionally, materials like acrylic, polyester, and nylon are not biodegradable. Synthetic materials are also a byproduct of the oil industry, considered a problematic and environmentally polluted industry. The fast fashion industry most favors synthetic materials because of their cheap cost. Because of the significant demand created by the fast fashion industry, much more synthetic fabrics are produced than the actual demand for clothing.

Many would think that choosing cotton over synthetic fabrics is better. On the bright side, cotton is biodegradable, but cotton production is problematic from many different aspects. First, cotton asks for an abundance of water to stay irrigated, resulting in lakes dring out. Secondly, even organic cotton farms have been found to use slave or child labor.

Viscose is created from wood pulp—around 30 percent of viscose and rayon sources from endangered and ancient forests. Many fast fashion brands like H&M and Zara have been using viscose from endangered forests. In 2014, all endangered and ancient forests were estimated to have deforested by 2017. However, no further studies have been made about the achievements of fast fashion in deforestation. The production of viscose is extremely chemical-heavy. Carbon disulfide is central to the process of viscose. It can affect the health of not only the workers of viscose factories but also those who live near the viscose plants. Some of the effects are heart disease, birth defects, skin conditions, and many types of cancer.

Some would argue that leather and wool are sustainable because they are more natural can biodegrade. But just because leather and wool can biodegrade should not make it more bearable. Sustainability should not, in any way, involve murder. There is barely any way to contribute to animal agriculture while being sustainable. Livestock and its byproducts contribute to 51 percent of all greenhouse gas emissions. Another issue with wool is the practice of melusing – the sheep's rare end is cut off to prevent flies from laying eggs.

Some of the more sustainable fabrics are hemp, linen, and Piñatex. Hemp is biodegradable, uses less water than cotton, produces three times more fiber per acre than cotton, and replenishes the soil rather than extracting its nutrients. Linen is a product of flax. It is biodegradable, requires less water than cotton, and also doesn't require any chemical pesticides or fertilizers to grow. Piñatex is a byproduct of existing agriculture. It uses pineapple leaf fibers to make Piñafelt and, in the end, making clothing.

Solutions to pesticides and fertilizer

There are several solutions to the overuse of pesticide. The first one is minimizing the use of pesticides by reducing the pest. This can be done by genetically modified cotton. This method is already applied in many countries and the outcome is significant.

The second one is to introduce birds instead of pesticides to kill insects known as biological pest control. It relies on parasites, pathogens, and predators to help control pests. In the field of cotton, natural enemies of these pests can be introduced to hold the population of pests below damaging levels. (Vyavhare & Kerns, 2019) For example, assassin bugs, big-eyed bugs, collops beetles, damsel bugs all feed on cotton pests. This method of pest-management excludes the negative impact of pesticide. This method also has side effects. Local native system may be disrupted by the new species introduced. These species can become an invading specie which causes more trouble than the pest itself.

The third attempt is to apply more advanced pesticides and ban long-lasting pesticides such as organochlorine pesticides. Using active and less toxic pesticides contribute to the well-being of the environment. Pesticides with higher degradation rate pose less damage to both organisms and human.

The nowadays chain of fast fashion includes 8 steps: raw material consumption, product design, manufacture, transportation, sales, and consumption. We plan to improve this chain by coming up solutions for the problems in all these steps.

Identify a Root Cause

Root Cause: A dear price for sustainability
Emily Herron, founder, and designer of EMLEE shared an anecdote about a colleague of hers who sourced French terry for a project: it was organic, milled in the United States, “gorgeous to the touch,” and from a distributor who paid its cotton pickers fairly. But it was $30 per yard — “two or three times the going rate for conventional terry fabric.” A dress can use up to six yards of fabric, so the fabric choice alone would add $75 to $120 to the cost of a sustainable dress. Obviously, the cost of a sustainable garment is much higher than a garment from fast-fashion brands, which to a much lower price when it comes to marketing. Since the producers always pursuit the higher revenue, they prefer to produce in the heated industry like fast fashion and to choose the factors of productions with lower close, such as the non-environmental friendly materials and the cheap labors, which both bring about environmental and social negative externality. Approaching from another angle, it is the dear price for sustainability that pushes the dealers to choose fast fashion industries. Therefore, more customers, especially young people, tend to buy fast-fashion clothes due to their extremely low prices, which skyrockets the demands of fast fashion to a large extent, causing the dealers to manufacture more fast-fashion garments instead of sustainable ones. Consequently, a negative feedback loop has formed. Such behavior also triggers consumerism to prevail in modern society, which stimulates people to buy fast-fashion clothes as they can satisfy their psychological needs at the lowest cost. The population of such modern culture will lead to more severe sustainability and environmental issues.

Generate Solutions

PureCycle’ s plant in Ironton, Ohio

The resulting PureCycle technology relies on a physical solvent-based process that uses less energy than a chemical process because it doesn’ t have to break down and build up the molecule. “It’ s the combination of the solvent choice, plus specific process steps, that enable us to purify this material in a way that nobody’ s been able to do before,” he says.

Layman’ s colleague and former classmate Scott Trenor, a senior polymer scientist at Milliken & Company, contributed a key set of plastic additives to increase the viability of PureCycle materials. Additives are chemical substances that modify the properties of plastics so they can be used in different types of products. For example, a car bumper would need to be more durable and impact-resistant, while a yogurt cup would need to be more flexible. Now Milliken and PureCycle are working together to scale and advance the technology, with plans to start commercial-scale production at PureCycle’ s first plant, in Ohio, in 2021.

New commercial-scale production
Additives (chemical additives to increase the viability of PurCycle materials
Polypropylene resin for use in a diverse set of applications
Purified and modified, the resin can be molded into different products

About the scale of this project: the first PureCycle plant is expected to purify and recycle 119 million pounds of polypropylene and produce 105 million pounds each year.

For initiatives such as PureCycle to succeed, consumers need to be mindful of their behaviors , and recyclers should focus on the ability and financial motivation to process more than PET and HDPE.

Solution for human rights violation

From the perspective of the governments, they should take more responsibilities to supervise the fast fashion industries and the violation of human rights behind, as they possess more authority and power. Legislation can be one means to help alleviate the severe situation. The government can adopt and implement the laws that protect the workers from violation of human rights and offers them justice and

equality. To be more specific, laws that forbid the (excessive) manual labor of child labor or pregnant woman can be enacted; Legal provisions that guarantee the proper salaries and rights of rest to the workers.
On the other hand, consumers, workers, governments, and NGOs (non-government organizations) can cooperate to fight against the egregiousness in fast fashion industries. Official organizations can request the brands of fast fashion to keep the transparency of their companies and industries, which can help ensure the identification of global apparel companies whose branded products are made in factories where bosses abuse workers' rights. Publishing supply chain information builds the trust of workers, consumers, labor advocates, and investors, and sends a strong message that the apparel company does not fear being held accountable when labor rights abuses are found in its supply chain (Corradini, 30). Transparency of the industries is where consumers can intervene and supervise illegal and improper actions.
An innovative approach to the issue can help resolve the original problem of the manufacturing process in fast fashion industries, which is replacing the physical workers with machines. This might seems to be a subversion to this industry, many companies in other fields, like electronics, have already practice this idea. By applying emotionless machines, controversy over human rights can be easily solved. From another perspective, the machines are capable of working day and night without resting, which is more efficient than manpower, avoiding the problems of salaries. Also, this can be environmentally friendly if the factories are designed as no-light ones.

Ethics of slave/child labor
The root cause that we have identified is that it is much more affordable to make unsustainable choices. The cheapest choice in labor is inevitable of corrupt ethics. Therefore, to find a solution for the ethical issue of slave/child labor, we looked into avoiding the use of human labor by automation. We raise another question by doing so: are we eliminating job opportunities? A dive into automation reveals that while machines replace some and many manual laborers, it creates just as many jobs. The World Economic Forum predicts that automation will result in a net increase of 58 million jobs. These jobs involve skills such as problem solving and creativeness. The jobs that have been created by automation involve higher skills and/or are of more complexity. Technology has been linked to the ending of child labor. So, the benefits of creating an automated line from plant to fiber to fabric and clothing might outweigh the negatives.

Alternative fabrics
An alternative to mainstream fabrics, recent innovations have made pineapples, coconuts, and bananas into fabrics:
Piñatex fabric and leather are made from pineapple plants that would have been left to rot. Piñatex has been keen on preventing the creation of unused waste. The

function of its leather is almost identical to those of animal produce. Moreover, Piñatex leather is half of what animal leather costs. Though utilizing a waste product and efforts to creating better fabric, Piñatex leather is yet to be able to biodegrade. The process involves collecting the leaves; extracting, washing, and drying the fibers; then purifying the contents. The fibers are bonded with corn-based polylactic acid to form a non-woven mesh.

Cocona is a process of bonding a coconut shell to existing fabrics such as polyester or cotton. The contents of the coconut shell are combined with a polymer base and turned into fibers. Carbons from coconut shells and volcanic and are mixed to create a microclimate between your skin and clothing, regulating both temperature and humidity. In short, cocoa keeps you cool in the heat and warm in the cold.

Banana or Musa fiber are made into fabric by using the fiber of the stem of banana plants. The harvest of bananas involves cutting the fruit, then the leaves and stem, to allow new fruit-bearing shrubs to grow from the roots. Over 1 billion grams of the banana stem have been thrown away each year for the harvest of bananas. Banana fabrics are durable, sustainable, and biodegradable.

The stems are soaked in water or a chemical solution to soften the fibers. Then it involves a labor-intensive separation of fibers from the waste areas of the plant. The separation is often done by hand. Once dry, the fibers are separated by their qualities: the inner or finer, while the outer fibers are more coarse. The inner fibers joined together to form a long thread, then spun wet to prevent breakage. The dying process comes next, then the yarn is woven into the fabric with many of the same qualities as silk. Banana fabric is soft, supple, breathable, absorbent, and has a natural shine. It is a fairly delicate fabric that can withstand hot water but should be treated as delicate. It is often used to make saris and kimonos. The outer fibers are coarser, yet are perfect for making bags, packaging material, and paper. It is naturally water, fire, and tear-resistant.

All three of these fabrics and/or technologies are plant-based byproducts. They each have their way of leading the industry towards sustainability and each has its drawbacks. None have revolutionalized the use of fabric in the fast fashion industry as none of these solutions can keep up with the demand the industry creates.

Government intervention —— Indirect Tax

As the root cause of the environmental issue in the fast fashion industry is the large market demand and supply enlarged by consumerism, the government can intervene as the third party to decrease the market demand and supply, and thereby decrease the negative externality of consumption and production.

One practical approach for the government is to impose an indirect tax. Since the clothing industry is the only targeted industry, the excise tax is the proper choice to impose on the expenditure of both consumers and suppliers. When the tax is imposed, many suppliers will not be willing to pay the additional expenditure and choose to leave the market, so the market supply can decline quickly. As the supply declines, a shortage will appear between the quantity supplied and the quantity

demanded at the previous price. Then, to keep the balance of the market, the price of fast fashion products will increase until the shortage disappears and the new market equilibrium forms, which is brought about by the decreases of quantity demanded and the increase of quantity supplied. In other words, because of the higher price, fewer consumers are willing and able to buy fast fashion garments. As a result, the market of fast fashion can be shrunk by the indirect tax. With the smaller supply, the factories will cause less negative externality of production to the environment, including the greenhouse gas emission, the discharge of wastewater, and waste of raw materials; with the lessened demand, consumers will produce less negative externality of consumption to the environment, including the large burden of wastes. Besides, the indirect tax can strengthen government revenue as well to provide larger funding to deal with other environmental problems.

Second-hand Material Market:

Since one severe environmental problem on the raw material of the fast fashion industry now is the large proportion of waste, the key step is to increase the utility ratio of the raw material. Instead of being stored in the warehouse and eventually thrown away, the leftover materials could be recycled in the market and thereby reduce the harms of the clothing industry to the environment.

The leftover materials always have much more values to be recycled than what we used to believe. The wasted leathers and plush fabrics can be made into some ornaments and artworks (Wu, 153). The leftover fabrics with relatively regular or large surface areas can be used on garments again. Moreover, brought back to the material factories, some wasted fabrics can even be processed into enhanced composite materials and used in the fast fashion factories as raw materials again (Wu, 153).

However, without a completed system for the recycling of the waste material, it cannot work well. Therefore, one solution is to build up a second-hand material market. It is not necessary to be a physical market located in cities. Instead, an online platform could be set up for factories to trade their materials efficiently and effectively. By making the best use of the raw materials, the fast fashion industry can thus decrease their negative impact on the environment since the serious pollution problem in raw material production and the landfill of waste materials can be reduced steeply

Encouragement of the Self-marketed Small Factories

Because one reason for large storage and waste is that the small factories can only charge the manufacturing part and cannot make their own decision on what to produce, one solution is to encourage the small and medium-sized garment factories to create their own brand.

When these factories can both produce and market their own products, they can gain a larger incentive to increase the utility rate of the raw materials. They can reuse their leftover materials to decorate their other own-designed products by

simply changing the color or shape, rather than throwing them away. More significantly, since the small companies seldom have large initial capital, they are more willing to buy the storage materials from other factories to develop themselves and accumulate funds (He, 58). With a larger demand for second-hand material, the leftover material trading platform can develop quickly as well. Then, the utility ratio of raw materials increases, and demand for new materials decreases. Thereby, the series of problems including the greenhouse gas emission in the process of raw material production is reduced.

Identify the Criteria

1. Cost, Profit, Appeal to industry.
Because the root cause we have identified relates to cost and efficiency, we should first consider its relation to profit. Are the aspects of this solution appealing to the industry? Are they able to compete against existing ways of production?
2. Sustainability: Water efficient, plastic-free, labor rights
To avoid creating an alternative instead of a solution, the benefits of this solution have to be precise. Does it solve existing problems? Does it contribute to other industries such as oil, farming, or livestock?
3. Demand
Do we need so many clothes? Will our solution contribute to the demand that the fast fashion industry has created? For example, will our innovation contribute to the durability of the clothing, leading to a possible decrease in demand for new clothes?
4. Feasibility
For a great solution to thoroughly perform its benign impacts, it has to be effectively implemented. Is the solution suitable with the status quo of the problem? Are the resources and techniques it requires accessible?

Evaluate the Solutions

Pure Cycle’ s Plant
The pure cycle plant can recycle the chemical materials needed in fast-fashion production, so it contributes a lot to the sustainability of this industry. Since it relies on new technology, the cost for a company to invest in could be high, so its demand in the market may not be large. Since this is not a technology widely used in the industries, its feasibility may not be very high.

Solution for Human Right Violation + Ethics of Slave / Child Labor
This is true that the policies and mechanization can solve the problem of human rights violation sustainably and be easy to operate. However, there are still some concerns remaining. The promotion of machines replacing human laborers in the factory will cause increasing unemployment in society. The investment to investigate the machines to decrease human labor is always large. The demand will differentiate among factories. The larger factories will be more willing to use the machines because of their economics of scale.

Alternative Fabrics
The alternative fabric is a necessary step to sustainably develop the fast-fashion industry. As the raw materials for the production, its demand is undoubtedly large. However, as a new technology, its investigation cost and production cost may cause it unaffordable for some small factories and thereby also decrease its feasibility.

Government Intervention — Indirect Tax
The indirect tax is a more smooth method to help develop a more sustainable fast-fashion industry. However, such means are not appealing to the companies as they will lose profits in the process. Nevertheless, this can help develop sustainably in the fast-fashion industry to a large extent. In this way, the companies need to comprise for their future profits. As the action will be taken by the government, the feasibility is high due to their prestige.

Second-hand Material Market
When the second-hand material market is available, the companies will have a new pathway to handle their products and materials. Normally, the low price in the second-hand material market is very attractive to the company. Also, there's no restriction to construct a second-hand material market as long as it follows the policy, which makes it plausible. Moreover, recycling of the materials makes the solution sounds more sustainable.

Encouragement of the Self-marketed Small Factories
This may sound less attractive to the companies as they lose some profits when there are other competitors. However, the self-marketed small factories can be considered sustainable to a large extent due to the severe competition, which pushes them to be more sustainable.

Make an Action Plan

1. Do research about second-hand materials
Online and offline research are crucial to start the project. The purpose of this research is to understand and list out the kinds of materials that can be circulated in the second-hand materials market. For exmaple, clothes made of mixed textiles are hard to recycle because the temperature to melt the chemical fabric is too high for cotton and linen. Online research includes reading scientific papers and investigating possible second-hand materials that factories may produce. Offline research includes visiting fast fashion factories.
2. Make a pitch
In order to get support in various aspects in the future, it is important to present our ideas innovatively and attractively. By making a pitch presentation, we can largely improve our figure and thus get funds and technical support more easily. In this stage, we can get the support from the government. The price of second-hand materials are usually too high. Through this platform, the government can subsidize the recycling industry to control the price.
3. Make a website
Since the second-hand material market will be online, a website can be used as the platform for the market. By contacting internet technology companies and gaining support from them, we can build an aesthetic and well-functioned website. These will be useful fuctions sorting all kinds of materials by the texture and wear to guide the firms to buy second-hand materials according to their need. For instance, the system recommends rough material for a shoe factory and gently used materials for a sock factory.
4.Contact fast fashion factories
To start off, we will contact several fast fashion factories to be our first consumers and experience using our website. We can start with a probation to check the performance of the materials. After customers have access to low-cost second-hand material, they will order more afterwards. This is also to ensure the stability of our market at the beginning stage.

Prototype and Test

Prototype Design

Please check the document attached.

Fast Fashion Chain

Feedbacks learnt from users

Three people of different genders and different social statuses are invited to provide feedback on our prototype.

Since Changshu is an important clothing production and trading center in Eastern China and we luckily have two groups members studying in this city, they went to a local small factory producing clothes for a fast-fashion company in Yanli Village, a village filled with more than one hundred small garment factories, and interviewed its employer and one employee there to learn about their perspective on our program.

The employer is a middle-aged man from Zhejiang Province. He mainly discussed the material, transportation, and recycling parts in our prototype. Here are his comments below:

"Your idea about the new materials is great, but I still have one concern. As a small factory without a large capital base, we usually choose the raw materials, including cotton and fabrics, with relatively cheaper prices and better quality instead of considering whether they are environmental-friendly. I do not know many small factories like mine choose to use the cotton grown with organic fertilizer and less pesticide or the synthetic fabrics produced using microplastic. However, if the government can provide subsidy these environmental-friendly raw materials, I believe more companies will be willing to produce and consume them and therefore protect our environment.

There are thousands of small factories gather in Changshu. Our products are sent to all parts of China or even different parts of the world. Even though the transportation is costly and polluted, it is much convenient to have the gathered

producing center like Changshu. However, I have to admit that it is necessary to set more production centers around China, so less transportation will be needed and the pollution caused by the tail gas emission can be relieved.

Well, the second-handed material market is really needed. There are always materials stored in the welfare for years and finally wasted. Selling them can not only help us clean the warehouse but also bring us more profit. An online market might be more useful. Even though Changshu has so many factories to trade, it is still more costly and unpractical to build and operate a physical market. The direct trade between the seller and consumer is much easier and avoids the price difference due to the middleman."

The employee that we interviewed is a woman in her thirties from the northern part of Jiangsu Province. Her response focuses on the part about the human rights and child labor issue. Here is her feedback below:

"Definitely, it is necessary to regulate the deprivation of workers. We always have to work from 7 a.m. to 10 p.m. and 28 days in one month. Everyone is asked to work for additional hours till 10 pm every day and only has 2 days to rest in one month. Even though the additional work brings me a higher income, I still think a better rest is more important. I really appreciate your work to notice this problem and come out with solutions to regulate it. I have been in factories since I graduated from primary school. At that time, I was only 13 years old. My body was still growing. I really needed more time to sleep and exercise, instead of sitting in front of the machines for whole days. I won't allow my daughters to drop school like me. I will ask them to keep studying instead of working too early. And I don't want to see so many kids have the same experience as me. I really hope the stricter regulation can bring these children back to school and have a more meaningful youth."

The third person is a woman in her forties, who is working in a bank in a large city. She sometimes consumes fast-fashion products for herself and her daughter. She gave her opinions from the consumer's perspective. She stated:

"I do not think my consumption of fast-fashion products will decrease a lot as their price increase a little resulting from the imposed higher tax because they will still not be expensive. However, I believe the price increase can definitely reduce young people's consumption and accomplish its purpose to decrease the environmental harms in the production process."

Improvement for next iteration

The first feedback we received is the concern about price. Small factories tend to choose raw materials at a cheap price instead of environmental-friendly materials. With our idea around the online second-hand material market, the price is already decreased during the second-hand material trading process. Based on that premise, we will minimize the profit of this platform and refer to a professional institute to set the most proper price for each product.

Additionally, we noticed the concern on human rights from our interviews. Although our platform focuses on the recycling of second-hand materials, we value human rights as a crucial topic in the fast fashion industry. After the platform is mature in the second-hand material market service, we will develop a section to educate factories and the public about human rights and child labor issues through workshops and videos. By promoting the right knowledge about these issues, we believe we will create positive changes to the community beyond us.
Lastly, we got to know the consumer’ s perspective that it is unlikely for consumers to decrease the consumption of fast-fashion products. Acknowledging this, we will first focus on the internal cycle between producers to ensure the use of recycling material to a maximum extent. Next, we will promote our market to the consumers. By encouraging them to donate excessive clothes to our platform, we can not only provide more products to the factories at a low price or for free but also increase consumers’ environmental awareness.

Team Credits

All group members identified one to two aspects of the challenge and generated one to two solutions for the aspects.
Leaders: Yanfei Zhu, Yunqing Chen
Lianbo Xia identified the root cause.
Mengxi Lyn, Zhen Yao, and Siye Chen are responsible to identify the criteria.
Yanfei Zhu and Yunqing Chen are responsible to evaluate the solutions based on the criteria.
Zhen Yao made the action plan.
Yanfei Zhu and Lianbo Xia designed the prototype.
Yunqing Chen did the interviews to get feedback from users.
Zhen Yao improved the prototype for the next iteration.

Onsite Conference File

Wu. Xinghua, Study of the Reuse of the Waste Materials in the Chain of Clothing Industry,
https://www.ixueshu.com/document/a66f79218e4f7c3e318947a18e7f9386.html
"Fast-Fashion: Unethical And Unsustainable – UAB Institute For Human Rights Blog". Sites.Uab.Edu, 2018, https://sites.uab.edu/humanrights/2018/04/26/fast-fashion-unethical-and-unsustainable/. Accessed 15 Sept 2021.
"Why Is Ethical And Sustainable Fashion So Expensive? - Ecocult". Ecocult, 2020, https://ecocult.com/sustainable-ethical-fashion-expensive/. Accessed 15 Sept 2021.
"Innovations In Recycling". Science, 2021, https://www.nationalgeographic.com/science/article/partner-content-innovations-in-recycling. Accessed 15 Sept 2021.
"January 29, 2020 - National Geographic". The Association Of Plastic Recyclers, 2020, https://plasticsrecycling.org/news-and-media/january-29-2020-national-geographic. Accessed 15 Sept 2021.
""Follow The Thread" - Full Report - Business & Human Rights Resource Centre". Business & Human Rights Resource Centre, 2021, https://www.business-humanrights.org/es/%C3%BAltimas-noticias/follow-the-thread-full-report/. Accessed 15 Sept 2021.
"Sustainable Fabrics: Pineapple, Banana & Coconut". Unsustainable, 2021, https://www.unsustainablemagazine.com/pineapple-banana-coconut-sustainable-fabrics-out-of-the-kitchen-and-into-the-closet/. Accessed 15 Sept 2021.
"The Fashion Industry Emits More Carbon Than International Flights And Maritime Shipping Combined. Here Are The Biggest Ways It Impacts The Planet.". Business Insider, 2021, https://www.businessinsider.com/fast-fashion-environmental-impact-pollution-emissions-waste-water-2019-10#:~:text=Fast%20fashion%20makes%20shopping%20for,pollutes%20the%20oceans%20with%20microplastics. Accessed 15 Sept 2021.
Ali, A., & Abdulai, A. (2010). The Adoption of Genetically Modified Cotton and Poverty Reduction in Pakistan. Journal of Agricultural Economics, 61(1), 175–192.
Brentrup, F. (2008, March). (PDF) Fertilizer, Biomass and CO2 Emissions. ResearchGate.
Kool, A., Marinussen, M., Blonk, H., & Consultants, B. (2012). LCI data for the calculation tool Feedprint for greenhouse gas emissions of feed production and utilization GHG Emissions of N, P and K fertilizer production.
Pimentel, D., & Levitan, L. (1986). Pesticides: Amounts Applied and Amounts Reaching Pests. BioScience, 36(2), 86–91.
Vyavhare, S., & Kerns, D. (2019). Integrated Pest Management 2019 Insect and Mite

Pests Control Suggestions for Cotton.
Wikipedia Contributors. (2019, May 8). Environmental impact of pesticides. Wikipedia; Wikimedia Foundation.

Judge Comments

" The team did a great job in identifying the environmental challenges facing the textile industry. I appreciate the team highlighting some of the social and human rights challenges with the sector as well, by pointing out the Bangladesh disaster. I also like the reflections that the team has made based on the feedback received. The team has identified many of the key drivers that promote wasteful consumption in the industry including the economics (again with special kudos for also digging into the human rights angle).

A part that could be explored further is the role of legislation or policies in pushing the industry in the right direction. The team has touched on it in places, but a more systematic analysis of that would help shed light on additional opportunities for solutions. I am also suggesting some questions that the team could use to take this work forward. For instance, how can water reduction or pesticide reduction help make the industry more sustainable? What can governments do to promote that? What role can information play in increasing sustainability? Is there a community education component to help promote better choices in the clothing industry? Is there a role for advertising, including through partnerships in reducing demand or moving demand in a sustainable direction?

As you take your work further forward, please remember to adequately cite references to other research. For instance, I would double check the contribution of livestock and byproducts to GHG – while it is high, it is not as high as suggested in the paper. I would also heavily reference Pure Cycle’ s work.

Overall, I think the team did a great job in understanding and developing something for the challenges facing the textile sector. I wish them the best in taking this forward as part of their academic work and professional careers.

"