



Creating the Vogue through Sustainability

waste management in the garment industry

Creating the Vogue through Sustainability: waste management in the garment industry

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A major research project presented to OCAD University in partial
fulfillment of the requirements for the degree of Master of Design in
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ABSTRACT

There are considerable environmental, social, and economic implications that derive from the fashion industry. Evaluating the complexity of the industry began with the business model and using the various systems tools to provide different perspectives to the question, “How can we make the future of fashion more transparent and simultaneously promote sustainable practices?”

The textile industry involves a lot of human resources in all processes, such as raw material collection, dyeing, processing, and sewing, and the wastage of resources and energy and increase in environmental pollution are caused by the short-term waste of clothing produced during these processes. This research project will seek to explore how the waste generated by the fast fashion industry during the manufacturing of the garments is managed. Approximately 15% of fabric intended for garment construction ends up on the cutting room floor and is discarded. Textile waste is not generally considered a ‘problem’ in waste management because, although materials are made with a range of chemicals, they are generally not considered toxic, in that they do not raise problems in the same way as batteries, tires or light bulbs. This project highlights the usage of unused fabric pieces considered as tailoring waste in the fast fashion industry.

The approach for the project was to investigate the current facts which included the process in the fast fashion industry, different practices by the brands, global supply chain analytics and most importantly the waste management system. Sustainability-oriented innovation calls for thinking and the reconfiguration of several elements of a system including system capabilities, stakeholder relationships, knowledge management, leadership and culture. This study integrated a deep analysis and understanding of the waste generated during the garment construction to alternatively use that waste to develop another material for better sustainability practices. Utilizing this research data, the testing for innovatively designing a new material made out of the waste generated by the industry was created. The purpose of creating a new composite material is to make use of the unused pieces of fabric discarded by the tailors. Further evaluation and analysis of the designed material helped in building a business model around the futuristic practical use of it. My analysis shows the designed material can replace a few non-recyclable things like foam used in the fashion industry. It can be used as a primary or secondary material in developing products. I conclude that this is going to be an ongoing research project to further work on variations of the material.

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Figure 1: Ethiopian workers by Eyerusalem Jiregna (Source: <https://www.theguardian.com/>)

Chapter 01

INTRODUCTION

Despite its environmental sustainability, the fashion industry is still growing and is on track to be a trillion industry. According to a report from the Ellen MaCarthur Foundation, less than 1% of the material used to produce clothing is recycled into new clothing, representing a loss of more than USD 100 billion worth of materials each year. Up to 95% of the materials that go to landfills each year could be recycled. The fashion industry wastes a huge percentage of textiles in the process of fabric production and clothing production. Currently, 5 % of solid waste is post-consumer textile waste, and most of this textile waste that goes to the landfill has cost problems to the environment. This waste can include fabric scraps from cutting, leftover fabrics from the rolls, sampling yardage, damaged fabrics, clothing samples, unsold garments, and second-hand clothing waste (Redress Design Award, n.d.). Fabric can also be wasted during the production process, trimming section, or during the printing and embroidery section (Bamisaye & Adeitan, 2018). According to Schipani (2019), the clothing industry's side effect on the environment goes beyond emissions. Fabric waste in the garment manufacturing industry is one of the biggest problems for manufacturing companies. Many of these scraps are dumped into a landfill, which generates many issues for the environment. The fashion industry stands as one of the leading industries globally, and it produces more waste than any other manufacturing industry. However, there is hope that this situation can be overcome through recycling and reusing fabric waste from the fashion industry. I will be researching on ways to reuse the fabric waste from the industry in this project. Targeting the waste generated by the fast fashion industry my research question is framed as-

How might we reuse the textile waste generated during the garment manufacturing process for creating an upcycled usable new material to foster circular design?

Secondary Questions:

- What might the futures of non-recyclable textile waste be?
- How might waste generated while manufacturing garments be reused?
- What are the futures of upcycled materials created from textile waste?

I briefly described the introduction in this section along with my aim and objective for this research project. Facts and details about the fast fashion industry is presented in chapter 2 as literature review. Further my research and analysis through the system and foresight tools which is discussed in chapter 3 which describes methodology followed by chapter 4 of designing the intervention. Intervention which focuses on the development of a new, sustainable material and a business model that would launch this material into the ethical fashion market. To conclude it is my reflection and next steps towards this project.

How might we reuse the textile waste generated during the garment manufacturing process for creating an upcycled usable new material to foster circular design?



Chapter 02

Figure 2: Textile offcuts in Bangladesh by Mohammed Anwarul Kabir Choudhury/Alamy (Source: <https://www.theguardian.com/>)

LITERATURE REVIEW

FAST FASHION INDUSTRY

The Industrial Revolution in the 1800s introduced textile machines, ready-made clothing factories, and mass production to the world. The resulting centralized system made it much easier and efficient to transport and supply goods as opposed to before. In the WW2 era, the Progressive Bundle System (PBS), a sophisticated mass production technique, emerged and shifted production toward large manufacturers over small and independent ones (Linden, 2016). The end of WW2 led to a major shift in American consumerism. Followed by years of rationing and frugality, Americans now adopted a “more, newer, better” mindset. In the mid-1970s, large retailers began to establish their house brands and product design to compete against the manufacturers (Linden, 2016). Furthermore, with the rise of globalization, delocalization, and increased realization of trade regimes, American retailers started outsourcing the labour and production in developing countries which made it cheaper than domestic manufacturers. North Americans send over 10 million tonnes of clothing to landfills every year (Sun, 2019).

People didn't always treat clothing as disposable until the fast fashion took off in the 1990s. Polyester changed things in the textile industry, the synthetic fibre made from petroleum costs half as much as cotton. By 2000 polyester took over cotton as the most popular fabric in the world. The term “fast fashion” first appeared in a 1989 New York Times article about Zara, the Spanish clothing company that was able to design, produce and sell garments within a matter of 15 days (Gazzola et al., 2020). It is a term used to describe a highly profitable business model focused on replicating high-fashion designs and mass-producing products at low cost to quickly place them into the market. This economic accessibility, while highly profitable, disregards the quality of materials used and their construction, accelerating the rate at which fashion products were being disposed of (Kozlowski et al., 2016). Consequently, consumers became addicted to these more affordable clothing options, buying at such a fast rate that they were unknowingly driving fast fashion with the idea that clothes could be seen as disposable goods. The mass retailers who managed to outsource their production to developing countries gained a competitive advantage and grew their market share. Those who stayed with domestic manufacturers started falling behind and started to become less profitable. Brands focused more on the face value of their intellectual property rather than on the specifics of manufacturing. In due course, outsourcing caused an array of predicaments. Clothing retailers were now able to distance themselves from the accountability and responsibility of their operations abroad. Once this great economic benefit was created, large retail corporations did not want to miss out. The industry is very profitable today because production is often outsourced to countries like India, Ethiopia, or Bangladesh that have lax labour laws, low wages, and no requirement to pay workers for overtime (Nguyen, 2020).

ENVIRONMENTAL IMPACTS

Chemicals are used in every part of the textile production for making fibers, bleaching and dyeing fabrics, etc. Fibres used for textiles are made from non-renewable fossil fuels, the environmental and social impact of the fashion industry is significantly increasing and doesn't look to be slowing down. The most common recycled material is plastic bottles to create recycled polyester yards. Data from The Recycling Textiles of Canada highlight on recycled textiles have the benefits of using 70% less energy, 75% less carbon dioxide and 86% less water being used when recycling fabrics. Recycled polyester uses half as much energy to make and save plastic from landfill. But recycled fabrics are expensive. They have been adapted by the fabric mills supplying to high end designers only. All used synthetic apparel can end up in dump yards or the second-hand clothing market. Accra, Ghana has one of the world's largest second-hand clothing markets. Every week they receive 15 million garments, nearly half of them goes to landfill (Insider, 2022). As mentioned earlier, out of all the chemicals manufactured annually, 23% are used by the textile industry (Charpail, 2017). Pollution generated during the manufacturing process is recorded but there isn't accurate data on the waste generated by the consumers. An average person throws away 37 kilograms of textiles annually (Sun, 2019). These mostly end up in landfills or the second-hand market as mentioned before. Landfilling is the dominant form of waste management in the world, and the environmental fate of textiles in landfills depends on fibre material. Today, retailers continue to use captivating marketing and advertising techniques to push this fabricated demand as much as possible (Weber et al., 2016).

Sustainability has taken a big hit with the production practices in the fashion industry. Sustainability is taking from the earth only those resources that are easily renewable while doing no harm to the environment. This allows for the needs of the current generation to be met without affecting the potential needs of future generations (Sharma & Narula, 2020). Pollution is increasing mainly because of the economic and political power of the industry, experts say (Yardley, 2013). In July 2018, the luxury brand, Burberry, made headlines after sharing it had burned \$37 million of unsold clothing and cosmetics. The brand's reasoning was to sustain its brand value by preventing the items from being stolen or sold at much lower prices (Davis, 2019). Consumers retaliated by boycotting the stores and using the #Burnberry hashtag on social media. Burning goods is a common practice in the retail world. However, brands are not obligated to disclose such information, so it is not openly known to the public. The fast pace of manufacturing to discarding has vast environmental consequences (Nguyen, 2020b). The depletion of the planet's finite resources has been the result of the ever-increasing rates of production for synthetics and natural fibers that rely on petroleum and agriculture (Simpson, 2019). Textile materials naturally made, for example, cotton and bamboo in the long run are biodegradable. However biodegradable materials, through the course of biodegradation they produce acid leachate, methane, nitrogen gases, and hydrogen sulphide as by-products of the process (Li et al., 2010). On the other hand, synthetic fibres such as nylon and acrylic may undergo slight degradation,

but the bulk of the material will remain in landfills indefinitely (Weber et al., 2016). The concept of using natural fibers in the composites instead of inorganic reinforcements like glass fibers is gaining more and more interest in these days. The natural fibers are simply preferred because of their low cost, renewability, and environmentally friendly structure. Fibers such as jute, hemp, kenaf, sisal, and wood fibers are the main fibers that can be utilized in composite materials due to their respectable mechanical properties (Bodur et al., 2017.).

A few examples for composite materials made out of waste fabrics are, the hanging seat, commissioned for an Art Institute of Chicago show on industrial design called Hyperlinks. It is fabricated from 3Di sail material (carbon, UHMWPE, and high molecular weight polyester thermoplastic resin), vacuum bagged and heat set like any composite part or any 3D moulded sail. This is something that might be referred to as a moulded composite textile (Graham-Jones & Summerscales, 2016).

Plant or fruit “leathers”, made from waste materials, are starting to gain traction.

Piñatex, for example, is a material made from the leaves of pineapples grown in the Philippines. Its making is substantially more sustainable than conventional leather and is totally animal-free. It requires less water and no harmful synthetic compounds that are biologically harmful to natural life. The leaf waste is recycled and utilized for compost or biomass. At present, the material is being utilized for upholstery in the first vegan hotel suite in London. Piñatex is currently not biodegradable (Jones, n.d.).

Most recycled textiles are turned into mattress stuffing or insulation and the original materials are from factory floor, not used in clothing (FabScrap, n.d.). FabScrap is a non-profit organization based out of New York playing a key role in fabric recycling and upcycling from the local designers. They are associated with 500 fashion brands from whom they collect around 5,000 pounds of fabrics, trims and yarns very week. They collect all kinds of unwanted fabrics from the brands including - sampling waste during the design process, defective fabrics, excess yardage, mock up garments, end of life rolls, cones of yarn, fabric swatches from the mill and the cutting waste during the garment production. They separate usable and non-usable fabrics from the scarp according to the fabric type. The small non usable fabric is shredded by the recycles and is called shoddy. Shoddy is used industrially in carpet padding, mattress stuffing, insulation etc. (FabScrap, n.d.).

According to Business Insider’s interview with the research and development department at H&M, H&M as a fast fashion brand has come with an innovative recycling technique for making new clothes from used apparel. They start with analysis the fabric and putting it into an ozone chamber to sanitize the fabric which takes about an hour. Then the buttons, labels, zippers are removed and the fabric is shredded to small pieces by a shredder. Some new virgin fibres are added to make the shredded yarns stronger. Another machine

mixes these fibres well together in form of a sheet. The mixed fibres are rolled into clumps and is fed into a machine which turns hem into a fibre web. Further the fibre web gets bundled into snake like slivers which are then spun into ply yarn, the building blocks of a new garment. The fine threads now make a new garment which is completely made by a machine. It takes three days to recycle one garment. The company marks this as a new breakthrough for recycling fabrics and now plans to expand on recycling the cutting waste in the garment manufacturing process in the same manner. With the current pace of this recycling machine, it would take almost 50,000 years to deal with world’s one week’s worth of waste from the market (Anonymous, 2022).

IDENTIFYING THE OPPORTUNITY

Textile production requires significant amounts of chemicals, water, energy, and other natural resources. During the decomposition process in landfills, textiles generate greenhouse methane gas and leach toxic chemicals and dyes into the groundwater and our soil. Cutting the garment from the fabric will always generate some waste. “Researchers estimate that even with conscious effort, leftover fabric could only be reduced to about 10% of materials used. On average, 35% of all materials in the supply chain end up as waste before a garment or product reaches the consumer. This could be cutting waste, un-useable stock due to last-minute design changes, spoilage in transport, or excess stock that is not sold on the retail market and, at times, is incinerated by brands.” (Anonymous, 2018). 47% of all fibre entering the fashion value chain becomes waste throughout the myriad of different stages of production from fiber, yarn, fabric up to a garment. 80% of recyclable waste does not get segregated by composition or waste type in production, and needs to be manually sorted. When passed to collectors and traders, 40% of the waste gets discarded (landfilled or incinerated) (Anonymous, 2017).

Fibre recycling advancements do exist, yet they are just utilized on a limited scale. Mainly, the methods can be divided into mechanical and chemical recycling. Mixes are generally reasonable for mechanical fibre recycling, where fabrics are shredded and pulled to change them into strands of shorter length. Shorter fibre length produces fabrics of lower quality and strength, so the results from this kind of recycling can't be used for clothing. Instead, these tend to then be “downcycled” to produce other composite fibre materials such as thermal insulation or carpet for use in the building industry. Some researchers have found ways of creating noise insulation from old textile fibres (Beall, 2020).

According to Fabscarp, big names like Marc Jacobs, J Crew and other high end clothing designers who are following sustainable design practices are segregating their textile waste for recycling. The focus of this project will be the fast fashion industry and their garment manufacturing system. Small businesses and slow fashion industry produce limited waste which can be segregated according to their fabric types but the fast fashion industries have their own tie ups with fabric mills which produce cheap and unsustainable fabrics. Through their excessive over production, they blame the consumer buying practices for the waste generated by the clothing industry to divert the attention (Oshri, 2022). Fabric wastage in the fast fashion industry is a growing concern. According to Reverse Resources (2016), fabric scraps are smaller fabric pieces found in between the pattern pieces. Once a garment has been cut, they are naturally created as the negative space between the pattern pieces. These scraps depending on the size of the piece are either reused to make accessories like buttons or patch work; sold in the fabric upcycling industry where these pieces are further sold or shredded for recycling or discarded as scraps which end in the landfills. The focus for this project is on these pieces of fabric, which are unused – where the tensile strength of the fabric is as good as that of the garment, which undergoes no

wear and tear, no washing but is still discarded. With the over production of garments in the fast fashion industry this waste is unaccounted by the big brands. The synthetic fabrics which are blends of different kinds of fibres are not recycled because it is difficult to sort them when they are discarded in bulk. The compositions of all synthetic fabrics are different and thus difficult to sort. Hence connecting this to composite material the intention of the project is to design a new composite material out of the existing waste created by the garment industry.

Sustainability in the fashion business is developing, not yet established, and many researchers have acknowledged the importance of investigating how it can be achieved. With sustainability factor the finances increase for businesses in the industry and hence they opt for the cheaper, easier and faster options. (Jadwani, 2021) Digital technologies have a mark in the advancement of the processes in the garment manufacturing industry but they do come with limitations. With zero waste pattern cutting the fabric wasted is negligible but on the other hand the design of the garment is compromised. The cycle continues where desired outcomes have both positive and negative impacts. The problem here recognised is both financial and environmental (Harbert, 2020). Sustainable practices are expensive for small businesses and the bigger businesses are too busy to consider this problem. Hence, I identify in the current situation sustainable practices is slow and upcoming solution identified by many fast fashion brands. Brands like Old Navy, H&M and Zara plan to be 25-45% more sustainable by the year 2030. Till then reusing the waste seems to be the right intervention than dumping it all in the landfills (Portela, 2021).



Figure 3: The Cancellation of Fast Fashion by Marcus Loke (Source: <https://unsplash.com/>)

Chapter 03

SYSTEMIC DESIGN AND FORESIGHT ANALYSIS

Systematic design refers to a process of design that looks not only at the problem that needs to be overcome, but also at the surrounding environment, and other systems that are linked to the problem. Systemic design integrates systems thinking and human-centered design thinking, with the intention of helping designers cope with complex problems (Jones,n.d). The system design toolkit helped me co create the intervention keeping in mind all the stakeholders in the system. The correlation of the services, products and the stakeholders helped to recognize common behaviors and interdependency. Emerging change will challenge our current assumptions, and over time today’s decisions, policies, and products will become obsolete. Foresight tools are an approach to sense-making overlapping waves of uncertain change in the context of our current assumptions (Foresight Toolkit, 2008). The tools provide are used to do futures thinking, sense making, trend analysis, scenario development and generating innovations for interventions. This section will provide data and analysis of the fast fashion industry through different systemic toolkit methods.

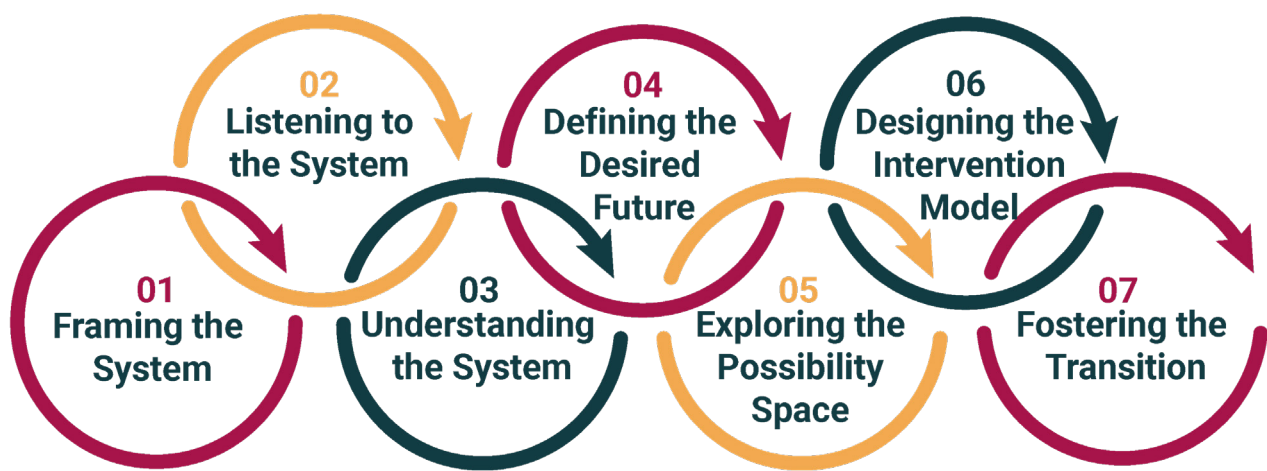


Figure 4: System Toolkit

1. STAKEHOLDERS IN THE FASHION INDUSTRY

The first step is identifying all the stakeholders who are involved, the actors that frame the system. This step will help in defining the initial boundaries, understand the necessity for change, identify the current and upcoming stakeholders and the emerging initiatives. I have used the Actors Map to frame the system. The actors map represents the relationship between stakeholders. It’s a view of the fashion system and its context (Jones, n.d.). The fashion system has developed into a global, omni channel, and fragmented system with numerous stakeholders and moving parts, thus making it very convoluted with multiple grey areas. Hence, identifying the various actors involved provides for a more comprehensive

understanding of the knowledge and power dynamics within the system. Acknowledging these dynamics is crucial for understanding the roles each stakeholder will have in changing the system, as well as the size of the impact they will experience as a result of the change.

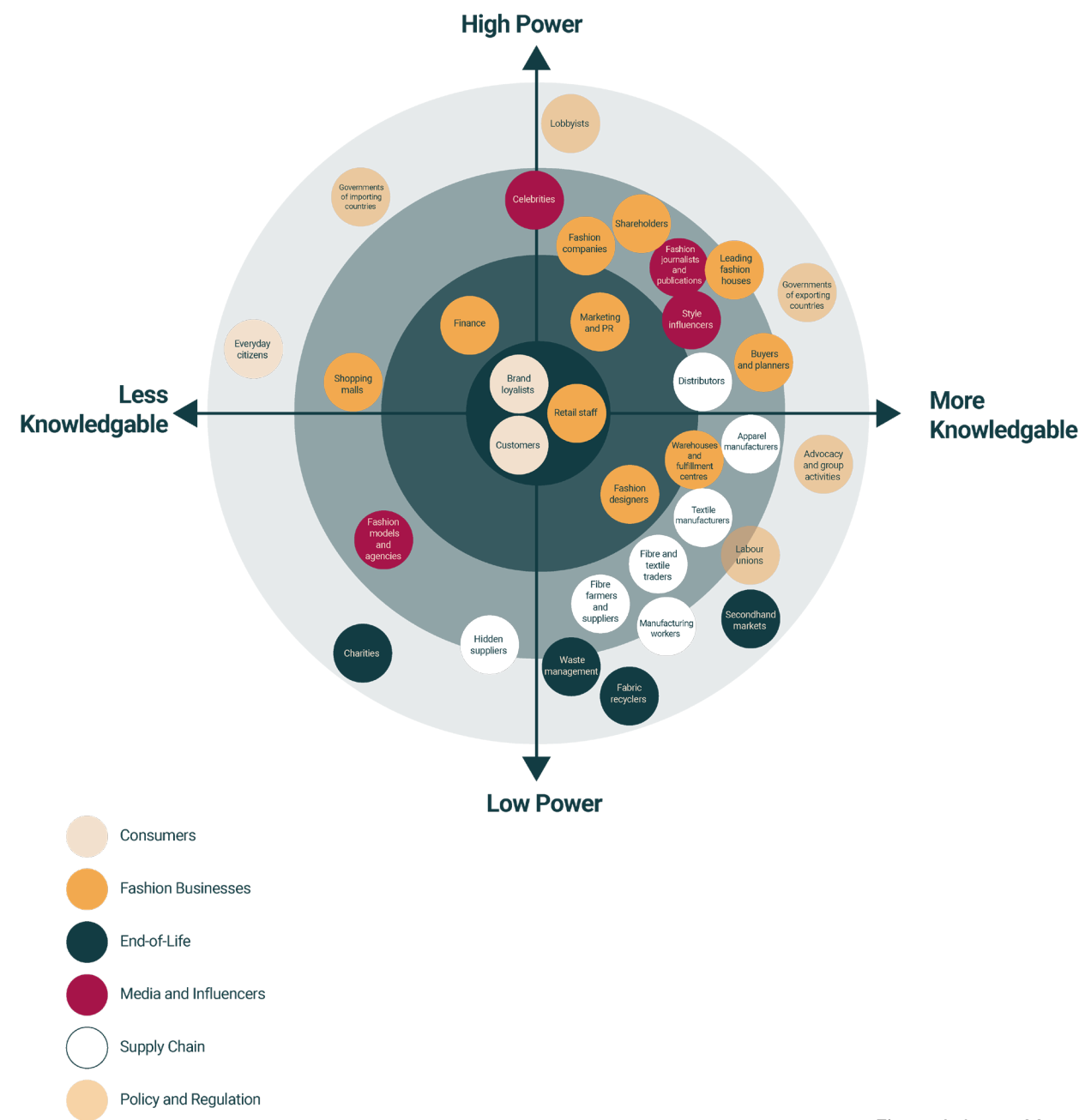


Figure 4: Actors Map

Actors were categorized into six groups and placed onto the map below to capture the knowledge and power dynamics as discussed above.

Supply Chain

There are many stakeholders directly involved in the supply chain of a garment. In fact, “the raw material sometimes exchanges 10 hands before it is converted into a t-shirt,” as one clothing garment can involve up to seven separate manufacturing stages distributed

across multiple countries (Gerretsen, 2021). Stakeholders along the supply chain process are responsible for activities like farming, ginning, trading, spinning, weaving, stitching, dyeing, printing, and embroidering fibers and textiles. They participate in a co-dependent functional relationship as the sequence of activities must be followed properly to produce a garment. Oftentimes, these stakeholders are dealing with strict deadlines, so production needs to be as efficient as possible to avoid any delay. As discussed earlier in this report, suppliers are also under pressure to maintain low operating costs to remain attractive to potential customers, making it difficult to adopt more sustainable production practices.

Policy and Regulation

Another group of stakeholders is those in charge of the policy and regulation involved in clothing production. Some countries heavily rely on clothing production to sustain their economies. The top clothing exporting countries include China, the European Union, Vietnam, and Bangladesh (World Trade Organization, 2017 as cited in Esri, n.d.). The local and federal governments of the importing and the exporting countries must coordinate shipment, supply and demand, and the laws that regulate those transactions. Labour unions are also part of this group as they hope to protect and better the rights and interests of the supply chain workers. Their priorities are often focused on reconfiguring the workplace conditions and regulating benefits. However, unions have relatively little strength in manufacturing countries, as employment laws make it difficult for workers to self-organize, and factories have a history of threatening and attacking union members (Human Rights Watch, 2016). Advocacy groups and activists, like Jeff Ballinger, disseminate information about the social, economic, and environmental concerns on the fashion industry and influence social change.

Media and Influencers

Long before the Internet and modern marketing platforms, the media played a critical role in communicating trends and creating consumer demand for fashion. The earliest account of the fashion magazine was in the 1860s, when the famous publication, Harper's Bazaar, featured in its latest issue a collection of designs by Charles Frederick Worth, "the first true fashion designer" (RISD Museum, n.d.). Today, the magazine is joined by other top players like Vogue, Elle, Glamour, and Marie Claire (Raaz, 2015). The fashion industry gained further momentum during the Roaring 20s through the rise of Hollywood. Movie stars were viewed as style icons, and retailers rushed to offer replications of the outfits they wore on-camera (Encyclopedia of Fashion, n.d.). To this day, several celebrities continue to be seen as fashion-forward, with some even operating their own clothing brands. In the present day, social media influencers now play an unprecedented role in fashion marketing. In a survey of 2,000 U.S. online shoppers, 47.5% of respondents said their most recent fashion purchase was inspired by social media (RetailWire, 2019). Influencer marketing works because it gives brands access to a dedicated following of people that trust the recommendations of

the influencer (Chen, 2020). Clothing reviews, styling tutorials, and testimonials of famous celebrities and fashion models on platforms like Instagram and TikTok are commonly used tactics to drive sales. Influencers have a level of referent power to set opinions and boost or tarnish a brand's reputation, making it all the more important for fashion industry players to pay close attention to their social responsibility efforts.

Fashion Businesses

Expected to grow in value from \$1.5 trillion in 2020 to \$2.25 trillion in 2025 (Shahbandeh, 2021), the global apparel market demonstrates few signs of becoming saturated despite intensifying competition driven by globalization. Fashion designers and retailers utilize varying business models to serve different consumer segments and create shareholders. Luxury brands, like Louis Vuitton, put design at the core of their business and outsource most of their manufacturing operations to create high margins. Zara (Inditex) utilizes a tight, vertically integrated supply chain to manufacture and sell low-cost, designer-inspired apparel (O'Marah, 2016). TJX, which operates off-price designer retailers, depends on strong merchandise buying capabilities to source brand-name apparel at discounted prices (Tyler, 2018).

Consumers

Ongoing demand to keep up with fashion trends continues to drive consumption of fashion products. The diverse actors within the fashion industry have collectively created a system in which demand is fabricated by leading consumers to adopt a "see now, buy now" mentality (Gazzola et al., 2020, p. 18). For example, they use targeted marketing techniques to deliberately make previous seasons' trends uncool to drive consumer behaviour and sales volume (Elrod, 2017). As a result of the industry's marketing efforts, the average consumer purchased 60% more clothing in 2014 than they did in 2000 but only held onto their purchases for half as long (Reichart & Drew, 2019). However, the COVID-19 pandemic might be bringing about a lasting shift in sentiment towards sustainable fashion. A McKinsey survey found that 67% percent of consumers believe that, in light of the pandemic, it has become more important than ever to reduce their environmental impacts (Granskog et al., 2020). Consumers also reported a greater intent to procure more durable garments, hold onto their clothes for longer, and purchase more of their clothes from second hand markets (Granskog et al., 2020).

End of Life

A garment may end up in one of many places at the end of its life. It could be thrown into the trash, donated to charity, or sold to a second-hand buyer. The average North American discards 37 kilograms of textiles annually, and much as 85% of those discards end up in landfills or incinerators (Gray, 2019). Although fabric recycling is also possible, it is hardly

feasible in places like Canada, the U.S., or the U.K. Only 13.6% of clothing is recycled, as the multitude of fibers, fixtures, and accessories that may comprise a single garment make it difficult to sort and separate its materials without labour- and skill-intensive recycling processes (Beall, 2020). In fact, the recycling industry in Western countries is relatively insignificant. For example, only a dozen recycling companies operate in Canada (Rabson, 2019). Because inconsistent recycling protocols across municipalities make it difficult for residents to learn how to properly sort and clean their recyclables, it has been more economically attractive for these countries to outsource their recycling needs to Asia instead of building their recycling capabilities in-house (Mosbergen, 2019). This is why many countries were left scrambling to find new recycling partners when China—which used to be the world’s largest importer of recyclable plastics—decided in early 2018 that it would cease to accept as many as 111 million tons of plastic waste (Katz, 2019).

2. FASHION INDUSTRY – SYSTEM ANALYSIS AND POTENTIAL SUSTAINABLE PRACTICES

This section will provide an overview of the system in the fast fashion industry from the initial stages of sourcing to end of life of a garment. The barriers to make the fashion industry more sustainable and the potential changes that can be adapted to make it more sustainable.

The fashion industry is well known for its “best-kept secrets” as manufacturing process details have never been publicly available (Lam, 2020). Although critics agree that brands can more publicly disclose their supply chains, to do this; however, is not so simple. In fact, 95% of fashion brands do not know where their materials were sourced, and 75% do not know where all their clothes are manufactured (Cheater, 2015). As depicted in Figure 6, corporations only have visibility to the downstream production activities in which textiles are assembled into garments. The actors and the stakeholders as described in the previous section are connected through activities and supply chains in the system. Each actor and their practices are interdependent on another actor of the system.

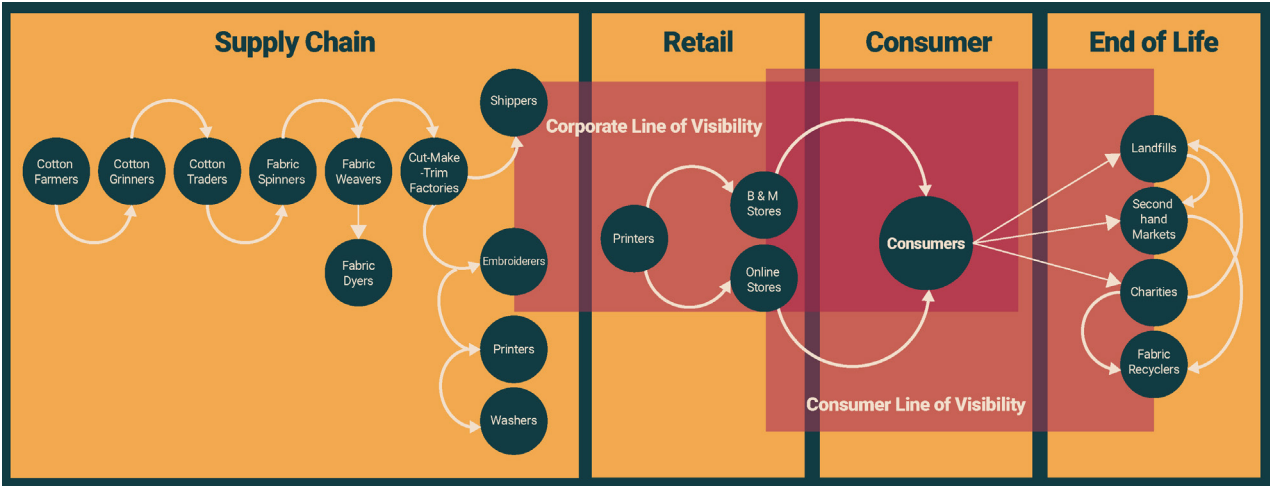


Figure 6: Fashion Industry System Map

System archetype are recurring patterns of behavior of a system. Loops indicate for generic patterns of behavior over time, particularly counterintuitive behavior. Figure 7 helps in analyzing and visualising how the factors of the system influence each other. As consumer demand increases, manufacturing demands (and costs) increase. This drives pressure to keep costs low by investing in efficiencies. Efficiencies hurt workers as well as the natural environment in which they live. Because efficiencies also reduce product quality, there is a spillover effect in which consumers dispose of their old clothes and buy new ones more frequently, thereby reinforcing the labour and environmental impacts.

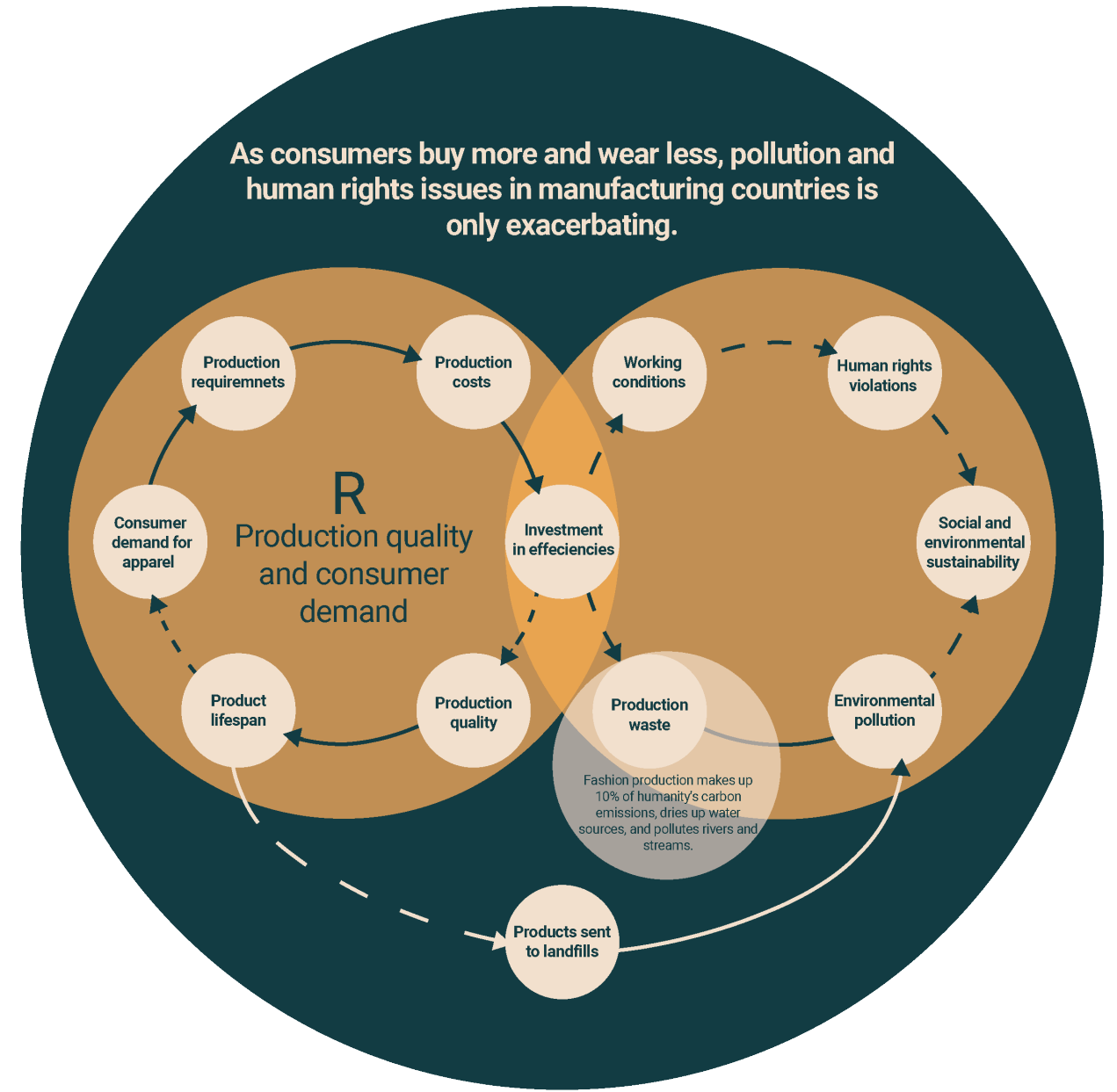


Figure 7: Influence Map

The way in which value is created in circular systems is radically different to the way it is created in linear systems. As much as 12 percent of fibres are still discarded on the factory floor, 25 percent of garments remain unsold, and less than 1 percent of products are recycled into new garments. The apparel ecosystem is fragmented, with no single player accounting for more than 1 percent of the market. (Lee & Magnus, 2021)

The loop of manufacturing and consumer demand needs a variety of strategies on three foundational capabilities –

Embracing Sustainable Design

Designing for zero waste requires material and product innovation. Scotland-based Johnstons of Elgin recently introduced Every Yarn, a material made from used yarns. As part of sustainable practices companies can:

- Invest in, incubate, pilot and test alternative materials and processes for a circular system.
- Radically reduce production waste and support, train and incentivize suppliers to reduce and reuse fibre, chemicals and packaging.
- Reskill designers and stimulate circular design innovation.
- Create momentum by collaborating and developing tools.

Ramping Up Reverse Logistics

Through reverse logistics, companies can recover items from disposal or secondary resale and thereby continue to derive value. Some companies are leveraging their own store networks for circularity, although very few also rent, repair or resell in store. UK-based Mulberry has maintained a leather library since it launched in 1971, offering repair and refurbishment for all its products. In 2020, the company launched Mulberry Exchange, a buy-back initiative under which customers can return bags to be repaired and resold alongside the current collection. Investment in efficiencies for companies can include:

- Design reverse logistics to optimize value retention, either by partnering with a trusted intermediary or – more likely in the luxury space – taking direct control.
- Leverage store networks to create in-store circularity hubs.
- Build out non-store collection points and home pick-ups to improve accessibility.
- Optimize sorting facilities and recycling technology, either in-house or with partners.
- Eliminate single-use packaging.

Supporting Customer Adoption

For younger consumers born into the sharing economy, adopting circularity is a natural step. However, older consumers may require education and encouragement. Some consumers believe there is a hygiene issue with second-hand clothes, and others struggle to translate their sustainable values into actions for a wide range of reasons. Going forward, companies can:

- Offer rental options such as subscription services and the option to buy rented products at a discount.
- Borrow online marketplace techniques to filter, sort and group assortments, or leverage retailer-curated collections.

- Enable peer-to-peer business, including resale and rental, and sweeten the deal with logistics and digital solutions.
- Create timeless collections, reflecting the declining prominence of seasonality.
- Offer tips for care and repair.
- Enable returns and recycling.
- Develop data strategies to inform business decisions. (Ahmed et al., 2021)

Circularity is likely to be one of the key business trends of the next decade. However, it is not the kind of revolution that can be led by a few leaders, while others wait and see. Rather, a collective effort is required, in which fashion companies, customers and all participants in the value chain collaborate.

3. DESIRED FUTURE: DEFINING A LONG TERM VISION

Apparel consumption is not expected to peak any time soon. By 2030, annual apparel purchases are expected to rise to 102 million tons, from 62 million in 2019—a 63% increase (The Sustainable Fashion Forum, n.d.). An estimated 92 million tons of textile waste is developed annually from the fashion industry. It is estimated to increase by about 60% between 2015 and 2030, with an additional 57 million tons of waste produced annually. It is anticipated that, by 2030, total fashion waste will be 148 million tons (Global Fashion Agenda & BCG, 2017). As evidenced so far, several key issues are plaguing the fashion industry. Some of these include the lack of honesty from brands, a lack of affordable sustainable clothing on the market, the environmentally intensive processes of the fast fashion industry, and poor labour conditions of fashion workers.

The Three Horizons tool helps to connect the present with the desired futures. It helps to identify the divergent futures which may emerge as a result of conflict between the present situation and the imagined futures. The 3 Horizons is key in helping to synthesize the challenges in the current fashion system, particularly around social and environmental sustainability. Not only were these tools important for understanding the present, but they also helped to visualize what an ideal future of the fashion industry could look like. This ideal future has a much slower pace of fashion to reduce the number of garments produced in addition to encouraging consumers to wear their clothes for much longer periods. In terms of the materials used, fashion would focus on the durability and utilization of clothing as a state of expression rather than promoting competition through classism (Foresight Toolkit, 2008). Figure 8 helps understand the trends and emerging changes in the industry. As per

the Foresight Toolkit, 2008, what do the horizons tell us-

- 1st Horizon – The first horizon focuses on the current context and conditions. The focus is on the stable facts and figures. What does now look like?
- 2nd Horizon – The second horizon is the actions taken in the present to resist change and to adapt to change. The focus is on creating, building and managing change. What assumptions are challenged by the changes, and how can we respond to the resulting opportunities and risks?
- 3rd Horizon – The third horizon is the transforming emerging changes, ideas about visions of preferred futures. The focus is on transformation and disruption. What's changing?

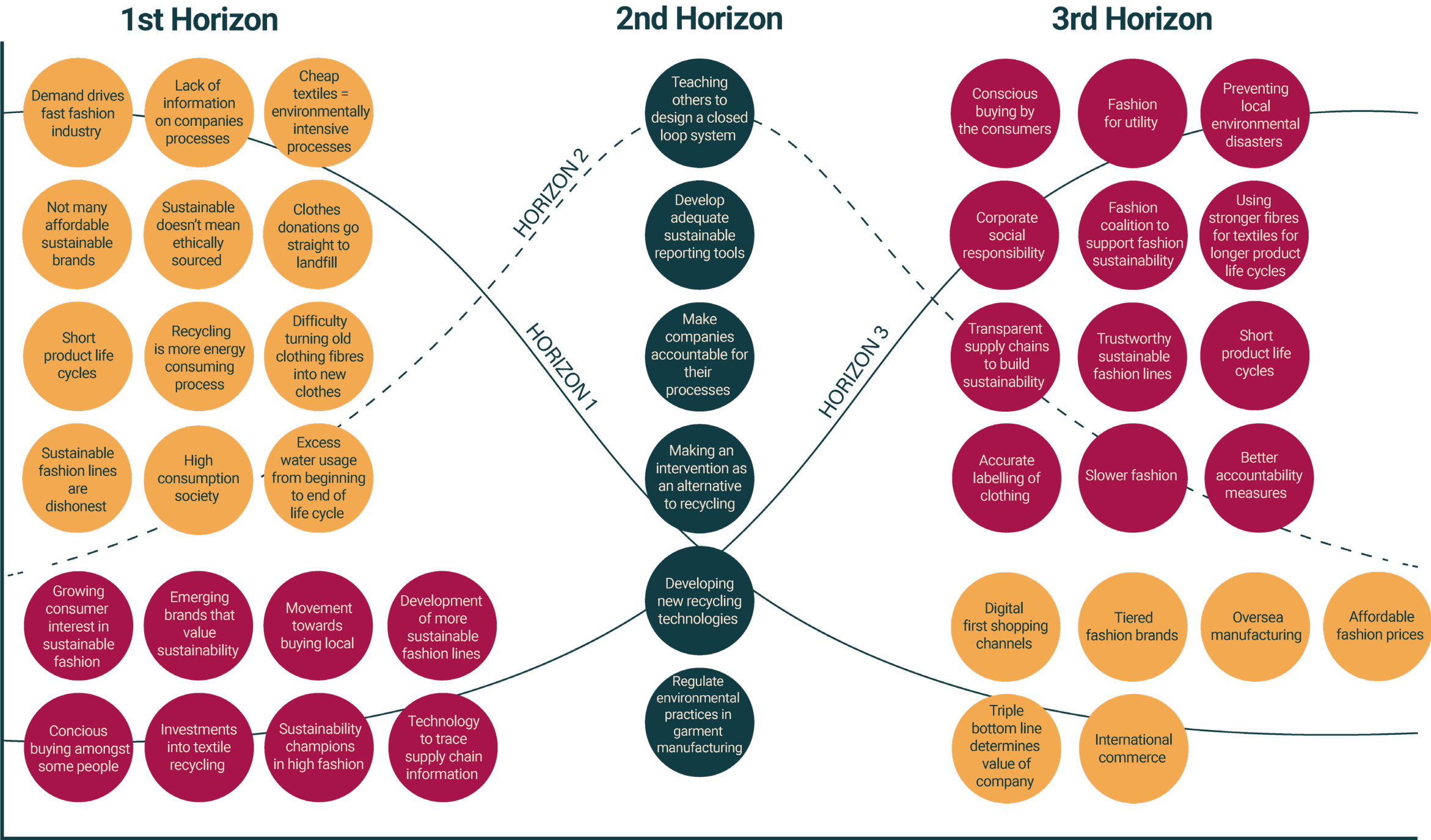


Figure 8: Horizon Scanning

4. POTENTIAL INTERVENTIONS

Despite the issues making it difficult to move towards transparency and sustainability, there are nevertheless emerging signals that are driving towards the idealized future. For instance, there is a definite culture shift that is occurring in fast fashion. At the consumer level, people are becoming more invested in buying sustainably and ethically sourced items, with 66% having said they are willing to pay a premium if necessary (Beltrami et al., 2019). In the fashion market, many smaller fashion companies are looking to differentiate themselves on sustainability and are developing their supply chains with a transparency-first mindset (The Good Trade, n.d.).

This section defines what potential solutions can be made in the system after scanning the emerging trends through the 3-horizon model. The intervention model helps in identifying what are the most promising places in the system's structure where a small shift in one thing can produce big changes in everything. Through a structure we can answer questions like - where and how can we intervene in the system? On which levels do you need to intervene to tackle the challenges? What interventions are needed?

Reflecting on figure 9, to reach this idealized future, systemic interventions are needed to propel the fashion industry forward. To begin, I recognized that transparency and traceability are integral for producing more honest, ethically sourced, and sustainably-made fashion. Developing interventions focused on research and development of making a new composite material out of the waste generated during garment manufacturing can help the recycling industry. As mentioned, recycling is one of the solutions for the waste in the fashion industry but consumes high amount of energy and other natural resources. Hence the intervention model helps in deciding where and how can an intervention be made in the system alongside the levels needed to tackle the challenges of the intervention.

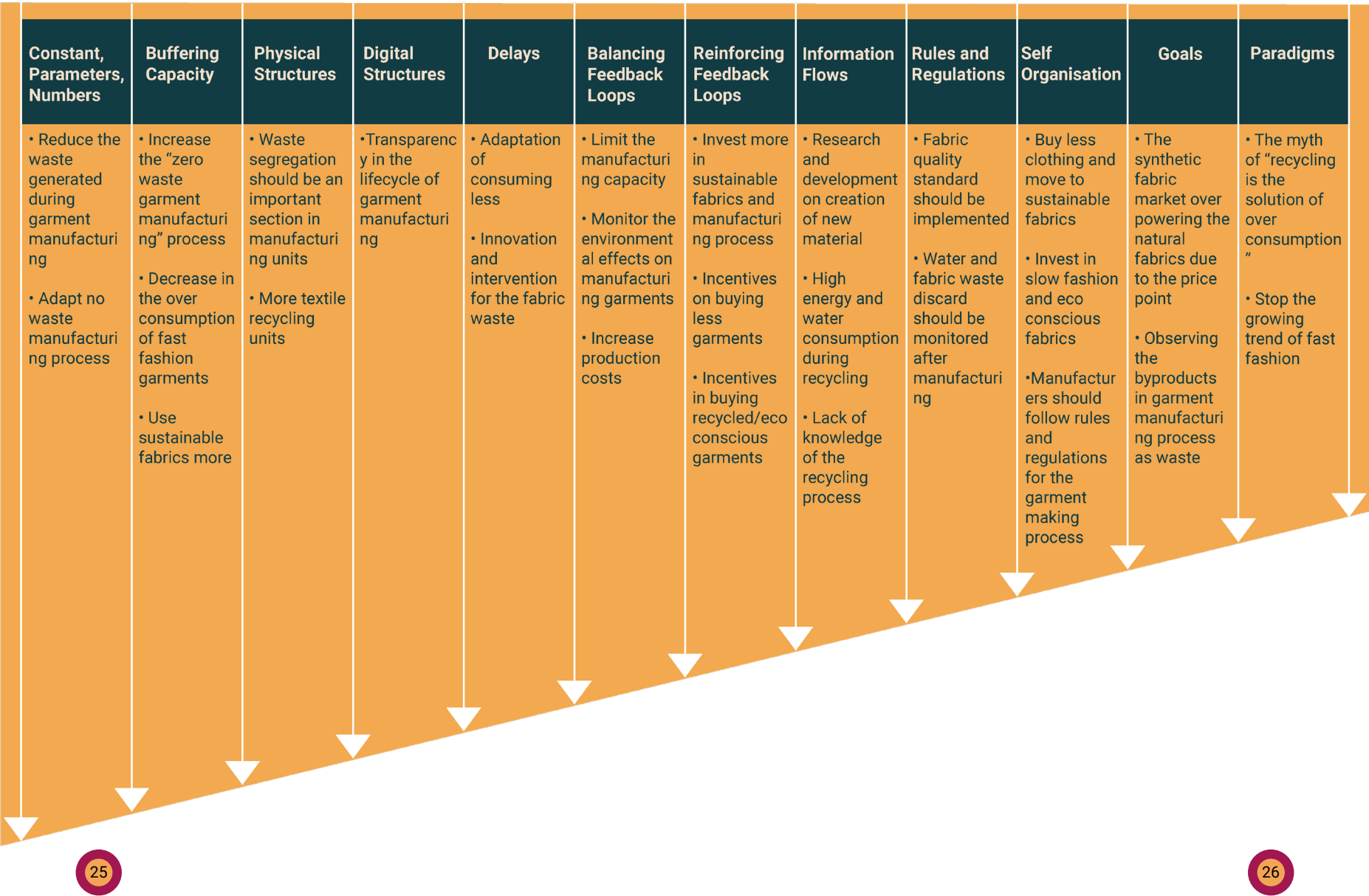
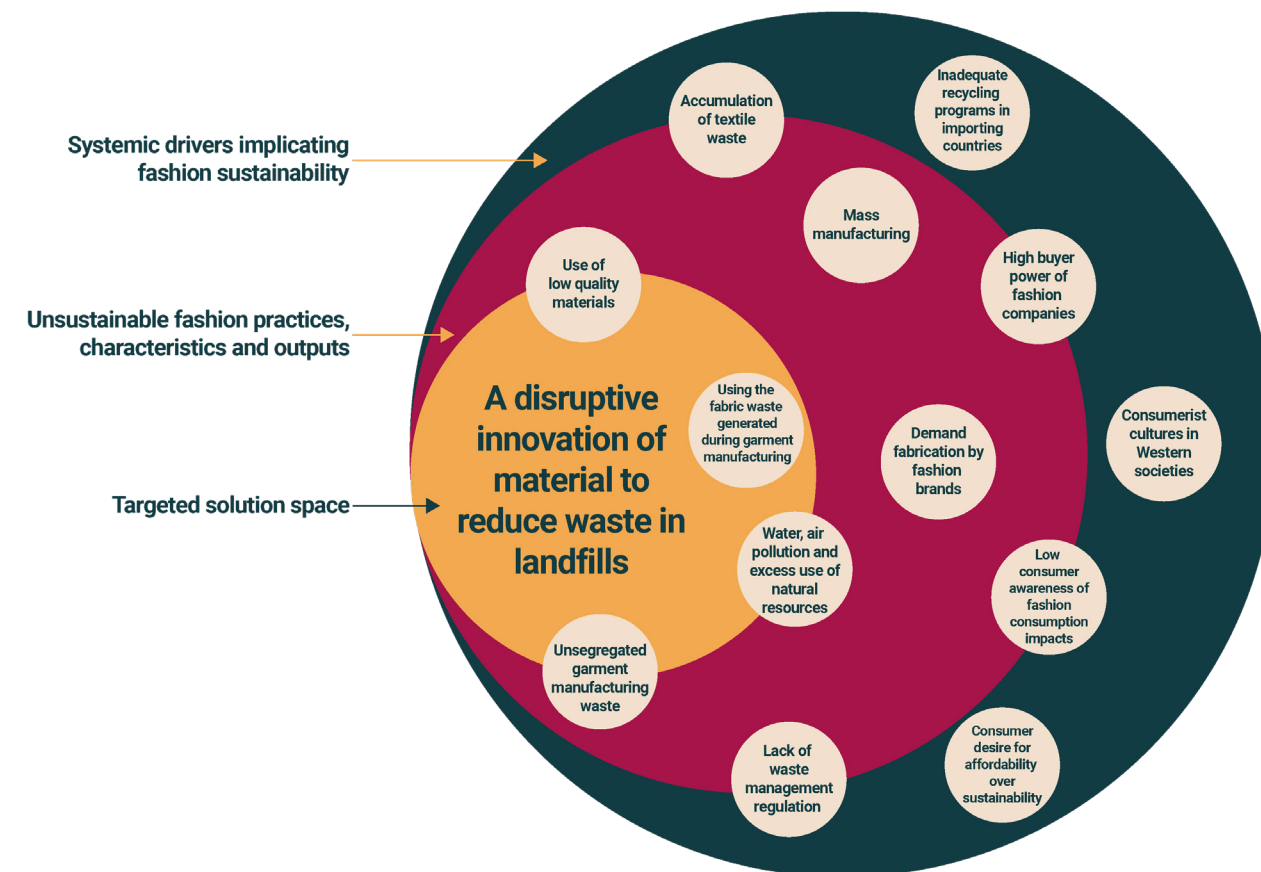


Figure 9: The Intervention Model

5. SCOPING OPPORTUNITIES FOR INNOVATION THROUGH MATERIAL DESIGN

In the previous section system design and analysis, I researched on the current practices, sources and influences in the fast fashion industry system. This helped in identifying the current trends and the loopholes for potential changes in the system through various interventions. After identifying emerging intervention strategies, it is very important to scope the possibility and the practicality of these changes on a large scale. Hence determining the scope of my research and analysis to further design the intervention is crucial. Effectively, my research confirmed the overlook of the sustainable fashion problem as evidenced through multiple causes and effects touching different stakeholder groups. Plotting the issues into a boundary map allowed me to position the scope of intervention into the broader problem space. A boundary map helps define boundaries in understanding the necessity for change, identifying the actual and future stakeholders and identifying the emerging initiatives (new ways of doing). Boundaries are recognizable by the structure of the system like same purpose, location, shared processes or interdependencies and lines of influence.



In the outer layer of the boundary map are the systemic drivers implicating fashion sustainability. These are broader issues for which actors along the value chain (i.e., fashion brands and their suppliers) are not directly responsible and would have difficulty changing on their own. For example, inadequate municipal and regional recycling programs make it difficult for fashion brands to reuse fabrics from discarded garments (Sun, 2019). In the center layer are the unsustainable practices, characteristics, and outputs driven and controlled by the fashion business model. Systemic issues over which the value chain has at least some level of influence, like the lack of environmental and labour regulation in exporting countries, transcend in-between this layer and the outer layer. Finally, at the core of the map is the targeted solution space— the wastage at every level needs to be handled differently. Here the target is the waste generated during the garment manufacturing process and hence an innovative composite material to reduce the waste in landfills.

Concluding the system analysis, I decided to move forward with transforming the waste produced during garment manufacturing into an affordable and accessible material. Adapting to sustainable practices and materials would be a gigantic scope for the entire industry and not scalable but introducing circular design can be a small step towards it. Looking at the industry stakeholders from the waste generation and management point, the policy and regulations are weak and manipulated by the brands. The brands are not following ethical practices which has led to transparency issues in the system. Defining the preferred futures through the three-horizon tool led to the conclusion of minimizing the waste in the landfills. The intervention model helped to foresee where the intervention is required and how will the intervention not add waste in the process. The innovative material is desired to have minimized the waste, not add more to the landfills in its after life and be a usable material on its own or replaces a current unsustainable material in the market.

Figure 10: Boundary Map



Figure 11: About the Bags of Waste by FabScrap (Source: <https://fabscrap.org/recycle>)

Chapter 04

DEFINING AND DESIGNING A NEW MATERIAL

The scope of the project was identified as an innovative material design to reduce the synthetic fabric waste in the landfills. The literature review and research on where the waste by the fashion industry goes helped giving the scope of the project a direction. The research highlighted how nonprofit organizations like FabScrap collect waste from the garment manufacturing units and endeavors to end commercial textile “waste” and maximize the value of unused fabric. They separate the waste into organic and synthetic fabric pieces manually and check if it can be reused, recycled or will go to landfills. According to FabScrap’s data designers want to recycle their waste but find it difficult due to lack of infrastructure and scale. That is where Fabscrap helps in collecting the waste, sorting it according to the different types of materials and then recycling it. They also sell the waste shredded fabrics, small pieces of fabrics and accessories like zippers, buttons etc. I bought the shredded fabric which they refer to as “shoddy” to work with for my research.

PROTOTYPING

For the initial explorations due to the restrictions during the pandemic, I started working with the material available at home and made matrixes in the kitchen. I shredded old t-shirts, cotton fabric with scissors and sun dried all the samples after adding the matrixes to the fabric pieces.

Explorations at home without any studio resources



Figure 12: Exploration 1

Exploration 1

- 3 table spoons white vinegar
- 1 table spoon gelatin
- 1 table spoon sugar
- Boil all ingredients together

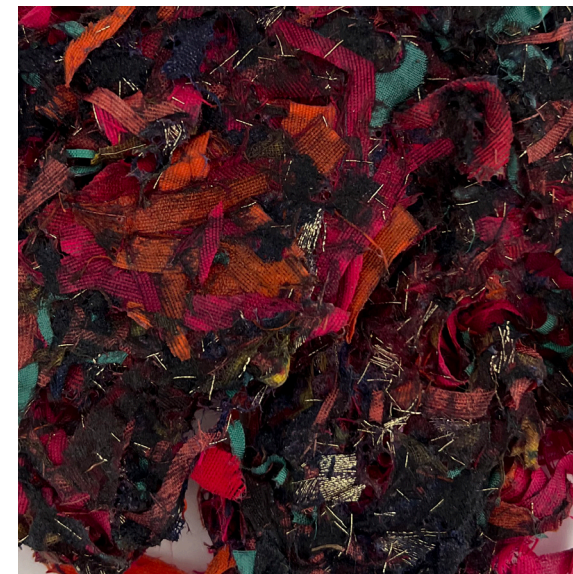


Figure 13: Exploration 2

Exploration 2

- 6 table spoons of water
- 14 grams gelatin
- 2 table spoons white vinegar
- Boil all ingredients together

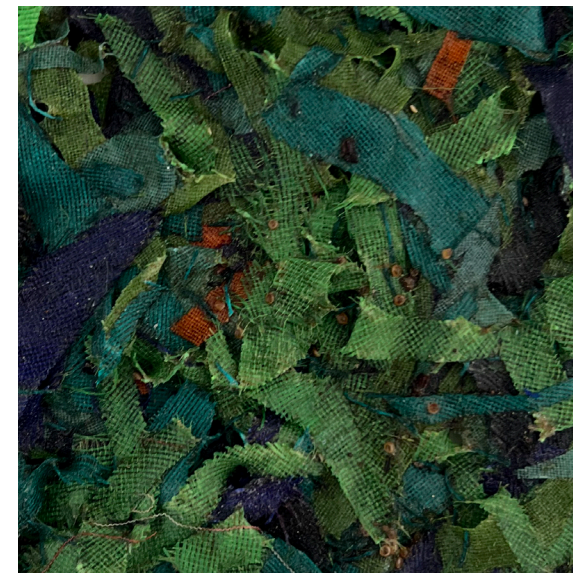


Figure 14: Exploration 3

Exploration 3

- 100 grams edible gum
- Boil in 3 cups of water



Figure 15: Exploration 4

Exploration 4

- 1 cup miada (flour)
- 1 cup sugar
- 4 cups water
- 1 cup alum
- Mix and heat all ingredients



Figure 16: Exploration 5

Exploration 5

- Add 2 table spoons of gelatin in a cup of water and put aside for 1 hour
- Add 3 table spoons of hot milk
- Mix and stir till it dissolves completely

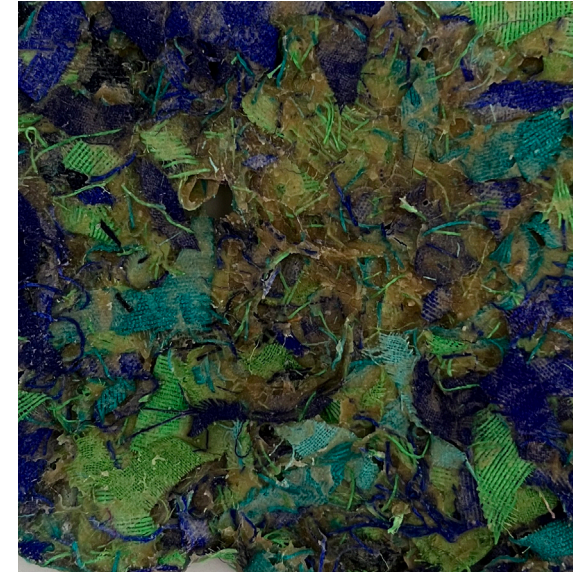


Figure 19: Exploration 8

Exploration 8

- 1 cup maida (flour)
- 2 cups edible gum
- Heat the mixture



Figure 17: Exploration 6

Exploration 6

- 1 cup maida (flour)
- 2 cups diluted saras
- Heat the mixture

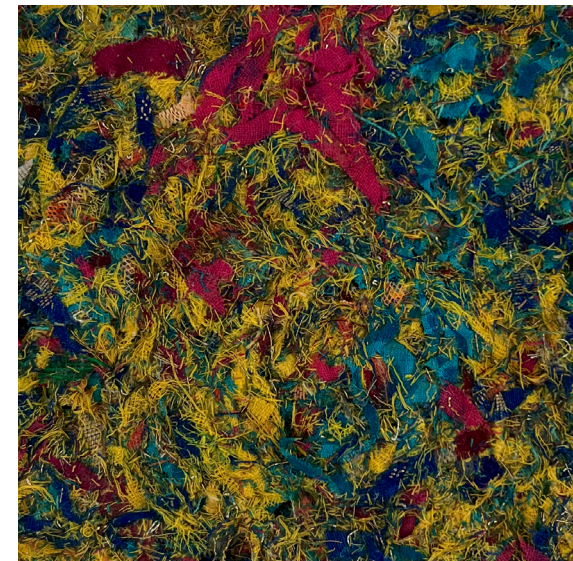


Figure 20: Exploration 9

Exploration 9

- 1 cup maida (flour)
- 2 cups boiling water
- Heat the mixture

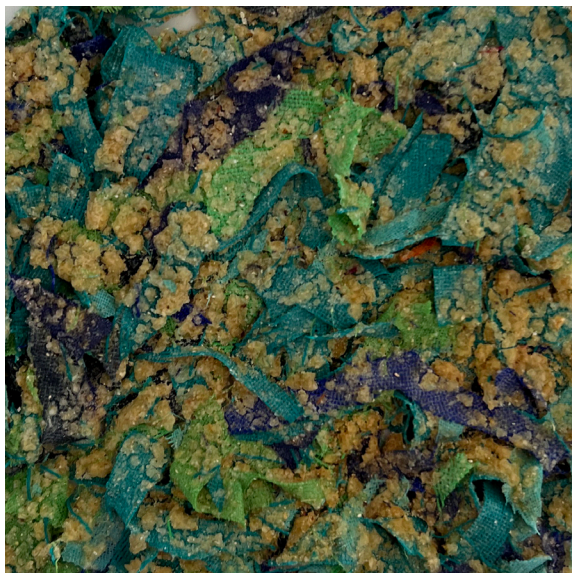


Figure 18: Exploration 7

Exploration 7

- 3/4th cup water
- 1/4th cup corn starch
- 1 table spoon vinegar
- Heat and stir the mixture
- Mix it with 1/4th cup cornstarch and cold water after it cools down

From these explorations I was trying to make the binding material sustainable and natural. But it certainly did not solve the purpose of use for a long period of time. The edible mixtures I used sustained without getting fungus or bad smell but couldn't see these composite materials being used somewhere. The positive outcome for the experiments was the techniques I used to make the matrixes and mixed it with the reinforcements were successful in terms of binding the materials and remained undamaged even if edibles were used.

As the pandemic restrictions were eased, I was able to get the scrap from Fabscrap. I bought the shredded fabrics. These fabrics are recovered from garment manufacturing units in New York City, and have been down-cycled into shoddy as a sustainable alternative to destruction and discard in landfill. This shoddy is generally used in mattress fillings. How I started working on shoddy was initially I tried to bind it through adhesives, checked how heat press worked on it, etc. I eventually started felting it through a machine. Felting doesn't require any additional element to bind the yarns together neither does it use a lot of non-renewable resources.

EXPLORATION AT THE TEXTILE STUDIO

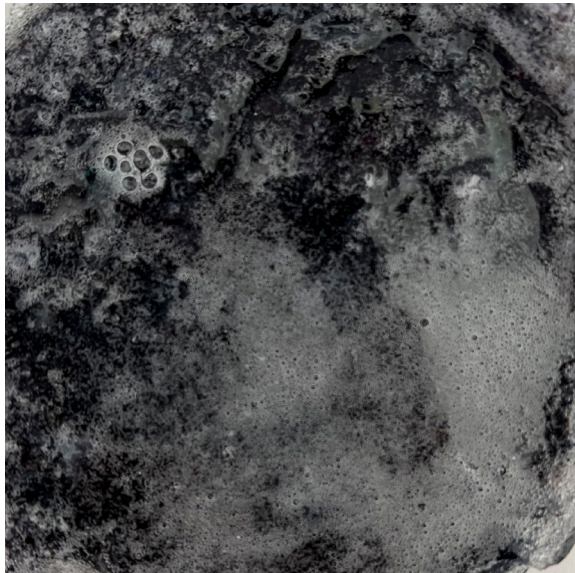


Figure 21: Exploration 10

Exploration 10

- Fibers mixed with eco plex resin

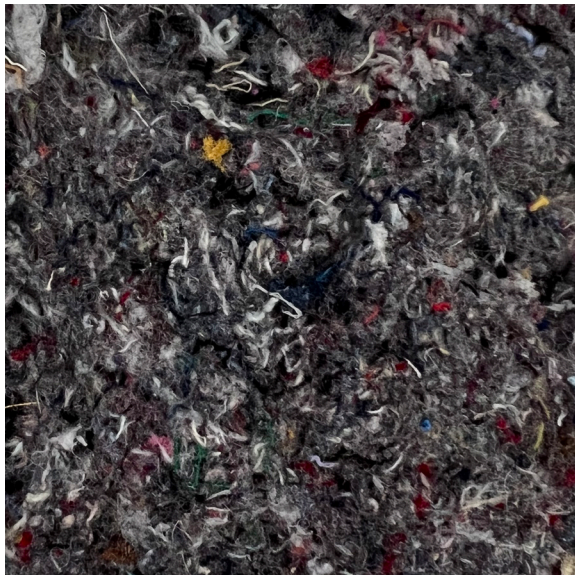


Figure 22: Exploration 11

Exploration 11

- Felting the fibers
- Felting with reinforcements

PROCESS OF THE DESIGNED MATERIAL



Figure 23: Step 1 : Shredded Fabric Scrap



Figure 24: Step 2 : Put the Scrap on a Fine Carding Tool (Hand Carders)



Figure 25: Step 3 : Carding helps to put the fibres in order



Figure 26: Step 4 : Remove it from the carders to felt it in an embellisher machine



Figure 27: Step 5 : Felting



Figure 28: Step 6 : Final Outcome

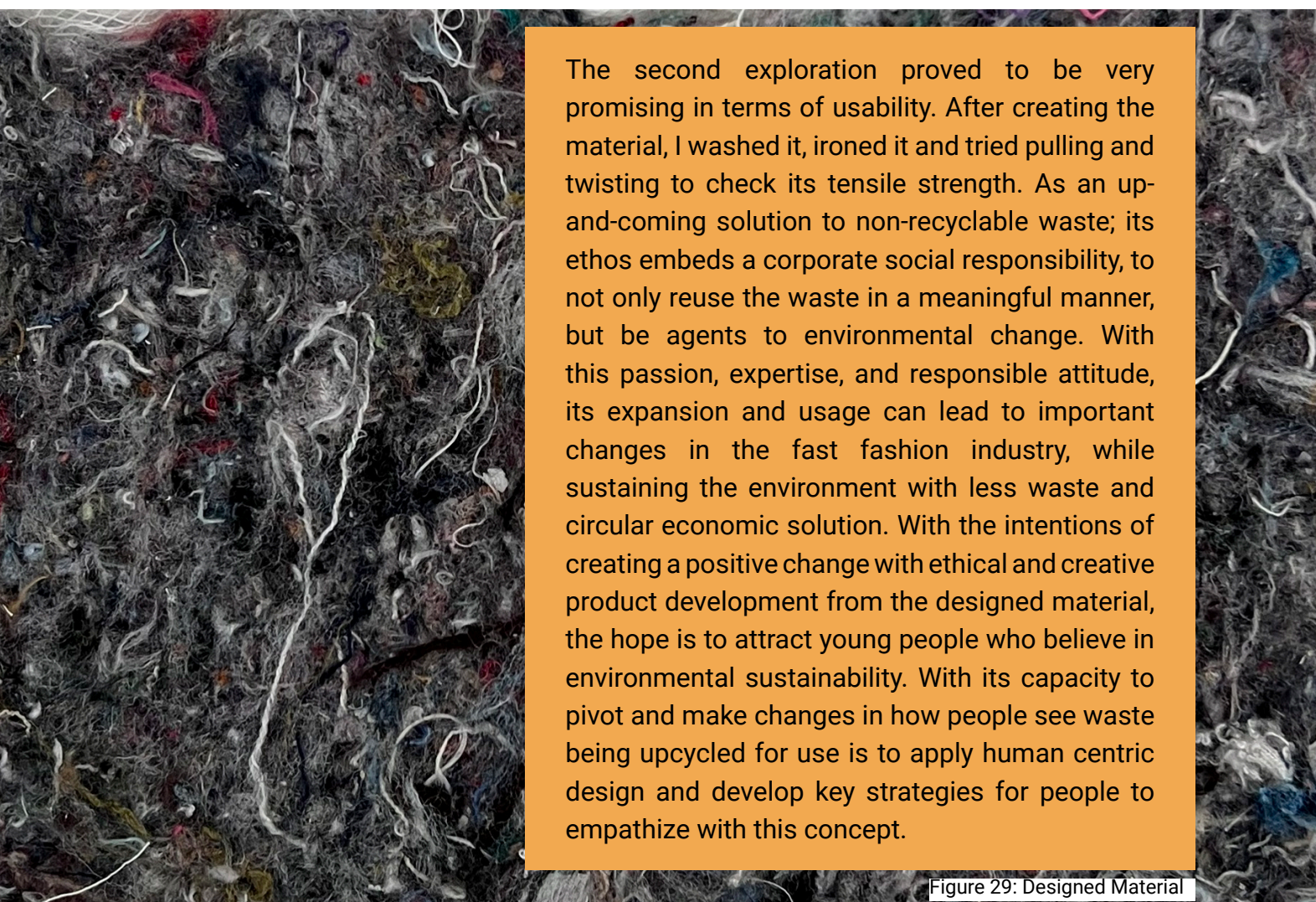


Figure 29: Designed Material

VALUE EVALUATION OF THE MATERIAL

To help see how the designed material would bring a change and help the consumers I built the value proposition canvas to define its value in a structured manner. A value proposition model helps to look at an innovation through a customer point of view (Osterwalder & Pigneur, 2010). Why would a customer buy or opt for a particular service? It communicates the benefits or loss to the customer. Diagram 7 visually represent the Value Proposition Canvas. This model justifies the circular design aspect from the research question - How might we reuse the textile waste generated during the garment manufacturing process for creating an upcycled usable new material to foster circular design? Circular economy means that products no longer have a life cycle with a beginning, middle, and end. Therefore, they contribute less waste and can actually add value to their ecosystem. When materials stop being used, they go back into a useful cycle, hence the circular economy (MacArthur, n.d). The designed material rationalizes how it is made out of waste without adding any additional matrix or reinforcement to it. The lifespan of the waste is increased before throwing it to the landfills. Through the value proposition we can see how the customers are going to promote circular economy through it and what was considered waste has gotten a value to it.

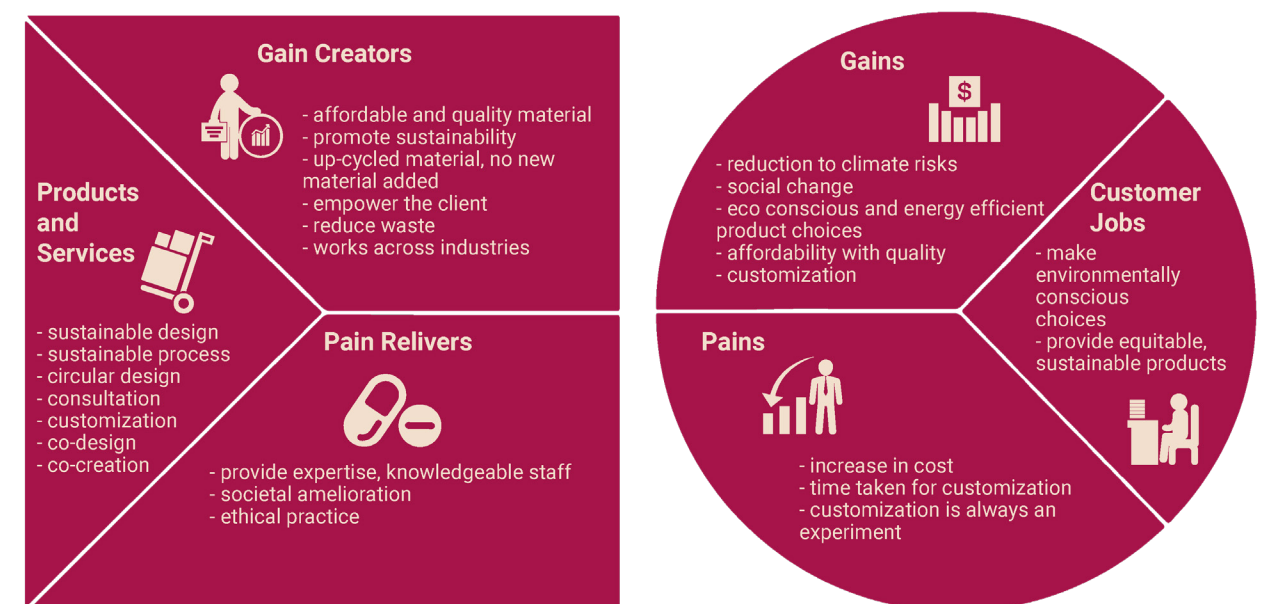


Figure 30: Value Proposition Canvas

Product and Services

The designed material is the key product with the value of sustainability and circularity in the design process. The term sustainability is preached by many but practiced by few. The designed material has been developed from the waste which would go to the landfills. Not only its creation is helping in create a circular economy but the process of making it sustainable as well. The designed material not only solves a single purpose for the

customer like “one size fits all” but it hinges on custom creation to the customer’s needs. It can be customized in terms of weight, adding another material or the future usage of it. The product will benefit the customer on a personal, social and emotional level.

The services rendered during the process will be sourcing, production, sales and consultation on designing the customized fabric for the best fit. Assistance during buying or trying a new material helps in the design process specially if the material is introduced for the first time. The co-design process helps the customer understand and compare different properties of the material while trying different compositions.

Pain Relivers

Pain relivers describe how the products and services reduce customer pains. The opportunity to promote circular economy, sustainable growth in the fashion industry and societal amelioration. This product will help produce savings in terms of effort and customer satisfaction. The effort designers put in to prove their conscious choices of materials or adapting sustainable practices could be shown via this product. It kills the frustrations and annoyances of continuously have to prove that. This would also wipeout negative social consequences the customers would encounter or fear in terms of loss of trust and status among their targeted end users.

Gain Creators

This part outlines how the designed material benefits the customer segment. The desire to positive approach towards waste and upcycled materials. The main gain by using this is the customer proves their little step towards sustainability and circularity which gives them the satisfaction of doing so. By providing a quality material with generating no waste with usability, accessibility and freedom to customize. The users will create a positive social status with improved and better-quality product. The material will be a good replacement for new synthetic materials, foam, plastic coated sheets used for padding, etc. The material can make a difference by producing less waste by new materials.

Customer Jobs

Customer jobs here are referred to how the customers want to be perceived by others and their role to accomplish a particular task. Customers buying the material are satisfying their material requirement for product development. Making environmentally conscious choices, these customers want to portray themselves as sustainable, eco conscious individuals. They are taking their steps towards reduction to climate risks, global warming and carbon footprint. This material provides with their need of an upcycled fabric which helps their raw material consumption requirements. They feel a part of ethical fashion with the responsible sourcing of this material. They interact with the business to explain

their needs and vision through this material. The customer needs to explain how they are going to use the material in order to get assistance for customization. They are a part of the of the whole product development process from co creating the material, designing the product, production and sales. Wearing multiple hats, the customer ensures sustainability in the whole process.

Pains

Paints describe everything that irritates the customer before, during and after trying to do the work. The pains could be the risk of poor customized material in terms of the weight or reinforcement type chosen by the customer which doesn’t work well for their desired outcome. The wait time to get the customized material could slow down their work which would risk their project. On the other hand, cost increases in customization process which would affect the price of their products as well as their investments. The fear of technically getting the customization request right and the financial risks would make the customers feel anxious and create persistent worry of their outcome. These frustrations and annoyance could lead to them being hesitant to choose this material or to incorporate this material in their design process. The material being introduced is new and hence the learning curve for everyone in the part of developing and using it is increasing over the period of time. The pains in the initial stage can be the trial-and-error approach in designing it.

Gains

The biggest customer gain is the value of a product made out of waste and creates circular economy. The quality is uncompromised and co creation gives the customer freedom to develop it according to their requirements. The expected gains will also include the tenacity to do something for the environment which goes beyond the desire to just buy a sustainably made product. Affordability with quality and adopting to social changes makes the individual value the product. This could also be a status symbol for the users to portray their conscious choices with gaining respect from individuals who see them sing it. They could stand out amongst their competitors through the choice they have made and desire to invest in it more.

MAKE THE UNACCEPTABLE, ACCEPTABLE

To make this material accessible for people to buy and how will the process of customization happen, I used the Business Model Canvas to outline the idea for implementation. The business model canvas is a great tool to help understand a business model in a straightforward, structured way. Using this canvas will lead to insights about the customers the business serves, what value propositions are offered through what channels, and how the company makes money.

The types of business model I think would work for the innovation would be a combination of long tail and unbundled business model. This combination works both in commercial markets and social sectors as per their definitions. This strategy maximizes social impact and increase revenue by creating new enterprises. The Long Tail Business Model works by selling a wide variety of niche products, which individually sell very little, but which in total generate high sales volume (Osterwalder & Pigneur, 2010). In general, businesses focus on marketing and selling a reduced number of profitable popular items. So, they make money by selling large volumes of a few items. The long tail business model does the opposite. It focuses on selling large numbers of unique items, niche products. On the other hand, the Unbundled Business Model is defined for three fundamentally different types of businesses – customer relationship businesses, product innovation businesses and infrastructure businesses (Osterwalder & Pigneur, 2010). The product innovation in this type of business model will enable premium prices and large market share due to the innovation. Rapid consolidation and high cost of customer acquisition makes it imperative to gain large number of customers. The business model in Diagram 8 reflects the combination of these two models.



Figure 31: Business Model Canvas

This business model is a hybrid of the long-tail model and focuses on the product innovation side of the Unbundled Business Model (focus on customizations). The material also has characteristics of mass customization with flexible add-ons to tailor-make the material according to how the customer wants to use it. It matches suitable niche groups like small businesses who have a sustainable circular design approach in their design process.

Customer Segment

The customer segment firstly introduces the business’s client segment. The customers would be eco conscious designers who are willing to incorporate and introduced the design material in their products. Understanding the customer segment, allowed to develop a business model that connects to eco-conscious customers. They identify themselves as sustainable designers supporting circular economy through their work. It relies on the wealth of knowledge from partners and stakeholders. The product is a connecting point between the waste created by the fashion industry and product designers. Through this material the indented value is to adapt to the existing materials available and not produce new in order to meet the supply needs. The fast fashion industry has introduced low quality materials and cheaper garments which has huge market demand but, in the process, sustainable aspects of renewable and non-renewable is compromised. It is important to look back in the process to make it more sustainable and environment friendly. Hence the introduction of this material will give a longer life to the non-recyclable fabrics which are the by products in the garment making process a longer life.

The product will deliver its key value propositions to its customer segment through channels that spread awareness of their proposition, engage, and acquire customers. Customers can customize the fabric in terms of weight, size and additional reinforcements. Revenue stems from material sales. Customizations and add-ons allow for increased revenues. Customer relations are key in enabling revenue generation from the customer segment and developing partnerships.

Key Propositions

The material is built for the purpose of promoting circular economy amongst sustainable designers who would adopt it for product development. This is a futuristic approach of non-recyclable textile waste generated by the fast fashion industry. Recycling consumes a lot of energy and new materials require raw materials but upcycled materials do not use excess of either of the resources. The product will deliver three primary value propositions to its customer segment:

- Circular Design: The design thinking approach that underpins this innovative material is that it allows one to explore new ways to create sustainable, resilient, long-lasting value in the circular economy – giving the creative confidence to redesign the world around you.
- Sustainability: The sustainability factor of the designed material is its origin from scrap. Non-recyclable waste is converted to a usable material with energy-efficient processes, use of renewable energy sources and ecologically regenerative development processes.
- Customizability: Provides material buyers with customization options of the weight of the material, layers and reinforcement options that fits their unique values and needs.

Channels

Channels are the desired way to reach the customer segment. How to reach the designers through different platforms? Strategically approaching would include spreading awareness of what they offer to their customer segment through a brand strategy. This comprises of online advertising (e.g., social media), product sales in pop ups, engaging customers through local community events, one-on-one meetings, public forums, and co-creation events. But initially the customers have to be approached through one-on-one meetings to get the word out in the community. The channels are integrated through the digital media which is the most efficient and fastest mode of communication these days.

Customer Relations

The company relies completely on the customers for growth and retention. The channels will promote and help in building the customer base. The experience building and connecting with them would strengthen long term connections. The customer relations are not only limited to the sales of the material but also with the channels that supply the raw material. Industry connections help spread the word and also give rise to potential projects and innovations. For example, FabScrap supplying the raw materials could also become a potential buyer of the material. They have a huge customer base which could be profitable to both the businesses. According to the current proposed plan, the product will interact with the customer segment in three distinct ways:

- Personal Assistance: Custom design for designers and test a variety of structural and aesthetic customizations.
- Co-creation: Co-creation workshops help new and existing customers to form relationships through facilitated design activities that help them build an innovative product.
- Personal Interactions: To introduce this material initially connecting with a large number of designers will be the plan of action. Meeting the designers who have conscious approach in the materials they use will be prioritized.

Revenue Streams

Revenue generation is key for a business to sustain. Sales of the material, products and custom-made materials will be the revenue generation stream. The creative element of introducing an upcycled material will provide justification of higher costs of the material. Initially the small market size and the startup of the business might be challenging in terms of revenue generation but the investments would help with eventual growth, expansion and building capital. The material value proposition will enable revenue generation through asset sales of completed standard and custom-built fabrics. Custom options including weight, size and reinforcement material choice, enable an additional fixed-price revenue

stream.

Key Partners

The key partners would be nonprofit organizations like Fabscrap who have the reach and access to all the waste the big fast fashion brand discard. Supplier relations are leveraged to purchase raw materials and supplies at competitive rates. They can collect, sort and shred to make it easy to card and felt.

The designers who focus on sustainable product development would be major external partners for selling the material. Financial support through loans and lines of credit will make banks and financial investors partners. Above all the skilled worker's team to make the material. The human resources are key for production, packaging, selling, marketing and collaboration.

Costs & Required Resources

For the revenue to surpass the cost, the business needs to monitor the fixed and variable costs for the three years. Capital expenditures will require funding from internal investment equity and external financial support from banks, other financial partners, and government grants and loans.

Variable costs that should be actively monitored include:

- Labor
- Raw material costs
- Import & export cost
- Marketing and customer service costs (at an hourly rate)
- Partnership costs for selling products in local stores
- Legal costs (i.e., Intellectual property, permits, contracts, etc.)
- Research and development

Fixed costs include:

- Manufacturing unit rent
- Utilities

With the prototyping and exploration, many small steps got to the current situation, and it will take many more hopeful gestures to move on to the preferable future. The material designed was a breakthrough in this research project. It justified all the aspects of the research question. The value evaluation through the proposition canvas helped in identifying the pros and cons of the material to the customers or end users. Building onto it the business model canvas laid a clear picture of how could the material be out in the market. The resources required to scale this project up and the channels through which it

will be supplied to the customers. This structure and system might change with the shift in power dynamics or stakeholder influence on each other over the period of time. It could also result in a more diverse ecosystem of businesses and initiatives and do good for the society.

CONCLUSION AND NEXT STEPS

This research project aimed to identify How might we reuse the textile waste generated during the garment manufacturing process for creating an upcycled usable new material to foster circular design? Based on the research and analysis of the waste generated by the fast fashion industry during garment manufacturing I reused the waste fabric pieces to create a new upcycled material. The literature review helped in understanding the current practices, upcoming changes and the futuristic sustainable approach progress. It also gave me a direction and organization on sourcing the waste fabric for exploration an experimentation. Further the system analysis was the base to map out all the stakeholders in the industry, the working style and practices, secrecy in the supply chain and unethical practices. This explained the power dynamics and influence of the stakeholders on each other in terms of resources, man power or the financial stability. I identified the loopholes in the system and the horizon scan gave me a clarity where the interventions could be introduced. Apart from the aim of this project I was also able to identify a few other potential intervention spots like ethical practices and transparency issues in the system where change could be helpful in the future. Pondering on the scope of the project it was necessary to consider the limitation of studio access which included using the tools and machinery due to the pandemic. Thus, in the initial phase all the explorations were done at home. I found those to be interesting in terms of explorations but the challenge was to foresee it being used in the real world. Post pandemic explorations were rather a practical fit for industrial use which answered my research questions on creating something new completely out of waste, can replace a few existing non-recyclable materials used in the fashion industry and doesn't add to additional waste in the landfills. This new material could be a great contribution in the fast fashion industry till they eventually adapt to more sustainable approach. To build value for this innovative material I further developed a business model. This assisted my thoughts in foreseeing this material being used and how could I put it out for the people to use it. It's important to think about the benefits of circular economy and why is it crucial in order to understand why would anyone use this material. Circular economy protects the environment, benefits the local economy, drives employment and leads to less dependency on new raw materials. By reusing and redesigning we would be reducing the usage of new materials hence fewer fabrics go to landfills.

How might we move from our current reality to a more hopeful future?

The next steps for me as a primary researcher in this project will be to continue building a stronger business model through different perspective like demography, geographical location and funding opportunities. More in-depth speculative business models could also be developed to delineate their practical, financial and logistical viabilities. With better studio resources I will be exploring more combinations of reinforcements and material design for expansion. It is my sincere hope this project gets funding and support from stakeholders in the industry to partner with a become a changemaker for a sustainable future.

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