UHASSELT

KNOWLEDGE IN ACTION

Faculty of Business Economics

Master of Management

Master's thesis

Fashioning a Sustainable Future: Circular Models, Emerging Technologies, and Social Responsibility

Nicolò Sproviero

Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Strategy and Innovation Management

SUPERVISOR :

Prof. dr. Jean-Pierre SEGERS

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Executive summary

1. Research Purpose

The fashion industry is facing enormous pressure to evolve from its traditional linear "take-make-dispose" model toward sustainable and circular business practices. The industry is one of the main contributors to environmental pollution. It needs to address main challenges such as excessive resource consumption, waste generation, and unethical labor practices. The rapid growth of consumer awareness, particularly from younger generations like Millennials and Gen Z, drives the demand for transparency, ethical production, and sustainable alternatives even more.

This study explores how innovative business models can reshape the fashion industry by incorporating circular economy principles, sustainability practices, and technological advancements. Artificial intelligence (AI), blockchain, and data analytics offer new opportunities to optimize supply chains, reduce waste, and increase transparency. These innovations support the industry's change to environmental responsibility and ensure profitability and long-term competitiveness.

It highlights the importance of integrating circularity with new technologies to address the goals of sustainability and profitability. It investigates how emerging business models can align with global targets like the United Nations Sustainable Development Goals (SDG 12), which focus on responsible consumption and production. This alignment is essential as brands want to meet societal demands while balancing economic success with social and environmental accountability.

During the analysis of the current industry trends and key challenges, the study wants to provide valuable insights into how fashion companies can move to circular and sustainable business models, promoting innovation and driving measurable progress toward a more responsible industry.

2. Research Methodology

The researcher used a qualitative approach to analyze the integration of circularity, sustainability, and emerging technologies within the fashion industry. Data collection was conducted through semi-structured interviews to have in-depth insights from different types of respondents. A total of 8 interviews were conducted, targeting participants from various sectors, including private companies, educational institutions, and industry professionals, giving a well-rounded perspective.

Due to geographical limitations, the 8 interviews were conducted online, each lasting an average of 45 to 60 minutes. This allowed for real-time discussions and dynamic exchanges. The interview format was carefully designed with tailored questions to address the key themes.

The diversity of the interviewees allowed for getting different perspectives, improving the reliability and accuracy of the findings. Data analysis followed a thematic approach, where key insights were categorized to highlight recurring patterns, critical challenges, and opportunities for transitioning toward sustainable, circular business models.

This methodological framework guarantees an in-depth study of the research issue. It offers insights that fill theoretical and practical gaps in the fashion industry's efforts to innovate and embrace sustainability.

3. Findings

After the interviews were finished, the researcher identified significant challenges and opportunities in integrating circularity, sustainability, and emerging technologies within the fashion industry. Financial,

technological, and social barriers continue to slow progress, while change remains achievable through innovative strategies and collaborative efforts.

One of the primary obstacles to adopting sustainable and circular practices is the high financial investment required. Infrastructure development, technological integration, and workforce training demand considerable resources, which can be prohibitive, particularly for smaller businesses. Effective financial management and the exploration of alternative funding solutions such as public-private partnerships, are crucial to overcoming these problems.

Technological limitations and the lack of skilled personnel competent in advanced tools like artificial intelligence, blockchain, and data analytics is a challenge. While these technologies offer potential options to optimize supply chains, reduce waste, and increase transparency, their implementation is often compromised by over-reliance, inefficiencies, or misinformation. Businesses need to find a balance between leveraging technology and addressing the gaps in expertise and infrastructure that are present in the industry.

The study shows ethical and social concerns as critical issues that businesses must confront. Algorithmic biases, unreliable supply chains, and the risk of greenwashing undermine trust in sustainability initiatives. Ethical governance, clear communication, and transparency are essential for the right use of emerging technologies and circular models to operate responsibly and equitably. This is especially important as privacy and fairness in decision-making processes become increasingly central to both public and regulatory examination.

Social acceptance also emerges as a significant barrier to circular fashion models. This is driven largely by limited consumer awareness and understanding of the benefits of sustainable innovations. Many consumers remain resistant to change, particularly when they perceive circular models as compromising affordability or quality. Public education and transparent communication about the tangible benefits of circular and sustainable approaches are critical for increasing wider societal acceptance. Notably, younger generations, such as Millennials and Gen Z, demonstrate a stronger willingness to engage with ethical and sustainable brands. However, this enthusiasm has yet to translate into broader, society-wide adoption.

Collaboration between public, private, and educational sectors is highlighted as a foundation for progress. Stakeholder engagement is pivotal for advancing sustainability initiatives, driving innovation, and addressing systemic barriers. Without cross-sector cooperation, meaningful and lasting change in the fashion industry remains difficult to achieve. Furthermore, the ongoing tension between profitability and sustainability remains central to the industry's transformation. Brands such as Patagonia and Reformation demonstrate how circular economy initiatives, such as repair programs, recycling, and resale, can effectively reduce waste while maintaining profitability. On the other hand, fast fashion brands like H&M face greater challenges due to the scale and speed of their production models, which continue to be fundamentally opposite from sustainable principles.

The findings show that while circular and sustainable business models, supported by emerging technologies, hold significant potential for transformation, several barriers must be addressed. Financial investment, technological expertise, and societal resistance are critical hurdles that demand targeted strategies. Clear communication, ethical governance, and multi-stakeholder collaboration are essential for

driving systemic change and ensuring the successful integration of sustainability and circularity within the fashion industry.

4. Critical Considerations and Recommendations

The research highlights critical challenges and offers actionable recommendations for overcoming barriers to integrating circularity, sustainability, and technology within the fashion industry. Addressing financial limitations, expertise gaps, social acceptance, and ethical concerns is pivotal to achieving systemic change.

Financial limitations remain a substantial obstacle to the successful implementation of sustainable and circular business models. The transition requires significant investments in infrastructure, advanced technologies, and workforce development. Look at other funding models like impact investing, crowdsourcing, and public-private partnerships to help ease the pressure. Policymakers and city planners can use these models to promote innovation while ensuring long-term economic feasibility.

Another critical issue is the lack of skilled personnel competent in technologies necessary for sustainability, including artificial intelligence, blockchain, and data analytics. Overcoming this gap requires a focused effort to develop educational programs and training initiatives that help workers with the expertise needed to drive technological innovation. Collaboration between educational institutions, industry leaders, and policymakers can create pathways to improve the workforce, accelerating the adoption of advanced tools that raise operational efficiency and reduce waste.

Social acceptance and trust in sustainable practices remain key determinants of success. Public resistance, fueled by limited understanding and skepticism toward new models, highlights the need for transparent communication and educational initiatives. Citizens and consumers must be informed about the benefits of circular economy approaches and technological advancements, particularly how they align with ethical practices and address privacy concerns. Open and ongoing dialogue with consumers makes sure that emerging solutions are embraced, increasing a collective commitment to sustainability.

Ethical considerations, such as transparency in supply chains, algorithmic fairness, and accountability, must be prioritized to build trust in circular and sustainable practices. Companies must implement clear ethical governance frameworks that address issues like greenwashing and exploitation, making sure that sustainability efforts align with societal values and regulatory requirements. Improved data transparency, supported by blockchain technology, can allow brands to track and communicate their progress toward sustainability goals, further strengthening consumer confidence.

Collaboration among stakeholders is another critical factor. The research underscores the importance of sustained cooperation between public and private sectors and educational institutions to drive innovation and overcome systemic challenges. Policymakers play a vital role in creating regulatory frameworks that support ethical practices. At the same time, private companies must lead by example through tangible commitments to circular economy initiatives and responsible business practices. Cities and companies can collaborate to achieve sustainability and profitability by cultivating these kinds of alliances.

The research also recommends regular monitoring and evaluation of sustainability initiatives to measure their cost-effectiveness and long-term impact. Implementing rigorous review processes allows companies to optimize resource allocation and continuously improve their operations. Measurable progress toward

environmental and economic goals is guaranteed by such evaluations of investments in technology and circularity.

Lastly, expanding the scope of future research is essential to address the limitations identified in this study. A broader analysis that includes diverse geographic contexts, particularly developing countries, can offer richer insights into the economic, cultural, and regulatory factors that influence sustainable transitions. Perspectives from governmental bodies would further increase the understanding of policy-making processes and their role in driving systemic change.

In conclusion, achieving a sustainable and profitable future for the fashion industry requires a multi-faceted approach. Financial support, workforce development, social engagement, and ethical governance must align to overcome current barriers. Businesses can successfully integrate circular economy practices and emerging technologies by implementing innovative funding models, fostering collaboration, and prioritizing transparency. These recommendations provide a pathway for companies to balance profitability with social and environmental responsibility, contributing meaningfully to global sustainability goals.

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1. Problem statement

In recent years, the global fashion industry has found itself at a critical crossroads. It was historically structured around a linear "take-make-dispose" model, now the sector faces intensifying pressures to address sustainability problems and incorporate socio-environmental considerations into its core business strategies. The change from a profit-only business toward approaches that integrate circularity and sufficiency has become increasingly urgent, as the old system cannot meet emerging environmental targets or evolving consumer expectations (Colombi & D'Itria, 2023).

The urgency for a new paradigm in fashion is driven by unsustainable production cycles, persistent overconsumption, and increasing waste. At the same time, there is a rising global awareness of eco-friendly and ethical practices, causing many companies to adopt circular strategies that minimize resource collapse and environmental damage. With its garment collecting initiative, brands such as Patagonia exemplify the nascent transition toward models that recirculate materials and prolong product life cycles (Gossen & Niessen, 2024). These shifts align with global sustainability agendas, including the United Nations' Sustainable Development Goals (SDGs), and reflect a collective drive toward more responsible production and consumption patterns.

Similar to the challenges that other sectors are facing, where innovation has requested the development of sustainable solutions, the fashion industry also demands a fundamental transformation. Accelerating interest in the circular economy underscores a restorative and regenerative outlook, encouraging resource reuse and recycling as opposed to conventional, linear operations (Hossain et al., 2024). Furthermore, emerging sufficiency concepts call for reduced production levels and greater respect for ecological limits (Gossen & Niessen, 2024), reframing profit-making to include the long-term well-being of both societies and ecosystems.

Contemporary consumers, particularly Millennials and Generation Z, increasingly value transparency, social justice, and environmental management. They show a stronger willingness to invest in sustainable fashion choices. This is an important market signal that sustainable and circular approaches can create both ecological benefits and commercial returns (Todeschini et al., 2017). Societal demand for fairness, ethical labor conditions, and reduced ecological footprints now influence corporate reputation and long-term competitiveness. These generational preferences reinforce the statement that sustainability and profitability don't need to be at odds.

Technological innovation is fundamental in advancing the circular economy within the fashion sector. AI-based trend forecasting to blockchain-enabled supply chain transparency, promises to optimize resource use, minimize waste, and foster trust with stakeholders. These digital tools can offer more intelligent, responsive, and responsible operations by enhancing product life cycles, reducing inventory inefficiencies, and verifying ethically sourced materials (Piana & Brustolin, 2023; Casciani et al., 2022).

Blockchain technologies can strengthen traceability and ensure ethical procurement, while AI-driven analytics help predict consumer demand, preventing overproduction and excess inventory. Data analytics further refine decision-making around material usage, energy consumption, and waste generation, enabling real-time adaptations in line with sustainability benchmarks. These integrated digital solutions

match the mission-oriented frameworks in other sectors, addressing not only environmental and social challenges but also strengthening economic viability over the long term.

Nevertheless, the implementation of circular and sustainable strategies in the fashion industry is not without challenges. High initial costs, fragmented global supply chains, and the inertia of firmly established business models pose hurdles. As in other sectors where sustainable innovations must be carefully aligned with market dynamics, the fashion industry must navigate these complexities to ensure that circular models do not remain theoretical ideals. Brands such as Patagonia, Reformation, and H&M illustrate varying degrees of integration between sustainability goals and technological adoption, providing case studies that highlight both progress and persistent struggles (Bulović & Čović, 2020; Thorisdottir & Jóhannsdóttir, 2019).

This research examines how emerging circular and sufficiency-focused business models, enabled by technologies like AI, blockchain, and data analytics, can adjust the fashion industry with the principles of SDG 12 to preserve competitiveness. It seeks to identify practices that reunite ethical sourcing, environmental stewardship, and economic returns. The dissertation will first review the theoretical frameworks of circular economy and sufficiency, then explore how firms integrate sustainability and digital innovation into their operations. By conducting a comparative analysis of leading brands, this study wants to show pathways for the fashion industry to transition from linear, exploitative models toward sustainable, inclusive, and suitable for future business strategies.

Figure 1: SDGs (University of Siena)

2 Literature review

2.1 Introduction

Fashion is a dynamic sector that includes different types of faces than just the one the crowd sees. It goes beyond apparel and accessories; it shapes trends and lifestyles, influencing personal identities for people who see clothes to identify in something, making it a real cultural and economic force. The fashion business models moved from traditional boutiques, cause of the various industrial revolutions, technological advancements, and, most recently, sustainability requirements. Understanding how these models have changed is very important because of the unsustainable nature of the field in all the years gone by.

The concept of unlimited growth has been changed by emerging business models that stress sufficiency, which calls on these companies to reduce output and consumption within ecological limitations (Gossen & Niessen, 2024). Managers must look more at sustainability in their decision-making process to find new ideas and models to help them realize these objectives.

Because of digital technology and sustainability, fashion brands create value, interact with consumers, and manage production by dual forces. The COVID-19 pandemic has helped the rapid rise of the transformation of online purchasing into a new world of direct-to-consumer (DTC) activity. For example, during the pandemic, many brands, including Nike, moved directly to business models that talked directly with the consumer because of a demand-supply shortage caused by the impossibility of going to a retail store. Since that time, Nike has continuously used digital technology, such as AI and customer data analytics, to improve consumer engagement through personalized online experiences and allow quick market responses in new ways (Huynh, 2021).

Retail stores are now being substituted by e-commerce, and brands are changing their business models with a greater focus on digital presence and operational agility. With these changes, fashion is moving into the digital age (Madsen et al., 2020). There is also a growing demand for brands to innovate and promote sustainability. Patagonia is a perfect example. The company pushes for environmental activism and has sustainability initiatives. Patagonia's Worn Wear program is the ideal activity to describe the company's commitment to sustainability which consists of motivating its customers to repair, reuse, and recycle their products. This represents a sufficiency-based business model that challenges traditional views of continual endless growth (Provin & de Aguiar Dutra, 2021).

Clothing companies are also becoming more aware of the need to change their practices by reducing their environmental impact and improving supply chain transparency. Emerging business models that explore new ways of business, highlight how brands are trying to find a balance between a profitable business without excluding an important need for sustainability. The industry's movement, toward much more responsible consumption and production, shows that it has started an era of innovation and adaptation to meet consumer trends regarding climate and ethical consumerism.

This literature review examines the value of research on emerging business models in the fashion industry and how technology, consumer behavior, and sustainability affect these cases.

2.1.1 Overview of Business Models Across Industries

The business model shows how a company creates value, generates revenue, and connects with customers. The fashion business models have changed significantly because of technological evolution, consumer behavior changes, and globalization. The industry has many market layers, including custom designing and fast fashion. Each market segment has its particular attributes and ways of operation (Thompson & Haytko, 1997).

The fashion industry has evolved and changed a lot during the various ages in terms of business models. It all started with the small local artisans' craft tailoring the dress for the client and adjusting it when it was broken, so people could reuse it. Then, the business moved into the standards of large-scale mass production. In the 19th century, clothing was mainly produced locally and most of the time through artisan crafts. At the same time, haute couture was coming out, especially in France and Italy. The mechanization and industrialization that happened to every industry in the late 19th and early 20th changed the production as they started a massive production. This invention led to ready-to-wear clothing which was a trend in the 1960s. This evolution changed fashion, which had to use more consumer-oriented strategies instead of the haute couture where the product was at the center.

Another evolution that happened was fast fashion, which started in the nineties with brands such as Zara and H&M leading the way. These two companies completely changed the market by shortening their manufacturing time and satisfying the rapidly changing customer preferences (Caro & Martínez-de-Albéniz, 2015). Fast fashion produced cheaper, trendier garments at speeds unseen before, with the applications of worldwide sourcing and technological advancement. This contrasts with the previous two-season cycles, and for the first time, brands started putting out collections many times a year. Fast fashion uses social media and pop culture to attract consumer which sees cheap products as fashionable, in this way, they are more attracted to purchase, also thanks to marketing through social media (Todeschini et al., 2017).

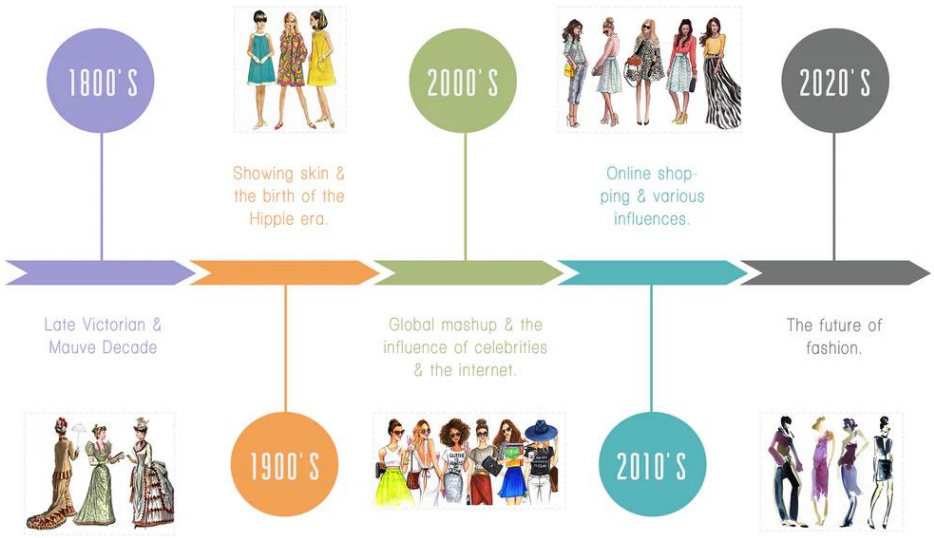

Figure 2: Fashion evolution (All Bags)

A global impact was seen in the world of fashion during the 20th and early parts of the 21st century through the decentralization of production and relocation to other countries with cheap labor. Businesses could expand their operations or reduce production costs, having the possibility to make fashion available to a larger audience. The rising demand for low-cost clothing caused this evolution as fast fashion brands became popular. Concerns have grown about labor conditions, especially in Asia. Nike is one of the most famous companies accused of this, taking the company as an example of resource and human exploitation, which caused a big issue for the businesses.

Fashion uses the globalization factor in many areas such as production and trade. In the Netherlands, almost half of the textile waste is exported to developing countries that don't have sorting or recycling facilities for this kind of waste (Dutch Textiles Material Flow Analysis, 2024). Paris, Milan, and New York remain top destinations for high fashion, but new entrants from Asia and Latin America are already adopting international styles. Gucci, a high-fashion brand, has already taken the step of producing lines meant for the Asian market, meaning that the demand there is already very strong. As a result, e-commerce bypasses borders, particularly geographical ones, allowing customers outside their country to access brands that were previously exclusive to their areas. The cross-border e-commerce industry is one of the fastest-growing segments of internet shopping worldwide, as it is a web outlet that targets new market participants (McKinsey and Company, 2021).

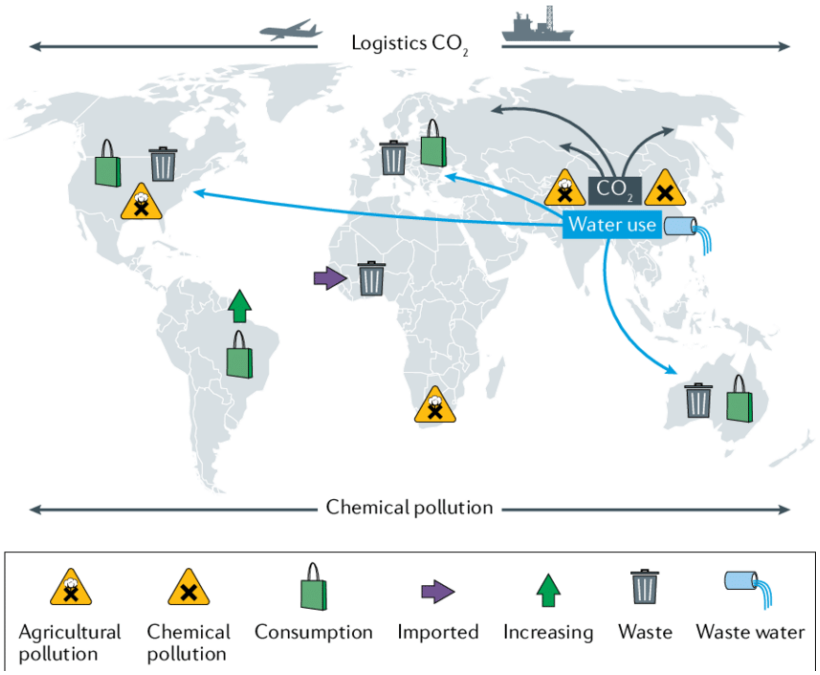

Figure 3: Global fashion (ResearchGate)

The McKinsey Global Fashion Index reported that the industry was worth $2.5 trillion as of 2019 but was seriously compromised by the COVID-19 pandemic, with a massive cut of 93% in profits in 2020 (McKinsey and Company, 2021). After this challenging phase, the industry started utilizing more environmentally friendly actual and economic production methods, ignoring changes in people's economic and production options.

Other than the global market, technological improvement helped the evolution of fashion. This is because all businesses, especially those in poverty and development, have shown a huge amount of technological growth potential. However, when new technologies are made, they are usually the focus of all the attention. Even though the Brazilian garment sector is still low-tech, it has seen significant advancements in production methods and technologies, but it does not rely much on R&D. The integration of advanced technologies, including automated fitting software and laser cutting machinery, has led to increased production levels and significant reductions in deterioration, which provides industries with a competitive edge in the global marketplace (Piana & Brustolin, 2023).

The new digital brands, e-commerce, and social media are opening extreme changes in how fashion is consumed, distributed, and marketed now (Kim, 2017). Online and social media have simplified operational procedures transforming it into new avenues to engage consumers (Rocamora 2013). This is a consequence of the industry that needed to change very rapidly for adapting to these digital strategy incorporation into new business models.

The technological advancement helped to reshape how fashion is viewed and delivered, but now there are concerns about the impact that fashion has on the environment. From a customer standpoint, brands in the fashion and other industries are pushed to adopt methods that reduce environmental impact. Consequently, they invested more in circular economy models, with strict standards for sustainable materials, and multiple steps to supply chain transparency. For example, because of the global transition to circular economy models, the Netherlands expects to recycle 30% of its textile content by 2030 (Dutch

Textiles Material Flow Analysis, 2024). Artificial intelligence, blockchain, data analytics, and other technologies are being used to improve supply chain efficiency, consumer engagement, and sustainability.

This involvement in going through a more sustainable business doesn’t collide with the use of traditional retail stores. The stores themselves are an attraction for traditional shopping. Macy's, for example, has a wide range of products but relies on customer traffic, with their larger inventory and expenses, and they use traditional advertising strategies such as television and print advertising to generate sales. The newest firms, such as Warby Parker and Glossier, are direct-to-consumer shops, eliminating the need for extensive physical infrastructure to reduce the cost of middlemen.

Reducing costs with the offer of better customization and targeting in marketing for more personalized customer experiences are the results of eliminating middlemen when creating direct relationships with consumers through online platforms.

COVID-19 had a significant impact on the e-commerce business, with much of the profit going directly to DTC firms. The pandemic period accelerated the need for companies to change their model, prioritizing having direct contact online with customers. E-commerce's portion of total retail sales increased due to changes in customer behavior resulting from the epidemic. (McKinsey and Company, 2021).

Many direct-to-consumer brands have emerged as market leaders. Warby Parker, Glossier, Casper, and Allbirds have all effectively executed direct-to-consumer models for eyewear, beauty products, beds, and footwear. Other sectors set an example that the fashion industry could be inspired by. Harry's and Dollar Shave Club have disrupted the men's hygiene market by selling razor subscriptions, while Away has revolutionized the luggage industry. This includes e-commerce and moving beyond accessibility to sustainability, transparency, and customization. Brands like Patagonia have integrated the DTC philosophy, which stresses environmental activism through various programs, that push for recycling or reusing goods to extend their life cycles (Provin & de Aguiar Dutra, 2021).

The current situation of the fashion industry has seen significant change and modification over the years, with globalization, digitization, and sustainability requirements. Following these changes is critical for a company to remain competitive in an industry whose rapidly changing market has faced worries about transparency, sustainability, and innovation.

2.1.2 Importance of Studying Emerging Business Models

The investigation of new aspects related to business models will keep an eye on how a company manages difficulties related to the presence of digital technology and associated safety concerns.

Emerging business models like the sufficiency-oriented, are pointing in a new direction for the industry. Sufficiency-oriented business models focus on ways to make products emission-free and customizable for the user with a maintenance plan and a lifetime (Bocken & Short, 2016). They are all about finding a balance between profit and social responsibility (Bürklin and Risom, 2020).

The Circular Economy is an emerging model that can provide numerous options for reducing waste in the environment through reduced consumption and demand (Provin & de Aguiar Dutra, 2021). The Business Model Canvas can help a business analyze future models to react to evolving consumer experiences and the environment in general (Becker & Bröcker, 2021).

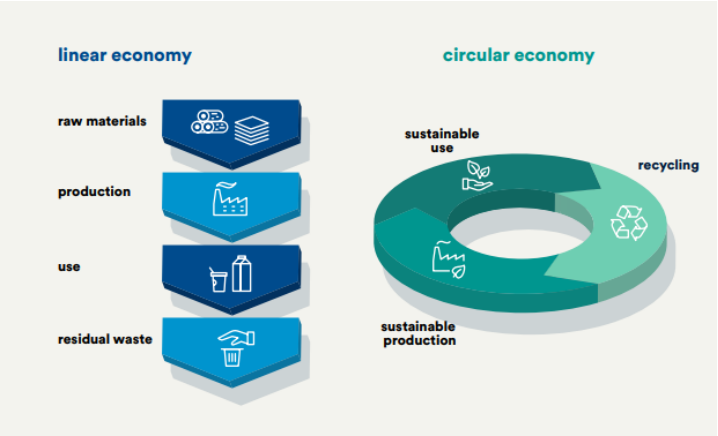

Figure 4: Linear and Circular economy (TOMRA)

The new fashion style that has turned into a whole industry is based on circular business models. This comes from companies' worries about how the old "take, make, and dispose" production models hurt people and the environment. For instance, the AMEND goal of Circular Economy (CE) is to reduce waste by improving the lifespan of products, cost-effective recycling of materials, and less consumption of resources. Using sufficiency-based business models offers another option because their purpose is to reduce net production and consumption altogether, because of the multifaceted characteristics of most typical multi-product circular business models in the current state. These days, one of these creative brands is Stella McCartney which tries to include all the characteristics of an innovative fashion brand (Gossen & Niessen, 2024). Their sustainable initiative is the most talked-of example of circular economy practices in the fashion industry.

Studying how these models can contribute to the internalization of value, competitive advantages, and quick technological advancements within the fashion sector reveals how some models can contribute to such an experience. Zara's business model, which includes both AI and RFID technology, enables fashion companies to run more efficiently while considering sustainability issues in real-time data and reducing inventory waste (Data en AI - Zara 2024).

Just like other industries, fashion also has a particular business model essentially based on a relationship with consumption culture, a demand often driven by variation of trends, and dynamic manufacturing cycles. The technology industry focuses on long-term cycles of innovation, with relatively higher expenses on R&D while the fashion industry is mostly reactive to consumer preference, social trends, and seasonal changes. Measurements in terms of this difference can be found in models such as the "see-now, buy-now" introduced by numerous fashion businesses to address instant consumer demand. These are in contrast to other industries, such as automotive, where product cycles span several years due to their complexity and regulations (McKinsey & Company, 2020).

Today's technology relies mostly on platform-based business models. Companies such as Apple and Google manage their ecosystems by combining software, hardware, and services, which is what differentiates their applications. Fashion has already adopted multi-channel methods; they are now exploring a comprehensive way to integrate traditional and Internet shops into an integrated customer experience. The most difficult challenge for fashion companies is predicting consumer behavior, which can take unexpected directions due to social media influences and worldwide trends. In a fast-moving

scenario, a more flexible and trend-agile strategy is essential. This would not be the case in industries such as automotive or technology, where consumer demand is more consistent and predictable (McKinsey and Company, 2021).

The automotive industry focuses on durability, safety, and legal compliance, with sustainability becoming increasingly crucial. In contrast, the fashion sector frequently struggles to balance sustainability and quick production demands. While the automotive sector is gradually transitioning to electric vehicles and sustainable materials, fashion is under intense pressure from customers and regulators to incorporate sustainable practices across the supply chain. The critics argue that the circular economy model, while promising, presents challenges such as rebound effects, which occur when circular activities fail to exceed average consumption increases, limiting the effectiveness of sustainability programs (Hossain et al., 2024).

Osterwalder's Business Model Canvas has also shown to be a valuable tool for examining and redefining business models in a variety of industries, including fashion. The BMC includes nine components: customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structure. Each BMC can be adjusted to meet particular challenges in the fashion industry, such as sustainability, customer engagement, and even market speed.

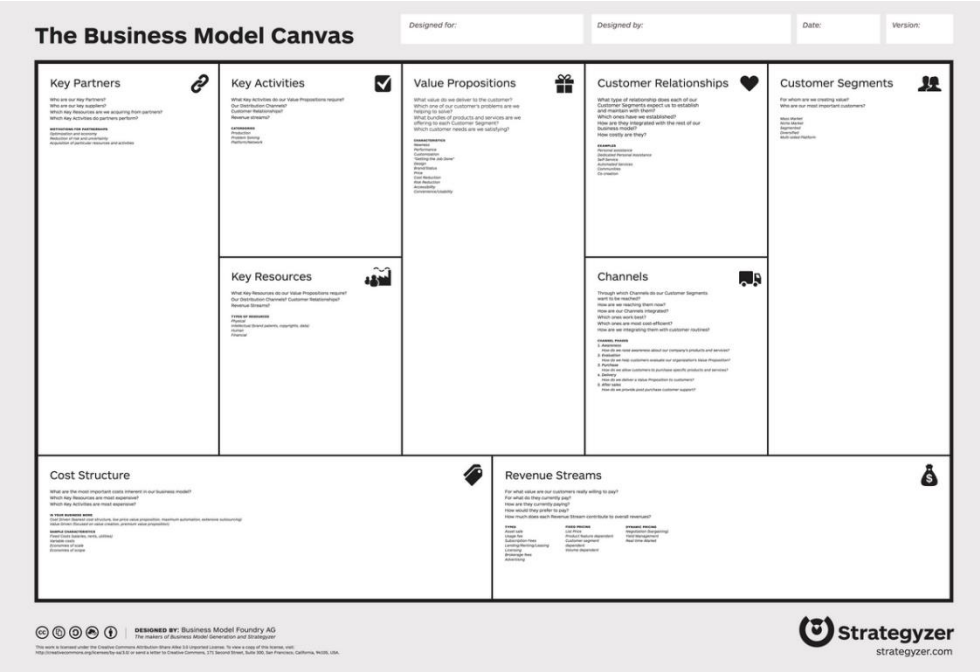

Figure 5: Business Model Canvas (Wikipedia contributors)

Patagonia's Worn Wear concept illustrates a circular business model. A consumer can fix, reuse, and finally recycle the Patagonia clothing he or she purchased. The usage of recycled fibers is limited even today. For example, they can return their already-used Patagonia garments to the stores and receive store credit; later, the company will fix the clothes and sell them as second-hand items rather than purchasing raw materials. Using recycled materials also implies a lower total environmental footprint generated throughout the manufacturing process (Provin & de Aguiar Dutra, 2021). The Netherlands might face some challenges regarding circularity in the textile sector: during production, 20% of fabrics

are wasted; consequently, when collected, 40% of textiles go overseas without appropriate sorting (Dutch Textiles Material Flow Analysis, 2024).

The excitement for "green" conditions, however, keeps it going by recycling and returning obsolete items. What would be difficult for the larger corporations is that the low-cost, high-turnover production approach that could reduce wear is completely at variance with the fast fashion principles. With its many creative and cutting-edge innovations, Zara has reportedly used the most synthetic materials at any time. The system's low recyclability and heavy reliance on fossil fuels lead to environmental issues (Data en AI - Zara, 2024).

Patagonia's Worn Wear project, for instance, can be mapped on the BMC to show how the business creates value through customer involvement and environmental commitment. The value proposition focuses on extending product lifecycles and reducing environmental effects, and the primary operations are clothing repair and resale. Customers can engage in the circular economy through Patagonia's channels, which include both digital and physical platforms, offering a smooth omnichannel experience. The company's dedication to sustainability is further supported by important alliances with suppliers of recycled materials and environmental organizations.

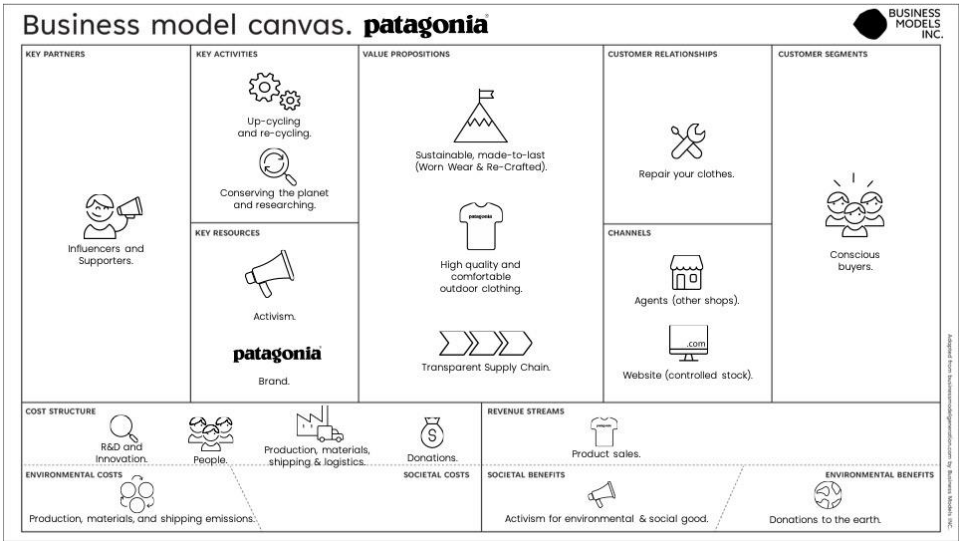

Figure 6: Patagonia BMC (Business Models Inc.)

This framework, which applies to companies like Patagonia, cannot be applied to the rest of the fashion industry, especially fast fashion, whose economic model is based on mass manufacturing and consumption (Thakker & Sun, 2023). Another example is Stella which develops a brand through the implementation of all of the sustainable tactics she creates for her area. Materials like vegan leather and recycled nylon demonstrate how circular principles have been achieved in high fashion. These are activities that they continue to do for sustainability through their biodegradable and animal-free products: new eco-friendliness standards among major firms.

Stella McCartney's sustainable business approach, which includes environmentally friendly materials, ethical fashion, and production transparency, is also a perfect fit with the BMC. Sustainable collections, creative textiles, and greater support for circular fashion concepts are examples of primary resources and important initiatives. Given the brand's heavy reliance on digital platforms and social media to engage with potential sustainability-minded consumers, channels and customer connections are essential. Access

to social media and the use of technology on the platform have become crucial for business goals in almost every sector, including the fashion industry.

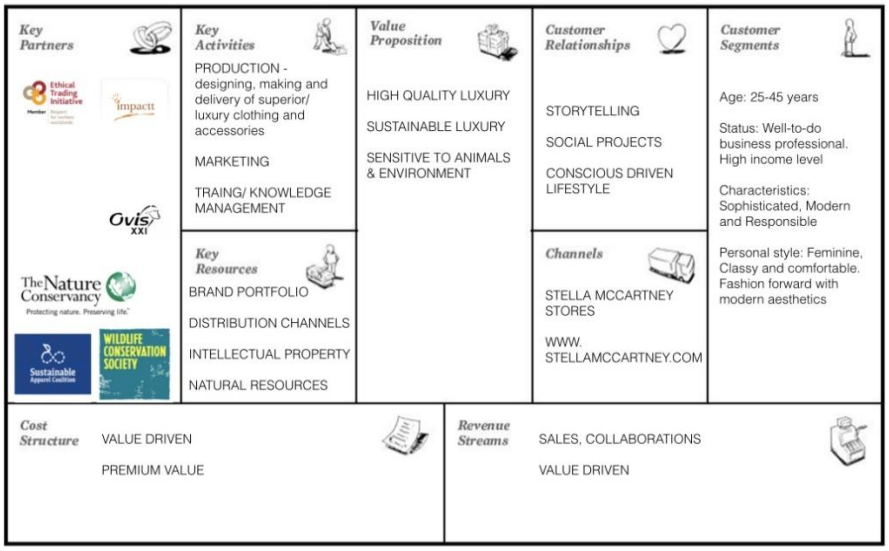

Figure 7: Stella McCartney BMC (Slow Footsteps, 2015)

Stella McCartney, one of the first high fashion pioneers to transform eco-friendly processes into high style, is an outstanding example of sustainability in the luxury fashion sector. One of the first high-end designers to stand up for cruelty-free fashion, McCartney bases her design concepts on a rejection of leather, furs, and any other animal-derived materials. By maintaining elegance and style without sacrificing environmental responsibility, the brand emphasizes the usage of recycled polyester, organic cotton, vegan alternatives, and more.

Through her collaboration with Bolt Threads, specialists in sustainable materials such as Mylo (a leather alternative derived from mycelium), Stella McCartney demonstrates yet again her commitment to innovation in sustainability. Furthermore, McCartney's work with Econyl, a material manufactured from recycled ocean plastics, shows how luxury fashion may potentially reflect circular economy ideals. Embracing sustainable practices, McCartney sets an industry standard for how the fashion world, while maintaining an environment, can evolve (Thakker and Sun, 2023).

This transparency in sustainability which is published in detailed environmental performance reports enhances the accountability dimension in fashion. A change in paradigm by which McCartney brings an evident transformation in the luxury consumption of responsible business models; it includes materials, ethical labor practices, and alliances with the leaders of sustainability.

In addition to providing access to high-end designer sources, the shift in consumer behavior from direct ownership to second-hand markets is an intriguing example of this new business proposition category. Customers are now actively accessing the resale market through platforms such as Depop and ThredUp to meet their increasingly growing demands sustainably, especially among younger generations that are more aware of waste reduction and recycling of clothing.

Mobile app-based Depop has emerged very popular especially in the Generation Z community as a platform that allows peer-to-peer buying and selling of second-hand fashion products. Depop encourages the reuse of clothes and accessories, creating a circular economy, and decreasing the need for fast fashion. Over 30 million users globally have taken to Depop to find unique affordable eco-friendly fashion.

ThredUp is one of the largest online saving stores, and it concentrates on prolonging the life of clothing by enabling people to buy and sell second-hand fashions. Customers who are worried about the negative environmental effects of fast fashion and are switching to more circular consumption habits are the ones who caused this change in the trash climate (Fashion Revolution, 2020).

These are the best demonstrations of how the second-hand market has been changing its path into the larger move toward sustainable fashion. Customers can recycle clothing through Depop and ThredUp, which reduces demand for their new production processes and helps reduce environmental issues related to traditional fashion models. The increasing second-hand shopping phenomenon along with the expanding circular economy presents new business models that will reshape the industry.

There is a growing demand in the fashion industry for innovative measures that meet the different sustainability goals. Traditional linear business models called "take-make-dispose" cannot exist in this new world based on sustainable practices. Circular business models, which would include recycling and reuse, are now the frontiers of innovations for fashion businesses. This facilitates the simple idea of return, repair, and resell in an attempt to extend the life of the product, therefore reducing new demand to be made of raw materials; an effective model of sufficiency-driven business practices (Provin & de Aguiar Dutra, 2021).

The technologies, such as big data analytics, blockchain, and artificial intelligence, can help all of them make significant progress toward being even more environmentally friendly. Each of these serves as the fundamentals to improve the transparency and efficiency of a supply chain, which will eventually show every transformation made within the environment. Finally, these technologies allow fashion labels to get real-time insights into how their consumers behave to model demand forecasting accurately and prevent a major source of various types of wastage: overproduction. Further examples might include H&M's Conscious Collection and Zara's Join Life, aspects of fast fashion that try to be less criticized in terms of their absolute environmental footprint (Chen et al., 2021).

New business models like Circular Economy bring both promises and challenges to the industry in trying to mix profit with sustainability, a reality that the fashion world has to understand and slowly accept. This worry can easily be articulated for the fashion industry as it sets its business strategy against these changing consumer landscapes built around frameworks like Osterwalder's Business Model Canvas.

2.1.3 Role of Technology and Sustainability in Business Models

Technology and sustainability are now at the center of any new business models for the fashion industry. Artificial intelligence, in tandem with data analytics and the application of blockchain technology, is redefining the supply chain (Madsen et al., 2020). Forecasting in real-time becomes possible, along with inventory management and customer customization, which enhance operational efficiencies, leading to customer satisfaction. Companies like Zara utilize an AI-powered RFID technology in logistics optimizations: operations speed up and respond to shifting trends without producing excess stock (Data en AI - Zara, 2024).

The sustainability campaign has emerged as a priority for the organizations because of consumer awareness of the environmental consequences of the fashion production process (Vijeyarasa & Liu, 2022). All brands are developing circular, reusing materials, and recycling business models. Sufficiency-orientated brands such as Patagonia generate practice with their Worn Wear campaign. Repair, resale, and extension of product lives reduce the demand for new raw materials (Provin & de Aguiar Dutra, 2021). These efforts are matched with worldwide initiatives such as the Sustainable Development Goals (SDGs) of the United Nations, particularly SDG 12, responsible consumption and production (Thakker & Sun, 2023). The adoption of sustainability practices in fashion reduces the negative environmental impacts, improves the brand image, provides loyalty reports to consumers, and opens new market opportunities.

Technology is changing business models, with customer engagement and sustainability driving that change. One clear case is Burberry with their AI-powered customer analytics to personalize client experience. Data from their online site and physical stores are used to create personalized marketing campaigns and product recommendations for the consumer, all driven by consumer input analysis. Machine learning algorithms, learn from customer behavior predictions and generate customer loyalty through optimized inventory management, which reduces waste from unsold goods (McKinsey & Company, 2021).

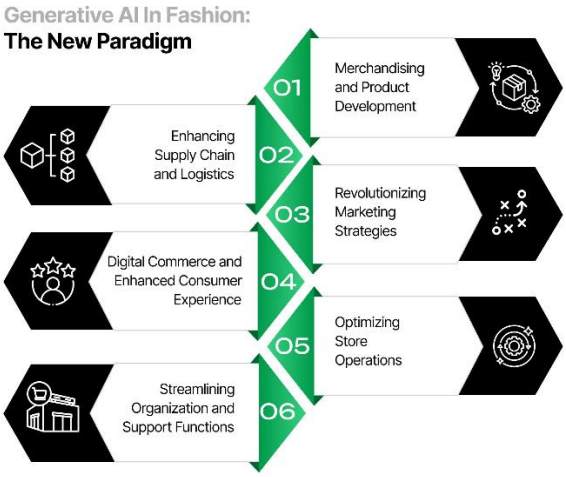

Figure 8: AI importance (Markovate, 2023)

Monetize transparency and accountability through blockchain technology. Different firms such as Everlane rely on blockchain technology for supply chain transparency as much more realistic artifacts would be secure without going through the normal process of sourcing and production. With Everlane's Radical Transparency customers can trace clothing back to the factory from which the product originated, committing to ethical labor standards as well as sustainable materials. The accountability aspect of blockchain also comes from the real-time tracking of resources or products, which reduces the risk of unethical practices (Huynh, 2021).

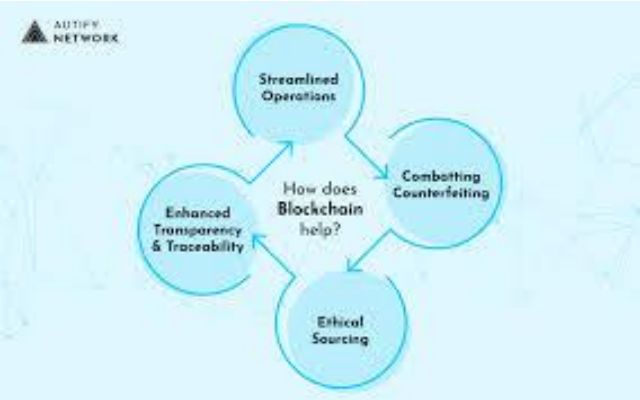

Figure 9: Blockchain importance (Autify Network)

In addition, challenges arise in implementing these technologies. There may be a good reason to get large amounts of precise data about many subjects for artificial intelligence applications. If a company is part of a distributed global supply chain, this is quite challenging. Given that installation costs can be prohibitive for small brands, integration such as AI will be very costly. Blockchain is still quite new with relatively few applications due to technical complexity, a lack of industry standards, and high costs of implementation. It requires full participation from all parties, which can be difficult to manage globally (Madsen et al., 2020).

By integrating AI technologies, blockchain, and analytics, fashion brands can live more aligned with what consumers expect and are working toward sustainability. Blockchain would ensure that the entire supply chain becomes clear; materials would be ethically sourced, and everything made could be traced. AI has revolutionized inventory organization and forecasting, and some brands like H&M and Zara have reduced their overproduction using this model, in which production matches demand.

Every industry chain in the world is committed to providing sustainable solutions within its potential that can lead to reducing the environmental impact. For instance, Unilever makes use of blockchain just to improve the supply chain transparency of palm oil suppliers; they are expected to conform to sustainable conditions when palm oil is brought to market. Unilever can check deforestation, illegal harvesting, and conditions of labor concerning this use of palm oil from source to product (Unilever, 2021).

Nowadays, eco-friendly and water-friendly technologies are applied by Levi Strauss & Co. in denim production. Waterless jeans are produced in smaller amounts of water. Water-related activities, like washing, usually consume over 3,781 liters of water for a one-pair denim production. Innovations such as ozone washing and reduced cycles of washing have registered over 3 billion liters of saved water (Levi Strauss & Co., 2020).

All of these technologies would have realizable outputs that are sustainable. Implementation, however, comes with challenges., Levi's techniques may not be easily scaled across industries, particularly to areas with deficit resources. The effectiveness of blockchain, however, relies on cooperation among all supply chain players and lacks a defined framework for extensive applicability (Huynh, 2021).

Circular Business Models can be the way forward for sustainability. H&M's recycling plan attempts to address some environmental problems related to fast fashion. Inaugurated in 2013, the Garment Collecting scheme permits customers to bring their obsolete items to stores for recycling or reuse. By

2020, more than 29,000 tons of textiles had been collected by H&M, which is equivalent to 145 million T-shirts (H&M Group, 2020).

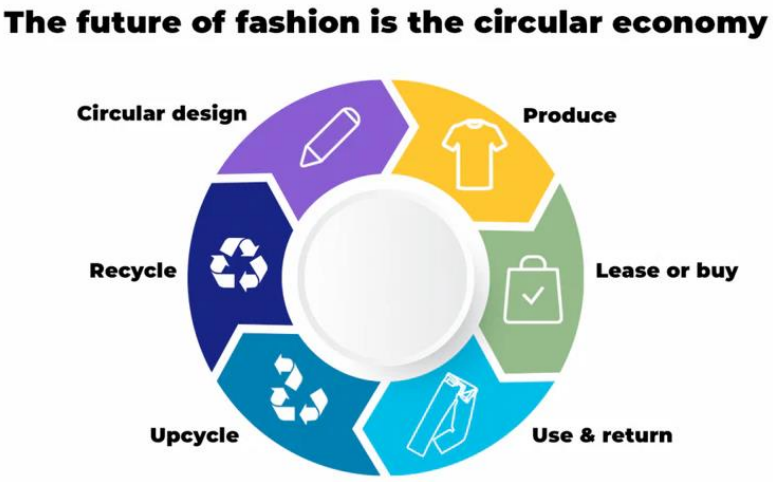

Figure 10: Circular business (Certilogo)

Using this operation, the company can improve its environmental image, especially among young consumers who seek more sustainable things. H&M's Conscious Collection and Recycling initiatives are all part of the strategies that H&M is working on to become a fully circular and climate-positive business by 2040.

Despite their many achievements, these initiatives continue to face severe doubts over their efficacy. The weight of the collection continues to outweigh the weight of recycled clothing, although there is only a small portion that is made into new clothes. This has therefore led to allegations that the project is more about "greenwashing" than actual change, demanding more systemic changes rather than superficial changes in the way of doing things.

Circular business models are also an option for sustainable companies, but they present difficulties for operational procedures, such as recycling materials from some unique products, which keeps the cost high for mass production. The quality of recycled fibers drops, limiting the options for reuse and most times requiring blending with new fibers. Some of the more logistical challenges include collecting, sorting, and global processing costs associated with recycled clothing, which all raise the carbon footprint as well as the business costs associated with recycling (Provin & de Aguiar Dutra, 2021).

The economics surrounding circular models is a whole unknown territory. Fast fashion needs economies of scale to produce products cheaply in record time. Recycling and reusing waste can compress production speed and add costs within profit margins to recover from it.

In broad theoretical terms, a circular model has been defined under industrial ecology and systems thinking. Industrial ecology's goal is to maximize resource usage with the view of the industrial system being a part of a larger ecological system and encouraging waste minimization and recycling of sources. Systems thinking indicates the impact that every intervention in one section of the system has within the entire supply chain requiring a holistic approach to sustainability (Ehrenfeld, 2007; Meadows, 2008).

Systems thinking emphasizes developing products from circularity. Therefore, the brands have to consider the overall product life cycle during their design perspective, through which they design for recyclable materials as well as durable products for reuse purposes. Apart from this kind of approach, circular models are limited in both their scope and impact.

How H&M effectively applied the benefits of AI to personalize consumer experiences, such as customer engagement and the increase in sales. Using customer analytics including purchase histories, preferences, and browsing behavior, the company can execute more personalized product recommendations. This experience improves customer satisfaction through a tailored shopping experience leading to increased repeat purchases. Demand prediction, optimal inventory level planning, and minimized unsold products have been made possible at H&M by AI-powered insights which lowers environmental impacts caused by reducing overproduction (McKinsey & Company, 2020).

Everlane has made an innovative shift of fully leveraging technology to build consumer trust. Through its transparency program, Everlane gives way to access to particular information on the sourcing and production of every product. The name also discloses cost breakdowns from labor to include materials to transport that give insight into manufacturing practices. Factory origination, environmental impact of materials, and ethicality of labor use for each product are revealed by Everlane's website.

This play with technology speaks to consumers who often regard eco-friendliness as an important factor in knowing about the ethical and environmental footprint of their purchases. It builds consumer trust and further fortifies the identity of Everlane as a leader in transforming ethical fashion (Everlane, 2021).

They offer consumers digital shopping engagements as well as assurance of ethical business practice through balancing profitability with sustainability as such brands embrace technology. Circular business models have the potential for waste reduction, requiring overcoming considerable challenges. While industrial ecology and systems thinking emphasize the need for systemic changes, they stand for a sustainable fashion industry, calling for balancing innovation and responsibility.

2.1.4 Impact of Culture and Consumer Behavior on Business Models

Culture greatly affects the dynamics of changing business models in the fashion sector. Because it reflects and develops societal values, customs, and trends, it is considered both an economic activity and a cultural phenomenon (Mukherjee, 2015). The pop culture effect has been one of the greatest influences on style popularity. Specific styles are in high demand within any hip-hop movement, thus affecting how businesses structure and model themselves around such trends (Whitley, 2011).

Today's consumers are more aware of the world than before, and we live in a digital age where they are connected easily. They look for openness, ethical behavior, and sustainability in their brands (Brewer, 2019). Customers have been pushed to adopt minimal consumption by numerous sufficiency-oriented firms that have intentionally adopted anti-consumerist advertising; for example, through Patagonia's campaign urging customers to "buy less, buy used" (Gossen & Niessen, 2024). These strategies related to the growing need for sustainable products and services are those that promote sufficiency, while also encouraging ethical consumption. Fashion businesses start adaptation strategies for their models that point towards sustainability, ethical sourcing, and online engagement. Social media and other digital platforms have pushed for the speed by which trends become viral and made customer interaction even

more personalized. Understanding these cultural and consumer developments is crucial for fashion companies aiming to stay relevant in an increasingly competitive industry.

The growing market has affected the industry, with their enthusiastic position towards a positive environment and ethical methods, particularly the Millennials and Generation Z. Their demand is for sustainability, transparency in the manufactured goods, and even customized shopping experiences. Communication plays a role for these businesses in re-evaluating their current models.

Millennials, currently at the peak of their purchasing years, have increased representations of customers expecting authenticity and ethical principles from the brands they buy. They require to know more about sources of materials, labor conditions, and ecological impacts as such generational changes launch companies into more circular business models and environment-friendly practices. Generation Z wants fashion brands to create comprehensive, customized products and seamless digital experiences because they value individualism and customization.

Figure 11: Young people with sustainability (SGI Europe, 2021)

These generations also use social media to express their views, making it easier to hold companies accountable for their ethical practices.

The Nike By You program allows customers to design their shoes in response to Millennials and Generation Z's demand for customization. In this dimension, Nike has taken consumer data and applied it to AI-driven insights to allow consumers to select colors, and materials, and personalize their shoes with text. Having this in traction may lead individuals to feel a sense of ownership and creativity, improving satisfaction and loyalty toward the brand. Through these, data analytics and consumer feedback at Nike help the company anticipate trends and respond quickly to changes in consumer preferences (Anderson-Connell et al., 2002).

Fast fashion has been characterized by short lead times for the company producing low-cost apparel; however, H&M has come up with the Conscious Collection as an unconventional method for adopting fast fashion as sustainable. Initially launched in 2010, this program has become linked to names such as organic cotton and recycled polyester. It seeks to reduce the brand's environmental footprint while

attempting to meet the desires of consumers towards transparency and ethical production. It can be said that although H&M is far from fully arriving at being a sustainable company, the Conscious Collection does reflect an effort made to meet consumer demand for more responsible choices in fashion (Provin & de Aguiar Dutra, 2021).

Consumer behavior mainly affects many corporations, just like Nike and H&M. While H&M concentrates on sustainability and Nike on the individualization process of its products, both focus on the current trend of ethical shopping and personalization values that Millennials and Generation Z increasingly attach to shopping. Such trends bring the requirement for the right change in business models and the engagement of younger generations to meet their ever-changing expectations.

Contrasting with each other in their approaches to sustainability are brands such as Patagonia and Zara. Patagonia has found its identity as a brand on environmental activism and sustainability. Its business model is highly circular, based on repair, reuse, and recycling as went along in its communications. Additionally, it inspires actions to get its consumers to repair and recycle clothes, and it uses organic and recycled materials besides being transparent about environmental impact. The brand even runs campaigns urging consumers to buy less which is a rather strange position for any sales-dependent company to take (Provin & de Aguiar Dutra, 2021).

Patagonia is known for its sustainability strategy, which also includes activism around environmental concerns. This has created a strong customer base and placed sustainability as a major competitive advantage, even to the extent of attracting environmentally friendly consumers and investors who prefer long-term value over short-term profits (Thakker & Sun, 2023).

Zara, which fits the fast fashion model characterized by very highly produced goods and large ecological footprints, has begun integrating sustainability into its existing model to meet consumer demand. Zara has launched a Join Life collection using organic cotton, recycled polyester, and other sustainable materials for its garments.

Although Zara has moved towards an environmentally friendly initiative, having sustainability integrated into a model of really high-volume production is difficult. It will always be hard for the activities of Zara to minimize the effects on the environment, considering its magnitudes. Critics contend that all the efforts are wasted because the backbone of high stock turnover and low-cost production remains inconsistent with the ideals of true sustainability (Chen et al., 2021).

For Patagonia, sustainability is not just a program; it forms the whole strategy making up the brand. Zara, on the other hand, uses the sustainability concept reactively to tackle pressure from customers and government regulation without changing the entire fast fashion system.

As an important element of the business strategy, companies use ESG (Environmental, Social, and Governance) performance indicators to track and report their performance against targets. ESG footprint frameworks allow the measurement of performance in environmental impact, social responsibility, and corporate governance to facilitate transparency in reporting, and they provide investors and stakeholders with better knowledge of the operational risks and opportunities.

For instance, environmental parameters within fashion metrics include carbon emissions, water usage, amounts of waste generated, and sustainable sourcing of material. Social metrics would comprise labor

practice, fair wages, working conditions, and diversity and governance metrics, including ethics for companies and sustainability. Patagonia consistently receives high scores in ESG ratings due to its environmental initiatives, transparent supply chain, and social concerns (McKinsey & Company, 2020).

There are determinants for investment decisions. The better performing environments feel somehow safer in that they can resist the changes in regulation and use more effectively the long-run trends such as the transition to low-carbon economies.

Research has begun to suggest that firms with high scores on ESG outperform the market over time. A 2020 MSCI report found that firms with attractive ESG ratings tend to have lower capital costs, are more stable, and have comparatively better stock performances, all implying that financial gains can be derived based on how business models embedded sustainability (MSCI, 2020).

ESG criteria are indicators of sustainability performance measuring and reporting by certain establishments to show their process to the consumers and investors. For instance, Patagonia has proved the business advantages of sustainability in its practice, while Zara is still fighting a battle on the goals of integrating sustainability into mass strategies.

Millennials and their successors, such as Generation Z, contribute to changing the fashion business model and instituting trends that transform these into sustainability, transparency, or personalization. This generation's transformation helps bring about innovation while demanding ethical business practices throughout the industry. Putting on top of the incorporation of ESG the changing face of consumerism is a sufficient reason to make companies realign their operations to push toward more urgent demands for sustainability and accountability.

2.2 Evolution of Business Models Before Digital Transformation

2.2.1 Traditional Retail Models (Pre-Internet)

Before the Internet, the fashion industry was indeed a traditional industry before moving to modernity. It relied almost just on retail with physical stores and local production processes. Long manufacturing cycles, delays, and marginal levels of global integration characterized these models with most supply chains using domestic or regional suppliers (Pickles & Smith, 2011). Nevertheless, it provided foundations on which more sophisticated and interconnected corporate structures would eventually be established.

At this time, the industry went through challenges such as increased costs of production and slow changes to meet consumer requirements. A regionalized production provided skills and craftsmanship specialized and offered stability and predictability in operations, especially in Europe (Back, 2017). The features that were once a standard are now being reconsidered as practices in modern sustainability, in which quality and durability are emphasized to reduce wastage and encourage ethical buying.

The industry faced problems such as high production costs and slow responses to changes in consumer demands during this period. Particularly in Europe, the former demonstrated specialized abilities and craftsmanship along with the assurance of steady and predictable operations (Back, 2017). These standard features are now being reconsidered in new developments in sustainable practices where durability and quality are emphasized to minimize waste and promote ethical purchasing.

Even today, these conventional paradigms have an impact by engaging customers in more intense physical shopping with skilled salespeople and selling assistance. These businesses have to essentially reinvent themselves in the era of Internet and convenience shopping, which dominated consumer behavior until recently. The lessons learned from that era can be helpful as a guide for modern apparel companies, particularly as they integrate sustainability and digitization with local production and quality.

The fashion industry on the whole was not as complex or heavily globalized as it is today. Long production cycles, regular in certain regions and with relatively little opportunity for global communication, decelerated the impact of fashion on the average consumer. Consequently, due to poor seasonal manufacturing schedules, designers and manufacturers took months to prepare collections before they debuted at twice-yearly fashion shows, creating a significant delay between creation and retail sale availability (Pickles & Smith, 2011).

Figure 12: Traditional fashion supply chain (Beyond Talent Recruitment)

On the regional level, industries localized their supply chains. For example, European fashion houses engaged in local artisan workshops, especially the most distinguished ones in France, and Italy. Generally, clothing for the mass market in the United States was produced domestically with very little overseas outsourcing, primarily owing to logistical challenges and trade barriers. These had produced rates much less high in production and distribution, compromised by the geographical limits of suppliers and manufacturing hubs (Back, 2017).

Without good global supply chains and digital technology, companies would find it hard to scale production and switch to changes in consumer demand quickly. This had some high costs of production, reduced flexibility, and, at times, overproduction based on forecasts done long before. Real-time data was communication lacking forming collaboration across the various stages of the supply chain, resulting in fill time delays for delivery of the product from producers to retailers (Provin & de Aguiar Dutra, 2021).

Department stores, as well as boutique retailers, were the main forces in the fashion industry before the advent of the Internet, holding an authority in dictating fashion trends and influencing consumer behavior. In the USA, department stores like Macy's and Bloomingdale's, along with Harrods in Europe, were leaders in offering a complete fashion selection. The department store directly associated with the manufacturers to provide buyers with a new trend, and relied firmly on in-store activities, where 'knowledgeable' sales representatives helped consumers. These stores also participated in numerous events and shows that would turn and inform important trends and preferences (Kim, 2017).

Often smaller and run by families, boutique shops focused on a market segment of unique and premium products and more personalized customer service. It was famous for stocking these designer and artisanal products that larger department stores didn't bring into their New York, London, or Paris havens. By presenting a more personal shopping experience as well as a curated one, boutique stores played an important role in protecting local talents and supporting new designers (Thompson & Haytko, 1997).

Brands in consumer department stores were associated together; visibility and ability for mass consumption were offered by the department stores while the signature brand took the prestige it conferred to the stores. Unfortunately, traditional retail restrictions surfaced, such as reliance on physical locations and regional supply chains, which limited its capability to respond rapidly to shifting trends and expectations among consumers.

Traditional luxury retailing can be seen in the case of Bergdorf Goodman, which, as a culture, is equally an icon in the New York City landscape. It redefined luxury retail through personalization and individual approaches sold to elite customers. There was prestige and an air of exclusivity as a result of the focus on building a very strong relationship with clients. All these things included the abilities of personal shoppers, private fittings, and customer-tailored service for all things Bergdorf Goodman, which attracted high-end consumers looking for more than products for experience and relationship with the brand. The cultural location was also supported by the store's Fifth Avenue site. This therefore has aligned Bergdorf Goodman to be strategically within the city's topmost elite circles of fashion capital. Thus, by curating product offerings and building long-standing relationships with designers and clients, Bergdorf Goodman managed to establish itself as a tastemaker in the luxury retail world.

Currently, a lot of brands have adopted digital strategies, while a few continue to adopt the traditional retailing approach mixed with modern elements to create immersive and appealing shopping environments. As a luxury skincare name, Aesop is known for having stores built under detailed designs. All Aesop retail spaces are sensory, joining architecture, design, and really simple aesthetics to originate feelings of calm and luxury. Each store has a unique design reflecting a location, ensuring there are no two identical Aesop stores. This differing physical shopping experience makes Aesop stand out in a digital age dominated by online sales.

Aesop blends classic retailing in-store with contemporary approaches to provide a so-called immersive shopping experience that evokes its ethics as a brand and builds deeper emotional connections with consumers. Therefore, the stores allow for a shopping experience that is slower and more deliberate, as opposed to the immediacy that an instant online shopping experience would still possess. This is more consistent with the age-old sales practices of high-end retailers like Bergdorf Goodman which happen to provide to consumers in the contemporary world.

Drive to online change and people who resist change cannot be always the guiding principles in the planning of a pre-internet fashion, which was characterized by a long production cycle, region-by-region supply chains, and dependencies on department stores and boutiques to manipulate consumer trends. Lack of global integration and real-time communication resulted in inefficient production and distribution, all bringing the prerequisites into the new conditions of life that have been dramatically changed by the digital age.

2.2.2 E-commerce Revolution and Global Reach

E-commerce took fashion relationships into a new era when it began in the 1990s. As the internet grew, matched with development in digital technology, so did the use of online infrastructure to draw close to a global audience more efficiently by retailers (Tidhar & Eisenhardt, 2021). The present-day has brought about democratization in fashion, whereby consumers now have very fast and without any barriers to access to a range of products from anywhere across the world (SHI, CEN, & LAI, 2021).

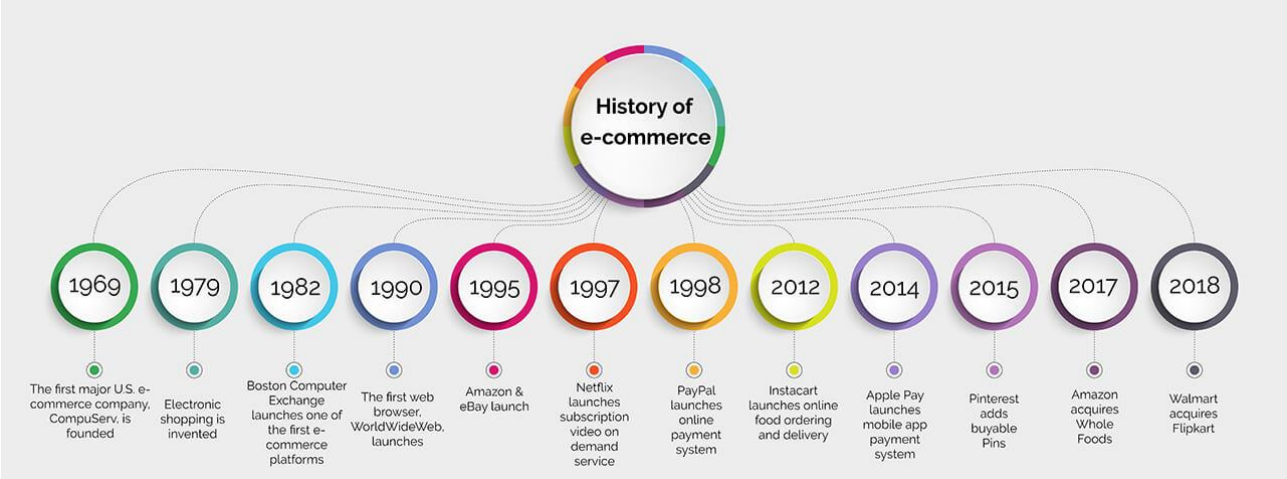

Figure 13: The evolution of E-commerce (42Signals)

E-commerce promoted fast-growing fashion, which implies shortening manufacturing cycles and speedily answering changing consumer needs. Consumers could now buy clothes from home without going to the locations where they buy at very reasonable prices, thanks to low-cost fast fashion and the convenience of the internet. This is of great revolution in the retail experience but poses fresh challenges to sustainability. The frequent collection launches and no delays in the turnover of fast fashion increase waste easily and carbon emissions, raising green concerns about the ethics of the business models (Chen et al., 2021).

These challenges have opened new doors to innovation and sustainability in applying technology for a digital transformation within the fashion industry. Brands using technology such as big data, AI, and blockchain manipulated supply chain activities and improved operational efficiencies to help consumer transparency (Colombi & D'Itria, 2023). This reinforced that new business models must go hand in hand with models of growth and sustainability, which are constantly demanded by customers and government regulatory bodies regarding the application of the possible responsible practices of the company.

Though e-commerce has traveled the passage of fashion, put quite simply, it becomes possible for marketing brand entire sells-on distance, abandoning any definitions of traditional retail and giving customers direct access to them (Guercini & Runfola, 2015). For example, the DTC model gave the possibility to customize services with local preferences and at the same time answer to the cultural and linguistic needs of different markets (Batista, 2013). Localization tactics were crucial for entering into new markets from localized payment methods to bilingual websites (Bürklin & Risom, 2020).

Online shopping has widened the reach of products previously considered impossible to access, affecting how consumers shop; however, successful retailers have had to adapt to these changing behaviors. With

the implementation of omnichannel strategies that integrate both online and offline buying experiences, many companies helped shape customers' purchasing experiences (Bertola & Teunissen, 2018).

The e-commerce revolution changed everything for the fashion business, with Amazon and eBay front and center leading the charge for online retail. Through these sites, in the late 1990s to early 2000s, one was simply given a look of the potential of digital markets; therefore, subsequent attempts at the online sale of fashion were inevitable. The start was with books, but later, through huge warehouse space management of logistics and supply chains, and customers' satisfaction through their conveniences, the company began including other retail industries, as well as fashion. In 2021, Amazon emerged as a major online fashion seller in America, which indicated its e-commerce superiority (Tidhar & Eisenhardt, 2021).

eBay, founded in 1995, created a new model of platform peer-to-peer sales. Although it was not initially focused on fashion, it became a destination for pre-owned and vintage clothes, providing consumers with an alternative to conventional shopping. The auction format allowed people to sell their clothes and accessories, then contributing to the emergence of a resale culture in fashion. This culture of resale grew tremendously during the year 2018 and it was then that people started buying limited-edition items just to sell at exorbitant prices in the future; brands like Supreme were leaders of this revolution. Indeed, eBay opened a whole new frontier to further developments in the fashion marketplace, given that consumer-to-consumer selling turned into part and parcel of the ecosystem of fashion.

ASOS and Farfetch originated to contradict the conventional retail frameworks until they fully accepted the use of a digital-first approach. ASOS has been transforming online shopping into a place with different brands of clothes and accessories, known to trendsetting consumers. Established in 2000, the company pioneered online shopping. Early on, ASOS had set extremely high standards for speedy shipping, easy returns, and user-generated content. In 2020, ASOS recorded a 24% increase in sales, mostly because it had quick adaptation to the digital market (Kohan, 2021).

Similarly, Farfetch came in 2007 and made a lot of difference for the high-end customers away from their homes. It built a platform that brought together a global assortment of designer items and opened the doors of luxury products that were otherwise accessible in those few places in the world. Using cutting-edge technologies, the platform operated on recommendations that were tailored to each user and allowed virtual try-ons as well, quite unlike any luxury retailer (Tidhar & Eisenhardt, 2021).

The combination of cloud computing, mobile commerce, and artificial intelligence has altered business models in the fashion industry in the way that firms optimize business operations, gain customer valuable insights, and leverage cloud resources to run their online operations without building one of their own, differentiating from totally expensive physical servers, as in the past. Additionally, because internet expansion has been quick and has included international breeding for many businesses, no fashion brand could have achieved its current level of industry stature without this ingenuity (Huynh, 2021).

Mobile commerce is rapidly advancing e-commerce since a growing number of consumers use their phones and tablets for online shopping and browsing. Mobile applications make an individualized experience that brings users closer to businesses by offering push notifications, deals, and a simple checkout experience. The advent of mobile commerce has improved influencer-based marketing in which the social media influencers' followers can shop via mobile channels directly, further strengthening the weight of this company's advert to its own social media marketing.

Especially focused on the fashion business model, AI could facilitate the collection and analysis of huge sets of customer data by a firm. Companies would use AI-based algorithms to make shopping experiences more personalized, optimize inventory, and set pricing strategies. These organizations evaluate customer preferences, purchases, and online browsing behavior so that they can make data-driven decisions as well as pretend to be refining their recommendations. This tech has helped firms such as Amazon and ASOS build extremely customized environments in which the consumer will remain repeatedly tied (McKinsey & Company, 2020).

Predictive analytics is another way AI has contributed to the supply chains. Through prediction and managing inventory, AI solutions help companies in waste management, better developing their schedules, and lessening stock-out scenarios in the fashion industry. For instance, Zara has now embraced AI-derived inventory management methods that permit it to spontaneously register changes in consumer demand and keep its stores updated with new trends to also help reduce overproduction (Chen et al., 2021).

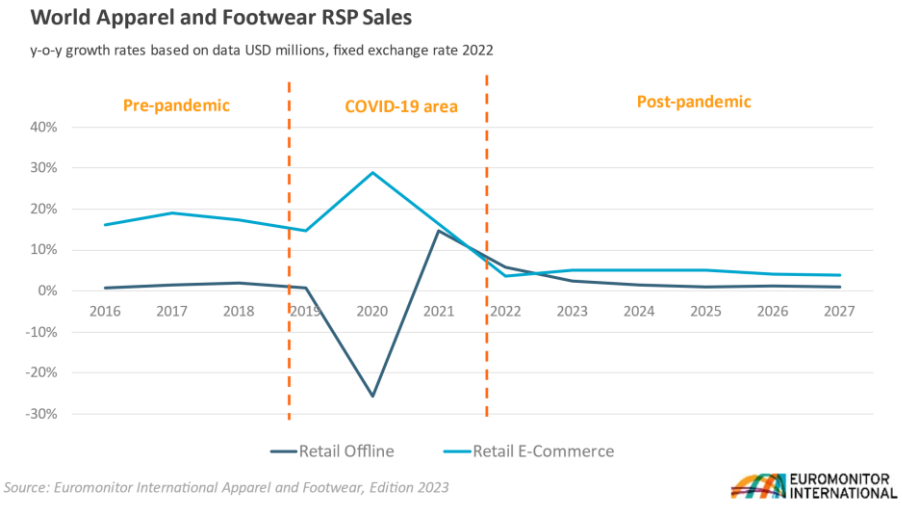

Figure 14: E-commerce traditional retail comparison (Euromonitor International, 2022)

E-commerce has become a new force in retail against which many brands have recorded maximum growth with the virtual shop of the brand. ASOS's 24% growth in sales in 2020 was largely driven by the capability of the brand to tap into the rise caused by e-commerce activities during the COVID-19 pandemic because of the robustness of its online platform (Kohan, 2021). Its flexible digital infrastructure accessible by plenty of products has beaten the global market's face and is now prepared to take up the challenges of a very quickly evolving retail market (McKinsey & Company, 2021).

Consider Zappos, an online shoe retailer when e-commerce came around for the first time and changed the way people bought shoes. Zappos has the impressive qualities that helped it become successful: putting customers first, especially in customer service and return policies. When every other person was afraid to buy anything online, especially shoes that everyone said had to be tried on in a store, Zappos created a way for everyone to buy online with free shipping and returns, and to some people who had return periods up to 365 days.

Indeed, Zappos established a very high standard for e-commerce by customer experience. The only customer service 24/7 and strong relationships with shoppers is how trust is built into online shopping.

Fast, uncomplicated returns are increasingly important for encouraging consumers to shop online. This ultimate customer philosophy ended with the acquisition of Zappos by Amazon in 2009 and consolidated its impact in the e-commerce space.

Zappos made a case study out of customer service and a grand museum example of showing how a brand literally can overcome all consumer hesitations. By taking away from the shopper all perceived risks about online buying of shoes, Zappos is assuring a lot of loyalty from buyers, setting new standards for other e-commerce sites.

These brands, such as ASOS and Zappos, have begun connecting with customers who have not been able to reach them through traditional retail formats, due to the globalization of e-commerce. Specific payment and delivery services are increasingly available in the regions where the demand is localized for that e-commerce site. The reached horizons of these establishments guarantee an incredible advancement in e-commerce as such organizations tend to grow more rapidly and at the same time provide personalized experiences to their customers.

The business paradigm of fashion is being transformed by the e-commerce revolution as well as by technologies such as cloud computing, mobile commerce, and artificial intelligence. Online retail businesses such as Amazon, eBay, ASOS, and Farfetch have been proving the case for how digital platforms can succeed against the bricks-and-mortar model, using newer technologies to collect customer data, personalize the experience, and improve supply chains.

2.2.3 Fast Fashion and Its Impact on Sustainability

Fast fashion has disrupted both business models and the sustainability of the fashion world, starting from the late 1990s to the early 2000s. Zara, H&M, and all fast-fashion global players did not take long to introduce new styles. This immediate consumer demand for such styles seemed to flourish on the ever-growing social media and e-commerce, making these consumers access the latest styles at lower prices (Todeschini et al., 2017).

Such rapid production cycles came with very high environmental and social price tags. The fast fashion sector was increasingly known for its waste, high water consumption, and carbon emissions, raising world criticism against such unsustainable standards. Overconsumption due to the cheap, disposable emphasis of fast fashion aggravated the environmental load on the world's resources (Chen et al., 2021). One of today's leading development issues is the resource problem. From all circumstances, the fashion industry is one of the top contributors to this problem.

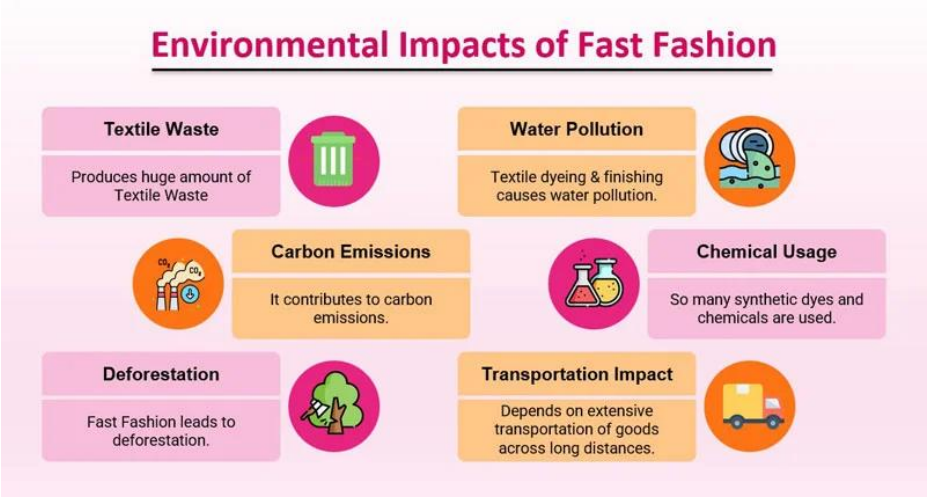

Figure 15: Fast fashion environmental impact (Textile Apex)

A growing focus on ethical and sustainable solutions is part of the response to these challenges. Brands increasingly look at circular business approaches: recycling, upcycling, and waste minimization by extending a product's life cycle (Provin and de Aguiar Dutra, 2021). Consumer awareness about the environmental impacts of fast fashion increases the demand for supply chain transparency, making consumers more inclined to inquire regarding how and where their products are created.

Their businesses buzz on rapid production cycles, low costs, and high product turnover. The brands have improved JIT manufacturing processes-pioneers in just-in-time production flexibility that allows them to react to recent fashion trends and create new clothes within two weeks. This formation of stock-in-process by synchronizing all steps in the production line (Monden, 2011) focuses on producing goods only when needed, minimizing waste and inventory costs. This agile process is supported by worldwide outsourcing to low countries such as Bangladesh, Vietnam, and China.

Zara has a more vertical multi-business supply chain, namely controlling all steps from design, to production, to distribution, to points of retail sale. Its use of just-in-time production allows it to manufacture in small groups of trendy items, evaluating how much it should quickly restock popular products. For this reason, new styles can be introduced up to two times a week and reduce superfluous inventory. Nevertheless, without a spare parts store, speed and collection account for considerable social and environmental costs (McKinsey & Company, 2020).

H&M uses a very nearly similar high-speed production model but leans further into sourcing from other corporations globally. H&M focuses on affordability and scale, producing billions of garments in a year. The company itself has introduced sustainability measures like its Conscious Collection as well as clothing recycling systems (Provin & de Aguiar Dutra, 2021).

Forever 21 represented the fast fashion business until its bankruptcy declaration in 2019 for extremely low prices and trend-based designs. The brand mainly focused on offering low-quality trendy clothes for young shoppers who wanted very affordable fashions. To make ends meet with the lowest in production, Forever 21 has depended on very cheap foreign labor, which resulted in low economies, but with the poor labor standards and quality of goods, put to consideration disposable fashion worsened the environmental cost aggravated by fast fashion (Chen et al., 2021).

The ability of these firms to have a competitive advantage through low production costs and a high degree of flexibility in responding to the market forces determines their success. To have a successful business strategy, these brands outsource production to low-wage countries and use JIT production to produce clothes in extremely high quantities rapidly. This method increases profitability and market domination.

Short production cycles and global outsourcing, which underlie fast fashion, have serious social and environmental consequences. The concentration on cheap, disposable clothes has led to an increase in textile waste. According to a 2017 report by the Ellen MacArthur Foundation, the fashion industry produces about 92 million tons of textile waste every year, of which many items sold at fast speed are thrown away after a few uses (Ellen MacArthur Foundation, 2017).

Since fashion is one of the most dangerous industries in the world, it causes a portion of worldwide CO_2 emissions that they have been attributed to it. By fast fashion, this problem greatly increased, as the new collections would regularly make its release. The fashion industry was responsible for the generation of 1.2 billion tons of gases per year, or more than all international air and sea transport combined (Carbon Trail, 2024).

An equally important theme is water consumption. The cultivation of cotton, meant to be the main fabric in most of the fast fashion creations, is a water-consumptive process. The amount of production done in fast fashion are potential contributor to water crises in some places (WWF, 2020).

Synthetic fabrics have an equal environmental footprint. Polyester, widely used in fast fashion, is derived from fossil fuel and does not decompose. Enduring microplastic pollution of rivers and oceans has resulted from it.

On the societal front, the fast fashion industry is under considerable examination for its unethical methods of labor. Most of the factories are in countries where labor regulations do not cover enough, therefore forcing poor salaries, poor working conditions, and long working hours for the workers. For example, textile workers in Bangladesh earn a monthly salary of less than $100, which is below a living wage as well. Events such as the 2013 Rana Plaza collapse, which took away the lives of over 1,100 workers, pointed out unsafe working conditions and thus the need for more transparency and ethical labor practices (Fraser & Van der Ven, 2022).

Figure 16: The negative impact of the fashion industry (Ken Education)

Some brands continue with the traditional method. Tommy Hilfiger still works on this model of seasonal collection, synonymous with traditional brands; Zara instead scores by having a fast turnaround time. While Tommy Hilfiger collected designs for managed collections months in advance with the tradition of the fashion seasons, spring/summer and fall/winter, Zara considered speed and flexibility. Its vertically integrated supply chain allows Zara to bring styles to stores in only anywhere from two to three weeks. This approach, or "see now, buy now," facilitates quick Zara response to trends that are in development while also literally keeping inventory up to date with real-time consumer tastes at a finer-specified level (McKinsey & Company, 2020).

In contrast, the traditional operations of Tommy Hilfiger would have a much longer lead time, which in turn would limit in and of itself any ability of that brand to react to the immediate requirements of its consumers. Zara's capability to adjust, and switch around adjustment production cycles is a dangerous contrast with that of the brands which are tied to long schedules of traditional seasons. As a result of that speed, Zara became more competitive and gained phenomenal revenues even though it was a target of various criticisms such as overproduction and wastage, and added to all these, it caused quite a huge impact as far as environmental issues were concerned.

New entrants into the business like Reformation have models that tend to balance the speed and responsiveness of fast fashion with a strong commitment in terms of sustainability. Fast fashion elements, such as the frequency of new releases or trend-driven designs, are applied within a sustainability-first approach. The company will try to utilize eco-friendly materials, sustainable practices, and open reporting on each product's environmental impacts.

What Reformation's model does, is create trendy yet high-quality clothes that align with the affordability and accessibility of fast fashion without sacrificing ethical production. The brand mainly involves producing small parts and requests minimum waste plus overstock and uses power renewables to mint factories. In addition to that, Reformation encourages openness through what it feeds into consumers to consider carbon footprints and water usage of its products to further appeal to an eco-conscious audience (Provin and de Aguiar Dutra 2021).

If Zara succeeds in monitoring trends that are short-lived with a volume model that is fast-to-catch-and-hold, then Reformation has been able to find that balance between the rapid agility one has in fast fashion and the taking care one does to the planet. To this end, it comes alive as a potential rival in a marketplace that is increasingly getting up on environmental impact. This way, by marrying design into trend and approach with sustainability, Reformation would seem to have attracted those who value ethical behavior in addition to cutting-edge designs.

Slow fashion, in contrast to fast fashion, is a movement that focuses on ethical, high-quality, and sustainable fashion production methods. Slow Fashion is something that proposes purchasing much less, but high-quality clothing that is intended to last longer and reduce its general environmental footprint. They say that the apparel and textile industry is among the biggest contributors to environmental degradation with only the fast-flying model of cheap, disposable fashion (Bocken and Short 2021). Fast fashion depends on temporary production cycles, which cause significant waste, resource dissipation, and unhygienic practices concerning society mostly in emerging nations, where labor is often exploited.

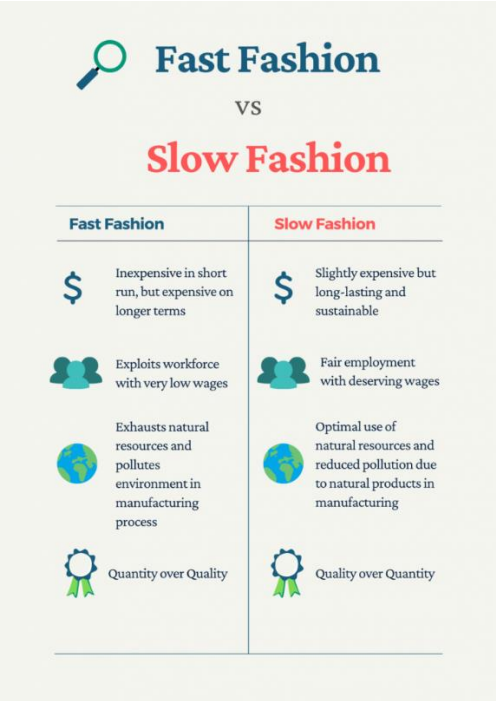

Figure 17: Slow/fast fashion of resource (English News, n.d.)

By complementing product lifespan extension with production efficiency in the resource and waste pipelines, slow fashion addresses such issues from the perspective of sustainability business models. Instead, slow fashion reduces the consumption end of the equation by producing long-lasting, timeless pieces to mitigate both environmental and societal effects from the overall footprint of the fashion industry. It resonates with a larger trend toward promoting circular economies and sustainable business practices, which also support transparency, fair labor, and stewardship use (Bocken & Short, 2021).

Fast fashion is associated with plenty of issues from human and economic rights violations, health risks from toxins emitted by fast-fashion industries, and waste from circular economies including wastage of textiles that would otherwise not be disposed of. On the other hand, while fast fashion has enabled brands such as Zara, H&M, and Forever 21 to dominate in the market with short production cycles and

low prices, the benefits on the environment and society carry a huge cost. The destructiveness of this industry is causing poverty in several nations, creating a large portion of the world's textile waste, carbon emissions, and water consumption along with the component of labor exploitation. This clearly shows that systemic change needs to be done. However, fast fashion companies now have a more major demand to adopt sustainability and ethical practices with growing consumer consciousness bringing these brands more attention from media to intensified pressure. New competition like Reformation has shown how new business models can bring speed without sacrificing responsibility.

2.3 Challenges and Opportunities in the Rise of Fast Fashion

2.3.1 Fast Fashion's Influence on Modern Business Models

During the mid-2000s to the following decade, fast fashion emerged and changed the nature of the fashion industry in approaching manufacturing and retailing by companies. Retailers like Zara, H&M, and Forever 21 invented the rapid production cycle through a mix of their flexible supply chains and improved manufacturing technology to offer high-fashion collections at really competitive prices (Caro & Martínez-de-Albéniz, 2015).

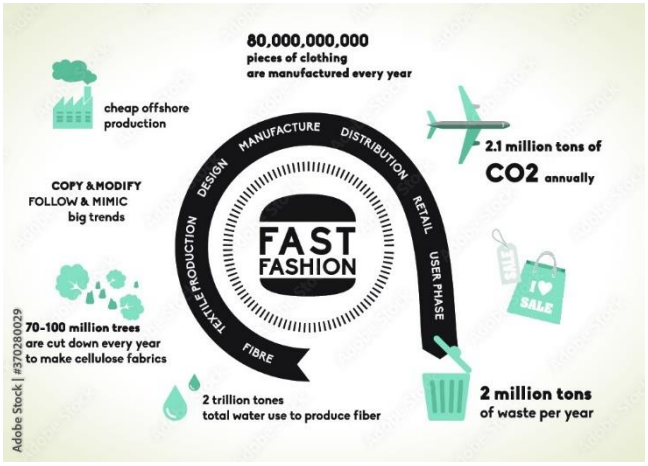

Figure 18: Fast fashion cycle (Adobe Stock)

With the "see now, buy now" strategy, these companies were able to quickly respond to design trends while ensuring that they keep their collections alive and fresh (Idacavage, 2018). It brought about the capacity to expand the supply chain and source production from low-cost countries such as China, Bangladesh, Vietnam, and maximizing efficiency and cutting costs (Taplin, 2014). Fast fashion brands were able to control every aspect of manufacturing and supply chain management, including ownership, vertical integration, and rapid throughput, so they didn't have to rely on judgments from others about pace and cost savings. It gave the other fashion companies greater control over supermarket shopping and influenced them to create more frequent collections and shorter manufacturing cycles.

This very economic strategy gave a competitive advantage but at the same time had serious sustainability and ethical concerns (Kaikobad et al., 2015). Unchecked pressure to make and sell at lower prices, while seriously compromising quality, creates a throwaway culture where clothes are seen as temporary and readily replaceable. Critics of this approach have faced quite some backlash from environmental and labor activists who defined the practices as unsustainable and the conditions of work as insufficient.

Fast fashion, like high fashion, is fundamentally at war with the fashion business of the past since it has entered the system as an unstoppable new type with its own high costs, exclusivity, and artisanship. Historically, haute couture was for the financial elite, who could afford unique fabrics and have their clothes hand-crafted for them. Fashion houses such as Chanel, Dior, and Givenchy exemplified this model: set the trend and eventually spread to the middle and lower markets. Haute couture as a concept remains more desirable in its luxury and artistry, emphasizing quality, innovation, and rarity (Back, 2017).

Fast fashion democratizes stylish clothes: mass-produced, derivates of high fashion style at an affordable price. Unlike before, when clients had to wait until the seasons changed before going to stores to see if a collection was available, fast fashion now enables them to have clothing in the store earlier than it used to be. Consumers get to enjoy trend participation almost instantly without the price tag of haute couture (Todeschini et al., 2017).

Fashion became accessible but not restricted to the traditional haute couture model. Fast fashion is cheaper and is more equipped for speed and volume than quality and craftsmanship. Cheap materials and simplified manufacturing processes are often the standards for fast fashion. This has led to the trends rapidly declining and styles becoming obsolete quickly so people invest in more frequent purchases and throw them away after a short period. On the other hand, haute couture focuses on timeless and long-lasting, high-end design. (Provin & de Aguiar Dutra, 2021) Fast fashion and haute couture are representations of a broader change in the economy of fashion consumption. Fast fashion has made brands widely accessible, but it has also done much to accelerate a throwaway culture and challenges the accumulated value that haute couture generates. Some argue that both can exist, haute couture being the incubator of creativity as well as fast fashion being the medium for democratizing trends consumption.

Fast fashion brands are cash cows, running massive volumes of apparel fast through rapid production and sales. Zara has an unbeatable capacity to bring new lines in weeks to store shelves. They keep in tune with changes in consumer tastes and inventories that reflect what consumers consider current.

Sustainability criticisms and even the COVID-19 pandemic are no easy challenges for it. H&M will continue to be profitable as it starts to meet demand in the sustainability space because it demonstrates that it is more accessible across a range of price ranges, from basic inexpensive fashions to its Conscious Collection (Provin & de Aguiar Dutra, 2021).

It had an economic and structural role in the success of fast fashion that made fashion companies have to adapt to an ever-changing time. Consumption of limited drops and collaborations is becoming so much more frequent with high-street fashion as luxury brands, which have always focused on biannual collections, are now introducing fast fashion-inspired strategies to keep close to customers: Gucci is one of the brands that are starting to go seasonless. It launches collections not following the calendar for the fashion world but from its agenda. This gives luxury firms a lot of latitude in reacting immediately according to market demands, reflecting the agility of fast fashion (McKinsey and Company, 2021).

It has created pressure on organizations in conventional fashion regarding prices and what profit they can earn with the fast fashion business model. Profit margins of fast fashion are quite low but profits are turned through great volumes of sales. The difference allows fast fashion to scale for high profits, unlike

the new ways in which traditional design houses must compete in affordably focused, accessible, and location-populated markets (Todeschini et al., 2017).

Recently, fast fashion has been having a representation in Forever 21 as it implies the risk and returns concerning this business model. In its glorious days, Forever 21 attracted all sorts of customers at speed with ultra-trendy design and cheap prices. The rapid expansion and high dependency on sourcing from low-cost manufacturers proved to be unsustainable and ended with the announcement of bankruptcy in 2019. The statement mentioned competition with online retailers and changing customer preferences, especially the growing demand for sustainability, to illustrate how fast fashion brands are quite vulnerable to market disruption and the need for a fast-changing industry to adapt to it (Chen et al., 2021).

Unlike most of the fast fashion brands that are anxious to catch the latest trend oftentimes, Uniqlo focuses is quality and long-term wearable clothing at affordable prices. Uniqlo's supply chain model wants to have a balance between fast fashion, efficiency, and product quality, allowing the company to offer low-cost clothes that are high quality compared with conventional retailers.

Uniqlo uses a just-in-time manufacturing system, like the one pioneered by Toyota in the automotive industry. This allows for production in smaller lot sizes, less overproduction, and creates less waste. In addition, Uniqlo carefully cultivates these long-term relationships with its suppliers, so that both parties can deal better and generate cost efficiencies. Other key products, such as HeatTech and Ultra Light Down ranges, have become base components to limit the amount of product that needs to be turned around constantly which ensures consistency at production cost and quality management levels.

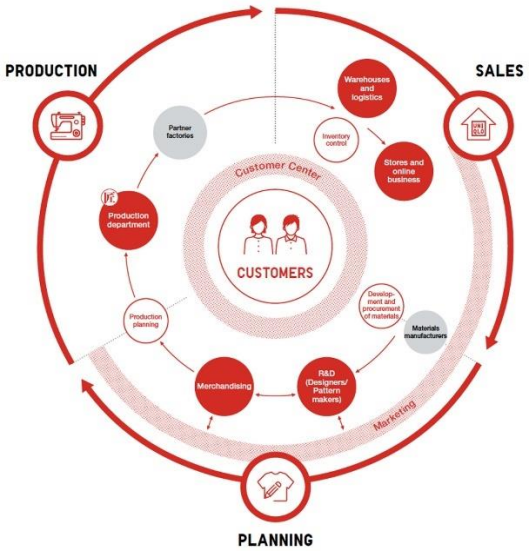

Figure 19: Uniqlo model (Fast Retailing)

Conventional fashion retailers would operate on that seasonal level where everything would be returned through larger inventories and this would lead to raised costs and almost always the risk of keeping unsold stock. This allows Uniqlo to have a perfect supply chain in terms of cost efficiency; it lets consumers have high-quality basic items at competitive prices without compromising durability, which distinguishes it from the other players in fast fashion (McKinsey & Company, 2020).

Unlike typical fast fashion brands that promote buying a lot and then throwing it away, second-hand and rental companies like Rent the Runway promote the opposite. Founded in 2009, Rent the Runway allows

customers to temporarily rent designer clothing and accessories at a fraction of the retail price and temporary ownership of luxury items without facing the long-term financial and environmental costs of traditional consumption.

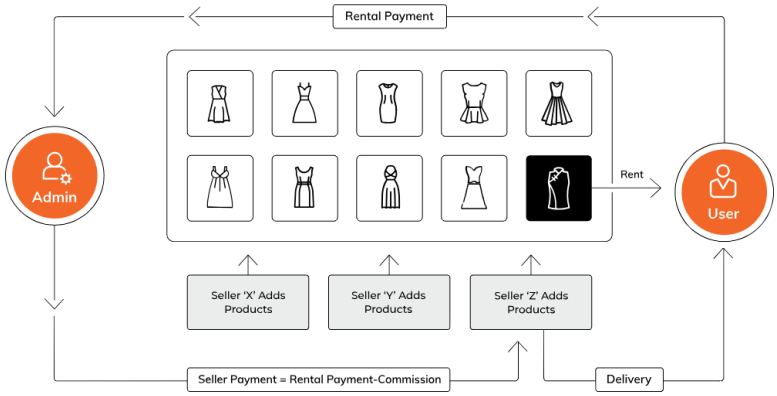

Figure 20: Rent the Runway (FATbit Technologies)

Rent the Runway subscription-based model gives users the ability to access rotating portions of their wardrobes containing high-end fashion pieces without purchasing them completely. Customers are starting to realize how much fast fashion has been damaging the environment by promoting more purchases rather than sharing and reusing items, which is why they are worried about it. In other ways from fast consumption, Rent the Runway also offers non-productive consumption organized by another circularity (Chen et al., 2020).

The company Rent the Runway also helps customers who prefer access to products rather than having them on their property by offering a method to enjoy fashion trends and designs without contributing to textile waste. The act itself significantly lowers the frequency of new clothing purchases while encouraging a responsible purchasing culture, making Rent the Runway a leader in apparel rental and an intense competitor to fast fashion companies.

Fast fashion has transformed an industry, resulting in remarkable profits and market shares for businesses like Forever 21, Zara, and H&M. Despite their continued illusion that fast fashion will be a sustainable long-term model, all significant earnings have negative economic and environmental effects, consequently the fashion industry's strong bluebloods must change. Emerging disruptors such as Rent the Runway in promoting different consumption alternatives increase the relevance of budget-sustainability balances in ever-greater influence in constructing tomorrow's fashion.

2.3.2 Unsustainable Practices and the Demand for Change

Fast fashion has brought in several costs concerning social and environmental costs. They also have increased the pace of production and have encouraged a kind of mentality of "pile it high, sell it cheap." These have resulted in more consumption and more wastage. They have increased the amount created and forced the fast fashion industry to depend excessively on synthetic and non-biodegradable materials. This resulted in a huge increase in textile waste and, ultimately, environmental degradation (Majumdar et al., 2022). Reports show that millions of tons of clothing are thrown away every year and end up in landfills, worsening the global ecological crisis.

Using cheap labor in low-cost manufacturing countries raises important questions concerning their possible exploitation and poor working conditions, wages, and long working hours (Ross, 1997). The public's demand for improved labor standards and transparency in the fast fashion supply chain has increased (Fraser & Van der Ven, 2022). Consumers are getting to know more about the injury that is done to them by what they buy; therefore, fashion companies are beginning to feel pressure to treat this more ethically and environmentally friendly in business practices.

Despite many criticisms, fast fashion companies have not moved very far from their original business models. This is characterized by a predominant "take-make-dispose" approach focused on speed and cost reduction. Gradually, however, some corporations define some programs for improvement in their environmental footprint, for example, launching some recycling programs for old pieces of clothing or trying out using sustainable materials like organic cotton and recycled polyester (Boström & Micheletti,2016).

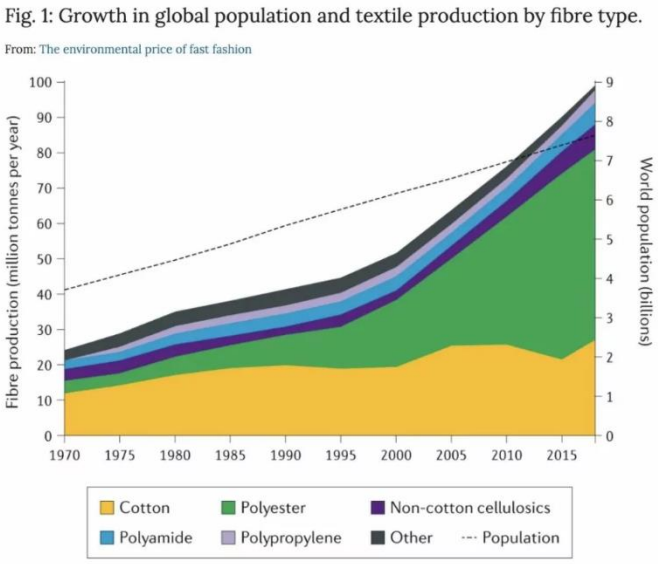

Figure 21: the growth in global population and textile production by fiber type (TS Designs)

They now speak of slow fashion and ethical fashion as regaining culture from the unsustainable output of fast fashion. These movements would appeal to more sustainable production, fair practices in labor, and less overconsumption. Slow fashion promotes the idea that consumers should invest in a higher-quality garment designed for a longer lifespan, unlike the fast fashion notion of throwaway clothing. The slow fashion movement is associated with local production, supply chain transparency, and sustainable materials usage (Pookulangara & Shephard, 2013).

Groundbreaking documentaries like The True Cost that came in 2015 have helped create awareness about the impact of fast fashion on the environment and society. The True Cost, which was directed by Andrew Morgan, shows how people work under deplorable conditions in garment factories in Bangladesh and Cambodia, where they are paid little and have to work under unsafe conditions. Further, the document states how the fashion industry has contributed to some of the environmental degradation, which includes enormous amounts of textile waste and the contamination of water supplies due to dangerous dyeing processes.

Rising consumer disturbance related to increasing awareness, because of the concerns on fast fashion touched with movements like the one led by Fashion Revolution under the hashtag, #WhoMadeMyClothes, towards demanding transparency and accountability within fashion supply chains. This encourages consumers to approach brands with questions about the working conditions and environmental effects of their products, helping build pressure for ethical practices. In 2019, boycotts against fast fashion brands like Forever 21 and H&M arose when customers decided on more sustainable and ethical alternatives (Fashion Revolution, 2020).

Figure 22: Who made my clothes (Lucy & Yak)

Due to increasing public attention and regulatory pressure, fast fashion big companies such as H&M, and Zara have developed sustainability programs to mitigate the impact of their operations on the environment. Critics argue, however, that these changes are just superficial touches to problems and do not cure the disease of fast fashion's unsustainable practices.

In 2010, H&M introduced the Conscious Collection as part of their broader effort to make their operations sustainable. The collection includes organic cotton, recycled polyester, and Tencel fabric made from sustainably sourced wood pulp. It was also reported that by 2020, 64.5% of all materials used in H&M's production were sustainably sourced, with the plan to increase that figure to 100% by 2030 (H&M Group, 2020).

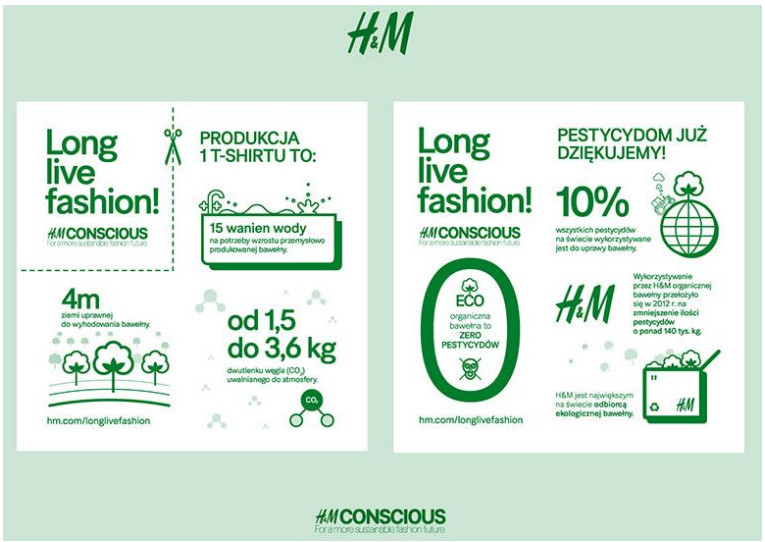

Figure 23: H&M conscious collection (H&M)

However, critics argue that the initiative is just marketing and not an actual effort to reduce fast fashion's environmental damage. According to a 2021 report released by Changing Markets Foundation, H&M practiced "greenwashing," which means that it publicized its sustainable line, while other parts of its businesses remained unsustainable.

Zara's Join Life range was introduced in 2016, which also focuses on sustainable materials like organic cotton, recycled polyester, and Tencel. The brand is targeting 100% sustainable production of all cotton by 2025 and 100% of products manufactured with sustainable or recycled materials by 2030 (Inditex, 2020). In addition, Zara has been water as well as energy-induced in its supply chain as effective efficient processes for reducing their overall environmental footprint.

However, like H&M, Zara also has been accused of not knowing the root cause. Perpetually creating new collections, which motivate consumers to buy over and over, results in a lot of consumption. The Join Life collection may be made from more sustainable materials, but the business model drives such volume that it completely undermines the initiatives of the collection. Without a drastic reduction in the production of clothing by the brand, those sustainability initiatives will not go that far (Chen et al., 2021).

Both the Conscious Collection of H&M and Zara's Join Lifeline have made consumers aware of these collections and further motivated them to use more eco-friendly alternatives within the fashion field. Unfortunately, though, their success has been limited because fast fashion, as an economic model, has been based on speed in production and consumption. Continually criticizing new numbers, affordable pricing, and inadequate duration for products, even the sustainable lines add to the higher pollution to the environment.

Such as both companies are committed to sustainable materials, but fashion still wastes over 92 million tons of textile waste every year in the world, a large part of which either gets into landfills or gets incinerated. Apart from that, the global fashion sector contributes around 10% of the total carbon emissions. Although fast-fashion brands are largely responsible for this high number, they are just some drop in the ocean when compared to their amounts of production and global supply chains (Ellen MacArthur Foundation, 2017). Certainly, changing sustainable materials alone will not solve these systemic issues in the absence of addressing the fast fashion model's core dimensions.

One very important and consumer-led movement to promote transparency and accountability in fashion comes with that of the Fashion Revolution movement. The movement was initiated from the tragedy that followed the collapse of a factory in Bangladesh, where more than 1,100 garment workers lost their lives in 2013 (Fashion Revolution 2020).

#WhoMadeMyClothes, the signature of the campaign of the movement, demands consumers to inquire about the people behind the production. More than that, they should be able to know the hidden working conditions around the globe to understand many garment workers' working conditions. On the under-pressure side, many known brands of these types of activities have been attracted to account matters relating to whom works in the shop where its products are manufactured, as well as its ethical standards and environmental impact (Fashion Revolution, 2020).

In reaction to increasing demand from consumers for sustainability, several of the big brand names in the fashion industry have initiated campaigns to lessen the effects of activities on the environment. For example, Nike has initiated Move to Zero, a program that targets the company's value chain without

carbon and without waste. The approach is a total of every feature from manufacture to product development, recycling as much as possible.

Nike has made remarkable steps in the achievement of these strategies from the time when recycled polyester was introduced as the latest Nike Grind program that would change industrial leftovers and unused products into new creations. The Flyknit shoe can now be produced from yarn made from recycled plastic bottles, thus keeping less wastage than a conventional production method. In addition to this, Nike has started investment in renewable energy production facilities and has also, in several ways, taken steps toward the elimination of single-use plastics from its packaging (Nike, 2021).

Indeed, the Move to Zero initiative is ongoing, which just shows Nike's public commitment, an important step towards true corporate accountability and improvement efforts in reducing consumers' carbon footprints and shifting to a circular economy. This sets an example that other bigger houses in fashion will follow to show how sustainability can be included within a truly global supply chain without really compromising profit or quality.

Such initiatives like H&M's Conscious Collection and Zara's Join Lifeline could be seen as steps towards better practices, but they are still initial in the attraction of large models of fast fashion. The production and continued manufacture of low-cost articles in large limits actual possibilities for environmental intervention. The pace and volume with which business is conducted under fast fashion must change fundamentally to enhance the effect of these efforts. Unsustainable practices of the fast fashion industry have caused the emergence of large consumer activism around issues such as the #WhoMadeMyClothes campaign initiated by Fashion Revolution for more significant transparency from brands. On the other hand, large corporations such as Nike set new environmental responsibilities through activities such as Move to Zero. Such great demands for change are likely to frame the future of fashion depending on consumer activism and corporate change in sustainable practices.

2.3.3 Shifts Toward Ethical and Sustainable Alternatives

The criticism directed at the unsustainable modes of fast fashion has a growing number of businesses preferring the circular business model of recycling, reusing, and reducing waste forms (Beser Ramada, 2021). Circularity reduces resource usage and enhances product life, and can be thought of as a potential alternative to the traditional fast-fashion model. This closed-loop approach also engages in recycling textile waste and customers return used items for reusing or repurposing (Pasqualicchio, 2021).

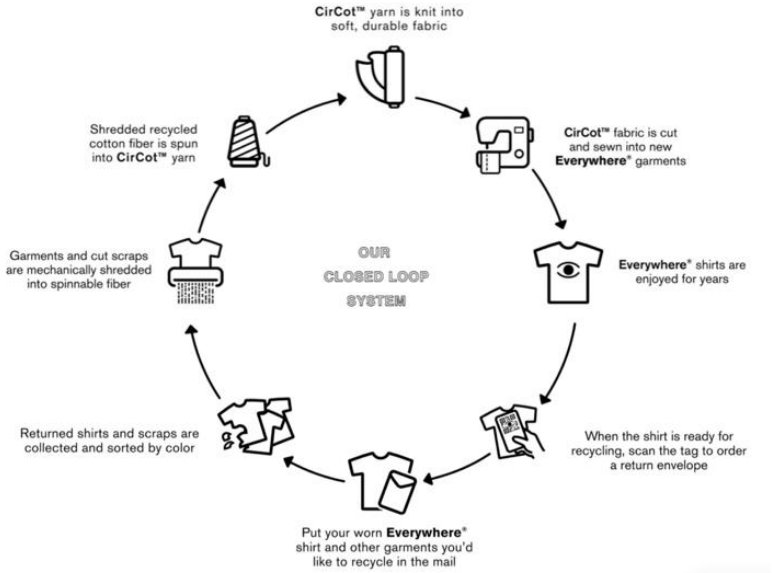

Figure 24: Closed-loop fashion (AIM2Flourish)

Fast fashion brands invest in recycling textile programs, helping make manufacturing methods less dangerous for the environment. The growing importance of sustainable materials such as organic cotton, recycled polyester, and new bio-based materials further cut dependency on virgin resources while increasing resource efficiency in the supply chain (Adamkiewicz et al., 2022). To reduce waste and excess, some fast fashion companies have even tried just-in-time thinking, which calls for producing things only when customers request them.

At least a few companies have improved supply chain transparency to address the growing need for ethical fashion. Some of the brands cultivate the consumers' curiosity on how and where products are made leading to more conscientious ways of consumption. Customers demanding improvements in production processes for the better welfare of workers such as a safe working environment and higher wages were consequently creating and carrying out these beneficial projects (Chen & Lin, 2018).

However, this is completely different from the fast fashion industry which has strong challenges to transform from its existing business models to genuinely sustainable models. This calls for collective effort within the entire fashion ecosystem and a redesign of existing business processes to maintain the balance of profitability, consumer demand, and sustainability. This is an area of constant re-thinking by such companies to stay competitive in the future.

Emerging customer demand for fashion that is considered ethical and sustainable puts alternative business models such as subscriptions for fashion and second-hand resale platforms in the upper spot. They will also request responsible consumption, prevent waste, and help circularity even as they displace fast fashion.

Platforms like Rent The Runway have established an entirely different paradigm of fashion through subscription. Instead of owning new items, customers can now wear clothes for a given period and return them after the rental period. This is popular for special occasions or very high-end designer pieces that customers would be hesitant to buy for a single use. By this, one would rather pay rent than buy a new outfit or dress. This would discourage demand for the production of clothes and reduce the negative

impact of overconsumption on the environment. Rent The Runway offers very short-term rentals and also options for monthly membership services that allow users to borrow a rotating selection of clothes. Subscription-based models present one of the biggest issues in terms of sustainability in the fashion world- overproduction. Here, paying customers get that alienation and novelty stroke without having to put their feet into the endless machine of fast fashion. However, the 'environmental gains' mentioned above will be nearly offset by the effects of carbon and water on large-scale cleaning and shipping.

Companies such as The RealReal as well as ThredUp have their focus on reselling unwanted clothes, making them part of a circular economy as lifetime goods-extended articles. These sites enable customers to purchase and sell used clothes instead of buying new ones. The RealReal has been growingly established as a luxury resale market leader among many others due to the market desire by consumers for sustainability and ethics. The 2021 Luxury Resale Report from The RealReal further advises that the closing figures of 2021 were over 19 million items sold through the platform. Therefore; they make a significant impact in new production while taking advantage of luxury resale and contribute towards sustainability within the circular economy (The RealReal, 2021).

Platforms for secondhand resale eliminate textile waste and fight stigmas by enjoyably repurposing clothing and making it appealing. Luxury reselling allows buyers to acquire extremely expensive designer clothes at a much lower price making it a respectable option against fast fashion. However, scaling is not as easy because sorting, verifying, and authenticating the used items requires a huge amount of resources.

Similar to the second-hand market, there is also the vintage market which is gaining appeal with customers who can purchase good quality old clothes at good prices.

Instead, recent several fashion brands born out of ethical and sustainable practices would have done well to put such elements directly into their principles and business strategy, as opposed to fast fashion companies. Reformation and Everlane are case examples of fashion brands where ethics formed a foundation on which other core business activities would be embedded-supply chain transparency, sustainable materials, and even labor standards.

To be recognized for fashion that cares about the environment, the designs and manufacturing practices of the company are focused on sustainability. As a part of this commitment to environmental transparency, the company has published reports on the relative savings on some measures such as water, energy, and carbon dioxide emissions, compared to conventional measures. Much of Reformation's collections will be circularly drawn from sustainable materials, surplus textiles, Tencel, or other recyclable fabrics. It is locally produced; most of its clothing is made in Los Angeles, which cuts down on carbon footprints incurred during shipping over long distances (Reformation, 2020).

What makes it different from these fast fashion brands, is slow fashion. Instead of producing hundreds of thousands of products in smaller cycles, this company produces limited numbers of each item, inspiring customers to shop mindfully. The transparency and environmental reporting of the brand touch eco-conscious shoppers, being a strong alternative to fast fashion who simply greenwash without any changes in their production practice.

Everlane markets its brand with "radical transparency" by telling the consumer exactly how and where their items are made. It publishes the materials, labor, and transport costs for each one and the final

price the consumer pays. Through targeting that, Everlane wants to bring the consumer toward itself as different from those brands that hide the actual cost of their products. Approving ethical labor practices, it partners with factories that align with stringent safety treatment and compensation measures for their workers (Everlane, 2021).

Everlane practices sustainability through the use of materials such as organic cotton and recycled polyester and sets high ambitions to reduce its carbon footprint. The firm promised to remove all virgin plastic from its supply chain and packaging by 2021. Everlane's transparency and ethical business practices have made a benchmark for how fashion manufacturers can involve sustainability in the operations of their company.

Unbelievably different from fast fashion brands like Zara and H&M, which are busy making strategies to turn these ideas into marketing tools, Reformation and Everlane have become alternatives to what more and more environmentally conscious consumers may want. Transparent dedication to ethical labor standards in sustainable materials set them apart from ordinary fast fashion brands whose transition to sustainability is only superficial without addressing their real causes.

Alternative models of business, for instance, subscription fashion and secondhand resale platforms, with Reformation and Everlane, are successful in their attempts at sustainability and reduction of possible ways by which the fashion industry can damage and hurt itself. These meet the increased understanding in the consumer mind to demand transparency and ethics, providing a scalable future in the way forward into a sustainable future for fashion. But even with these alternative pathways, problems exist in how logistics can be arranged, how far such schemes are scalable, and how competitive they are. Success will therefore be determined by the ability of the alternatives to find ways of bringing together profits in the long run with an ethical model and educating consumers to understand the long-term benefits of ethical fashion.

The proliferation and rising importance of alternative business models and ethical firms create new possibilities for exiting fast fashion's environmentally damaging practices. Subscription services, secondhand marketplaces, and companies like Reformation and Everlane suggest that business and sustainability can exist together, potentially pointing toward a more responsible future for fashion.

2.4 Technological Innovation and the Shift Toward Sustainability

2.4.1 Digital Transformation and Business Model Evolution

Emerging technology has transformed the structure of businesses regarding digitization in the fashion industry, caused by sustainability factors. This increased use of digital platforms, from social media to e-commerce, is now a critical component of the fashion business strategy; it allows firms to interact more directly with customers, track trends in real-time, and optimize operations across the value chain.

Digital marketing and social media perspectives have revolutionized the way fashion is consumed and publicized. Major social media platforms such as Instagram, Facebook, and TikTok have brought trends closer to the people and democratized fashion by giving them a microphone in the fashion conversation (Ananda et al., 2019). Nowadays, consumers share their ideas, get in touch with brands, decide what to buy, and will thus have an impact on the market. Companies also need to be flexible and agile in business

restructuring, as new collections are updated regularly to satisfy the expectations of trend-driven digital consumers.

DTC brands, like Warby Parker and Everlane, flourished as they ignored traditional retail and instead used digital platforms to engage with consumers directly and to sell to them. The product's design, engineering, and manufacturing all incorporate flexibility and adaptability in distribution and marketing to meet particular business needs. Companies have become skillful at scaling their operations and offering experiences that would be cost-effective with a digital-native strategy. Internalization of business models into environmental and ethical principles through the use of digital tools is increasing the pace toward sustainability transformation. Through data analytics, artificial intelligence, blockchain, and other digital means, corporate firms rely on such tools to improve transparency and efficiency in their supply chains, resulting in waste reduction and resource improvement (Madsen et al., 2020).

AI is the cause of such a monumental transformation in trend forecasting, customer customization, and even supply chain management in the fashion arena. An exemplary model for the paradigm that uses artificial intelligence as its backbone might be an online subscription personal styling company: Stitch Fix follows machine learning algorithms and human stylists to provide tailored recommendations to customers. Using purchase history and feedback, the company can make individualized recommendations (McKinsey & Company, 2020).

AI-enabled software by Stitch Fix captures comprehensive data such as customer surveys, style preferences, and social media trends to predict the outfits that a client might like next. Client feedback helps to learn and increase recommendations as one progresses. For instance, when a client consistently gives a plus grade for a type of clothing, the algorithm gives priority to similar ones. This level of customer satisfaction on the part of the tailor would be the ultimate complaint, as it would further reduce returns, which are a common problem in online retailing today.

AI is also increasingly evolving in the area of predicting trends. More and more, fashion brands and retailers are beginning to embrace AI in predicting the next trends via social media, e-commerce, and other behavioral analytics. AI solutions allow organizations to get organized around the consumer dynamics/change faster by pattern-matching against emerging market dynamics with consumer preferences, recovering from design to delivery time. This allows fashion businesses to be ahead of the game in satisfying consumer requests, mitigating the overproducing and wasted inventory risks (Todeschini et al., 2017).

The digital channels have enabled consumers to co-design the product with the companies, increasing their participation and personalization. Super sportswear companies like Nike and Adidas have used digital technologies to bring consumers into the design process and enrichment of supply chains.

Nike is well-known for co-creating with customers through its Nike By You platform (previously NikeiD), allowing consumers to entirely customize their shoes and equipment. Consumers can modify colors down to materials, creating an ownership sense and creativity. Consumers create unique, one-of-a-kind products reflecting their tastes through a very simple online platform. In particular, this promotes customer satisfaction and reduces inventory risks, as a large part of customized products are made to order, thus reducing waste (Nike, 2021).

Alongside that, digital technologies are incorporated by Nike into its supply chain. Using AI and machine learning tools, the company optimizes inventory management along with forecasts on demand, and real-time shifting production adjustments according to market data. This leads to avoiding overproduction, getting actual stock levels with the demand of consumers, and reducing the effect of unsold items on the environment.

Similarly, Adidas has embraced the change in digitization via its miAdidas platform which allows customers to design their sneakers. Robotic process and 3D printing speedier production of custom-made shoes are done closer to the consumer, using Speedfactory technology by this brand. The downside of such an initiative is the reduction of lead time in production and the localization of manufacturing, a significant factor towards sustainability since it avoids the carbon footprints that come with flying goods worldwide (McKinsey and Company, 2021).

The utilization of artificial intelligence in supply chain management has been made by Adidas. Predictive analytics makes the brand able to gain accurate forecasts of demand and respond accordingly, as customer preferences change. That is how Adidas prevents unnecessary overproduction optimizes its global distribution network, creates a minor environmental impact, and increases the efficiency of operation.

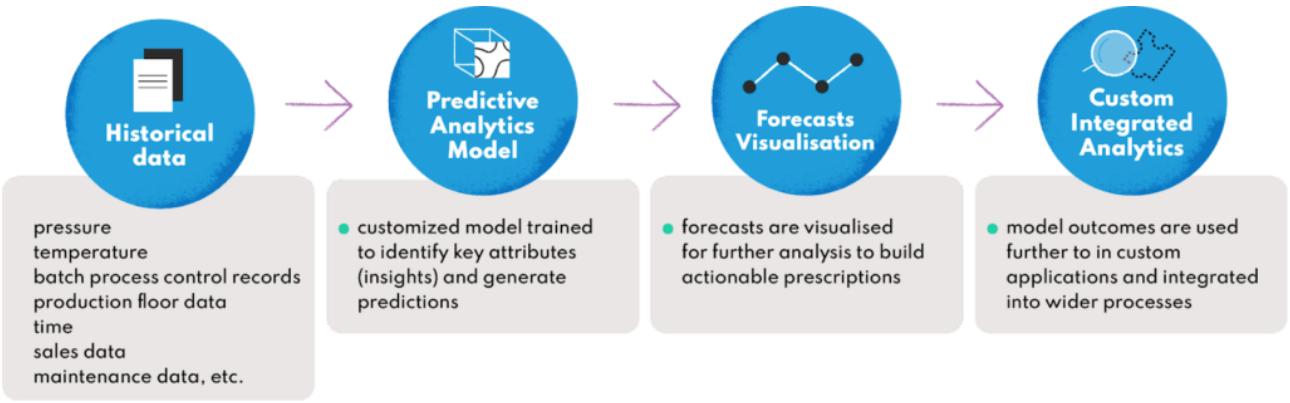

Figure 25: Predictive analytics (DiLytics)

Tools powered by AI provide trend forecasting, personalization for customers, and supply chain optimization and have transformed the fashion industry. Case studies from Stitch Fix, Nike, and Adidas show the role of AI and digital platforms in anticipating consumer demands, reducing waste, and improving the experience for customers through personalization and co-creation efforts. As artificial intelligence evolves, its function in the future of fashion becomes even more important as it allows them to conduct their businesses more sustainably and present highly personalized experiences to the customer.

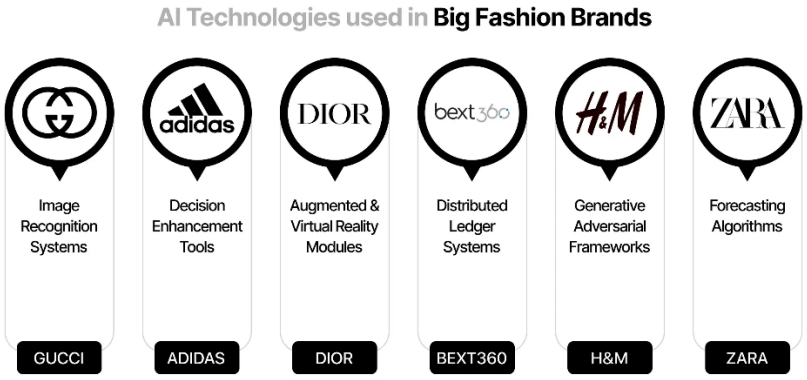

Figure 26: AI technology in fashion brands (Markovate, 2023)

The marketing strategies adopted by DTC brand last year which boasted of renowned sales were incredibly inflated because they are top-on-the-mind when it comes to sales during the pandemic since consumers around the world have made available entirely digital platforms owing to state interventions on lockdowns and social distancing. The increase is attributed to e-commerce, as convenience and safety make consumers buy while sitting at home. Some such brands that practiced balanced operations like this are Warby Parker, Glossier, and Allbirds.

Emphasis for the future is on how digital shift matters for fashion companies in the present growth trend for the adoption of digital online experience by customers. The pandemic made fast-forward these trends by turning digital commerce into a major part of the evolution of business models.

Well, from now on the Retail Experience is going to increasingly see Augmented Reality (AR) playing an important role. With AR technology, consumers will appreciate being able to see product visualizations in their wireless environment, which would allow them to buy online and still offer an almost physical shopping experience. An initial successful adopter is IKEA, which has its popular IKEA Place app that allows customers to visualize furnishings and other home decor items in these spaces by using their smartphone cameras (IKEA, 2020).

Similar AR applications are now being developed in the field of fashion, where customers are ultimately able to try on clothes and accessories virtually. Companies like Zara and Gucci have in their investigations undergone experimentation with AR to the consumers to virtually try on outfits, footwear, or even makeup, enabling home-based shopping. It is anticipated that as AR technology improves, it will be a prerequisite for online retailing, transforming ways with which brands interact with customers about their experiences. The brand can benefit greatly from this combination of reality and augmented reality through more customized client engagements, lower return rates, and increased customer satisfaction.

The digital transformation of fashion is happening rapidly as a result of the pandemic. This change has generated heavy online sales in recent times by DTC brands. More futuristic trends like Augmented Reality will improve the shopping experience even more. As digital technology is increasingly adopted by consumers, it is expected that investments in augmented reality and other innovations will prepare brands to face the challenges posed by rapid change within the retail landscape.

2.4.2 The Role of Data, AI, and Blockchain in Sustainable Practices

Today the possible sustainability practices that find application in the fashion industry are easily reached using data analysis, artificial intelligence, and blockchain technology. Such innovations open up a possible design of the business model that is entirely new and more sustainable, optimizing the entire value chain from design to production, distribution, and marketing.

Through good decision-making for fashion brands regarding trends and also concerning the management of inventory, data analytics could prove to be helpful. Consumer behavior and preference tracking could further eliminate overproduction, take back waste, and inform one about better consumption production timing (Jain et al., 2017).

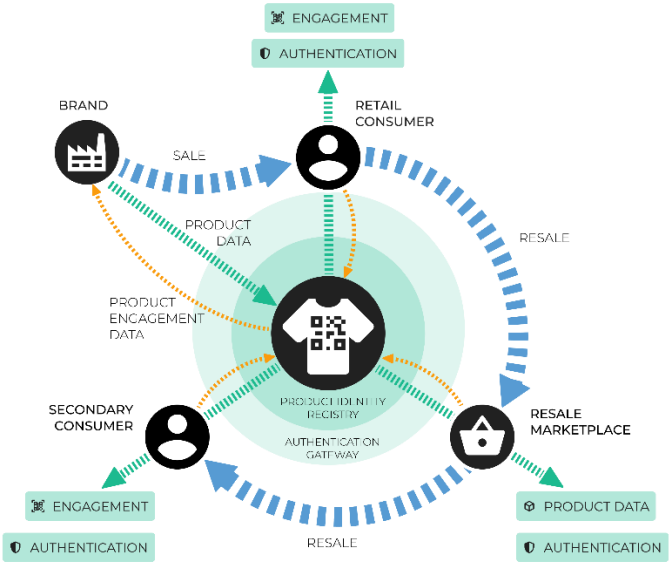

Figure 27: Digital authentication could drive a resale revolution for fashion (World Economic Forum, 2021)

Today's real world has shown that AI raises the bar in real-time prediction of demand, allowing rapid adjustment by firms to changing customer needs and greatly improved efficiency in those supply chains. These AI technologies provide the highest benefits through targeted marketing and create a more personalized experience for customers, resulting in effective engagement and lowering unnecessary returns and excess inventory.

It provides a track-and-trace mechanism for all product processes from raw materials to finished items, guaranteeing ethical and sustainability compliance throughout the supply chain (Huynh, 2021). Such a mechanism can create consumer confidence, especially as modern consumers desire transparency and accountability from brands.

Similar to the benefits of these technologies, there would be difficulties in putting them into practice. Data protection concerns, technical skill gaps, and difficulties obtaining fashion-specific data are all potential obstacles for any organization hoping to fully integrate data analytics and AI applications into its operations (Madsen et al., 2020). On the other hand, careful handling for purposes of compliance with the GDPR and the other regulations regarding data use is tackled to ensure proper handling to prevent abuse of the data.

Another emerging use of the blockchain is for increasing transparency in its operations in terms of sustainable sourcing. One of the major frontiers is Avery Dennison, which has created an RFID-based blockchain system to track products along the supply chain. Avery Dennison is a materials sciences company of global stature. Their platform, Janela, puts RFID tags into apparel to maintain records related to origin, material composition, and the manufacturing process. The information is then safely held on a blockchain where it creates an unalterable record of the journey of the product from raw materials to finished goods.

RFID tags and blockchain can ensure or provide consumers with reliable information on the ethical and environmental credentials of their clothing manufacturers. This improves traceability by confirming that resources have been sourced responsibly and that labor practices are ethically acceptable. With a smartphone, he or she can scan the RFID tag on each garment to get accurate details of its creation, the materials used to make it, and compliance with environmental and labor requirements. This system promotes accountability along the supply chain, helping to reduce such concerns as "greenwashing" (Avery Dennison, 2021).

Despite the significant advantages in terms of openness, blockchain and RFID technologies have their challenges as well, such as the scalability issue. RFID systems would have to be deployed at a cost that would be beyond the reach of smaller companies, given the large supply chain that has to fall under an RFID-based tracking system. This is mainly because the decentralized structure of the blockchain increases security and transparency but at the same time causes inefficiencies as far as interfacing such legacy supply chain systems designed not to integrate these new technologies is concerned (Huynh, 2021).

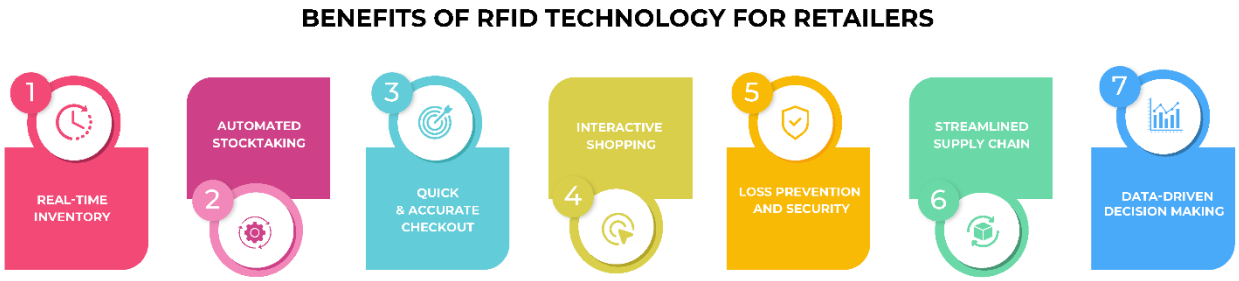

Figure 28: RFID technology (RFID4U)

While the thinking fashion industry has been digitized, it does not end there. There are still some hidden issues behind these new technologies. The biggest of which is algorithmic bias. AI is developed based on past data, so any biased information, say, about 'Gender', 'Ethnicity', or 'Body Type', will get amplified in decisions made by AI. For example, some recommendation systems favor certain 'Body Types' without focusing on others, excluding its users or customers who do not belong to the general profiles, limiting diversity while encouraging undesired stereotypes (McKinsey & Company, 2020).

Another problem consumers face is privacy. The use of AI for personalization and trend prediction necessitates the assembling and analyzing of huge amounts of consumer data, creating systemic questions about how it is used, stored, and shared. To some extent, consumers want personalized recommendations, but as much as those concerns grow in numbers, another one comes regarding how

much personal information is accessed by firms, particularly concerning their online buying behavior, location data, and social media activity. These issues have been further accentuated since the advent of the General Data Protection Regulation, which the European Union enforced to guarantee strict limits on how companies would collect and process personal data.

GDPR requires organizations to get users to consent to collect their personal information intentionally, ensure they are aware of how the data is going to be utilized, and assure them that they are free to access this data as well as delete it. For instance, to fashion companies, it could mean re-evaluating the methods they use to collect data on consumers and ensuring that their AI systems are GDPR-compliant. Offenses here would cost billions of dollars in fines, calculations often put at 4% of global revenue for the organization. For that reason, businesses that work with any form of personalization or trend analysis are exposed to huge risks associated with data regarding customers whether exercise or operation is in a country with a different legal tender (GDPR, 2020).

AI systems must reach an equilibrium between the privacy of data and personalization of it. Highly personalized shopping experiences can provide customers benefits, but then overly collecting data may have certain privacy problems with mishandling the data damaging customer confidence. To target fashion companies toward using intelligence-enabled personalization while complying with GDPR, stringent monitoring for data protection and transparency on the use of data is required (McKinsey and Company, 2021).

The multi-dimensional role of Blockchain, Artificial Intelligence, and data analytics gives way to curating sustainability in various forms from enhanced visibility to personalization and inventory management at increased levels. These bright ideas also have challenges: algorithmic bias, consumer privacy, and compliance with increasingly stringent GDPR principles. New technologies keep on being integrated into their business models by fashion companies, and overcoming this will bring forth the totalities of the benefits of the innovations all within ethical dimensions and consumer trust.

Introduction into smaller enterprises would, however, seem improbable on the greener side, contrary to large companies. These include companies with substantial financial resources investing in technologies like blockchain, AI, and AR, while smaller businesses frequently experience financial difficulties due to the high costs of putting these game-changing technologies into practice.

For example, Everlane has made a brave commitment to source and price everything inside its four walls, clearly supporting that. It has spent tons and tons of money on technology that provides a detailed look at how its supply chain affects the environment and society. The only thing that may go against these transparency investments in eco-sourcing materials, factory audits, and very sophisticated software for tracking and reporting production is that they all cost money, and they don't fall below even a mid-size brand. Those are not just technology costs, but constant monitoring and updating of those emissions required to keep that information accurate and up to date (Provin & de Aguiar Dutra, 2021).

Smaller brands must balance investments in sustainability with the need for competitive pricing. Using technologies requisite for transparency ensures trust, but it brings about accumulative costs, which could be rather exorbitant for smaller companies. Brands have recently faced challenges from new industries outside of banking as they learn about this new, technologically advanced regulatory environment.

The introduction of the General Data Protection Regulation significantly changed the way fashion companies handled consumer data. This is especially true for those companies, such as Zalando, that quite easily win millions of consumers through digital means. There were quite several discussions among the principles and cultural practitioners in the industry who did not comply with the new law.

Like a real European fashion platform, Zalando flourished on user data personalization in facilitating shopping experiences, recommending products, and optimizing marketing strategies. The GDPA's stringent provisions regarding consumer privacy and security, however, were taken very seriously. Users had to provide explicit permission before any data collection or processing could begin, have easy access to or the ability to delete their personal information and be given clear information about how their data was being used.

The GDPR has multiplied the complexity and cost of data systems management. Along with the necessary physical infrastructure such as secure servers and encryption technologies, it calls for dedicated data privacy teams. Zalando, among other brands, should be open in the way customer data is used to personalize offers to avoid accusations of being invasive and unethical. The violation of GDPR provisions results in huge fines and brand damages. It, therefore, becomes necessary for organizations to invest heavily in compliance systems and still want to offer personalized services (Zalando, 2021).

New technology promises much for fashion brands. However, small companies are often lacking in funds for trying to embrace those technologies, as demonstrated by Everlane's transparency initiative. Regulatory frameworks, too, like the GDPR, do not give any exemption but instead add more complication, like in the case of brands such as Zalando, which relies on consumer data to enhance user experience in shopping. The evolution of technology will have to be matched up with the response to consumer needs and the cost that strategic innovation will need from regulatory requirements.

2.4.3 DTC Brands and Circular Economy Initiatives

DTC companies and the circular economy are two important trends in the fashion industry, adopting digital transformation-firsts and sustainability imperatives.

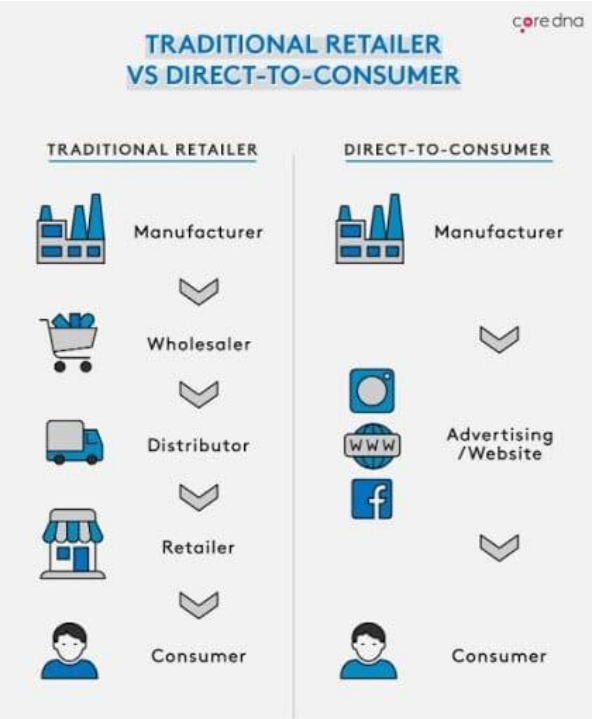

Figure 29: DTC brands (Brightpearl)

Companies such as Everlane and Warby Parker strongly embrace digitized, consumer-focused sustainability. By selling directly to consumers on a digital platform rather than going through middlemen, these companies have streamlined processes and less waste among others. For example, Everlane practices extreme transparency in its costing, like how much is spent on production, through what means of material, and ethical standards through the factory. This method understands consumers better and fulfills their wants of having sustainable and ethically manufactured dresses (Paintsil, 2019).

The move to circular business cases that encourage recycled manufacture, reuse, and waste reduction by brands is another great evolution. Such is evidenced by the Garment Collecting Program for H&M in which clients can take back unwanted items for recycling. These are all processed to create a new product. There is an effort to reduce the amount of textile waste and promote circularity in the fashion industry. Similarly, you have Patagonia, which has adopted the circular economy to include repair services and persuades people to buy upcycled through Worn Wear, extending the life of their clothes (Beser Ramada, 2021).

This is particularly applicable to fashion, as highlights the uses of digital tools-driven innovations and sustainable business models for companies to meet increasing consumer demand for sustainability but still profitably stay ahead of the competition.

Everlane is a DTC clothing brand famous for its radical transparency. This philosophy essentially allows full disclosure of how much each item costs, with a breakdown from supply to labor, shipping, and final retail price. Everlane is believed to be a trustworthy company by how it opens up to consumers about how its products are made and society replaced in every step of the production process.

It maintains ethical manufacturing and only works with factories most compliant with labor laws. The site offers pictures, descriptions, and third-party evaluations for each factory to confirm compliance with fair

wages, safe working conditions, and maximum working duration. Through opening up such information, Everlane allows its customers to have a complete purchasing experience the customer can better understand purchasing choices, most often for this opaque industry.

In the long run, Everlane wants to eliminate all virgin plastics in its supply chains. They also launched recyclable goods such as their new ReNew collection, which includes outerwear made of 100 percent recycled polyester. Additionally, the company began programs for carbon offsets to minimize the environmental impact of shipping emissions from its global distribution network.

Always blamed for considering those aspects, Everlane has essentially failed to address the true problems with fast fashion. Even more, the frequent introduction of new styles leads to overconsumption and waste. This is the dilemma that any global brand would face to earn but act ethically.

Patagonia is still considered the pioneer in stitching together environmental activism, ethical sourcing, and circular economy principles in a sustainable fashion. The declaration, "We're in business to save our home planet," ties the company to an ethical lane in environmental sustainability. The motivation for the circular economy by Patagonia is to increase the lifespan of products through their repair, reuse, and recycling programs.

A prime example is the Worn Wear program for encouraging wearers to repair Patagonia clothing instead of throwing it away. The company has free online 'how to' instructions and repair kits, runs a mobile repair service as a no-charge full-service repair for consumers, and houses its repair center. Customers may then sell Patagonia products back to the Worn Wear platform for store credit, with re-warehousing for resale at a discount. This program increases product life and decreases the generation of new clothing, with overall impacts on the environmental footprint of the company (Patagonia, 2021). Patagonia has offered recycled polyester from plastic bottles since the early days of sustainable materials. By 2020, 68% of its materials came from recycled fabrics. By 2025, it has even promised an institutional commitment to making all products 100% renewable or recycled. This, in fact, emphasizes the goal of the company being circular and minimal dependency on virgin resources (Patagonia, 2021).

In contrast to fast fashion companies that prefer disposability, Patagonia has a different human touch: durability and repairable. Sustainability is demonstrated by the fact that profit is not the deciding factor, demonstrating that sustainability and profitability are not mutually exclusive.

H&M's Garment Collection Program was launched in 2013 to address the environmental consequences of fast fashion. The initiative enables customers to drop off unwanted clothes of all brands and recycle them or deliver them for reuse at H&M stores. The company uses a global textile recycling firm to split the items it receives into categories of re-wear, re-use, and recycling.

By 2020, H&M decided this initiative had redirected as much as 29,000 tons of textiles away from landfills in the equivalent of over 145 million T-shirts. However, the amount entered into the system is much less than the clothing produced by H&M every year. In 2021, H&M produced almost 3 billion garments to highlight the limitations of its recycling initiatives (H&M Group, 2021).

Critics say that such initiatives do not address the main agenda of overproduction; if one were to consider H&M's Conscious Collection and its Garment Collecting Program, they are efforts in progress. Due to technological limitations, very little collected clothing can be recycled back into new textiles and

removable downcycled into less valuable products. The recycling process itself is quite resource-intensive, so does undermine some sustainability goals intended by these programs (Changing Markets Foundation, 2021).

Allbirds, on the other hand, tries featuring exclusive materials like merino wool, eucalyptus fiber, and sugarcane-based foam, making all its sneakers eco-friendly. Allbirds' goal is to reduce carbon footprints by depending on renewable resources and implementing waste-free practices throughout the supply chain. They are indeed a company doing business without carbon emissions, compensating for them through sustainability investments in renewable energy and forest conservation projects.

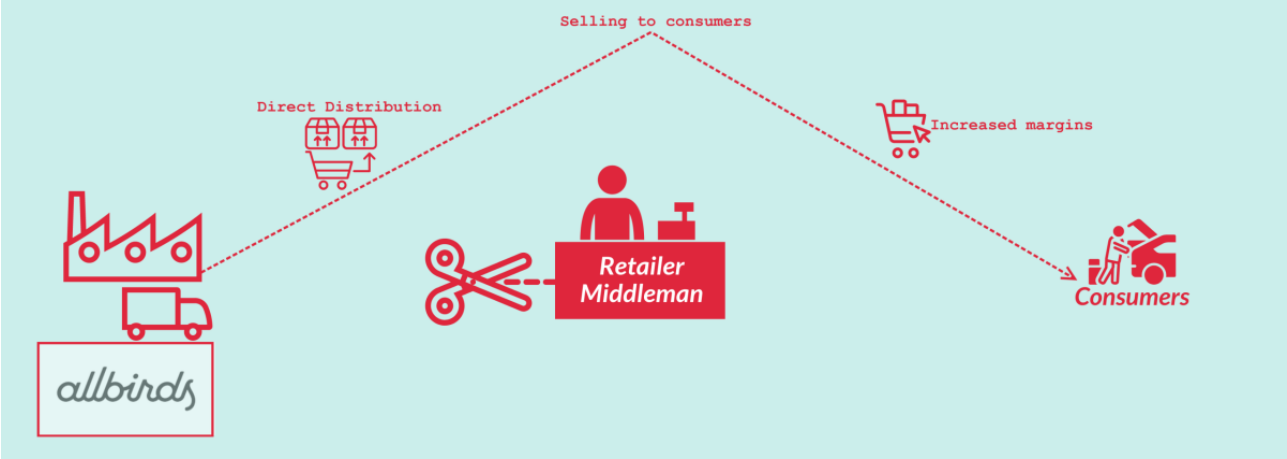

Figure 30: Allbirds model (FourWeekMBA)

Simplicity and minimalist design are what Allbirds is all about, but all these are in line with transparency when it comes to applicability on every product. One gets a carbon footprint label for each of Allbird shoes, which helps understand their environmental cost. Sustainable materials and transparency distinguish Allbirds from not just other types of footwear but also from environmentally conscious consumers of sustainability and moral production.

Sneakers like Nike and Adidas are traditionally made out of synthetic materials that come from petroleum-based plastics and are polluting the environment and generating carbon emissions. However, some of the things they are adapting into their business strategies towards sustainable practices include technologies like the Flyknit of Nike that conserves materials. A majority of the products still depend on conventional materials and are produced using larger production processes, which generate substantial waste.

The attention is currently on Nike, Adidas, and other comparable traditional brands for consciously changing their ways about the recently implemented sustainability practices intended to reduce the ecologically damaging footprints of their products. Move to Zero, for example, is a campaign initiated by Nike, with big promises of zero waste and zero carbon emissions. The famous footwear producer, Adidas, said that it has already produced shoes from ocean plastics, thanks to its partnership with the environmentalist company, Parley for the Oceans. The actions by these companies are admirable, but still, much of the gap needs to be filled to match the direct-to-consumer kind of selling such as Allbirds, which is truly value-based and not the fragment work from would-be understood stock.

Everlane and Patagonia exhibit the principle of ethics and the environment within business strategies for direct-to-consumer firms, the perfect replacement for fast fashion. The most exemplary case is that of H&M's Garment Collecting Program; this illustrates the controversy between the best of circular economy principles and global-scale manufacturing. So, while there were signs of progress, there remain considerable hurdles, particularly regarding overproduction and wastage by the fashion industry. Circular economy initiatives hit the road through the deadlock that will make companies weigh environmental goals against economic profitability in practices that will require scaling sustainable technologies.

DTC brands such as Allbirds want to lead the charge in absorbing sustainability into the business model through limited production runs, eco-friendly materials, and transparency. The likes of old-guard brands such as Nike and Adidas, however, have the challenge of transforming large, established supply chains. Eco-friendly products will have to expand demand as time goes by, and this will certainly put DTCs first in coming up with standards with the circular supply choice of trees in a sustainable fashion.

2.5 Future Trends in Business Models

2.5.1 Personalization and Customization with Technology

Technological advancements are making personalization and customization traits of the industry. This implies that customers can design customized fashion items. Many highly personalized and one-to-one shopping experiences are practically possible for consumers in their demand for fashion that mirrors their preference through the inclusion of artificial intelligence (AI) and data analytics by fashion brands (Anderson-Connell et al., 2002). Through studying consumer behavior, these brands will be able to personalize product recommendations and shopping experiences, according to each consumer's unique needs, based on their patterns of consumption, preference, and purchase history.

New futuristic technologies such as virtual try-ons, augmented reality (AR), and even 3D printing are what enable consumers to visualize and customize a product before buying it. This will create the added effect of interactivity and immersion in the actual shopping experience, transferring that into a much more meaningful association with people and the brands they represent. Such an augmentation in personalized experience will also create an increase in satisfied consumers, as well as higher conversion rates paired with average order values.

On-demand manufacturing is facilitating great levels of customization. Brands are using 3D printing and robotic tailoring to efficiently and quickly produce individual garments, allowing the consumer to change such flexible characteristics as size, fit, style, and color. AI-powered styling tools give fashion choices, personalized styling, and customized outfits to consumers for their body's shape, individual taste, and occasion (Gong & Khalid, 2021).

For instance, Nike uses industrial robots to manufacture Flyknit shoes. Flyknit shoes use a single strand of yarn and form an upper that is tailormade to particular organization patterns with robotic knitting machines. This process of knitting is supposed to reduce material wastage because it makes fabric-specific components for shoe making according to what is needed by customers. Using Robotic Tailoring, the customer chooses the design from a given template initially, after which the production can start without any further delay. One more added value of robotic tailoring is manufacturing on demand since it produces an item only when ordered, thus addressing the disadvantages of overproduction in traditional models of fashion.

Figure 31: Nike Flyknit (Nike)

Robotic tailoring has become a big part of this new concept of customization. Nike, one of the companies adopting this technology in their operations, has its status changed. The Flyknit sneakers are one example of how Nike has changed their production methods. In producing the Flyknit sneakers, the company worked on continuous units of fabric that could be fashioned according to designs made with robotic knitting machines. This process enhances precision, and it requires lower material use. It also allows on-demand production, meaning that items would be created only when required, and therefore reduces the issues of overproduction traditionally experienced in fashion.

Through co-creation platforms, brands offer more opportunities for consumers to participate in the process of designing the products. In this way, consumers are empowered and encouraged to innovate and build loyalty to the brand as the end product becomes closer to themselves. As more and more customers show the need for personalized product preferences, the potential fashion house that uses this technology is even more likely to differentiate itself from rivals.

The fashion industry's approach to mass customization has lately shifted due to technical advancements like 3D printing and robotic tailoring. From the above discussion, it is clear that such a big brand can be expected to produce personalized items on a massive scale by combining efficiency with the unique features demanded by individual consumers.

For example, Adidas recently launched its Futurecraft 4D sneaker with a 3D-printed midsole customized to the user's weight and foot shape. Teaming with Carbon, a 3D printing startup, Adidas has developed shoes with an exceptionally high degree of customization using lightweight and sustainable materials that will improve performance. This gives one shoe a fit different from another shoe and at the same time improves sustainability through waste-less production.

Figure 32: Adidas Futurecraft 4D (Design Life-Cycle)

Realignment of supply chains from mass production to individualized products poses major challenges. Present supply chains designed for mass production must be reformulated to support very flexible supply systems that can offer specific orders in real-time. They have also modernized their supply chain management systems responding to the demand for personalized products through artificial intelligence and machine learning to analyze customers' reactions and manage inventories. The Nike By You program at Nike consists of a set of different sneaker designs that customers can build themselves or personalize. This program, however, would require a flexible supply chain capable of processing numerous design combinations. AI-powered forecasting solutions help companies like Nike minimize excess inventory by accurately predicting consumer preferences and aligning production with demand.

Following these customization advantages, the technology costs associated with robotic tailoring, as well as 3D printing, would be quite significant. Investments would be high in terms of machinery and maintenance and operation expertise for such facilities. The larger players like Nike and Adidas easily absorb such large investments because they do not need the upfront cost for small companies to go upscale regarding competition. Well applied, these technologies can save in the long term by eliminating a waste of materials, reducing labor costs, and increasing production cycle times.

Many clients say that tailored services make them feel good, which motivates many of them. The consumer testimonials reflect a growing trend as consumers seek more and more personal and meaningful shopping experiences with increased brand loyalty. Personalized products allow Nike to strengthen its relationship by increasing opportunities for repeat purchases and the long-term love of the brand (Nike, 2021).

In addition to producing goods, their brands have quickly incorporated AI-enabled strategies to offer tailored suggestions and shopping experiences. The application of Nike uses data-driven intelligence to suggest items based on preferences and previous purchases to the customers, ensuring that they feel valuable and understood. This, besides increasing sales, serves to create an atmosphere of loyalty and the reuse of customers.

3D printing, but as much made possible through technology, is fast gaining acceptance as the next big thing for personalizing fashion. Adidas is currently using 3D printing to develop customized shoes and is leading in this area by launching its Futurecraft 4D initiative in shoes. On the other hand, midsoles are the products of Digital Light Synthesis technology contracted with Adidas for the uses of midsoles

designed specifically for certain athletes, providing optimal cushioning support based on foot shapes and activities.

Such levels of personal and public customization in shoes are revolutionary within the whole footwear industry. This would be the product of enormously personalized and sustainable shoes for Adidas. The company's 3D printing method is said to be reducing material wastage and energy consumption, in comparison to the old method of production. Speed production and on-demand manufacturing have been made easier with this technology, which is consistent with circular economy approaches and the waste of excess stock (Adidas, 2021).

Other fashion houses are trying to exploit 3D printing from personalized accessories to form new construction techniques and fabric types. As the technology develops, it is expected that 3D printing will create an increased amount of tailored products addressing the new wave of personal and environmental interests in fashion.

3D printing into robotic tailoring creates new business models of mass customization in fashion as much for Nike as for Adidas. These technologies not only allow brands to offer individualized products according to some demand, making fashion unique and sustainable, but they also overcome financial and logistical barriers. It turns out that the benefits of personalization, in the long run, are more waste reduction than any increases in customer satisfaction, which strongly supports the mass commercialization of this industry. This is the personalization of technology coupled with customer transformation through 3D printing and AI; the industry is being converted from providing personalized experiences and products to consumers. Personalized consumer and institutional pursuits will only have a stronger base in shaping the future of fashion as the adoption of these technologies continues to increase.

2.5.2 Circular Economy and Sustainable Practices in Emerging Models

The transition in the fashion industry now is from the linear traditional business models to circular business models focusing on sustainability and responsible consumption. Because of environmental concerns, the companies adopt, emulate, and lean toward waste elimination, a reduced carbon footprint, and greener practices throughout their supply chains. Circular business models (CBMs) are the most relevant source conservation and waste reduction strategies promoted within a resourcing loop closing concept or methodology. This made resource efficiency very important within some industries like fashion (Hossain et al., 2024). These models do not adopt the traditional linear "take-make-dispose" systems; rather, they integrate reuse, recycling, and upcycling into more eco-friendly practices (Kara et al., 2022).

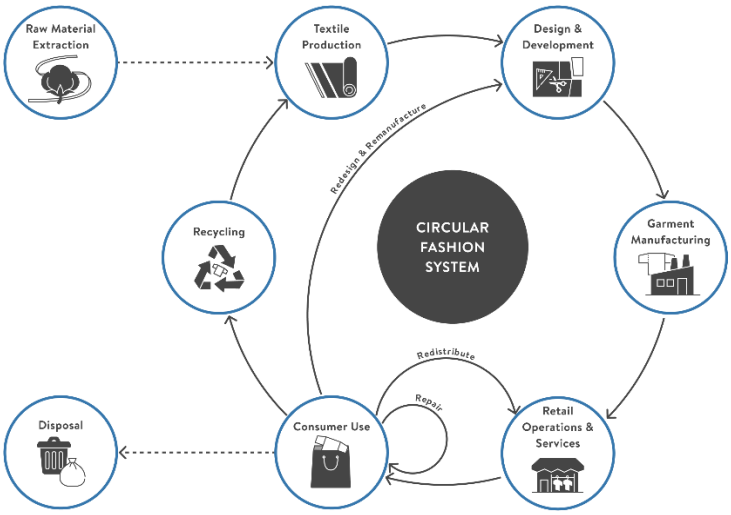

Figure 33: The circular fashion system (Redress, 2022)

Such transformations nowadays happen mainly through innovations in material science. Sustainable materials are bio-textiles, sourced from food industry waste as raw material, and can replace old conventional textiles. Moreover, such materials not only reduce the environment's carbon footprint in fashion production but also satisfy consumers' need for environmentally friendly products (Provin & de Aguiar Dutra, 2021).

Closed-loop supply chains and reverse logistics systems have been made by brands to enable customers to drop off and recycle old items, intending to reduce the consumption of raw materials while extending the lifetime of products. This new resale platform has made it easier for customers to join the circular economy by purchasing secondhand or renting a piece of clothing, thereby reducing such textile waste and promoting a culture of sustainable consumption (Salmi & Kaipia, 2022).

In other words, companies are responding to consumer pressure to become more transparent by conducting product life cycle assessments of their operations, including sourcing, production, distribution, and disposal, in an effort to determine and, to the greatest extent possible, reduce their environmental impact. These assessments also point the way toward new and improved processes for reduced energy use, waste reduction, and enhancement of the work environment itself. They hardly know that as more consumers take an interest in where and how the products they buy are sourced, the more important transparency and traceability of product origin will be (Turner et al., 2019).

Sustainable materials play a very important role in making the transition of fashion to a circular economy. Bio-fabricated leather and lab-grown textiles are very prominent innovations making it possible to replace traditional animal and chemical-material-based textiles. Bio-fabrication uses cells to create leather-like materials, avoiding the use of animals and farm animals, which are linked to a number of environmental issues, including deforestation, water usage, and methane emissions. Modern Meadow and other pioneering companies brought about this technology to create resource-efficient bio-leather that behaves like conventional leather-textured without the resource-intensive processes of nurturing animals.

As a sustainable substitute for such conventional textiles, protein-synthesizing or microbial-fermentation synthetic textiles are all being developed. These can replace cotton or polyester textiles, the cultivation and manufacturing processes of which have detrimental impacts on the environment. Cotton-carrying

crop demands a lot of water and inputs of pesticides, and oil-based polyester generates microplastic pollution. Companies like Bolt Threads produce Mylo, a leather-like material from mycelium, the root structure of mushrooms. Environment-friendly and biodegradable, this product makes the jump into a circular economy as it creates materials that can then be recycled or fully composted at the end of their life cycle, thus offsetting reliance on limited natural sources.

With consumer and regulatory pressures for more sustainable products developing, the adoption of such materials will likely continue to grow. However, a great challenge remains to scale the innovations to meet the global fashion masses' demand for mass production. The current cost and energy-intensive nature of laboratory-grown textiles may prevent fast-moving adoption, especially for fast fashion businesses whose product costs and processes are cheap and efficient.

Besides development in materials science, the imminent legal and regulatory challenges will drive the fashion industry toward circular economy models. One such important regulatory framework is the Circular Economy Action Plan (CEAP) of the European Union, which has its basis in the broader European Green Deal for greening the economy in the EU. Special actions in the CEAP are put in place for the fashion and textile sectors and focus on waste reduction, recycled material utilization, and sustainable design principles. The strategy provides for demands on textile designers to come up with durable, recyclable, chemical-free fabrics and emphasizes the necessity of extended producer responsibility (EPR) programs, which would make producers accountable for the whole lifecycle of their products, in a post-consumer phase as well.

The CEAP itself could revolutionize the way fashion houses need to do business by developing circular models to meet the new and emerging sustainability criteria. The focus on recycling and using sustainable materials can encourage interest in bio-fabricated leather and lab-grown textiles since these brands will be held accountable for environmental compliance. Setting up legal recycling targets and financial penalties for overproduction and waste also drive the fashion industry to rethink its current high-volume low-cost production cycle models.

For brands operating within the EU, that means an inevitable increase in supply chain transparency and closed-loop solutions where waste in the system is reduced and product recycling or reuse takes place. With such regions replicating and establishing similar legislation in their territories, the attention toward circularity is meant to extend beyond Europe. For instance, in the US, calls for stricter federal rules have been forced to account fashion industries for their environmental impacts, while states such as California have already approved legislation to lower textile waste.

Such laws like the CEAP have the power to change the entire face of the fashion industry. The constant threat of financial penalties and reputational damage would make the fashion brands put in place circular economy practices in their operations, leading to widespread acceptance of sustainable materials, better product designs, and improved recycling and take-back schemes.

Figure 34: CEAP (Europanels)

There is growing evidence of how adopting circular models has had a positive impact on waste management across industries. Consider IKEA, for instance, which has begun to apply the principles of the circular economy to furniture production. As noted in the IKEA Sustainability Report 2020, recycling and refurbishment efforts toward product longevity have generated a 14% improvement in waste management results across operations. The commitment goes further as IKEA wants to be circular and convert all its products to renewable or recyclable equivalents at the end of their lifecycles by 2030.

Such initiatives have demonstrated that great volume waste exhaustion is also compatible with a stronger business model. With product take-back programs and designing products to last, IKEA serves as a true model for other industries, like fashion, where most initiatives are just emerging to promote the activities of circularity. Even though it is possible, there are several obstacles in the way of the widespread implementation of circular economy projects. One of the clearest is how recycling programs become prohibitively complicated and costly to implement. H&M is launching the recycling scheme under the umbrella of the garbage collection program. This sets a typical example of the challenges associated with recycling on a big scale.

H&M encourages visitors to bring their old clothes into stores, which then go to sorting for resale, recycling, or repurposing. Although it is being applauded for creating awareness about textile recycling, the program has come under fire for making little difference. Of the total clothing collected, a very small amount gets recycled into new clothes due to the technology and logistic problems in recycling mixed fiber and fabrics. Breaking down and recycling textiles involves an energy-intensive process, which theoretically waste the environmental benefits behind the programs.

Scalability is key to the challenge facing circular fashion initiatives. Many of the clothing recycling programs are new entrants, and infrastructure to effectively process large volumes of textiles has not yet reached maturity elsewhere. Additionally, of the many recycled textiles, the majority merely get downcycled to lower-value ended products like insulation or cleaning cloths, instead of being reused to make new high-quality garments. The overall environmental impact of these programs is limited and far below the potential impact (H&M Group, 2021).

Even in such situations, brands like H&M invest in R&D to improve the efficiency and scalability of textile recycling. Innovations such as chemical recycling technologies and closed-loop systems have bright hopes

for the future; however, much investment and cooperation shall be needed across the industry to make this circular fashion a reality on a large scale.

The fashion world has begun moving towards an increasingly sustainable future with having developed sustainable materials like bio-fabricated leather and lab-grown textiles and legislative pressures such as the new EU's Circular Economy Action Plan. Overcoming the hurdles now of scaling these technologies will mean coping with rules imposed by recent regulations, but a considerable increase in the market can be expected as the demands of consumers and governments for a more ethical fashion will undoubtedly drive even further influence in these developments. It would indicate a shift of movement related to the way fashion is produced and consumed, with the circular economy emerging as the best prospect to ensure the future sustainability of the industry.

Examples of circular economic models like that of IKEA and H&M are providing positive results in waste and sustainability reductions, but scaling, on the other hand, remains an imperative challenge of these models, especially concerning the fashion industry. Despite the significant advances achieved by businesses, the technology and infrastructure necessary to undermine the promise presented by circularity in fashion are still in the early stages. However, continuous innovations and collaborations would be the key to these challenges and making circular practices a common business model in the coming years.

2.5.3 Emerging Tech-Driven Business Models Across Industries

Sustainable and innovative business models can take many different shapes, depending on the diverse industries they are used. The fashion industry has not been Unaffected by some touch of innovations that involve new technological advancements such as the application of AI, blockchain, and big data as engines to operations toward optimization, transparency in supply chains, and customer experience personalization (Dragomir & Dumitru, 2022).

Fashion firms will modify production according to the real-time demand made possible by algorithms that minimize overproduction, improve inventory control, and raise accuracy in forecasted future trends. This would also add advantages to reducing waste and moving closer to achieving a more sustainable fashion supply chain. Another significant benefit of blockchain technology is its ability to source raw materials ethically. Because the entire supply chain can be tracked, consumers can feel more confident about the products they are purchasing and whether they are meeting ethical and environmental production standards (Huynh, 2021).

This is how, today, many of the tech-driven models spread their wings and flourish particularly along the runway. Even companies like Ford-Car own blockchains and use data analytics for better resource utilization, less wastage, and transparency in production processes. These digital modalities indeed make it possible for a circular economy where materials will be recycled and reused, even going beyond their environmental footprint.

In an era where all businesses are expected to participate in the sustainable technology complex by applying innovation to change, it is going to easily be matched by such an ability to innovate and adapt to the demands of business in a global environmental arena.

However, different company models are adopting this new technology in different ways. For example, fashion uses AI, robotics, and blockchains to ensure efficient supply chains for better consumer customization along the course while conserving minimum environmental impact. Differences will be in service delivery by tech-driven models in comparison to the automotive industry or technology-based industries. However, the introduction of five lessons from Tesla for the automotive industry and Apple within the technology industry needs to be considered by fashion brands.

What technology has done in fashion would be focusing on customer experience and sustainability. For example, AI predictive trend analysis tools give brands such as Zara and H&M faster and more precise launches of new collections while still being able to make real-time adjustments to changing customer tastes. Personalization platforms include Nike By You and Stitch Fix, which each use machine learning algorithms to provide customized products for users according to individual specifications. Just as predicted, fashion companies have also started to invest in supply chain optimization, closely leveraging productivity with AI and blockchain for production monitoring, material ownership tracking, and assurance of sustainability through enhanced sourcing transparency.

All of these sustainable goals are compromised by the quick truck between the fashion industries. Bringing innovation and sustainability together requires a difficult balance under pressure created by individual consumer personalization and rapid response to the trends. Most of the technology used in the fashion world is customer-oriented, paying an insignificant level of attention; for example, to innovating products or base manufacturing processes, unlike the automotive and technology industries.

In contrast, as seen in the case of Tesla defined innovation in the boundaries of business structure and product development. This is not simply through making high-performance electric vehicles (EVs); beyond that, it changed the game with autonomous driving, over-the-air software updates, and battery technology, as well as all those other advances where a product improves function and power after purchase, to put it in simple terms, like updating one's smartphone software. To be able to do so, brands have to come up with a model of continuous improvement of unfortunate changes after production to developing products that are constantly evolving.

Another lesson for fashion brands would be Tesla's method of vertical integration, covering critical elements of its supply chain and the manufacturing process. Considerable investment in research and development brings Tesla less dependence on external suppliers, consequently accelerating and enhancing innovation. In the same way, fashion companies can achieve progress in terms of closed-loop production or sustainable raw materials in their supply chains, transforming ownership into innovation. This would assist in the management of the environmental footprint associated with production and would also accelerate a transition into a circular economy.

Tesla's focus on the construction of ecosystems serves as other vital guidance; its supercharger, software, and customer care networks will be provided for totally integrated use, not just within the car. Similar ecosystem-building methods could be used to integrate digital platforms, product personalization, recycling or repair services, and sustainability initiatives into the consumer experiences of fashion brands. This would lead to a broader customer experience focused on longer-term engagement rather than buy-and-forget transactions.

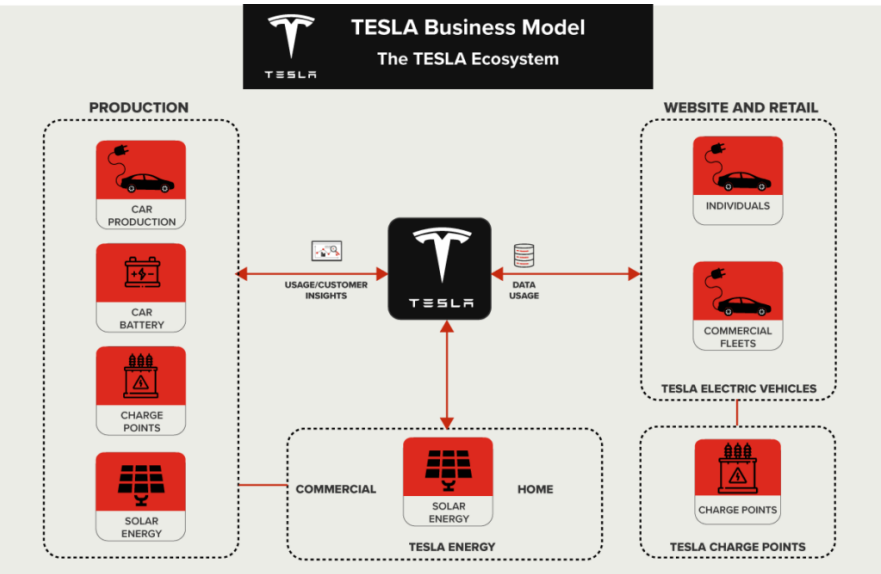

Figure 35: Tesla model (Fox)

In the technology sector, Apple has been very successful in creating very demanding high-end products with design, user experience, and a well-managed environment. Products from Apple have this interconnection, enabling you to access not to just a gadget but an entire suite of services and connected experiences. Apple is a firm that fosters innovation and guarantees user orientation in every aspect of its product lines, including hardware and software.

Fashion manufacturers can learn from the priorities of Apple as far as design and user-centered innovation are concerned. Nonetheless, the heavy upfront cost would be required to drill deep into design and address the various aspects involved in the product and the experience of the customer to inspire desire and loyalty in fashion brands. Another lesson was the green haul of Apple, recycling materials, and minimizing package footprint. What is known as Apple's typical strategy of pursuing solid, long-lasting things appears to be no different from slow fashion, repair services, and durability, which are the latest essential terms in the fashion sector.

The brand is using digital spaces to reinvent access with consumers and one great example can be found in Balenciaga, reaching all-new highs in 2020 when the brand conducted its Fall 2021 collection fashion show using a completely virtual reality environment, where designs were modeled virtually by avatars in a futuristic video game. Indeed, this digital runway would reduce the impact associated with traditional runway events and reach a global audience interactively.

It opens the door to experimentation with virtualization, especially during difficult times like COVID-19. Balenciaga's digital runway showed ingenuity with how virtual spaces can engage fashion audiences beyond any physical limitation and towards tech-savvy consumers who are spending more and more time in digital worlds. Such virtual fashion shows will be truly unique, memorable experiences that would increase the consumers' degree of connection while cutting the cost associated with physical events (Kering, 2021).

One extremely interesting new revenue stream that may be adopted as digital fashion grows is non-fungible token (NFT) sales. Non-fungible tokens are unique digital assets using blockchain technology to verify ownership and authenticity. They opened up a new market for virtual fashion items. Dolce &

Gabbana delved into non-fungible tokens by launching the first digital fashion collection, "Collezione Genesi", which showcases both couture physical and virtual items.

Digital fashion is meant to wear noises as NFTs for avatars, enabling virtual environments like video games or social media platforms. Evidence to show that these digital collectibles are worth it is that they adopt the same rights as those a physical item worth a fortune gives: exclusive. This is where modeling for cash comes in, which explains why the recent sale of Dolce and Gabbana's NFT line brought in millions of dollars.

Digital media will create further opportunities for fashion to create limited supply and exclusivity approaches somewhat similar to limited-issue physical items. NFTs will not only be an increasingly viable revenue model for luxury houses targeting this digitally growing consumer base of digitally interested fashion collectivists but easily accommodate a market set to be one of the most lucrative niche markets by drawing in digitized and real-world owners (Friedman, 2021).

Models for a tech-hyped fashion business would consider supply chain transparency, rapid adaptation to trends, and customer customization. While studying their technological and automotive counterparts, fashion firms could also take inspiration from increasing verticalized process production, building integral ecosystems, and innovating at both product and process levels. They might learn from Tesla regarding continuous product improvement and Apple's model of design-centric innovation to implement their technology-induced strategies around sustainability, experience, and long-term brand loyalty in the fashion industry. In that way, fair and sustainable consumption would be able to satisfy demand but would have efficiency improvement as well as personalization.

Digital and virtual spaces are at the very heart of the future development of business models in fashion. Virtual fashion shows, such as those put on by Balenciaga, are a very innovative way to get the consumer engaged, whereas the growing area of NFTs, where Dolce & Gabbana has recently put its first toe, is another chance to realize revenue channels for luxury fashion. Well into the trend, both real and digital fashion is going to be a part of this industry's evolution and business development, providing ways to link creativity with big profits.

2.5.4 The Role of Digital and Virtual Spaces in Future Business Models

The emergence of digital and virtual fashion is revolutionizing the sector and presenting fresh chances for individuality and creativity in the world of technology. Fashion brands are investigating ways to incorporate digital fashion into their offers as consumers interact with virtual worlds more and more. Customers who want to express themselves online are starting to favor digital accessories and virtual apparel that is made especially for the digital world (Choufan, 2022).

Currently, virtual fit testing, fashion shows, and styling services provide those immersive and interactive shopping experiences consumers look for. Brands can collaborate with these virtual influencers on gaming platforms and educate the younger people who have grown up using these forms of digital media (Hwangbo et al., 2020). The more the boundaries between virtual and actual worlds disappear in those digital events, the more opportunities for engagement arise.

Digital fashion's positioning for the future, the smallest amount of what appears to be fabric, and the new methods of conducting business from birth to death in terms of customer touch points. It's even more

relevant for the models in business as it invites companies to create numerous ways for engagement with customers to be the most sustainable and immersive.

The future of fashion is likely to be through spaces that are closer to being digital and physical; it could change how customers perceive and interact with fashion such as through virtual clothing collections, digital avatars, or fashion influencers. Virtual fashion production creates an innovative avenue for income as it is more sustainable about resource use and waste generation compared to physical fashion.

The advent of digital and virtual places changes how fashion firms relate with their customers; it has led to their new business models toward virtual fashion, digital apparel, and immersive metaverse experiences. Early adopters in this line are luxury brands like Gucci and Balenciaga, combining how to appeal could be established toward a younger audience with tech-savvy lifestyles using these new channels while still holding other age and condition traditional offerings.

Balenciaga is leading the way in virtual fashion experiments. In 2021, the company partnered with the gaming arena of Fortnite, an online video game by Epic Games and distributed worldwide. Players could purchase digital clothing, commonly referred to as "skins," intended for the use of their in-game characters. These pieces incorporated actual physical designs from Balenciaga. In this instance, the partnership was set up to illustrate the merger of fashion and gaming into one, as well as how brands would extend their outreach into these digital domains. This is an example of how successful virtual fashion can attract newcomers, including gamers and metaverse users not engaging with traditional products. The success of this merger not only raised Balenciaga's brand visibility with the young generation but also allowed the development of new income sources independent from the creation of the physical lines.

Figure 36: Balenciaga x Fortnite (Gulf News, 2021)

Gucci is also an early adopter in the world of digital fashion, taking its first steps into augmented and virtual reality. In 2021, Gucci introduced the Gucci Virtual 25 sneakers available only for digital purchase. Thanks to the Augmented Reality (AR) filters, customers could "wear" these sneakers in the social worlds or virtual platforms. Gucci has suggested the metaverse with such milestones that include collaboration with Roblox, a virtual platform where users can purchase Gucci virtual accessories for their avatars. The projects have been a great success, generating a lot of excitement among young customers who are interested in the lines related to digital goods and the metaverse. Entirely digital fashion offerings from Gucci are questioning traditional ideas of ownership and value and are pushing to redefine what clothing is.

Figure 37: Gucci Virtual 25 (Dezeen, 2021)

These accomplishments with virtual fashion would signify a shift in consumer behavior, with an increase in interest regarding digital experiences and products. For instance, members of the younger generations, particularly Generation Z, are open to spending a lot of their time in a virtual setting because, in their culture, online identities and avatars are visibly perceived to be as precious as real-world identities and avatars. This speeds up the changes in the consumer value system where some people will pay a premium price for fashion items that they never would wear in real life but are happy to exhibit in virtual worlds and social media. With so much momentum behind digital fashion, it is about to become quite an important part of most brands' strategies, allowing direct interaction with customers without the need to pollute the world with physical clothing being produced.

Emerging technologies will contribute to disrupting and redefining business models in the world of fashion like virtual influencers and NFTs. NFTs are non-fungible unique digital assets that are put on the blockchain, and they have gained huge popularity in the art world and the world of fashion as the most exclusive way to gain ownership of digital items. Some fashion companies are looking to integrate NFTs into their business models, where the customers pay for virtual pieces but of a very unique kind. A perfect example in this instance is RTFKT Studios, a digital fashion company that sold a virtual sneaker as an NFT for much more than $3 million in 2021 (Hypebeast, 2021). The sale showed how, by having these limited-edition digital equivalent assets traded, fashion companies would create new revenue channels and enrich the income possibilities by establishing such limited virtual products, similar to physical luxury goods, to be traded and resold within the digital domain.

They are also the future superstars in the digital fashion world. They include computer-generated personalities such as Lil Miquela, who have sponsored advertising campaigns for top brands of fashion and have massive social network followers. Virtual Influencers will be one new, imaginative, and flexible way for brands to engage with consumers. They are beyond the time, do not require any physical maintenance, and can appear anywhere at any time in any digital environment. Therefore, as they become more sophisticated, these virtual personalities are sure to have an alarming effect on consumer tastes and how virtual and digital fashions are utilized in brand marketing endeavors.

NFTs, virtual influencers, and digital clothing are all parts of the new trend that threatens the conventional economic infrastructures adopted by fashion. It minimizes the production and the holding cost of goods because things created by Originality Gain get generated as exceptions digitally. All such aspects will help cut down waste and emulation emissions while at the same time opening up new markets and streams of revenue for fashion businesses. In this digital world, consumers can own and sell digital items as if they were physical items, and brands can earn money through these virtually experiential engagements in ways that are not impossible.

One of the most significant aspects of digital wear regarding sustainability is that it shifts the very paradigm of textile manufacturing, cutting down on both tangible production and waste. Consumers first try on their clothes using their digital avatars, making it very unlikely that they will return to the main area of wastage in the fashion industry. Brands such as Gucci have incorporated augmented reality into their applications, which allows customers to visualize how the garments or accessories look on them using smartphones or other digital devices. Such virtual try-on lets the consumers have a view of how it looks and fits without physically moving products back and forth.

Indeed, the environmental benefits are enormous. Fashion selling depends on large production, shipping, and return of the goods, all of which lead to the generation of a massive waste of textiles, carbon emissions, and packaging waste. With virtual try-ons, brands can not only reduce the amount of overproduction but can also forecast demand better and make less return on products. Most returns result in the trashing of unsold stock. Digital fashion decreases the need for multiple product samples and subsequent test runs, as designs can be made, tested, and perfected in a virtual environment before manufacture.

For example, the digital fashion startup The Fabricant is producing garments entirely in a digital format that can be worn in digital worlds, including social networks. The purchases are made by consumers just to wear them digitally, resulting in no environmental costs of physical production. This creates a new fashion consumption pattern that demonstrates how digital technology may protect these sectors from damage from pollution, waste, and physical resources (The Fabricant, 2021).

Though the metaverse is new to the world of fashion, that has not stopped companies like Gucci and Balenciaga from putting in place such operations. While millennials or Gen Y and Gen Z continue to show their influence in behavioral change what is demand among consumer interest is fast. Fashion will be able to reduce its environmental impact and open up new opportunities for some firms with the help of virtual influencers and NFTs. The industry is preparing itself for an incredible, and most exciting, change from history into the digital world. Besides the new ways of consumer businesses, the digital and virtual space has now a promise as a strong waste-reducing and sustainable mechanism. Virtual try-on or all-digital clothing production could reduce the resource costs of traditional manufacturing, overproduction, and returns. As technology improves, so will its ability to effect more sustainable practices in fashion.

3. Methodological Framework

3.1 Research Context

The exploratory research technique is the primary form of research effective for an unknown topic or for which there has been little research. Identifying the possible questions and hypotheses for future research is part of exploratory research. This form of research is exciting when new or poorly understood phenomena emerge.

According to Swedberg (2020), further exploratory research is one tactic that can be taken to understand certain behavioral phenomena more completely in the social sciences. This exploration can be done through interviews, case studies, and observation. This thesis uses qualitative data gathered by expert interviews. Semi-structured interviews give some ideas, and in-depth insights into participant attitudes, behaviors, and experiences.

A qualitative approach appears to be kind of the most relevant type of approach for such a research problem. It leads the research toward collecting fairly comprehensive and contextually rich information, very critical for identifying patterns, themes, and trends. More precisely, the research was directed toward getting together views, experiences, and knowledge from the stakeholders in the public and private sectors as well as educational institutions. Continuous sub-questioning during the interviews ensured that the data collected would be both broad in coverage and reflect the complexity of the subject.

The study uses qualitative research to discover more of the research topic into nuances but would provide a solid understanding of the interface between them. This goes beyond the discovery of emergent themes but also enhances the chances of such contributions being made more significant to the field.

Sector	**Candidate position**	**ID**	**Sex**	**Duration**
Private sector	CEO and Owner	C1	M	31 mins
Private sector	Managing Director	C2	M	68 mins
Public institution	Writer and Senior Advisor	C3	M	71 mins
Private sector	Filmmaker	C4	F	40 mins
Private sector	Founder and ex-CEO	C5	F	47 mins
Educational sector	Freelance Journalist and Educator	C6	F	60 mins
Educational sector	Journalist and Educator	C7	F	44 mins
Educational sector	Designer, Educator and founder	C8	F	18 mins

3.2 Research Question

This research is guided by a single, main question:

How can new business models in the fashion industry integrate circularity, sustainability, and new technologies to safeguard profitability while promoting social and environmental responsibility?

This question wants to research the aspects of innovation, environmental sustainability, and economically sustainable forms in the context of the fashion industry. More specifically, this can be defined by investigating the effects that the principles constituting a circular economy impose on the production-consumption patterns of the reuse of resources and the minimization of waste. Along this line, such an exploration will investigate how these sustainability initiatives can minimize environmental impact and enable good practices with respect to global development toward responsible development.

This research can be quite extensive, as it could include issues concerning the significant impacts even a new technology such as artificial intelligence, or of newer technologies like blockchain and data analytics, can have on achieving transparency and improved operational efficiency as well as innovation. Even this could touch on all these about the increasingly inevitable need to keep the profit from all these functions, not defining sustainability with economic viability. Above all, the question dimension is that of diversity and the social responsibility perspective can business models cut across labor ethics, community participation, and fair distribution of resources to make them problem-solving and more inclusive in the industry itself?

Consequently, this research question also presents itself as being based on several integrative dimensions, itself an expression of contradiction, as usually taken in sustainable development, that is, between innovation and industry viability in a world that appears to be increasingly responsible in an economic sense.

3.3 Methodology Approach

The research adopts the use of semi-structured interviews for the collection of primary data, gaining a deep understanding of how implementing new business models in the fashion industry can leverage circularity, sustainability, and new technologies. The primary objectives of these interviews are to investigate the ways, barriers, and opportunities through which businesses can be made to fit profits along with social and environmental accountability.

The sample population was set up thoroughly taking care of the roles, experiences, and positions of participants in the fashion industry, especially those participating in sustainable and innovative practices. They targeted professionals from different sectors such as sustainability experts, people in the media, people working in education, and leaders in the industry, to make it truly diverse. They were also identified via LinkedIn and existing professional networks.

The interviews started with general questions to establish a profile of each participant, including their role in the organization and area of expertise. The participants were approached via mail and were given a brief overview of the study, its objectives, and the format of the interview. All the respondents contributed with valuable insights, which served as the primary data source for this research study.

This method increases the possibility of exploiting the intersection study of sustainability, technology, and profitability. It complements an understanding of how the fashion industry can innovate and adopt responsible business models.

3.4 Data Collection

Data collection for this research was undertaken with the use of a combination of semi-structured interviews and a present academic literature review. Because the nature of the fashion industry is global, and also because of where the participants were located geographically, all the interviews were done online through platforms such as Google Meet. This proved to be more flexible and enabled the participation of respondents who were outside the immediate region, including those in different countries. Face-to-face interviews could elicit an open atmosphere and allow for the observation of nonverbal signals (Ritchie, 2013), but it left for equally credible and valid data as those conducted face-to-face. This approach enabled the expert to conduct interviews around logistical problems without compromising data quality.

The semi-structured format allowed interviewees to share their points of view while still being directed toward the research objectives. All interviews started with warm-up questions so the interviewer might gain an understanding of the respondent's role, background, and organizational context. Moreover, this first introduction helped to build up a good relationship and contextualize the interviewee's point of view. Thereafter, the researcher goes into further depth with specific questions on the major issue of the study.

Interview questions were categorized thematically to substantiate the coverage of all the aspects related to the research objectives. Each theme had its sub-questions to help discussion and tap into more detailed information. Participants were given the questions beforehand so that they had the time to consider and write their answers and raise any questions for the researcher. Preparation made this even more reflective and thoughtful for profound exchanges in the interviews.

In addition to primary data gained from interviews, relevant academic literature continued to flow into the data collection process, integrating and strengthening the findings. The qualitative interviews and secondary research ensured a full understanding of how business models in the fashion industry could correspondingly take in circularity, sustainability, and new technologies.

3.5 Data Analysis

The data analysis process for this study involved systematic and rigorous working through transcriptions, organizing, and interpreting the same captured data from semi-structured interviews. In order to maintain as much of the integrity of the respondents' perspectives as possible and to guarantee that their voices remained at the center of the analysis, the first step involved the literal transcription of the audio recordings of the interviews. Although there was little that needed to be captured on tape, this meant that some attentive listeners had to repeat certain points from the interview transcription captures on the spot.

To analyze the data, thematic coding was used. Using this qualitative analysis method, the analysis reveals somewhat obvious but recurring themes and patterns in the data. With this in hand, the researcher now has a mechanism through which to systematically define and tag sections of text that would best stand for specific theoretical or other descriptive ideas, overall forming a web of

interconnected thematic concepts (Gibbs, 2007). This paradigm creates possibilities of going deeper into the trends that can eventually lead to identifying trend meanings within the data.

The analysis started with an extensive round of reading through the transcripts so that the researcher could familiarize himself with the material and get a sense of the general scope of the information captured in the recording. That first reading allowed the researcher to come up with some initial themes and broader notions that laid the foundation from which more intensive searching could be made. After reading the entire document, the researcher now applied a systematic approach to examining the selected text and carefully identified and categorized relevant passages with specific concepts or ideas. Every segment has assigned a unique code that serves as a reference for closely related portions across the dataset. Not only has this process a reduction of the data into manageable categories, but it has also ensured that themes and patterns can be traced and analyzed consistently.

In the course of coding, the researcher focused on refining the themes that emerged with the grouping of related concepts and recognized their significance for the research question. This phase demanded much attention to the intertwining of themes and how they corresponded to the goals of the study, all to prevent the analysis from crucifying or oversimplifying the data's complexities and subtleties.

Over time, it has been built into a framework that understands and represents the respondent's point of view without misinterpretation or subjectivity. The researcher never focused on the analysis of the voice but most on capturing the meaning of the concept expressed following Sutton et al.'s (2015). This systematic approach gave the researcher a chance to draw meaningful conclusions for insightful findings.

4. Findings

4.1 Challenges in Adopting Circularity and Sustainability

4.1.1 Financial Barriers

The move towards sustainable practices poses some financial challenges to businesses in this period, mostly small and medium-sized (SMEs) that usually do not have the funds for investment. This part tries to go deeper into the costs that companies face with sustainability; the costs associated with green technologies; and how to balance profit alongside environmental objectives.

Over the past years, there has been an increasing demand for green products, a subsequent increase in compliance regulations, and a growing awareness of environmental issues. While these have positively affected innovation in the fashion industry, they are not without heavy financial expenses, especially for SMEs with little capital stock. Oftentimes, the sustainable transition requires very heavy upfront capital investment whose returns can hardly be guaranteed; that's why it becomes quite difficult for smaller players.

These financial challenges can be fundamentally classified into three categories, namely: high costs for sustainable materials and certifications, SMEs-specific constraints, and lack of access to financing and incentives. The contributions from industry experts and practical examples that illustrate how these aspects relate to businesses of various sizes represent an obstacle to the progress to sustainability in the fashion industry.

Adopting eco-friendly methods, and incorporating green technologies and certified materials come with high upfront costs. Sustainable materials, according to C2, maybe 30–40% costlier than the average materials, increasing the financial strain. Companies might face costs for infrastructure improvements, supply chain changes, and workforce training, in addition to materials.

Big companies face the greatest hurdles in shifting to sustainability due to the high-cost investments in process changes, infrastructure, and workforce training. C8 emphasized that modifying production techniques to comply with sustainability requirements may be very costly as well and would create problems even for stable businesses.

This leads to problems in justifying the expenditures to decision-makers. C4 stated that executives are pressured to focus on immediate returns, and profit in the short run, instead of longer-term benefits such as sustainability. As profit margins go down and the uncertain nature of economic payback further complicates decision-making, many organizations do not easily bring up resources for an initiative that has no direct paybacks.

Though achieving the standards of sustainability and getting certification brings one more layer of financial strain, these processes usually imply careful monitoring and audits that are time-consuming. More than that, such expenses have created a barrier or completely blocked the adoption process for SMEs with a limited budget; this disparity will leave those firms that can innovate, like the well-funded ones.

In general terms, SMEs are not able to reach the benefits of economies of scale, which adds to that strain. Smaller businesses charge more per unit than their bigger competitors, who use extensive operations to spread costs.

Increased costs are mixed by limited access to funding, as smaller companies find it far more challenging to reach out to the multiple of different financial services and green finance sources as they lack in skills or resources in navigating the complex financial landscapes.

Balancing sustainability and profit remains an overwhelming issue for businesses. However, as C8 put it, if companies try to convince the stakeholders concerning returns over a short period of time, it makes such an argument difficult for them when that kind of investment does not return as expected and often leads to delaying or incomplete adoption.

Also, institutional support is not much available for SMEs itself. Governments have holistic policies paying no attention to the needs of smaller businesses. On account of priority compliance by regulatory frameworks, instead of facilitation, SMEs are pushed further back in transitioning to sustainable practices.

Emerging markets paint stark contrasts in accessibility to funds. Poor financing infrastructures matched with a reluctance on the part of banks to finance what they suppose as high-risk eco-initiatives leave many businesses unable to source the funding necessary to invest in sustainable innovation. Even in developed markets, programs are either poorly funded or poorly targeted, thereby leaving SMEs out of effective support.

Direct public incentives tax exemptions, grants, and earmarked green funds can provide great leverage in terms of cost reduction. C1 and C2 stressed the importance of these measures in helping SMEs compete with bigger firms. Take for instance C1's narration of the second-hand voucher system: it demonstrates how an innovative approach in terms of financing can somehow align economic viability with sustainability while reducing material losses and consumer loyalty.

Targeted interventions are required to overcome these financial barriers. Subsidies, co-financing platforms, and well-tailored government schemes could level the playing field for smaller companies overdue access to sustainability investments without jeopardizing their financial footing. A state-level addressing of the paradox will go a long way toward ensuring an inclusive transition to sustainability within the fashion industry.

4.1.2 Technological Gaps

Sustainable and circular business models within the fashion industry are vitally dependent on possible transformative technologies. Innovations in material processing, supply chain management or waste reduction hold a significant promise in improving efficiency and decreasing the environmental impact. Many of these have not yet been put into practice, since industrialization on a large scale has several cost, scalability, and integration barriers involved. This section discusses already available technological solutions and capabilities as well as systematic obstacles hindering the overall deployment.

Sustainable technologies span a wide-open field for the fashion industry. From bio-based materials to low-impact manufacturing equipment, the field includes data-driven tools for production optimization and waste minimization. For example, bio-based dyes and low water dyeing systems, according to C2, dramatically cut down on the environmental footprint textiles have by using less water and energy in

their production. Closed-loop systems, emphasized by C6, ensure better sustainability through recycling water and energy during production processes, incurring less operational money. AI-based tools help supply chain efficiency by forecasting demand and harmonizing production to conform to actual market needs with very important advancement, has been described by C3.

Technology has a bright future but still faces several challenges. High initial costs mostly stop small businesses, especially SMEs, from purchasing any resource-efficient machines or advanced processes. As to C8, virtual design programs like Clo 3D help to lessen the waste, especially in the phase of prototyping since the user can do prototypes without a lot of physical samples. She states that it is more restricted due to financial barriers to acquiring it, particularly for SMEs that are not highly resourced in such advanced tools.

C1 indicates that innovations affecting low-water dyeing systems are financially beyond the reach of many SMEs, thereby creating a gap between larger companies that can afford it and smaller players who struggle to compete. Limited technical know-how, especially in operating state-of-the-art tools like AI and statistical models, is a further obstacle to adoption. C4 largely articulated the gap in skills that makes implemented technologies less effective than actual engineering investment for further development. She also narrated that practical training and knowledge sharing should be done to ensure that new technologies are in place for proper application. Without a skilled workforce, most innovative tools like Clo 3D have a high chance of non-usage, decreasing their possible impact on sustainability.

Emerging markets face several hurdles in their request for energy supply even with reliable and outdated equipment, not to mention the additional obstacles to adopting advanced technologies. Innovations like zero-waste pattern making and AI infusion for demand forecast require colossal investments in infrastructural and human resources that fulfill the sustaining condition. According to C8, these kinds of innovations would help eliminate the bottleneck in energy efficiency only if backed by institutions as well as multi-stakeholder collaboration. As noted by C7, such limitations are aggravated by insufficient institutional support, which doesn’t help firms reach the requisite resources or guidance needed for modernization. Most of these SMEs from such locations face systematic disadvantages limiting access to capital and supplier networks: all these are constraints on new technologies.

This keeps increasing the unseen potential implications regarding the slow rate of adoption of advanced technology. It also accumulates a lot of consumption, adding waste and demonstrating many more missed opportunities for operational efficiency. All this creates inertia in sourcing towards sustainability targets and makes the eligibility for competitiveness in markets globally where consumer preferences and regulatory frameworks tend to favor environmental responsibility. As C5 warned, companies that cannot bridge the transformation transition into sustainable technologies lose relevance and shares in the market to more agile competitors.

In order to fill the technological gaps, multiple stakeholders would need to work together in a coordinated manner. Financial incentives, such as subsidies, tax breaks, and grants, can help sensitize the adoption of advanced technologies by offsetting initial investment costs. Training and knowledge-sharing programs can contribute to closing the skills gap and empowering businesses for maximized benefits from these tools, as advocated by C3. Partnerships between businesses, universities, and research institutions will push innovations and help knowledge and resource transfer. Industry consortia, as C7 discusses, may

allow companies to share best practices and technologies across the board while sharing costs and speeding up adoption.

Sustainable technologies will also require a cultural reorientation within the industry. For the long-term growth and resilience of the firm, investment in technology should take the form of as-seen-fit rather than optional. Policymakers, industry leaders, and academic institutions need to come together in the support of a conducive environment for innovation to fulfill all the diverse needs of businesses across regions and market segments.

Overcoming these elements could help the gaps brought about by technology in the fashion industry to be closed, as it can be seen by the progress that is being made towards a sustainable future. Not only will this advance environmental performance, but it will also provide a competitive edge internationally and access to a fairer transformation toward sustainability.

4.1.3 Consumer Behavior

Consumer behavior could act as a crucial factor in the fashion industry's transformation towards sustainability. There is a growing interest in eco-friendly products among consumers, but many of them remain very price-sensitive; this creates a gap between their ethical desires and purchasing realities. Such a condition is quite onerous for businesses seeking to match ecological practice to the world's very competitive price-driven market.

The consumer values and behavior gap will almost certainly continue. Many consumers might prefer sustainable goods, but they are not willing to pay the extra price for them. C8 insisted that the needed palliative, in closing this gap, is education, in that it facilitates an understanding of the true environmental and social costs of fast fashion. They observed that superficialities rather than deeper understanding, often guide most such purchases. C1 mentioned the increasing expectation that all brands should have some environment-friendly options; yet, the cost would always determine the choice considering middle and lower-income families. Even among ethically minded consumers, price, rather than principles, reigns. Fast fashion and low-cost, high-volume models are the dominant ones. As C3 argues, fast fashion brands weigh on economies of scale and marketing to get consumers, sustainable brands do not have the same advantage due to high production costs.

C5 has described this phenomenon as a quick-consumption mindset; users would therefore purchase items mostly because they are cheaper than at other places. By this, overconsumption is perpetuated and adds to the already growing phenomenon of waste. It is easy for people to overlook the fact that, no matter how much an individual is aware of environmental issues, the attraction to disposable fashion is considerably much stronger than the long-term returns a person can get through durable, as well as sustainable, products. Such behavior creates a barrier for brands that are all too eager to change the purchasing rituals of consumers to sustainability.

Changing of mindsets regarding consumer expectations is happening, though younger generations are at the forefront of driving this change. According to C8, this means that brands should listen to and reach out to younger consumers via platforms such as social media, where awareness is arguably more widely spread. They encouraged brands to use storytelling and education to illustrate how their sustainability efforts impact people, creating a sense of joint accountability among consumers. Moreover, as pointed out by C7, millennials, and Gen Z are more aware of environmental and social issues and actively seek

brands that share their values. This generation is also more inclined to demand open visibility and accountability from companies that practice greenwashing. C2 stated that such certificates and transparent labels will serve as essential tools for brands that wish to build bonds of trust and credibility with environmental consumers.

The growing presence of second-hand markets has illustrated the changing consumer necessities. As C1 said, second-hand fashion will be for environmentally conscious shoppers because they get high quality for low prices and also promote a circular economy. Companies that have put second-hand into their business model, prove how this new trend can create opportunities in sustainable practices.

In connecting the ideal life with consumer behavior, some strategic approaches have to be done to fill the gap. Awareness-raising on the environmental and societal costs of this form of fast fashion is a critical component. C3, on the other hand, noted that storytelling makes value for sustainability come alive to consumers who should be allowed to learn and remember that convenience is not everything and neither is quantity more important than quality and long-term effects.

However, accessible and sustainable product lines could even affect some of the ethical fashion segments. Furthermore, it could catalyze changing consumer behavior transparency. Consumers, as C8 puts it, increasingly demand evidence of sustainability witnesses or revelations about, for example, the supply chain will not be sufficient. Clear and honest communication, building trust, and legitimizing any sustainability claim will be the base for reaching goals. According to C4, affordable collections meant for smooth production and material sourcing would then be related points of contact for price-conscious consumers without having to sacrifice sustainability. Differentiated pricing models, recycling incentives, and loyalty programs linked to sustainable purchase programs are other means of inspiring and promoting responsible consumption.

Another thing to add is that the communication about environmental sustainability efforts should come from the brand. As C7 summed it up, stories should be told about the environment on the part of the brand, or perhaps form an ethical practice bringing trust and loyalty. The reality of very detailed sustainability reports and lifecycle information does attract consumers to make informed decisions based on this aspect and pretty much aligns with connecting their value to purchasing behaviors.

Further, innovative techniques can be formulated for cost-cutting in sustainability. Technological innovations, like how easily AI assists in demand forecasting and makes production techniques efficient, could reduce costs while still keeping the quality. Apart from these ways, there are also options like industry consortiums for sustainability or resource sharing that can most certainly lessen the financial weight as well as logistically.

Neither consumer behavior seems to be the main problem of fashion adoption for the healing of sustainability; it serves as an opportunity. In fact, it demands new pricing strategies, transparency in pricing, and suitable consumer education concerning changing expectations so that it can overcome the open division between ideals and actions. That is, these efforts will make consumers heavier users of responsible consumption; the same will go toward achieving a more sustainable and inclusive future for the fashion industry.

4.2 Innovative Business Models

4.2.1 Second-Hand Market Implementation

Second-hand markets have emerged as the newest-generation, most progressive sustainable business model in the fashion chain value addressing environmental concerns as a practical alternative. Lifecycle extensions of garments, waste reduction, and the consequent lowering of environmental damage by production costs are all part of the circular economy model, an inextricable part of the growing demand by consumers for value and sustainability.

C8 pointed out that second-hand markets reduce waste to address wider social issues. A model has been used to democratize access to sustainable fashion to all social classes, allowing them to involve themselves in circular practices. In addition, second-hand markets provide highly meaningful work in sorting and distribution, which is an important addition to their social effects.

In this section, second-hand markets are viewed in terms of the case studies and insights from the industry, CRG including its very successful approach. It highlights the operational frameworks, the financial dynamics, and strategic innovations associated with these initiatives and how they prove that they can provide a base for the sustainability transition for the industry.

The implementation of second-hand markets implies that innovative operational models should be adopted in business strategies that encompass sustainability. For example, in the CRG approach, customer participation through a voucher system forms part of the evaluation. As C1 explained, clients return used garments to receive vouchers, which create a closed-loop model, with all materials being retained within the brand's ecosystem. This is not only a method of promoting recycling, but it also enforces brand loyalty by creating a tendency for repeat purchases.

Logistics efficiency is the part that enables all functions to be collected, sorted, and distributed. CRG uses integrated local collection hubs to help facilitate these activities. All items returned go through a quality assessment before being sorted for resale or recycling before distribution. High-residual qualities are resold; while damaged stock is processed for material recovery. This model of operation minimizes waste as it keeps costs manageable so that the brand remains competitive and meets its goals in sustainability as C4 mentioned.

In addition, the second-hand market implicates extensive environmental benefits, since this market reduces fabric waste and conserves natural resources. According to C3, the reusage of garments reduces the amount of waste destined for landfill or incineration and relieves some of the intensive resource use that new clothing production requires. That is another advantage, beyond the reduction of greenhouse gas emissions, particularly in high-emission segments such as fast fashion. These second-hand markets further contribute to a greener and more sustainable industry by reducing the requirement for new production.

From the social aspect, second-hand markets provide equal access to fashion that is sustainable. According to C5, the cost-effectiveness of second-hand clothing gives sustainable practice opportunities to the consumers within emerging markets and income at the lower end. Such inclusion opens the appeal of eco-friendly fashion, linking beliefs with the realities of economics. The involvement of the sector

ranges from the collection of garments, sorting them, and their resale; all have a significant impacts on social classes.

Achieving economic sustainability is an ongoing challenge for second-hand market circulation initiatives. Gathering and sorting labor-intensive processes, associated logistical complexities, and resource constraints that are accumulated efficiently, especially for smaller companies. C8 argued that consumer education is very important for the success of second-hand markets. They argued that though affordability serves as an incentive, consumers would also need to understand the environmental reason for extending the life of garments. Raising awareness using storytelling and targeted campaigns would then serve second-hand brands in ensuring consumer loyalty and participation in circular systems. As C1 noted, profitability is usually based on scaling up the average number of transactions to enable cost reductions per unit.

Moreover, logistical cost is another barrier. Collection, quality assessment, and redistribution of garments require substantial infrastructural work combined with specialized power, which increases operations costs as C6 noted. Smaller players have an added disadvantage with competitive competition from global platforms such as Vinted which can utilize an economy of scale model to successfully command the market with prices that are low, as mentioned by C4. All this requires innovation in strategies to make smaller initiatives distinguishable and attractive to loyal customers.

Their limitations are numerous. It is a problem that not just technology helps in achieving. The companies even partner with logistics providers, or maybe technology companies, or just even other brands, then streamline operations and share resources. C8 spoke about the second-hand markets and the innovative voucher system, which can be a reward, such as discounts or loyalty points that customers can collect every time a garment is returned. The above strategies improve the recovery of materials while building a trusting relationship with a customer of the brand. Digital aids like AI-based sorting systems and blockchain traceability apps make operations more efficient and transparent. Modernization and optimization in the supply chain increase efficiency and lower costs therefore maximizing scalability.

The future of second-hand markets is in implementing synergies within states backed by advanced technologies and cross-sector collaboration. Tax breaks, subsidies, and infrastructure funding are some of the policies that can make a better environment for second-hand operations as noted by C7. Integration of digital platforms for resale and a list of higher-end AI-powered quality assessment systems will definitely bring more efficiency and reach to the market.

Collaborations between used-goods companies, policies, and NGOs create supportive regulations and enhance public awareness of the benefits of circular fashion. The collaboration creates a mutual framework that in turn sets economic targets alongside sustainability goals and creates the first driver of innovation and the broader market impact.

Second-hand markets tend to coin purchasing behaviors as they can redefine value and normalize circular practices. The companies that innovate solutions and have deep conversations with consumers through compelling storytelling and transparency in marketing will most probably be the models of this evolving sector.

Second-hand markets offer a revolutionary angle toward the fashion industry under the umbrella of environmental, social, and economic aspects. Extending the life of garments and creating a waste-free

environment could also give access to diverse consumers to sustainable fashion. These issues are among the most critical challenges facing the industry. Breaking the barriers posed by economically sustainable practices will require several levels of strategies, including collaborations, technology enhancement with the industry, and institutional support.

With the right strategies in place, the second-hand market can drive the fashion industry's transition toward a more circular and responsible future, balancing profitability with environmental and social impacts.

4.2.2 Transition to Slow Fashion

The shifting trend from fast fashion, which deals with quick production cycles and throwaway clothes, is gradually coming to slow fashion, which is another type of fashion with high-quality, durable, and sustainable garments. This model will mark an intentional break away from mass production and transitory trends toward more timeless designs, quality fabrics, and mindful consumption. There has been a growing call from consumers for sustainable products, and even brands are feeling the pressure of regulations and the environment. While the model brings great benefits in terms of much lower environmental footprints and overall reputation improvements for brands, so great challenges that will need to be met with strategic adjustments.

Slow fashion purposely ensures that customers have high-quality materials and also artisan-made products that have a high prospect of being worn longer. C1 best explains this by stating how CRG serves this aspect by designing lines that reflect the longevity and versatility of pieces so that customers can wear pieces beyond certain seasons. This concern for quality and not quantity is consistent with an increasing number of consumers' preferences for well-made, long-lasting clothing, which they say increasingly becomes a better investment compared to disposable fast fashion. Production with fewer but superior designs and materials allows slow fashion brands to tread lightly on the environment while maximizing the worth of their products, as C3 indicated.

The main thing slow fashion is about is building those everlasting designs and consequently sustaining the need to update wardrobes frequently. C6 says that neutral colors and classical styles keep making those clothes items relevant over that time and there would be less chance for a consumer to be short and to take after changing trends. The whole design philosophy then encourages mindful consumption while accountable to a brand's reputation value and quality, so valuable when placed against the super-fast pace of obsolescence of fast fashion. Slow fashion redefines clothes from disposables to an investment by evoking a stronger connection between consumers and the things they buy.

So, if you ask me, I will say that slow fashion is about timeless design creations. These creations reduce the need for a person to frequent updates in the wardrobe. C6 stressed this by saying that neutral colors and classic styles have a way of making clothes relevant with time, thus lessening the pressure on a consumer to keep up with those changing trends. It encourages responsible consumption besides being quality and enduring attributes of this brand compared with the vibrant speed of obsolescence that characterizes fast fashion. It changes clothing from disposable commodities to investments since it creates a rather stronger bond between the consumers and the items they buy.

Slow fashion offers huge environmental advantages. According to C2, making clothing durable decreases the number of times consumers will have to replace it, conserving resources such as water and power. By

prolonging the life cycle of products, it reduces the amount of waste and achieves more extensive sustainability goals like lower greenhouse gas emissions and less pressure on landfills. Economically, slow fashion allows brands to position themselves as premium players by deeply differentiating themself from competitors through an appeal to quality and timelessness. As was noted by C4, this strategy increases customer loyalty because customers appreciate the craftsmanship and durability of these products and, therefore, are willing to spend on more costly items. Socially, slow fashion tackles labor exploitation through smaller, ethically managed production runs. As indicated by C5, such an approach improves conditions at work and pays fair wages while catering to the growing ethical demands of consumers and regulators and captivating further a brand's reputation.

There are considerable hurdles in the shift to slow fashion, which, despite having numerous benefits, brings with it a lot of challenges. The major hurdle would be for consumers to get along to paying higher prices for durable and sustainable products. C1 mentions how most shoppers who have become accustomed to the low-price tags of fast fashion will be reluctant to spend more on slow fashion items. This reluctance is worsened by the fact that price-sensitive populations have considerably less regard for what may be perceived as the long-term value of better-quality items in comparison to immediate affordability. All this can be addressed using price strategies combined with the consumer education initiative concerning the merits of investing in ethically produced durable clothing. Financial strains are hindering slow-speed modeling too because they are the smaller players. C3 said that this involves huge investments in high-class materials and quality production methods, stretching one's resources and thus needing help from the outside, by way of incentives, partnership, or creative funding options.

Another major challenge involves competition from fast fashion. As C6 continues to note, the ranges of price points and varieties that can be offered by fast fashion keep a wide number of consumers in the market and often emphasize quantity over quality. Slow fashion brands then need to position themselves differently through their unique value propositions, such as sustainability, durability, and timeless design as important motivators for poor consumption models. The transition to slow fashion has implications for cultural and operational change within organizations. To this end, organizations ought to dispense with previous speed chases at production and assume slow and deliberate speed at operations, which sometimes calls for training staff, reconfiguring supply chains, and establishing relationships with ethical suppliers. Change resistance may further complicate this whole process; strong leadership and clear communication are essential for successful implementation.

They need to adopt a holistic attitude that involves educating consumers, innovating on operations, and collaborating strategically. Such campaigns would enable consumers to relate the slow fashion phenomena with its environmental and social sustainability dividends and reasons for value buying less but well. Many examples as C3 picked up were storytelling around the product and its craft and sustainable sourcing would build trust and therefore inspire deliberate buying habits. Be it collaborations with new designers or advocacy, these kinds of things would make a slow fashion line look more appealing to different consumer groups and also reinforce the messages of the brand regarding innovation and ethics. An investment in sustainable materials and technologies is an operational excellence that further boosts a brand profile in the environment and at present in consumer appeal.

Changing from fast to slow involves a paradigm shift in the industry to meet urgent environmental sustainability, economic viability, and social equity challenges while building a culture around mindful

consumption. This path may be difficult, but the brand, consumer, and Earth's welfare can gain very much. Prioritize to bring quality, innovation, and transparency that positions the business as an emerging leader in sustainable fashion while driving the industry into being more responsible and resilient.

4.2.3 Multi-Stakeholder Collaboration

Sustainable business models for the fashion industry increasingly develop in the context of multi-stakeholder collaborations with private and non-governmental organizations, universities, governments, and other important actors. These collaborations allow resource-sharing to include knowledge and expertise, enabling innovative solutions to complex problems that no single entity could possibly handle on its own. The section explains some of the possible benefits, uses, and challenges of multi-stakeholder collaboration and identifies its role in independent approaches to transition industries toward sustainability.

They act as intermediaries and advisors while also serving as certifiers of businesses. Most importantly, an NGO equips businesses with international standard compliance and ethical practice. According to C1, it is already quite apparent that partnerships such as these with Fair Wear and the Bangladesh Safety Accord have a huge impact on improving working conditions in production facilities by providing pathways to less stressful wages, as well as safe and non-discriminatory conditions. However NGOs provide a structural framework for the understanding and improvement of supply chains so that the results will not only make life easier for workers but would also allow brands, if they were participating, to become leaders in the ethical-production phenomenon.

In addition, NGOs provide technological capabilities and fill the gaps in knowledge and resources primarily in small businesses and emerging markets. C5 also cited the importance of NGOs in resource-efficient production training, supply chain audits, and other advisory matters for resource-efficient production. Supposedly, they are instrumental in making a culture of transparency and accountability within that organization, where visible indicators of commitment towards sustainability use certifications such as Fair Trade and GOTS. These certifications reassure stakeholders and also give a competitive edge to the company in a market shaped increasingly by ethical purchasing decisions.

Partnering with universities and research institutions also accelerates sustainable practices through exposure to specific knowledge and cutting-edge technologies. Partnership with those academic institutions enables companies to venture into alternatives to traditional textiles, closed-loop production models, and improved methods of manufacturing. Partnership with research institutions enables the leveraging of research capabilities for knowledge and trial of more advanced materials such as bio-based fabrics or recycled manmade fibers, as remarked by C3. C4 mentions that universities also could help provide high-tech facilities to analyze the environmental impact of materials or optimize production processes; academic collaborations are important to companies looking for specific issues.

Besides technical support and services, academic partnerships also become avenues for talent development and knowledge sharing. The C8 emphasized the importance of using academic institutions for more than just research-involved programs but for practical training as well. They pointed out that such partnerships train and create a pipeline of professionals ready to implement sustainable practices, as it is where students directly get involved with companies while studying. Programs that involve industry professionals work together with academic researchers in creating opportunities for practical

applications of academic innovations and equipping businesses with insights into where the trends are heading. According to C6, these types of collaborations could benefit both academia and industry.

Public-private partnerships have now emerged as one of the many good strategies that enable the green economy. In an effective sense, they combine the resources, innovations, and assets of both the governments and private sector organizations to actualize more widespread solutions to systemic challenges. C7 indicated that government incentives like tax breaks, grants, and funding for sustainable projects encouraged businesses to adopt environment-friendly business practices. Usually, these projects imply that the government provides centralized infrastructures for recycling, whereas the business organizes logistics and distribution for efficient resource recovery. Most successful PPPs show examples, particularly on the European continent, where aligned public policy and private sector innovation can deliver scalable solutions for sustainability, according to C4.

The collaboration among multiple stakeholders is interesting but can be difficult when it comes to the differences in objectives among stakeholders. For instance, businesses mostly try to look at profit maximization, while NGOs and the public primarily concern themselves with obtaining some social and environmental benefits. As earlier observed by C3, unless both parties communicate, and set out common goals, these types of diverse priorities deactivate collaborative ventures. In this type of situation, trust and transparency become critical. According to C6, therefore, open lines of discussion and accountability measures are very critical for ensuring the commitment of all stakeholders and their feeling of value in a partnership.

Collaboration will also be more effective if it includes setting clear, measurable objectives as well as solid governance arrangements for synchronizing activities and tracking progress. C7 made it clear that such efforts are part of specific, time-bound goals that are backed up with metrics. Such goals provide a common framework guiding decision-making and ensuring accountability, enabling stakeholders to assess the effectiveness of their collective actions which indeed called for concerted efforts.

It is the most promising potential for catalyzing the changes needed to drive sustainability in the fashion sector. Such multi-stakeholder partnerships make way for knowledge-sharing, resource-sharing, and innovation, which nurture long-term systemic changes that cannot be achieved by individual actors. When properly managed and by transparency, trust, and goals, collective engagement wouldn't just deal with tough sustainability issues but also build corporate reputations, while adding value to communities and the environment.

It shows the impact of collective action in sustainability, with NGOs, academic and public-private partnership actors included all in a collaborative frame. This multi-stakeholder approach, however, promises several benefits - from better innovation to a wider social and environmental result - keeping alive the challenges of alignment and trust. These types of partnerships well capture what should be an all-inclusive and positive model of change: enabling the fashion industry to position itself as the marketplace leader for sustainability on a global level.

4.3 Role of Technology in Promoting Sustainability

4.3.1 AI in Production and Inventory Management

Artificial intelligence (AI) and advanced statistics have radically changed and transformed ways of production and inventory management in the fashion industry. This has been proven to be very effective both for operational efficiency and sustainability goals. Some of the ways around which AI and advanced statistical models can get away from some of these sensitive issues in the industry are the correct allocation of resources, accurate demand forecasting, and even disposal requirements.

Artificial intelligence and predictive analytics have changed the way companies plan their production volumes and inventory levels. Using past consumer trends and historical data, companies would be able to anticipate their market needs and avoid possible high costs from overproduction. According to C1, CRG employs this type of forecasting for matching production with actual demand by using predictive models to reduce wastage associated with surplus inventory and unsold products. This now leads to a shift from intuitive forecasting toward data-biased decisions ensuring production remains in line with market trends. Using this, wastage will be reduced, and it becomes speedier, enabling a faster response to modifications in consumer behavior.

The effects of predictive analytics on the environment correlate impartially. For example, overproduction in the fashion industry consumes excessive resource capital including water, energy, raw materials, and the production of greenhouse gases and landfill wastes. This statement is strong with a C3 quote asserting that AI measures of forecasting minimize those impacts by aligning production volumes with actual consumer demand. Thus, in all respects, this retroactive kind of approach probably continues to support the more significant sustainability objectives of the industry while conserving natural resources.

Retail is the area where AI will make the most radical revolution in inventory control because of new technology in real-time monitoring, automated repetitive processes, and dynamic and instant adaptation to changes in the marketplace. As C2 stressed, the AI system would benefit the firms in tracking stock status in their different locations and complement actions in correcting such as reordering or reallocating inventory. Stockouts and overstocking will be eliminated, and transportation logistics will be simplified to reduce costs and emissions. For example, if AI notices inventory going low in one warehouse, it can have surplus stocks transferred from another, thereby streamlining operations and having less environmental impact.

Automation has improved these practices by eliminating all manual oversight, greatly lowering the chance of errors made by humans. AI-powered systems can perform autonomous inventory reordering through predictive models, allowing resource optimization to be devoted to strategy. Companies can therefore recalibrate their inventory strategies in real-time, particularly during peak demand periods or supply chain disruptions, according to C6. Continuous improvement in the accuracy of machine learning algorithms through historical data enables companies to predict future scenarios with growing precision.

AI adoption is founded on economic arguments. The cost savings should be significant as they can come from reducing waste streamlining logistics and automating inventory processes. In its claims, as C5 states, AI will optimize production flows and resource allocations; profitability can be increased, making a firm more competitive. In addition to gaining benefits of improved brand reputation, such alignment is considered sustainable and attracts consumers and investors who are conscious of environmental issues.

Indeed, adopting AI technology in the fashion industry could be revolutionary but is still very challenging. The implementation costs, according to C1, usually prevent small and medium enterprises (SMEs) from investing in it. For most companies operating with just-in-time margins, being exposed to the financial risks associated with the implementation of AI outweighs its perceived benefits. Public-private partnerships, government incentives, and subscription-based software models can help mitigate the initial pressure of acquiring these technologies making them more available to a much wider group of companies.

Another obstacle is the technical skills involved in setting up and managing AI systems. Many companies do not have the necessary expertise to work with these latest technologies adequately. The workforce development and collaboration between the universities and the technology providers to close the gap were emphasized by C4. Employees learn the attitudes required in AI workflows enabling easier transitions and maximum benefits of these tools with training and upskilling programs. C8 emphasized how critical such partnerships could be between academic institutions and technology providers to fill the emerging skills gap. Personalization of training programs to industry-specific needs could equip the workers in the relevant industry with the necessary tools to fully utilize AI-driven solutions.

Cultures of resistance in organizations pose difficult barriers, according to C6, by which skepticism about new technologies and fear about the loss of job security affect AI adoption. Manage effectively the change, improve information on the benefits of AI, and raise awareness for the complementary link with human work: this is the best breakthrough into such resistance efforts. The acceptance process would then be staged in pilots and feedback sessions, and then generate ownership and trust over time. The radical change can affect the employees, especially the more experienced, who may want to resist these new changes.

Much more could be used in economic and environmental benefits from applying AI to production and inventory management. All of which ultimately would drive the fashion industry towards sustainability, efficiencies, and therefore profits. This would greatly require investments in human resources and change management: all of this would count in helping their employees move to a completely new mode of operations. Good integration of AI will make a genuine catalyst for innovation in a fashion that would efficiently manage ever-changing market demands while fulfilling sustainability goals.

4.3.2 Adoption of Green Chemistry

Green chemistry has just recently emerged as the latest developing trend in the fashion world to date about environmental issues on textile production such as dyeing and smart innovations in materials. Its strong emphasis is on renewable resources; minimal waste production and safer production activities, developing a sustainable approach towards their environmental stewardship and operational objectives. This section will respond to the singular opportunities and challenges that green chemistry is likely to throw up, especially in terms of bio-based dyes and new materials, concerning the future of the fashion industry.

One of the most significant opportunities offered by green chemistry would be the consideration for the reduction of environmental footprint in textile production. According to C2, bio-based dyes can be seen as potential substitutes for the synthetic dyes currently used because of the environmental pollution from water and associated health problems to all workers handling them. These dyes will prove to be even

more beneficial in that, as renewable plant-derived materials, they can dispense with the use of harmful chemicals, particularly the azo ones, which pollute water systems among other things, and harm aquatic ecosystems. They also contribute to decreasing the demand for petrochemical derivatives and thereby help in reducing the total greenhouse gases released during the entire production process.

Green Chemistry represents much more than introducing innovations in dyestuff; it also involves developing biomaterials such as fibers from algae and fruits as well as their associated textile items. C4 pointed out that these alternatives were not just biodegradable but also demanded a lower input of chemicals and less water in their production. This integrated the potential application of these materials to replace typical cotton fibers and, thereby, reduce resources expended due to the production of polyester, a non-renewable, petroleum-derived product. It set simple value chains with brands that were sustainable and environmental impact at the other end.

The other trigger encouraging green chemistry adoption is consumer demand for eco-friendly products. According to C6, the emerging trend by which green-minded consumers are becoming increasingly demanding regarding certification and labels that would demonstrate that a product meets the sustainability credentials has inevitably driven up the sales prices of items advertised as biodegradable or eco-friendly and secured for them a committed market niche; this becomes a strategic initiative for brands wishing to further their market appeal in these changing consumer preferences.

The adoption of green chemistry, notwithstanding its promise, has serious hurdles to overcome. The performance limitations appear to be a major obstacle as noted by C2; bio-based dyes frequently do not compete with synthetic ones in durability, brilliance, and consistency. These limitations are crucial in mass production where quality and aesthetic value prevail. Addressing such problems will call for different research and development initiatives such as natural mordants and sophisticated bio-based fixatives in the search for performance improvement of eco-friendly dyes.

Cost is another serious hurdle and C3 has said that most times this lifestyle is much more expensive because of the complex raw materials and processes involved in the manufacture of bio-based products. These costs can be heavy for businesses that do not possess the economies of scale that can make the initial investment tolerable. By this time, the high cost will in all probability limit demand growth but not at the same pace as the demand-creation of such a barrier to prevent the widespread diffusion of green chemistry.

Apart from the more publicized infrastructure gaps, these pose substantial challenges to an emerging market where facilities for bio-based material processing are non-existent. C7 underlined the need for specific equipment and training that would complement activities in green chemistry, which unfortunately most manufacturers are not capable of offering. It is impossible to invest heavily in building these infrastructures and scaling such innovations to meet global demand under the conditions they have created.

Collaboration and innovation should be encouraged in overcoming the barriers. Work between fashion companies, research institutions, and technology providers can help bring forward less expensive but more efficient green chemistry solutions. Direct collaboration, C5 said, could produce joint research projects whose output could increase the performance of bio-based dyes and materials while at the same time improving production costs due to shared expertise and resources. Besides, governments can also

be very important if they come forward with financial support in terms of subsidies, grants, or tax preferences for companies engaged in sustainable practices. Would have thought however that this kind of change would take probably more than a generation in the normal approach that would transform in essence, the internal infrastructure of per-organization management.

However, standardization and accreditation will promote a fast increase in the adoption of green chemistry standards. If clear global standards were laid for eco-friendly materials and processes, as proposed by C3, transparency and trust would have covered the consumer market. Certifications, such as GOTS or Fair Trade, not only stake claim for the environmental credentials of a particular product but also put the brand in a superior position over competitors, increasing the reputation and loyalty among customers in the marketplace.

Green chemistry has multidimensional advantages for the fashion industry over time. The main advantages of direct benefits can be summarized as lowering degradation to the environment, lower operating costs, and higher brand equity. Currently, the major barriers include costs, performance limits, and infrastructure gaps. Several avenues are being explored to mitigate these adversities, such as in intensified R&D, financial initiatives, and cross-the-sector partnerships. It is true that every investment in green chemistry will ensure the future of the fashion industry concerning ecology and consumer demands, which can be balanced with innovation.

4.3.3 Energy Efficiency in Manufacturing

Increased demands for a greener environment and sustainable design practices have placed energy and water efficiency improvement at the center of sustainable manufacturing. With high-tech haunts like heat recovery systems and water recycling processes, the industry can significantly reduce its environmental footprint while improving productivity.

Energy efficiency is the backbone of the whole environmental impact reduction program in textile manufacturing. It is relevant to the incorporation of technologies for saving energy, like heat recovery systems, renewable energy, and super-efficient motors, within the production process to reduce as much as possible energy and greenhouse gas emissions from processes. According to C2, heat recovery systems are systems for energy recovery that collect energy during dyeing, drying, and finishing processes, using it further in the same or a different process. The energy is then reused to heat the water or air that would need to enter the system, resulting in a considerable cut down on energy inputs. The economy saves on energy costs for a long time.

Electricity is another milestone for energy-efficient manufacturing. Indeed, as C4 noted, factories are bringing increasingly solar panels and wind energy into production, which enables companies to generate their electricity and reduce conventional power grid dependence. Renewable energy sites not only save operational costs in the long run, but they also provide the global climate goals of reducing carbon footprints. Furthermore, companies doing such activities may be entitled to government incentives or deductions from taxes, which adds more possible solutions for financial feasibility.

High-efficacy electric drives, as C6 emphasizes, also taken together consume energy optimally. Such motors consume far less energy than the traditional ones but deliver similar or sometimes even higher production capacity. However, due to the higher initial capital investments, they appear not to be economically viable in the short run, but their life and operation cost savings produce them valuable in

the long run. These technologies are most applicable in the energy-intensive fields of textiles, where even a marginal improvement results in a dramatic saving in both cost and environmental terms.

Just like those technologies of water efficiency, this is also a highly resource-consuming textile production process, particularly dyeing and washing. According to C3, closed-loop water systems permit the reuse of water multiple times in the production process. These systems treat and recycle wastewater so that a large portion of it can be kept from having to be drawn fresh and shifted out as waste pollutants. Environmental benefits include the conservation of freshwater resources and reduction of pollution levels in natural water bodies, while economic benefits come from lower costs for water acquisition and disposal.

By employing advanced wastewater treatment technologies, water efficiency is elevated to new peaks through contaminant removal followed by direct reuse of treated water in subsequent production stages. These technologies tend to feature the combination of biological, chemical, and physical purification processes of wastewater, as C5 explained. The melting of the ice cap is a telling time in environmental impact on the textile production process, with a significantly lower chemical load released into ecosystems. Added to this is the competitive edge by which companies adopting this systems strategy gain in the eyes of such increasingly eco-conscious consumers.

Tremendous advantages stand for energy and water efficiency technologies. On the contrary, high initial investment costs are a significant hurdle for businesses. As C1 pointed out, it takes huge money to invest in systems, such as heat recovery or water recycling, and many companies find it difficult to commit to such investments. Such schemes must be well complemented with grants and other incentives, including subsidies and low-interest loans from governments and industry associations.

The other obstacle is the technical know-how required for efficient installation and operation of these systems. C4 mentions that training is supposed to be incorporated into such programs as these, helping workers to acquire skills in working with advanced technologies. Such partnerships are done because, according to this knowledge transfer process, the local businesses maximize their purchases.

Further important barriers are infrastructural limitations found in developing economies. C7 referred to the issue by observing that poor access to clean water, energy, and unorganized waste management creates difficulties in implementing sustainable practices. Addressing such issues requires a partnership effort between government, non-government, and industry actors.

The creation of public-private partnerships (PPPs) and industry consortia can significantly improve the mitigation of barriers. It can pool resources, make risks manageable, and promote innovations resulting in more environmentally sustainable technology. Besides, such would necessitate governments putting up most parts of the infrastructure and offering some incentive to boost adoption.

Using energy and water-efficient technologies in textile manufacturing would result in much environmental and economic improvement as it increases the consumption of resources at lower costs while increasing efficiencies in the operational footprint. All these are in line with the sustainability goals of the industry and keeping the competitiveness factor alive. There would need to be considerable engagement from businesses, governments, and all relevant stakeholders to overcome the barriers caused by the high costs and lack of expertise and infrastructure. By adopting the right strategies, the

fashion industry stands to lead the globe in manufacturing practices that are more sustainable and towards a much more responsible future.

4.4 Stakeholder Engagement

4.4.1 Employee and Supplier Involvement

Every employee and supplier's active agreement will ensure that successful sustainability initiatives in the fashion industry realize their potential. Making these key stakeholders part of decision-making as well as operational processes allows companies to firmly establish sustainability at all operational levels, creating a seamless and cohesive environmental strategy as well as a social response strategy.

C8 repeated their claim regarding the effectiveness of employee education toward an organization's sustainability goals. In essence, creating a culture of sustainability needs employee involvement as it has been synonymous with a lot of stakeholders as well. Key insights point to the fact that ongoing workshops and open discussions help employees understand their work in a larger context so that they can develop responsibility through such values adopted by the organization. In this regard, C1 notes that well-developed workshops and regular training programs effectively take employees through the sustainable development agenda of the organization and the bigger sustainable practice picture. A workshop provides an open space allowing employees to air their ideas and concerns and begin to understand their impact and role in achieving departmental environmental objectives. This engagement works to build knowledge and build a strong sense of ownership and relationship with the overall company mission.

Incorporating sustainability into everyday work responsibilities cannot be achieved only by education. C3 also confirms that including employees in decision-making processes increases their engagement and motivation. Incorporating employees in strategies and policies developing around sustainability allows them to feel more invested in the success of such efforts because they are involved in the "make-it-or-brake-it" business decision-making processes. Creating a cross-functional team or cross-functional teams with the responsibility of developing and implementing green initiatives will further improve that sense of participation, ensuring that sustainability is seen as an organization-wide responsibility. Continuous training is also among the critical components of employee engagement. Sustainability is incredibly dynamic: it is emerging into new technologies, new practices, new behavior, and new regulations, almost daily. It was, therefore, C6's view that these new skills and knowledge need to be offered to employees for their adaptation and readiness to meet the inevitable challenge of emergence through change. Continuous training does not keep employees up to date but fosters innovation and continuous improvement: it ensures that sustainability remains alive and dynamic at the core of the operations of the company.

As much as operational efficiencies will be gained from involving employees in sustainability initiatives, there is far more value to be gained from that connection at the employee personal level: A workforce that is connected to the organization's values is likely to be more motivated, more innovative, and more loyal. A culture of sustainability would allow companies to create job satisfaction and attract talent that aligns with the company's mission, providing the ability for a solid, internal foundation for sustainability projects.

The suppliers also have a very important role in this aspect of the fashion supply chain: they form the supply chain from the backbone to the main supply modules that directly affect the environmental and social impact of the production processes. C2 placed a note on long-term contracts with suppliers, thereby enabling sustainability towards environmental and ethical parameters. These contracts give the supplier the ability to invest in sustainable technology and other practices, thereby achieving a win-win for sustainability rather than short-term cost savings.

Clear communication of the sustainability objectives is another critical area of effective engagement of the suppliers. C4 authority stressed the importance of clear communication and continuous dialogue between business entities and their suppliers. This ensures that the expected environmental and social performance of suppliers is defined vis-a-vis the expectations of the businesses and ensures that suppliers are in tandem with the goals of the business. Such reporting and feedback mechanisms further bridge gaps in aligning companies and suppliers as they journey to finding solutions to problems and celebrating milestones.

Local sourcing is a fairly good method to increase the sustainability of the company and improve relationships with suppliers. According to C7, this is because sourcing has fewer transportation-related emissions and supports regimes around backgrounds by sourcing from local suppliers. When companies work closely with them, they also generate trust and collaborate with them, providing an avenue for more transparent and effective partnerships. That's because short supply lines create a case where businesses can respond faster to demand changes and increase overall operational flexibility.

The benefits can be seen in the positive involvement of employees and suppliers in such sustainability initiatives, but the situation cannot be without problems. For instance, resistance to change can act as a barrier for employees in adopting new practices when the sustainability initiative requires changing the way things are done and prioritizing activities. In order to resolve this, however, there should be a massive education campaign to demonstrate the foundation of the new systems both to the organization and in personal terms, then provide sufficient experience, training, and reward for contributions to sustainability goals.

On the supplier side, the economy is based on diversities and differences in the different regions, and social values in the region are undefined concerning sustainability. That would be the reason why building trust, making resources available, and driving incentive packages will approach these obstacles. Digital tools/platforms, maybe even blockchain technology, could also result in an improvement in accountability and transparency-oriented supply-chain management such as towards the observance or compliance of suppliers with respect to sustainability standards.

Employee-supplier participation in sustainability would be the common approach toward the best efficiency coupled with the efficacy of stakeholders and a powerful brand image. Building corporate pressure allows the organization to form collective efforts in stakeholder engagement with regard to sustainability and meaningful impact. Addressing the challenges that come with engagement requires strategic investments in education, communication, and technology that empower all stakeholder groups to participate in a sustainable future for the fashion industry.

4.4.2 Consumer Transparency

As consumers become increasingly conscious of sustainability, transparency becomes one of the most instrumental elements in building consumer trust and loyalty. It is no longer sufficient for companies in the fashion domain to reveal just generalities or vague phrases about their environmental and social practices; rather, to be considered credible by the latest industry standards, they must provide exact and verifiable evidence of returns on investment made in their social and environmental initiatives. By empowering effective communication on its sustainability efforts, the suppliers gain their customers' confidence while enabling them to make informed purchasing decisions. The range of approaches, such as certification, storytelling, and emerging technologies for transcending such expectations has been identified for consumption while educating companies on how to find themselves distinguishing in a marketplace.

Transparency will undoubtedly play a leading role in the current calls for more accountability, especially from the younger generations. Millennials and Gen Z consumers do make a difference here, because they tend to buy brands assuming they are open and upfront about their practices and impacts noted C3. In turn, that may be the most likely reason we're seeing companies doing more or committing more to be authentic and being more sustainable. Thus, transparency is no longer an option in marketing; it has become a business-critical requirement that would shape consumer attitudes and behavior towards purchases.

Certifications are essential for transparency regarding consumers. Independent validation has been provided so far regarding a company’s sustainability claims. However, as C2 informed, the gap between what corporate claims versus what consumers believe is narrowed through independent validation such as Fair Trade or GOTS (Global Organic Textile Standard), thus providing proof that products do meet the standards set from environmental and ethical perspectives. For example, GOTS attests that a textile product has been produced from organic fibers via environmentally responsible practices; Fair Trade, meanwhile, ensures that workers are given fair salaries and a safe working environment.

These certifications certainly make it easier for consumers to make decisions, providing very simple and clear labels of sustainability. They provide a competitive advantage for a company because they can show responsibility and match customers' values. C4 added that such certifications also act as safeguards to prevent greenwashing, as they reassure consumers that sustainability has been certified by an independent third party. By leveraging these forms of validation into product labeling, marketing, and online channels companies can thus gain credibility and be in a position to garner trust so evocatively.

Transparency comes from beyond the certificates, and it is most certainly about how companies communicate their sustainability journey. Authentic storytelling proves a strong support for linking emotional ties with consumers. As made by C8, education through storytelling is the best means by which consumers can relate to sustainability. They even proposed employing tales connecting sustainability to the possible real-life implications of improving worker conditions or waste reduction to engage and inspire consumers. Real-life stories about raw materials, communities of origin, or lives affected by sustainability initiatives could be said to generate a narrative that speaks to someone on a personal level, as C5 discussed. For instance, a firm may say that going organic would mean less water used or a better life for farmers in poorer regions. Campaigns such as these with stories and educational elements could be engaging to consumers themselves. Ideal platforms for this would be social media,

where companies could showcase some of their efforts in short video clips or infographics or even use interactive content. As noted by C7, it is about direct engagement between the brand and the friend through digital channels ability to have an open forum where consumers can ask questions and comment and be made to feel part of the brand journey.

These emerging technologies such as blockchain and online traceability platforms are changing the transparency in the fashion industry. As described by C4, a record is kept in the blockchain for every immutability of a transaction or single processing in a supply chain, so traceable by the consumer back from raw material to retail sales receipts. A blockchain system could, for example, allow a customer to read a QR code on the label of a cloth and see information regarding where the fiber came from; the factories in which it was made; and the life cycle of environmental impacts made on each step of production.

The same goes for these online traceability platforms, with similar-valued features, such as centralized access to data, certification, and sustainability metrics in supply chains. They increase the confidence of consumers by real-time verification of claims. Also, it allows companies to show what they have done, such as reduced carbon emissions and other accomplishments, to be made publicly accessible and transparent.

Understanding complex sustainability information without overloading or confusing consumers is one of the hurdles to consumer transparency that C1 noted. It is true that several pieces of sustainability information, such as footprints of carbon, consumption of energy, or traceability of the supply chain, could be rather too tough for an ordinary consumer to understand. In this light, clarity and accessibility must be prioritized in messages by companies.

The contribution of different tools like infographics, videos, and interactivity in engaging formats of easy understanding could extract information from complex data. For example, an infographic that could explain the environmental benefits of letting a fabric be recycled compared with that of being manufactured traditionally, a short video might have little pixels on the source of a company's water consumption in production. Such measures in simplifying detail ensure messages from the brand resonate easily with consumers while they become trusted and understandable.

Challenges include openness to critical opinions, high costs, and internal barriers. According to C3, consumers can reject omissions by focusing on what companies fail to disclose. Accordingly, the balanced approach to disclosure-inclusive both successes and hurdles-can help mitigate that risk. Such commitment to honesty and continuous improvement gives brands credibility even when they are still on their sustainability journeys.

Internally, resistance against certain practices can result from a lack of comprehension of their intrinsic excellence. Most successful in this regard would be employee training together with pilot programs that teach lessons valued in clear terms about the company's transparency goals. Technology providers and third-party organizations could reduce costs and improve efficiency in traceability system implementation.

Consumer feedback, engagement metrics, and sustainability performance indicators can be utilized to evaluate the effectiveness of transparency attempts. It provides really important insights about how consumers prioritize or worry about transparency tools: for example, scanning QR codes or visiting traceability platforms, and also keeps track of how those consumers use those tools. And, regular

reporting on sustainability progress complemented with available channels for consumer input means that transparency becomes an ever-evolving and living practice.

Transparent testing with consumers is one of the vital parts of trust building and improving brand reputation, positively moving the industry closer towards the reform of accountability. Certification, storytelling, and cutting-edge technology enable organizations to authenticate their sustainability efforts and create lasting, impactful relationships with their customers. Strategies that simplistically simplify information, help internally create alignment, and balance success to areas of improvement are vital to overcoming the complexity and resistance often associated with introducing new activities.

Today, transparency not only helps differentiate brands but also positions them in a leading place for sustainability. It opens up new avenues for consumer empowerment by ensuring the appropriate provision of accessible verifiable information and thus encourages the marketplace to become more ethical and responsible, strengthening the long-term relationships of companies with increasingly conscientious customers.

4.4.3 Building Partnerships

The fashion industry seeks the support of partners, including businesses, governments, NGOs, and academic institutions, which mobilized more than ever to achieve sustainability targets. This partnership has facilitated the sharing of resources, expertise, and infrastructures so that companies can better address environmental and social challenges.

The government plays a very important role in bringing incentive policies and infrastructural development for sustainability. According to C2, for every financial benefit offered by governments to industries, whether in the form of a tax credit or a grant, it becomes easier for industries to take in environmentally friendly technology or activity. For example, grants to pay for renewable energy installations or tax reductions for waste reduction projects lower entry barriers for several companies on sustainability and encourage investments with long-term horizons.

C5 so stated that the provision of such facilities as systems for recycling spent textiles or grids for renewable energy could be part of the public-private partnerships. It is after the government meets its main public sustainability goals that these facilities become usable for businesses in the types of infrastructure that help implement sustainable practices.

Government-sponsored targeted programs, especially from the European Union, also help to boost green technology adoption effectively in an area like Europe. Such schemes give businesses funding, training, and access to modern tools for nurturing innovation and syncing with public-sector big-picture goals. Coming together will have governments and businesses forming supportive ecosystems for environment sustainability; risk-reduction and investment with that for-the-greens.

Non-governmental organizations contribute unique expertise, monitoring capacity, and credibility within sustainability partnerships. As C1 highlighted, such kinds of NGOs as the Fair Wear Foundation assist organizations in ensuring ethical practices across supply chains from labor rights to environmental management. Through this partnership, NGOs open up businesses to independent assessments and certifications that help in ensuring compliance with international norms.

NGOs serve as a bridge between businesses and local communities. They have local knowledge, as pointed out by C6; therefore, companies can generate projects that will deal with the needs of the local communities while achieving corporate goals of sustainability because they have an extensive network in a local context. Such partnerships had positive social and environmental results. The enhanced reputation of the company is boosted by this together with strengthening stakeholder relationships.

NGO certifications produce an independent verification of a company's claims regarding sustainability and thus create trust with its consumers. Certifications such as Fair Trade or organic labeling give clear proof of compliance with ethical and environmental standards that allow such businesses to differentiate themselves in a highly competitive market.

There are many advantages behind partnership businesses, governments, and NGOs, including the operationally effective way to accommodate shared resources, as well as credibility. As C3 revealed, combining resources can reduce costs while speeding up the implementation of sustainable practices. For example, in waste management or recycling initiatives jointly conducted, businesses create the infrastructure and expertise needed to realize economies of scale.

He says that the partnerships with research institutions and technology providers motivate the development of new materials, processes, and technologies, these innovations not only improve environmental performance but also give companies a competitive edge in the market.

In addition to that, they can enhance public trust and the credibility of the brand. As said by C4, founding a relationship with some very renowned NGOs or government programs works as an endorsement of one's commitment to sustainability quite well for any company. This credibility serves to reinforce consumer loyalty around the brands and to further distinguish them in an increasingly concerned market.

Partnerships gain benefits over other things like: misaligned objectives, trust, funding constraints, etc. C1 hypothesized that will probably cause some friction because their priorities differ. As it would be, the emphasis on profitability from the company's focus might conflict with the emphasis on social equity from the NGO's end. The partners must develop clear, shared goals, defined roles, and division at the beginning: if alignment and understanding are to be obtained.

The trust should also be around the issues. C5 said that because in most cases of partnership initiation, companies usually approach by distrust. The company may not want to advertise to the public because the company fears criticism from the public. NGOs doubt corporate motives: they may not even be willing to work with business organizations. This can be resolved through open communication, clear expectations, and the gradual introduction of cooperative activities through pilot efforts to create relationships of value and joint commitment.

Funding restrictions, according to C7, will also be a major market constraint for future partnerships, especially in initiatives that require intensive resources, such as infrastructure development. However, businesses may tap into various funding channels, such as government grants, philanthropic contributions, or innovative financial models such as impact investing, all of which ensure that partnerships are sustainable and remain impactful over time.

In the coming years, digital technologies and industrial alliances will go a very long way in increasing partnerships. As C4 pointed out, blockchain and AI can improve cooperation through increased supply

chain transparency and real-time data sharing. Then this information is verified by the application of blockchain in tracing a textile's lifecycle; this way, one gets verifiable evidence for sustainability claims, thus creating trust between stakeholders.

As mentioned by C6, cross-sectoral alliances therefore provide good opportunities for collective action on common challenges such as waste management or reduction of carbon. Such alliances will be able to catalyze systemic changes, fast-track innovation, and even lobby for positive policies because they bring together companies operating in a similar industry.

Reasons government supports regulatory bases and funds our infrastructure so as not to stop being important partners. Such a stipulates that an enterprise with missions founded on sustainability will generate access to resources and benefits aligned with goals of collaboration that businesses would have with governments. These enable businesses to friendly governments, NGOs, and stakeholder partnerships for internal complex challenges, resource sharing, and innovativeness. Among other challenges, misaligned goals and financial constraints create hurdles. However, applying proactive approaches such as clear communication, project-by-project approach, and other diverse forms of funding can make these partnerships meaningful and productive.

Collaboration forms a pathway through which businesses government and civic bodies bring about positive change. One such avenue is that partnerships offer change. They serve in a form that seems very appropriate in a world that increasingly controls movement toward sustainability. By bringing together businesses, governments, and NGO patrons, risk can be minimized; a more sustainable, inclusive, and resilient industry can take a minimum step toward international improvement of terrible environmental and social impacts.

5. Discussion

The research focuses on how the revolutionary business models in fashion can account for profit-generating circularity, sustainability, and advanced technology in viewing the social and environmental responsibilities of the industry. This chapter tries to understand the results in existing literature and critically evaluate their implications and possible limitations, with potential future research and application avenues indicated.

An industry's path toward sustainability is determined by its financial constraints, technological shortcomings, and interactions with changing consumer views. Emerging advanced technologies could take advantage of markets' insufficient use in promoting innovation; for example, AI and blockchain. However, small and medium-sized businesses have limited options for adopting these solutions in terms of cost and technicality. The entire industry's transition is complicated by the fact that not all of the most fundamental changes in consumer purchasing habits toward sustainability are real. The findings further refine the significance of what they suggest in engaging alignments with contemporary academic discussions on those practices.

The research states that the business models emerging in fashion, the recycling initiatives, reuse systems, modular design-now claim priority over waste elimination or resource optimization. Material reuse, garment service repair, and modular product design increase the time for use, which minimizes reliance on virgin resources. Regarding "Worn Wear," for example, Patagonia supports initiatives that increase longevity while also utilizing the benefits of circular principles to reduce environmental effects

and increase revenues. Such models face many hurdles, but they act as barriers to the general acceptance of this model. Initial costs are a primary barrier to widely adopting the model. For SMEs, this becomes especially critical because they usually do not have the funds necessary to invest in high-end recycling technologies or circular supply chains. Cultural resistance is also an obstacle since customers and enterprises that are used to fast fashion could face difficulties in adapting to slow but substantially more sustainable consumption cycles. This comes out of a "quick consumption mindset" where price and speed are seen as more important than the environment in taking the long-term view.

Such findings are highly in line with what has been drawn from the philosophy of Cradle-2-Cradle which very much emphasizes designing products that can be reused or recycled permanently without ever creating waste. Notable features of the circular economy such as prioritization of renewable resources, mitigation of environmental damage, and close-looping systems are rising in the emerging models of fashion. Modular designs like this one fit in nicely with the framework that makes it simple for freshly developed products to be fixed or repurposed, which supports the waste elimination campaign.

If you examine the alignment and consider the results, the differences appear as larger gaps when one places the findings in the context of other studies about operationalizing the circular model on a global level. While past research has pointed at the scalability of the circular practices, evidence states the calls of market fragmentation and geographic discrepancies preventing that switch. For instance, emerging market SMEs experience infrastructural challenges as well as a lack of access to financial resources to adopt the advanced technologies needed for circular operations. The Cradle-to-Cradle framework's more optimistic aspirations, which presume that all markets would have equal access to sustainable resources and technology, are really different from this.

In most parts of the world, consumer awareness and education are still lacking, which is probably the most significant obstacle to the adoption and acceptance of circularity. Unlike findings in more developed markets, where consumers give evidence of increasing acceptance of sustainable practices, emerging markets tend to have consumers who still largely depend on cheap, resource-dependent clothing and therefore set further challenges to circularization.

Emerging business models in the fashion industry seem to be increasingly influenced by practices that incorporate sustainability and social responsibility. The main areas that need attention are labor standards, reduced environmental footprints, and community engagement. Brands like Patagonia and Stella McCarthy would promote equal pay and safe workplaces without compromising the ethical labor practice in the businesses, just like H&M's 'Conscious collection,' which emphasizes eco-friendly materials and recycling programs to showcase the alignment of production with the environment.

Fair Trade certification and Global Organic Textile Standard (GOTS) certification can be recognized as help in establishing the legitimacy of sustainable claims and making corporate entities accountable. Moreover, they give consumers tangible proof that ethical practices exist throughout the supply chain to build confidence and credibility in the brand. Their findings, however, prove the opposite in terms of being easily implemented. There are high costs, complicated regulations, and difficult accessibility, not to mention that of small and medium-sized enterprises, which form a barrier to full implementation. Also, the issue of "greenwashing" clearly shows the need for strong certification standards that the issue keeps from false promises and consequently lack of transparency.

The results fit well with the Triple Bottom Line (TBL) model, which involves balancing the environmental, social, and financial dimensions of sustainability. The presence of fair labor practices and environmentally friendly processes as an integral part of the business community justifies the theory that sustainable operations can produce the dual benefits of profit maximization and social equity. Customers' positive reactions to Fair Trade-certified clothing, for example, demonstrate how tackling social issues may translate into business advantages for brands, increasing TBL's reach into modern markets.

The findings have also opened up gaps, which would be a setback for TBL scalability in the fashion industry. Although previous studies suggest that a balance between the three bases can be achieved, there are practical barriers, such as uneven access to certification and a fragmented supply chain, preventing this. A holistic supply chain transparency would be the most relevant barrier condition dealing with it. These findings indicate that consumers are concerned with visibility in sourcing and production practices, supporting other studies that indicate the need for transparent operations to enhance brand reputation. Everlane and similar companies that advocate radical transparency have capitalized on this to generate trust and loyalty in consumers.

Innovative technology innovations include blockchain, artificial intelligence (AI), and augmented reality (AR), which disrupt the fashion industry around circularity and transparency. As an example, blockchain supports the effective tracking of products within supply chains. The traceability of a product is made possible by the unchangeable records of its journey, from the moment raw ingredients are sourced until the sale price. They create consumer confidence and facilitate respect for sustainability parameters. AI systems collect and analyze information to help in the efficient execution of production planning and inventory management, minimizing waste and ensuring that supplies meet reality at the consumer end. For example, virtual try-ons through augmented reality reduce the sample size needed and promote efficient resource use.

These innovations show great promise, but their associated expenses and technologies will still reveal a relatively unstoppable economic and technical barrier to their adoption. The high costs of installation, particularly with blockchain, stand in the way of SMEs being able to tap into the benefits. The difficulties also increase the fragmentation across the global supply chain, which makes integration with these systems even more challenging for most smaller companies without adequate technical know-how or infrastructure. For instance, AI systems are heavily reliant on data availability and quality, which is not uniform across various geographical regions, a fact that restricts even more their functioning in certain markets.

These results also confirm the general line of existing research arguing for the tremendous potential of blockchain in encouraging supply chain traceability, as this study reviewed different cases and revealed how they can include verification of ethical sourcing and monitoring environmental impacts, especially in complex supply networks. As an illustration, Provenance created a system that uses blockchain to track sustainable practices and allow consumers to check the parameters for ethical production claims. All these applications provide evidence for the role of technology not only in providing tertiary security and accountability but also in concerns regarding transparency.

Scalability remains an important hurdle. Results speak to the "voice in the literature" about the unmatched adoption of technologies such as the examples presented with blockchain in the global market. If advanced economies normally have the infrastructure and financing resources to use such

systems, then emerging economies run into some serious barriers. The two main issues preventing the widespread use of new technology are a lack of knowledge about it and inadequate infrastructure, according to research on supply chains in less developed areas. So, as AI advances with the optimization potential for operations, the same is limited by fairly unequal access to the most important big data and computation resources for effective implementation.

These conclusions add significantly to the overall understanding of the principles of circular economy and sustainable business models. They also show how emergent models of modular design, recycling programs, and open supply chains extend to the theoretical frameworks of circular economy and sustainability in the study perspective of understanding circularity as an integrated practice. These would not only give priority to waste reduction and the efficiency of resource use but also provide pathways for action to implement sustainability into the business strategy of traditionally resource-intensive industries such as fashion.

This is in addition to the investigation that is enriching the ongoing debate on the balance between profitability and sustainability. Apart from showcasing the potential for leveraged advanced technology like blockchain and AI to optimize operations while addressing environmental and social objectives, this research equally supports the assumption that profitability and circular business models are not necessarily the opposite but collaboratively entrepreneurship-dependent through innovation and strategic alignment. High costs and barriers to scalability, however, indicate that trade-offs will require industry-wide collaboration and accompanying policy frameworks for de-risking and inclusion.

These findings involve more actionable insights for brands wanting to include sustainability and circularity in their business models. A significant entry point will be investments in technology such as blockchain and artificial intelligence (AI) that promise improved transparency and operational efficiency, with blockchain showing promise for tracing supply chain practices and validating sustainability claims, built block by block with consumer trust; AI-driven demand forecasting reduces overproduction and waste. These tools enable multiple improvements of profits together with the rising consumer expectations for ethical and sustainable practices.

Supply chain partnerships are another strategic base of importance. Collaborative suppliers, technology suppliers, and industry partners foster the exchange of resources, efficient procedures, and expertise across industries, especially regarding the operational and financial obstacles that the industry is trying to overcome. For example, closed-loop recycling systems would significantly lower costs and help contribute to more circular flows; industry consortia and PPPs would be helpful in access to and collective problem-solving with advanced technologies.

This means that brands should be demanding and valuing more targeted support mechanisms to create an enabling environment with respect to the financial and operational limits. Subsidies, tax breaks, or grants could be used in order to reduce the high expenses associated with implementing sustainable practices. Green funds for SMEs, which are jointly set up by governments and financial institutions, are essential so that these firms can acquire the needed technology and certification in their efforts toward sustainability without compromising their financial status.

It is very important to educate consumers about sustainability and circularity. The brand should also include them in transparent communication campaigns that specify the environment and social footprint

of the products. Consumers can be encouraged to make more responsible purchases by reminding them about the route an item of clothing has gone, from the ethically sourced materials to the possible recycling alternatives. There are many interactive tools available through which consumers can be empowered to make informed decisions, such as carbon footprint calculators or AR-enabled transparent features. Instilling an attitude change from cost-driven thinking associated with fast fashion to seeing long-term value in the durability of sustainable products should be also possible.

To this extent, brands may not only overcome dependency factors preventing the realization of circularity but also become the reason sustainable innovators. An approach like this would significantly transform the fashion business from one that generates wealth to one that is affluent through social and environmental concerns.

Government interventions play an important role in fashion towards sustainable and circular practices. Fiscal incentives such as tax exemptions and subsidies would reduce the high costs faced in adopting new technologies and environmentally friendly practices specifically for small and medium-sized enterprises. These measures will help level up the competition by allowing companies with little resources to invest in circular certifications and models.

The governments are essential to legislation on accountability and traceability between supply chains. For instance, if tracking materials from their origins and production methods using technologies like blockchain were necessary, they would have to embrace all of this under the accountability exercises because it would lower the risks of greenwashing. This would be covered under the corporate accountability. Just like that, public policy will also require a turn-off in all circular economy initiatives such as extended producer responsibility (EPR) in which a firm should consider the entire lifecycle of the product, including recycling and waste management. Global units should be between governments and international entities in framing any harmonized standards for circularity and sustainability. Through the concrete development of comprehensive regulatory environments and combined specific support, sustainable fashion policymakers can fast-track entry into the cost-effective and relevant world of fashion.

It comes up with critical findings circular circularity and sustainability while constraining technological integration within the value chain of fashion; however, some weaknesses need to be acknowledged.

Sample Representation

The findings are based on interviews and data collection, which might not capture the diversity of actors across the fashion supply chain. For example, they may be talking about the smaller and resource-poor players along with the players in industrially less developed regions. As a result, this tends to bring the results in favor of hypotheses that are more relevant to bigger, better-funded businesses while leaving knowledge gaps about the existence of barriers for smaller stakeholders.

The study stresses the importance of developed markets, with associated infrastructural and financial resources, favoring the implementation of sustainable practices and technologies. This study provides an incomplete global perspective in terms of developed and emerging markets. These regions, usually characterized by fragmented supply chains, limited access to technology, and others, are described as having serious barriers to adopting circular and sustainable business models. The analysis excludes them, limiting its relevance to the global fashion ecosystem.

In assessing this long-term, developing technology is difficult for the study, particularly in terms of the promises that come with using blockchain and AI. While anticipation for these instruments is abundant, practical proving and scale are still under interrogation due to the immaturity of this adoption. Rapid changes in technological progress only serve to complicate assessments of their long-term relevance and unexpected side effects. This limitation indicates the futuristic need for longitudinal research on how these technologies will change the industry's future dynamics.
Such limitations suggest the need for more such studies where the researchers' participants range beyond SMEs and emerging market stakeholders to understand better the industry's challenges and opportunities. Further longitudinal studies should be carried out to document future progress as well as tangible benefits regarding currently emerging technologies and their containing on implementing circular and sustainable business practices. Filling this gap will enable applicability and future findings to be more robust in leading to an increasingly sustainable global fashion industry.

Current research includes many leads for future research that can generate a new agenda of research on what is essentially comprehended and not understood regarding sustainable business models in the fashion industry.

Another area for research would be how much culture and geographical contexts shape the application and further development of circular and sustainable models; future studies would focus on emerging economies having particular challenges that need to be understood more closely in terms of the larger adoption and applicability globally. In this direction, an argument would be made about the role the local economic, social, and regulatory environments play in shaping the success or failure of sustainability initiatives.

Another topical area of future research will include a dimension that deals with the future evaluation of the long-term impacts of new technologies such as blockchain, artificial intelligence, and augmented reality on circles and sustainability. In this regard, it is about the long-term scalability of such technologies, efficiencies, and operational aspects, and not the requested consequences of bringing these technologies into practice. Longitudinal studies may represent quite a big consequence on how durable and adaptable these tools will be in the rapid-change environment that is fashion.

The contribution of the consumer to create attractive circular business models is an issue that certainly needs to be explored further. Future research may examine how education, incentives, and marketing approaches affect consumers' sustainable behavior. Consumers also take steps to level the gap between the expressed preferences of common consumers toward sustainable behaviors and the purchasing behavior of consumers, and brands align their strategies with expected results.

Studying these aspects would add much to the overall global agenda of scholars toward the effective development of tactics for integrating sustainability and circularity focus within the route of global fashion. This research answers the questions while showing how new business models can link circularity, sustainability, and high-tech in the fashion industry, intelligently balancing profit optimization with accountability to society and the environment. The results show that recycling initiatives, modular design, and transparency via blockchain are very relevant for waste reduction and accountability; however, obstacles remain, such as lack of financing and technical barriers as well as consumer behavior inconsistencies.

The theory of research extends its contribution to understanding the principles of circular economy and sustainable business models, going so far as to discuss their practical applications within resource-intensive industries. It also advances the discussion on how practices can increase profit and sustainability through innovation and collaboration. Policy plus observation assists some practical actionable strategies, such as using advanced technologies and supply chain partnerships, and brand overcoming adoption barriers.

Many challenges and opportunities await the fashion industry. Poor economics and technical limitations are likely to be conquered only through concerted industry, policy, and consumer action. In the meantime, there will be a growing demand for sustainable practices through which brands will have the opportunity to take the lead in changing the industry into a more responsible and resilient sector. All these findings also form a solid basis upon which future studies will build into continuous innovations and improvements toward sustainable business models.

6. Conclusions

6.1 Addressing the Research Question

This research shows that circularity, sustainability, and technology can be integrated into the fashion industry, and it is essential for long-term viability. It is possible to effectively address social and environmental issues while maintaining financial stability by implementing creative business models and collaborative approaches that encourage change between businesses. The study shows convincing strategies for companies that have to apply to flourish.

One of the more significant issues in this respect is that modern technology will be a component of this integrated model. Businesses can track their inventories, reduce waste, and optimize their manufacturing processes with the use of technologies like artificial intelligence (AI) and predictive analytics. As pointed out by the findings, it could be said that using AI-enabled systems can very reliably predict consumer demand, and production matches what is needed in the market. Consequently, this reduced overproduction, a main source of wastage in the fashion industry, and made possible better resource efficiency. Moreover, with the use of energy-efficient technologies and green chemistry solutions, companies can significantly reduce their damaging footprint in terms of the environment even as they streamline processes.

Changing towards circularity is an important aspect of any sustainability in the fashion industry. Second-hand markets and neutral collections prove possible circular business models extending lifecycle longevity, waste reduction, and satisfying growing consumers' needs. It presents concrete examples, such as voucher systems for second-hand clothes, which encourage people to join the circular economy while cultivating loyalty to brands. Neutral collections are made from durable, ever-timeless aesthetics and provide an alternative to fast fashion cycles, preferring quality over quantity, all in line with slow fashion ideals.

Combining sustainability with financial goals remains an ever-possible practical problem for firms. Although adopting sustainable practices tends to require high upfront investments, the findings indicated that by using innovative practices, the expenditure can be recovered in the long run. Additionally, it is important to have public-private partnerships, government incentives, and sponsorships from NGOs in order to change businesses into sustainable models. Further, aligning sustainability with the consumer

preference for high quality and durability in products can profit because consumers increasingly value ethical and environmentally responsible brands.

This research shows that circularity, sustainability, and technology are very complex, but in some way within the fashion industry's reach. Advanced technologies, circular practices, and the right balance between sustainability and the financial end of things will allow a company not only to minimize environmental impact but also to increase its competitive position in a highly dynamic marketplace. These approaches confirm the breakthrough power of engaging innovation in business with that of sustainability and show ways for the industry to deliver valueless environments along with profits.

6.2 Theoretical and Practical Implications

This research makes a double contribution to theoretical frameworks as well as practical applications related to sustainable fashion. Incorporating circularity, sustainability, and technology into the context of this research will also fill up gaps in academic knowledge and provide industry stakeholders with possible actionable imperatives.

This writing enriches the academic world by highlighting the significance of circular business models as a driver of sustainability in the fashion industry. For quite some time now, the industry has operated within the traditional "take-make-dispose," linear application modes of business at the expense of environmental degradation and resource exhaustion. The research demonstrates the ability of circular business models to recover or regenerate virgin resources, and waste elimination, and extension of a product's lifecycle to disrupt these unsustainable norms.

Understanding circularity is what the findings show now. Taking together elements such as second-hand markets and green chemistry, along with AI-driven inventory management, the research includes models of circularity that disturb going beyond recycling as the only activity. It emphasizes how technological innovation and cross-sector collaboration may drive the actual implementation of a circular system. This is most probably impacted by consumers' behavior, production concentration in quality, and financial viability. This would then emerge as an all-round framework for further analysis of circularity within the fashion sector. The insights would actuate a new research route into exploring the scalability and adaptability of such models across different industries.

This research is practically a roadmap for firms that want to integrate sustainability and profitability with their operations. The findings indicate three critical foundations of success: quality, collaboration, and technology.

The shift is towards products that are not consumed as fast, but instead stand the test of time. Quality means that investments in material and craftsmanship can be put into the lifetime of a product and save resources, reducing waste, and adding an element to brand reputation. It also supports the development of excellent business practices in such initiatives as neutral collections and voucher systems for second-hand clothing.

Collaboration remains the key ingredient in this road map. The study underlines the significance of partnerships with NGOs, government, and academic institutions within each country for access to resources, expertise, and infrastructure. Through such partnerships, more sustainable practices will be adopted as well as legitimacy and transparency will be added, which will increase stakeholder and

customer trust.
Finally, the adoption of advanced technologies like AI and green chemistry proves to be a game-changer in operations efficiency and sustainability. It optimizes production and inventory management, while the eco-materials and processes lower the environmental impact. This allows companies to achieve sustainability objectives without compromising financial performance, proving that profitability can coexist with environmental responsibility.

This thesis more extensively contributes to understanding the ways and mechanisms of developing circular business models for sustainability in the fashion arena. The framework presents businesses with a strategic horizon concerning their environmental-related and financial goals, heavily emphasizing quality, collaboration, and technology. The insights are both academic directions but also routes for businesses to take action within a more sustainable future for resilience and innovation in a rapidly changing industry.

6.3 Limitations

This research focuses on the integration of circularity, sustainability, and technology in the fashion industry and has limitations. These limitations, however, can be acknowledged as a component of the study that might improve its transparency and act as a basis for additional research that would refine or expand its conclusions.

The qualitative technique of the study, which relies on a small number of interviews with workers from selected stakeholder organizations, is the first restriction. While these do provide some insightful in-depth views, they are limited in scope and likely not representative of the full range of barriers and practices in the fashion industry. For example, they are influenced heavily by the experiences and specifically the opinions of individuals working in particular contexts or organizational roles; do not adequately account for the variations in markets, cultures, and geographical areas that may impact the adoption of sustainable practices in other sectors of the industry.

Another important limitation of the present study is the absence of quantitative data to support the findings. This allows for a more in-depth understanding of the mechanisms and motivations that govern sustainable practices with qualitative data. However, these data sources lack statistical validation to warrant generalization for a larger population. Quantitative metrics, such as waste reduction, cost savings, and consumer acceptance rates, could substantiate benefits from secondhand markets; AI-driven inventory management; or green chemistry. Otherwise, the findings will be construed as illustrative rather than conclusive.

It lacks a significant engagement of other groups about the sustainability of fashion, such as consumers, policymakers, or even global suppliers working in less-regulated markets. The role of such groups is critical in providing the sustainability trajectory of the fashion industry; their inclusion could help to understand better the barriers and opportunities for circularity, sustainability, and technological advancements within the field. For instance, consumer behavior could be surveyed or analyzed through policies-affected case studies.

The temporal scope of research is yet another limit, to its temporal nature. This would be true as with further developments of tooling, frameworks, and trends in the fashion industry, sustainable practices,

and technological innovations are so fast-paced that they become outdated quickly. There is always an exigent need to examine the evolving dynamics between sustainability and technology or circularity through research. Despite this study's valuable contribution to understanding sustainability participation in the fashion industry, there are still certain shortcomings, such as a lack of qualitative data and a small number of qualitative interviews. This may expand further research by including several mixed-method perspectives from different stakeholders to adapt to the changes in the industry. In order to promote sustainability in the fashion industry, future research can close these gaps with deep insights and verified materials.

6.4 Recommendations for Future Research

Although this research study offers numerous insights into the integration of circularity, sustainability, and technology in the fashion industry, many areas are still left for future research. Future studies should better inform, strengthen the study itself, and fill in the gaps left by this study in understanding the key parameters of change toward sustainable practices.

Another area relevant to the study is consumer behavior toward sustainable products. Most importantly, while this research has shown that consumers face discrepancies between their ideals and actual consumption, this study should look much deeper into consumer motivations, entries, and the willingness to pay for sustainability. Understanding, for instance, how price sensitivity, perceived quality, and trust in brand impact perceptions could lead to better marketing strategies and more appropriate product design from the perspective of consumer values. Such large field surveys and behavioral experiments may provide quantitative data to support the qualitative data obtained from the research.

Another major research opportunity would be the scalability of second-hand and circular business models. Certainly, concepts such as second-hand voucher schemes or circular design collections hold great promise, but the economic and operating viability in scaled-up environments is still not clear. Some possible directions for future research may be challenges regarding the replicability of these models across diverse market segments, geographies, and product categories. Research around the linkage between logistics, acceptance by consumers, and competition presented by traditional business models would be an excellent support base for even larger launches by businesses of these emergent practices.

The interventions from policy bring a third area of considerable promise for accelerating the conformity to sustainable practices. Governments determine the regulatory and financial landscape for business. Future research may investigate the ways by which such policy measures, for example, tax incentives, subsidies for green technologies, or stricter environmental regulations, affect the adoption of sustainable business models. Comparative studies among regions with different policy contexts could provide examples of the best works and identify the most effective interventions for bringing about industry-related changes.

Future studies might focus on deepening our understanding of consumer behavior, examining the scalability of circular and second-hand models, and identifying politically motivated initiatives that would encourage a stronger push for sustainability. One day, the studies may deliver the promise of future research efforts, making it possible to advance the sustainability agenda for the fashion industry and beyond.

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Addendum 1: Interview Questionnaire

Warm-Up Questions:

1. Could you please introduce yourself and describe your role within your company or organization?
2. What inspired you to focus on sustainability and innovation within the fashion industry?
3. Can you briefly overview your company's journey towards integrating sustainability and new technologies into its business model?

Main Questions:

1. Sustainable Business Models
    - What specific sustainable and circular business models has your company adopted, and how do they operate within the fashion industry?
2. Technology Integration
    - How have you integrated new technologies into these sustainable business models, and how have they impacted your operations?
3. Balancing Profitability and Sustainability
    - How does your company balance the need for profitability with the implementation of sustainable and circular practices?
4. Financial Impact
    - What financial outcomes have you observed since adopting these new business models, both positive and negative?
5. Role of Technology in Profitability
    - In what ways have new technologies contributed to both your sustainability efforts and the company's profitability?
6. Measuring Impact
    - How do you measure and report on the social and environmental impacts of your sustainability initiatives?
7. Challenges and Solutions
    - What are the key challenges your company has faced in integrating circularity, sustainability, and new technologies, and how have you addressed them?
8. Supply Chain Management
    - How have sustainable practices influenced your supply chain and sourcing strategies?
9. Consumer Alignment

- How do you ensure that your sustainability initiatives align with consumer expectations and market trends?

10. Competitive Advantage
    - Can you provide examples of how sustainable practices have given you a competitive edge in the market?
11. Stakeholder Engagement
    - How do you engage employees, suppliers, and customers in your sustainability journey?
12. Partnerships and Collaborations
    - What role do partnerships and collaborations play in achieving your sustainability goals?
13. Regulatory Influence
    - How do regulatory frameworks and policies impact your sustainability strategies and implementation?
14. Fostering Innovation
    - What approaches does your company take to foster innovation in sustainability and technology to enhance profitability?
15. Future Trends
    - What future trends do you foresee at the intersection of fashion, sustainability, and technology?
16. Industry Collaboration
    - How can the fashion industry collectively move towards more sustainable practices while safeguarding profitability?
17. Advice for Others
    - What advice would you offer to other fashion companies aiming to integrate circularity, sustainability, and new technologies into their business models?
18. Consumer Behavior
    - How do you see changing consumer behaviors influencing the adoption of sustainable practices in the fashion industry?
19. Lessons Learned
    - Can you share any key lessons or best practices from your experience with integrating sustainability and technology?
20. Future Plans

- What are your company's future plans for further integrating sustainability and technology to enhance both social responsibility and profitability?