FICCI



Knowledge paper on

Embracing Transformation in Textiles: Sustainability, Digitalization and Innovation

TAG 2024

Knowledge partner
wazir
ADVISORS

Table of Contents

1. Global Textile and Apparel Market Overview 3
2. Indian T&A Industry Overview 6
3. Trends Impacting the Global T&A Industry 8
4. Embracing Transformation in Textiles: Sustainability, Digitalization and Innovation 10
5. The Way Forward 21

About FICCI 24

About Wazir 25

List of Tables

Table 1: Global Apparel Market (US$ billion) 3
Table 2: Global Major Exporters of Textile & Apparel 2023 (US$ billion) 4
Table 3: Major Apparel Exporters Share in the Global Trade (US$ billion) 5
Table 4: MMF Based Product Global Trade (US$ billion) 9

List of Figures

Figure 1: Global Textile & Apparel Trade (US$ billion) 4
Figure 2: Domestic Market of India (US$ billion) 6
Figure 3: India's Domestic T&A Market (US$ billion) 6
Figure 4: India's T&A Exports (US$ billion) 7
Figure 5: Global Apparel Exports of Major Countries (US$ billion) 8
Figure 6: Case Study of ThredUp 13
Figure 7: Brands Initiative towards Sustainability 13
Figure 8: Global Brand Initiatives towards Digitalization 15
Figure 9: Case study of Rieter and Haelixa, DNA traceability solution 17
Figure 10: Global Brands Initiatives towards Innovation 18
Figure 12: Growth Roadmap 21

Introduction

The textile and apparel (T&A) industry in India holds a significant position in the global market and is one of the oldest and largest sectors of the country, catering to both domestic and international markets. It stands as the country's second-largest employment generator after agriculture, notably benefiting women and rural populations.

The global textile and apparel (T&A) industry is undergoing a profound transformation, shaped by shifting consumer preferences, economic fluctuations, and technological advancements. In 2023, the industry, remained stagnant driven by a complex interplay of factors, including inflationary pressures, interest rate hikes, and a general slowdown in volume growth. Key markets like the United States, the European Union, and China continue to dominate, holding a combined 43% share, while emerging economies such as India and China are set to be the fastest-growing apparel markets, fueled by robust economic growth and rising disposable incomes.

This report delves into the critical trends shaping the global textile and apparel industry, including the disruptions in supply chains, the growing demand for functional and synthetic textiles, and the imperative of embracing sustainability, digitalization, and innovation. It also explores how India, with its rich textile heritage and emerging economic power, can capitalize on these trends to become a leading player in the global textile and apparel market. Through a combination of strategic policy initiatives, infrastructure support, and a focus on product diversification and garmenting, India can overcome the challenges and seize the opportunities presented by the rapidly evolving global market.

1. Global Textile and Apparel Market Overview

Global Apparel Market has seen a slow growth

In 2023, the global apparel market experienced significant shifts driven by changing consumer preferences, economic conditions, and technological advancements. The global apparel market in 2023 is estimated at around US$ 1.7 trillion and has grown by 1% in 2023 compared to 2022 and is expected to grow at a CAGR of around 4% and reach US$ 2.28 trillion by 2030. US, EU and China are the largest apparel markets comprising around 43% combined share. The growth observed was primarily in value terms, while there was a decline in volume due to a general economic slowdown. This slowdown was driven by the effects of inflation and subsequent interest rate hikes implemented by central banks in major markets during the year. China and India are expected to be the fastest growing apparel markets. The high growth in these markets will be primarily driven by the economic growth and increasing disposable income of a large population base.

Table 1: Global Apparel Market (US$ billion)

Region	2019	2023	2030 (P)	CAGR 2019-23	CAGR 2023-30 (P)
United States	235	289	350	5%	3%
EU-27	264	267	310	0.3%	2%
China	184	181	250	-0.4%*	5%
India	78	102	180	7%	8%
UK	69	79	95	4%	3%
Japan	101	61	70	-12%*	2%
Brazil	48	49	60	1%	3%
Canada	28	29	35	1%	3%
RoW	621	644	920	1%	5%
Total	**1,628**	**1,703**	**2,280**	**1%**	**4%**

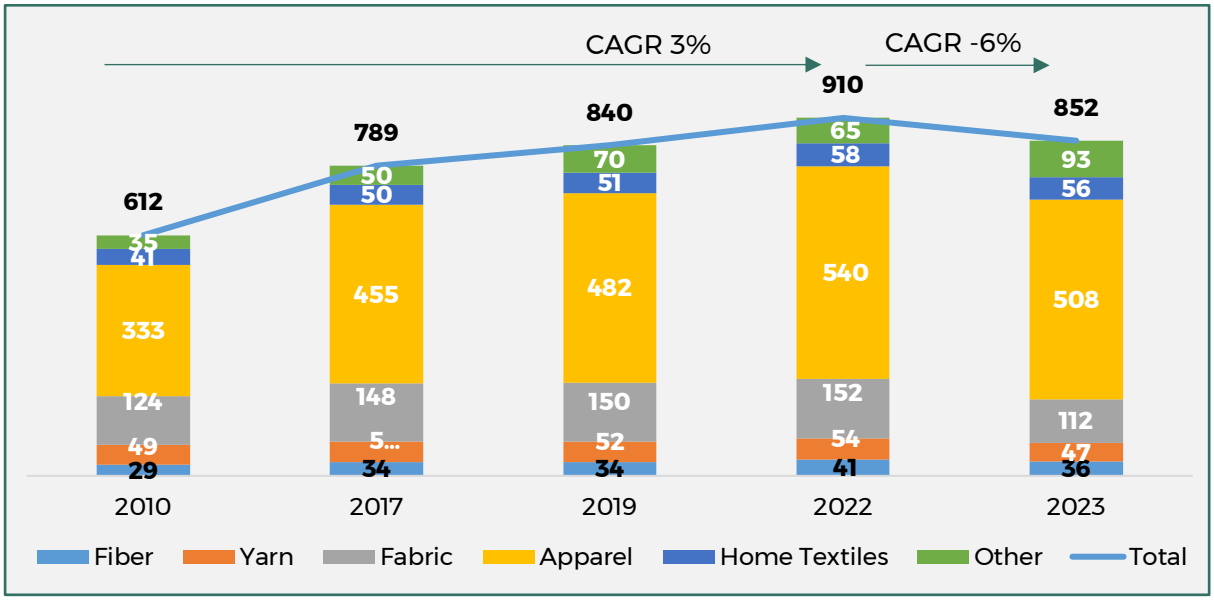
Source: Euratex, US Census Bureau, HKTDC, Ministry of Economy, Trade, and Industry, TEXBRASIL, Statistics Canada, IMF, and Wazir Analysis.

*The decline in Chinese and Japanese apparel market is due to its currency depreciation against US$.

Global Textile & Apparel (T&A) Trade has slightly declined

The textile and apparel trade continued to be influenced by a combination of global economic trends, shifting consumer preferences, and industry-specific dynamics. Due to a broad slowdown in demand driven by inflationary pressures in key consumer markets, the overall global trade in Textiles & Apparel (T&A) saw a decline in 2023. The global T&A trade is estimated to be US$ 846 billion in 2023 and has declined by -6% in 2023 compared to 2022. The recent challenges notwithstanding, the trade has continued to grow over the years in the long term. Global T&A trade accounted for US$ 910 billion in 2022 growing at 3.2% CAGR since 2010. Looking ahead, with an optimistic consumption outlook and easing of macroeconomic challenges, the trade is expected to rebound and continue its upward trend, potentially reaching US$ 1,200 billion by 2030. This projected growth highlights not only the increasing demand but also the enduring resilience and potential of the T&A sector on a global scale.

Figure 1: Global Textile & Apparel Trade (US$ billion)



Source: UN Comtrade & Wazir Analysis

China, holding a 34% share, is the world's largest T&A supplier. However, a significant trend has been buyers diversifying sourcing from China to mitigate sourcing risks. The US ban on Xinjiang cotton has accelerated this shift. While China remains a major supplier, its global market share has decreased 2010. The market share lost by China has primarily been captured by Bangladesh (6%) and Vietnam (5%). Meanwhile, India, which holds a 4% share of the global market, has seen a slight decline of -1% CAGR since 2019. Despite this, India's robust ecosystem, stable political environment, and rising disposable income of people present a significant opportunity for the country to emerge as a viable alternative to China in the near future.

Table 2: Global Major Exporters of Textile & Apparel 2023 (US$ billion)

Country	2010	2019	2023	CAGR (2019-23)	Share (2023)
China	234	279	291	1%	34%
Bangladesh	18	44	47	2%	6%
Viet Nam	14	44	39	-3%	5%
Germany	30	41	41	0%	5%
Italy	32	36	40	3%	5%
India	27	36	34	-1%	4%
Türkiye	22	29	33	3%	4%
RoW	237	332	327	-0.4%	38%
Total	**613**	**840**	**852**	**0.4%**	

Source: UN Comtrade

Table 3: Major Apparel Exporters Share in the Global Trade (US$ billion)

Major Apparel Exporters	2010	2023
China	43%	30%
Bangladesh	5%	9%
Viet Nam	3%	6%
Italy	5%	5%
Germany	5%	5%
Türkiye	4%	4%
India	3%	3%
RoW	32%	38%
Total	**333**	**508**

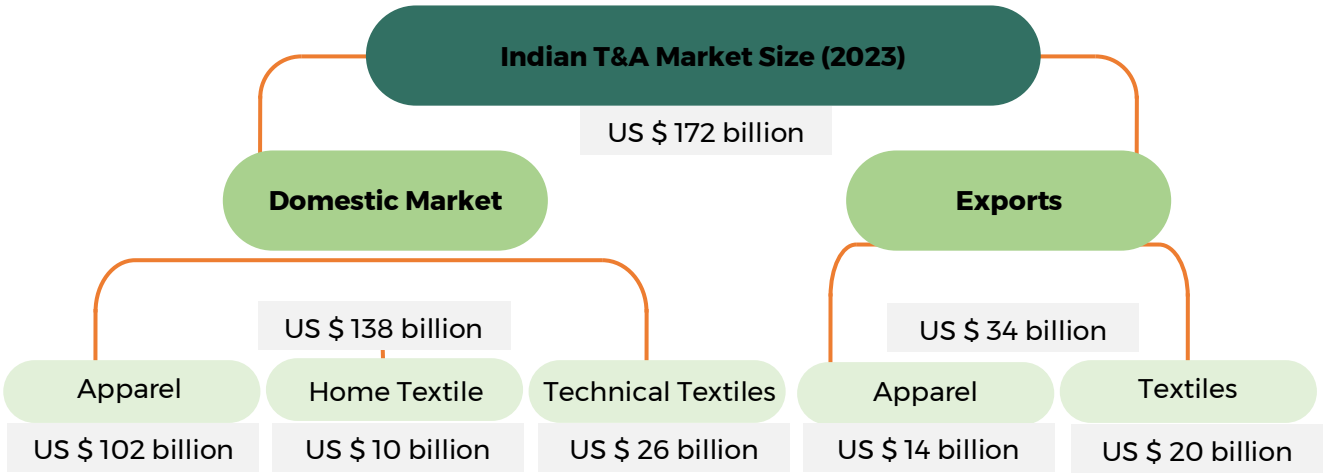
Source: UN Comtrade

China, Bangladesh, and Vietnam remain top apparel exporters and have maintained their leading positions for over a decade. Although China's share in apparel exports has declined by over 13% from 2010, it still retains the largest supply share. Conversely, both Bangladesh and Vietnam have seen their shares double. Meanwhile, India, along with other countries, has maintained a constant share.

2. Indian T&A Industry Overview

India's textile and apparel industry is one of the oldest and most significant sectors of the country's economy, playing a crucial role in its industrial output, employment, and exports. the sector is a major economic driver, contributing approximately 5% to the nation's GDP, the second-largest employment generator in India after agriculture. The textile and apparel industry has become a significant contributor to the Indian economy, reaching an estimated value of approximately USD 172 billion in 2023. Despite facing various challenges, the industry has continued to grow, largely driven by robust domestic demand. While export growth has been sluggish in the past, there is now substantial potential for India to expand its share in the increasing global trade of textiles and apparel.

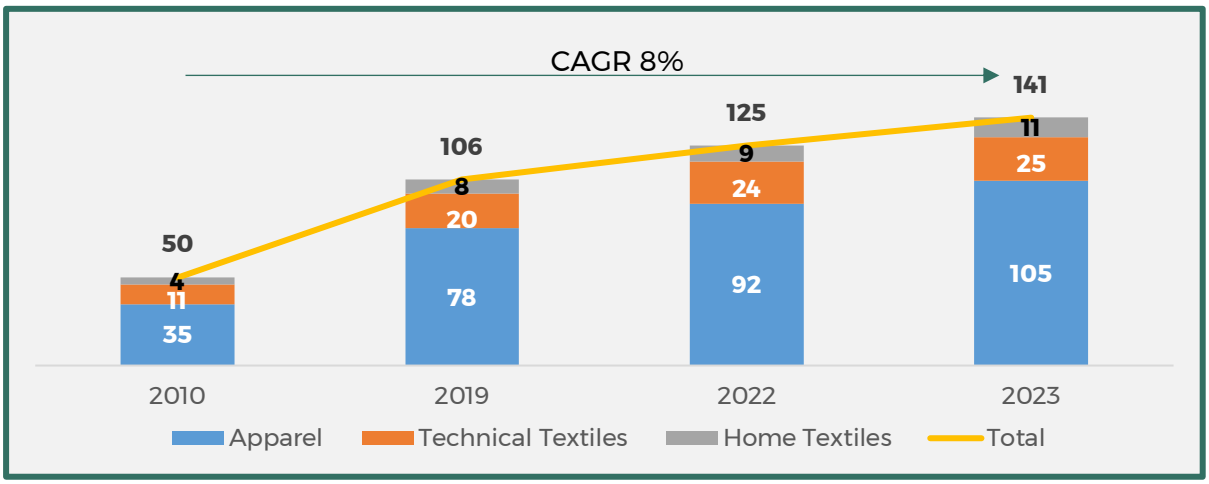
Figure 2: Domestic Market of India (US$ billion)



Source: Wazir Analysis

The domestic textile and apparel market is currently valued at approx. US$ 138 billion. Apparel, which accounts for the majority of the market is expected to grow at a rate of 9% CAGR, followed by technical textiles, which is predicted to grow at a rate of 11% CAGR. Home Textiles, another important constituent of the domestic T&A market, is also expected to grow and reach a substantial value of US$16 billion by 2030 growing at 7% CAGR.

Figure 3: India's Domestic T&A Market (US$ billion)

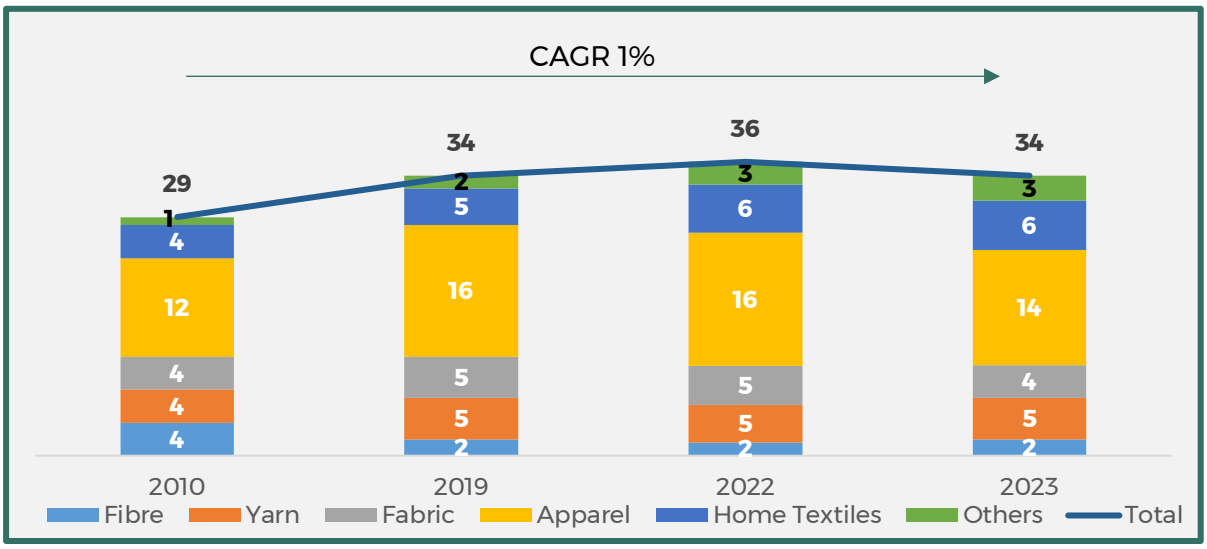


Source: Wazir Analysis

India's exports have experienced a slight decrease

The textile and apparel sector is a major contributor to India's total export earnings. Currently, it contributes to 8% of total export earnings of India. India's textile and apparel exports in 2023 was US$ 34 billion decreasing from US$ 36 billion in 2022. The decrease in exports in 2023 can be attributed to various factors like sluggish demand in global market primarily driven from advanced economies like United States and EU, both of which are significant export markets for India. Additionally, geo political tensions and high inflations have aggravated the situation.

Figure 4: India's T&A Exports (US$ billion)



Source: DGCIS & Wazir Analysis

Apparel is currently the largest exported category in India's exports with a dominant share of 41%. It is followed by the exports of home textile and yarn with 16% and 13% share respectively.

The Indian government has implemented proactive measures to bolster the textile and apparel industry, including the Production Linked Incentive (PLI) scheme, which seeks to expand the product portfolio and increase exports. Additionally, the 'Make in India' initiative, which emphasizes domestic manufacturing, aims to establish India as a global manufacturing hub. These supportive policies collectively demonstrate the government's commitment to fostering growth and enhancing the sector's competitiveness.

The "China +1" strategy offers India a crucial opportunity to establish itself as a key player in the global supply chain. With its ample skilled workforce, cost-effective production capabilities, and well-developed textile infrastructure, India is ideally positioned to attract significant investments. Furthermore, India can take advantage of Free Trade Agreements (FTAs) with major partners like Japan, South Korea, and ASEAN countries, along with ongoing FTA negotiations with the European Union and the United Kingdom. By leveraging these opportunities, India is set to become a major force in the changing global landscape, catering to the growing demand for textiles and apparel while contributing to economic growth and job creation.

3. Trends Impacting the Global T&A Industry

Disruptions in Supply Chain

Increased lead time and freight cost due to Red Sea crisis

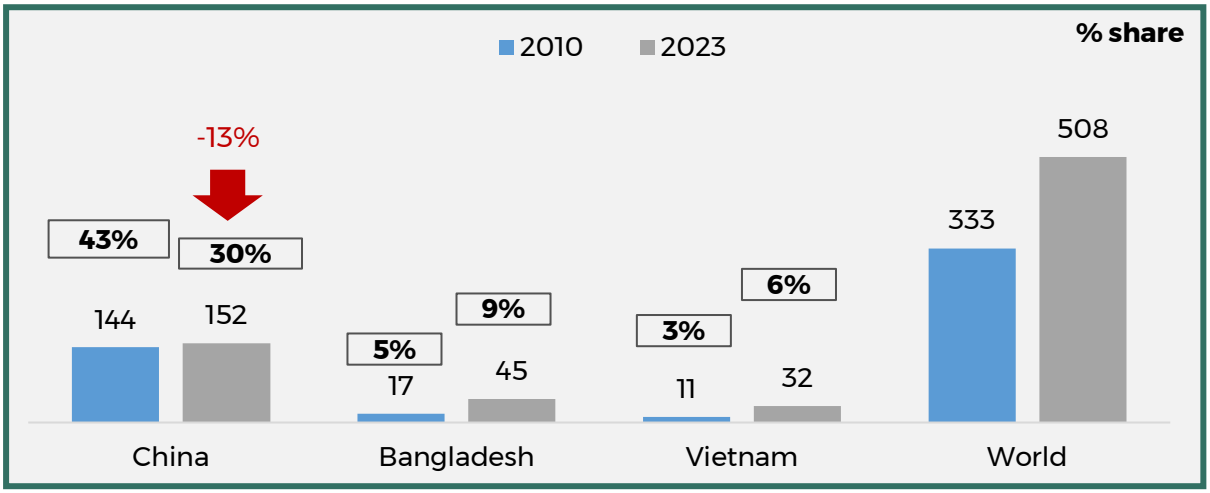
Due to the crisis the situation has become deeply entrenched, with current pressures on luxury global supply chains expected to continue for the remainder of 2024. European retailers sourcing goods from Asia are significantly impacted, with ships being forced to reroute around the southern tip of Africa to avoid the Suez Canal. This detour adds approximately 10 to 12 days to the transit time. According to some brands their sea shipments from Asia to the UK have seen an additional three weeks added to their delivery timelines.

The ongoing geopolitical disruptions, such as the conflict in the Middle East, have kept sea freight costs significantly above pre-pandemic levels. According to the Drewry World Container Index, while the average cost for a 40-foot container has decreased by 47% from its 2021 peak of $10,377, it still remains 291% higher than pre-pandemic rates. Currently, the cost stands at $3,996 per 40-foot.

Buyers Diversifying from China – "China +1"

The "China +1" strategy refers to the growing trend among textile and apparel buyers to diversify their sourcing and manufacturing operations beyond China. This approach has gained momentum as companies seek to reduce their dependency on China, driven by factors such as rising labor costs, geopolitical tensions, trade wars, and supply chain disruptions. China has been the most favored sourcing location for decades, dominating the textile and apparel trade across the globe. However, recent years have seen a shift in this trend with an increasing number of countries looking to move their sourcing base out of the country. Human rights related allegations in Xinjiang have also intensified pushback against China, especially by US and EU. Countries like Vietnam, Bangladesh, India, and Cambodia are emerging as popular alternatives for textile and apparel manufacturing. These countries offer competitive labor costs, improving infrastructure, and favorable trade agreements, making them attractive destinations for companies looking to diversify.

Figure 5: Global Apparel Exports of Major Countries (US$ billion)



Source: UN Comtrade

Increasing Demand for Functional Wear

Functional wear refers to clothing or textiles designed with features such as durability, breathability, absorbency, and functional finishes, tailored to meet the specific needs of the wearer. Initially, the primary focus of functional clothing was purely on its utilitarian aspects. However, over time, its appeal expanded, leading to an increasing emphasis on balancing functionality with comfort and style.

As functional wear gained popularity, consumers began adopting it for casual settings, such as playing sports or working out, even when certain specialized features were not strictly necessary. With the growing trend of active lifestyles, the demand for functional apparel is expected to continue rising as more individuals seek clothing that supports both their performance and comfort needs.

Increasing Demand for Synthetic Textiles & Apparels

The global demand for synthetic textiles and apparel has been steadily increasing due to several factors. Synthetic fibers like polyester, nylon, and spandex are favored for their versatility, durability, and cost-effectiveness. These materials are widely used in various industries, including fashion, sportswear, and automotive, due to their strong performance characteristics such as moisture-wicking, quick-drying, and resistance to environmental factors.

Demand of synthetic based product is evident from the rise in exports. MMF based products constitute half of the T&A global trade, reflecting growth with a CAGR of 5%, increasing from US$ 267 billion in 2010 to US$ 424 billion in 2023. Within this segment, apparel holds the major share with exports valuing at US$ 249 billion in 2023, showcasing CAGR of 5% over the last decade.

Table 4: MMF Based Product Global Trade (US$ billion)

MMF Based Products	2010	2019	2023	CAGR (2010-22)
Apparel	137	233	249	6%
Fabric	48	70	65	4%
Yarn	26	30	29	2%
Home Textiles	15	22	29	5%
Fibre	11	11	11	0%
Others	31	43	41	2%
Total	**267**	**408**	**424**	**5%**

Source: UN Comtrade

Sustainability, digitalization, and innovation are emerging as critical trends in the textile and apparel industry, driving transformative changes across the value chain. To further enable and capitalize on these trends, several strategic steps and initiatives need to be undertaken which are given below in detail.

4. Embracing Transformation in Textiles: Sustainability, Digitalization and Innovation

The textile industry is increasingly focusing on sustainability, digitalization, and innovation to address the challenges of modern consumer demands and environmental impact. Companies are adopting sustainable practices by using eco-friendly materials, reducing waste, and implementing circular economy models. Digitalization is enhancing efficiency and transparency through technologies like AI, automation are streamlining production and supply chains while enabling personalized customer experiences. Innovation remains a key driver of growth, with the development of new material, advanced manufacturing techniques, and new business models that push the industry forward.

Further is given below how sustainability, digitalization and innovation can transform and enhance the textile and apparel industry:

4.1. Sustainability

Green Fashion: Embracing Sustainability and Circular Fashion

The fashion industry is undergoing a transformative shift as sustainable practices and circular fashion become increasingly prominent. These developments are driven by growing awareness of the environmental impact of traditional fashion production and consumption, alongside a rising demand for more ethical and sustainable options. Sustainable Practices involve integrating eco-friendly methods and materials throughout the fashion value chain. This includes reducing water and energy consumption during production, managing waste effectively, and using raw materials that are renewable or have a lower environmental impact, such as organic cotton, recycled polyester, and biodegradable fabrics.

Circular Fashion is a concept that challenges the traditional linear model of fashion, where products are made, used, and then discarded. Instead, circular fashion promotes a closed-loop system where materials are reused, recycled, and repurposed, extending the lifecycle of products and minimizing waste. This approach encourages the design of garments with their end-of-life in mind, ensuring that they can be easily disassembled, recycled, or upcycled. By keeping materials in use for as long as possible, circular fashion aims to reduce the need for virgin resources and lower the overall environmental impact of the fashion industry. Incorporating sustainable practices and circular fashion into the core of business strategies is becoming essential for brands to remain competitive and relevant in a rapidly evolving market. These approaches not only help mitigate environmental risks but also offer new opportunities for innovation, collaboration, and growth in the fashion industry.

Given below are few examples of the initiatives taken by global brands to promote sustainability.

- H&M – Aim for 50 % of our materials to be recycled by 2025
- Zara – Targeting 100% organic linen and recycled polyester by 2025
- Adidas – Targeting 100% recycled polyester by 2024
- Uniqlo – Targeting 50% recycled materials by 2030
- Nike – Targeting 100% waste diverted from landfill with at least 80% recycled back into products by 2025
- PUMA – Targeting 75% recycled material by 2025.

How Sustainability can be achieved in Textile and Apparel Industry

Below is a detailed explanation of how sustainability can be achieved in the textile industry:

1. Sustainable Materials

- **Natural Fibers:** Utilizing natural fibers such as organic cotton, linen, hemp, and bamboo, which are biodegradable and require fewer chemical inputs, can significantly reduce environmental impact. Organic farming practices avoid synthetic pesticides and fertilizers, promoting soil health and reducing water pollution.
- **Recycled Materials:** Using recycled fibers, such as recycled polyester from plastic bottles or recycled cotton, reduces the need for virgin resources and decreases the energy and water usage in the production process.
- **Innovative Eco-friendly Fibers:** Development and adoption of new sustainable materials like Tencel (lyocell), made from sustainably sourced wood pulp, offer alternatives that are less resource-intensive.
- **Biodegradable Materials:** Using biodegradable materials ensures that textiles can decompose naturally at the end of their life, reducing landfill waste and environmental pollution.

2. Sustainable Manufacturing Processes

- **Water and Energy Efficiency:** The textile industry is a major consumer of water and energy. Implementing technologies that reduce water usage, such as waterless dyeing or closed-loop water systems, and adopting energy-efficient machinery can significantly lower the environmental footprint.
- **Use of Non-toxic Chemicals:** Transitioning to non-toxic, biodegradable dyes and finishing agents can reduce the harmful effects of textile production on workers and the environment. Certifying processes with standards such as OEKO-TEX can ensure harmful chemicals are avoided.
- **Waste Minimization:** Reducing waste during the production process is crucial. This can be achieved by optimizing patterns to minimize fabric offcuts, recycling production waste, and repurposing textile scraps into new products.

3. Sustainable Business Models

- **Recycling and Upcycling:** Establishing robust textile recycling systems can help in repurposing old garments into new products. Upcycling, where old materials are transformed into products of higher value, is another effective strategy.
- **Product Take-back Schemes:** Companies can offer take-back schemes, where consumers return used products for recycling or safe disposal, promoting a closed-loop system. For ex H&M gives discount in exchange of old clothes.
- **Circular Economy:** Embracing a circular economy model, where products are designed for reuse, recycling, or composting, ensures that textiles do not end up in landfills. Brands can implement take-back programs, where consumers can return old garments for recycling or repurposing.

4. Policy and Regulation

- **Government Regulations:** Governments can play a crucial role by setting regulations and standards that promote sustainable practices in the textile industry, such as mandating sustainable sourcing, reducing carbon emissions, and ensuring labor rights.
- **Incentives for Sustainable Practices:** Providing incentives for companies that adopt sustainable practices, such as tax breaks, subsidies, or recognition programs, can encourage broader industry-wide changes.

5. Ethical Labour Practices

- **Fair Wages and Safe Working Conditions:** Ensuring fair wages, reasonable working hours, and safe working conditions for all workers in the textile supply chain is essential for social sustainability. Certifications like Fair Trade and SA8000 can help verify that ethical labor practices are in place.
- **Community Development:** Engaging with and supporting the communities involved in the production process, particularly in developing countries, through education, healthcare, and infrastructure development, can contribute to the overall sustainability of the industry.

6. Innovation and Technology

- **Advanced Textile Technologies:** Investing in research and development of new textile technologies that reduce environmental impact, such as digital printing, which uses less water and energy, or smart fabrics that can monitor and reduce their environmental footprint, is essential for long-term sustainability.
- **Blockchain for Transparency:** Implementing blockchain technology can provide transparency throughout the supply chain, ensuring that sustainable practices are being followed and allowing consumers to verify the sustainability claims of their purchases.

7. Collaborative Efforts

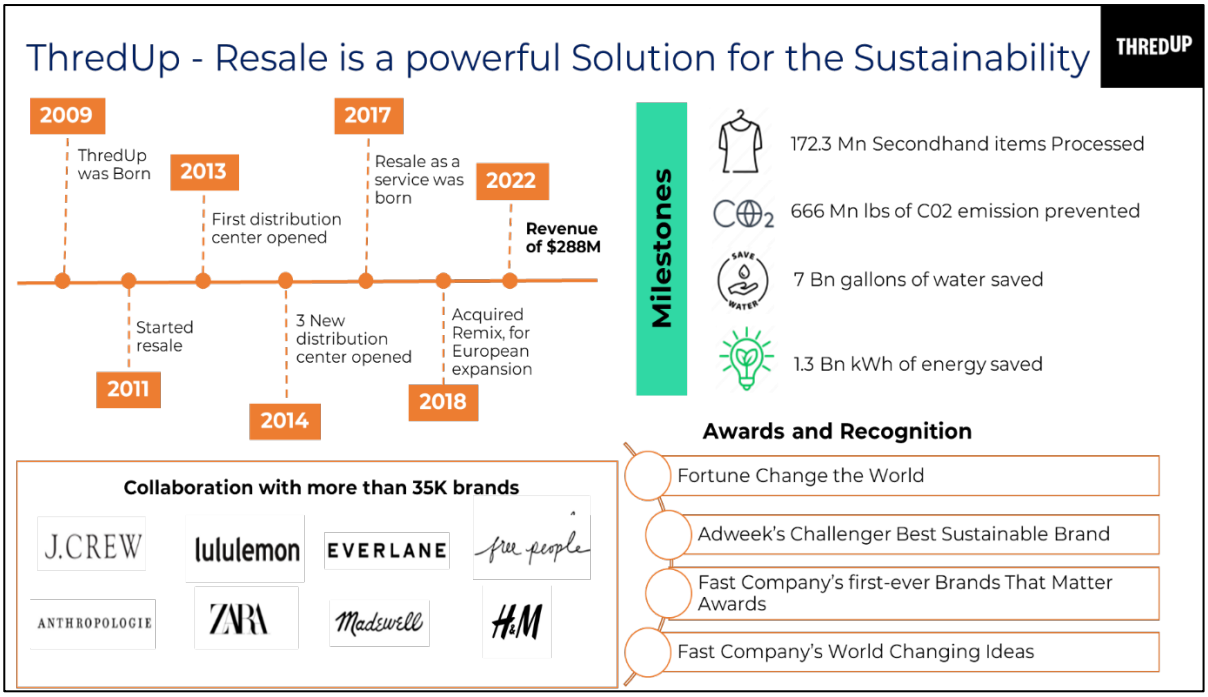
- **Industry Collaboration:** Collaborations between brands, suppliers, governments, and non-profit organizations can drive collective action towards sustainability. Sharing best practices, resources, and innovations can accelerate the transition to more sustainable textiles.
- **Global Standards and Certifications:** Adopting and adhering to global standards and certifications, such as the Global Organic Textile Standard (GOTS), the Better Cotton Initiative (BCI), and the Higg Index, can ensure consistency and credibility in sustainability efforts across the industry.

Case Study of ThredUp

ThredUp is a leading online resale platform that specializes in secondhand clothing, with a strong focus on sustainability. Their mission is to promote circular fashion by extending the life cycle of clothing and reducing textile waste. Through their innovative resale model, ThredUp encourages consumers to buy and sell used clothing, thereby reducing the demand for new garments and minimizing the environmental impact of the fashion industry.

Circular Fashion: ThredUp's core initiative revolves around promoting a circular economy in fashion. By providing a marketplace for secondhand clothes, they help reduce the amount of clothing that ends up in landfills, thus addressing one of the most significant environmental challenges of the fashion industry.

Figure 6: Case Study of ThredUp



Global Brands Initiative towards Sustainability

Figure 7: Brands Initiative towards Sustainability

H&M	H&M starts the used garment collection program along with rewarding customers upto 20% for the return	Levi's	Levi's foray into the Repair, reimagine and recycle program. Partnered with Blue Jeans Go Green Program for jeans recycling
DECATHLON	Decathlon is resorting to reverse shopping to advocate circularity by taking back the active wear to repair, recycle and resale	MUD JEANS	Lease your jeans with Mud Jeans for 12 months, later choose to either keep it or return back for recycling
WORN WEAR RECRAFTED patagonia	Patagonia in association with Infinited fiber company starts the used t-shirts collection programs for upcycling	UNIQLO	Uniqlo released a new policy for the return of used apparel to sort them further for repair, reuse, recycle or donate
ZARA	Zara enters resale markets with pre-owned services, also book repairs and donate unwanted items to cut carbon footprints	ARVIND PURFI	Arvind and PurFi Global partners to reduce the amount of textile waste going in to landfills

Challenges faced to achieve Sustainability

Below are the key challenges faced in making the textile industry more sustainable:

1. **High Costs:** Sustainable practices often require significant investments which can lead to higher production costs.

2. **Lack of Infrastructure:** Many regions lack the necessary infrastructure for sustainable supply chains, making it difficult to implement eco-friendly practices on a large scale.

3. **Technological Limitations:** Innovations in sustainable textile technology are not yet widely available or affordable, and current recycling technologies have limitations, especially with blended fabrics.

4. **Post-Consumer Supply Chain:** India primarily revolves around the lack of infrastructure for the collection, sorting, and recycling of used textiles. Most used garments are discarded or informally repurposed, with no organized system for collecting and channeling them into recycling streams. Additionally, the limited recycling facilities in India are not fully equipped to handle post-consumer textiles, which often involve mixed fibers and contamination. This results in significant amounts of textile waste ending up in landfills, hindering efforts to promote a circular economy and reduce the environmental impact of the textile industry.

5. **Regulatory Gaps:** Inconsistent or weak regulations and enforcement in different regions hinder the widespread adoption of sustainable practices.

6. **Market Competition:** Competing with the fast fashion industry, which prioritizes low costs and quick production, makes it difficult for sustainable brands to thrive.

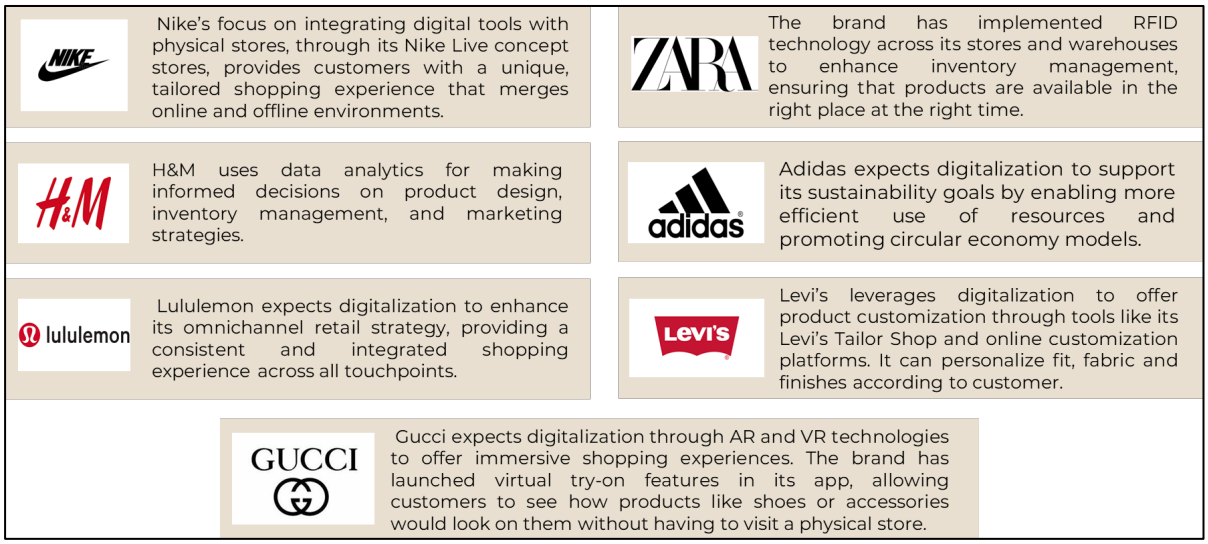
4.2. Digitalization

The Digital Transformation Imperative

Digitalization is reshaping the textiles and apparel industry, driving significant changes across the entire value chain. This transformation is not just about adopting new technologies; it's about rethinking how the industry operates and adapts to market demands. By integrating digital technologies, companies in this sector are enhancing efficiency, improving transparency, and offering more personalized customer experiences. Digital transformation is becoming a key competitive advantage, enabling businesses to stay agile and responsive in a rapidly evolving market.

Global brands initiatives towards Digitalization

Figure 8: Global Brand Initiatives towards Digitalization



Key Technologies Driving Digitalization

Some key technologies are given below:

1. **Automation and Robotics**

    - **Productivity and Precision**: Automation and robotics are revolutionizing textile manufacturing by increasing productivity and precision. Automated systems can handle repetitive tasks such as cutting, sewing, and packaging with greater accuracy and speed than human workers.
    - **Scalability**: The use of robotics allows manufacturers to scale operations more effectively, adapting to changes in demand without the need for significant increases in workforce size.

2. **Artificial Intelligence (AI)**

    - **Predictive Analytics**: AI-driven predictive analytics are enabling companies to anticipate market trends and consumer preferences with greater accuracy. By analysing vast amounts of data, AI can identify patterns and predict future demands, allowing businesses to make informed decisions about inventory, production, and marketing strategies.

- **Design and Personalization**: AI is also being used in design processes, enabling the creation of personalized products that cater to individual customer preferences. This technology can generate design options based on consumer data, allowing brands to offer more customized and appealing products.
- **Supply Chain Optimization**: AI helps optimize supply chains by forecasting demand, managing inventory levels, and identifying potential disruptions. This leads to more efficient operations, reduced waste, and faster time-to-market.

3. **Blockchain**

- **Transparency and Traceability**: Blockchain technology is enhancing transparency in the textile and apparel supply chain. By providing a decentralized and immutable ledger, blockchain ensures that every step of the production process is recorded and traceable. This helps in verifying the ethical sourcing of materials, ensuring compliance with environmental and labor standards, and building trust with consumers.

4. **3D Printing and Virtual Prototyping**

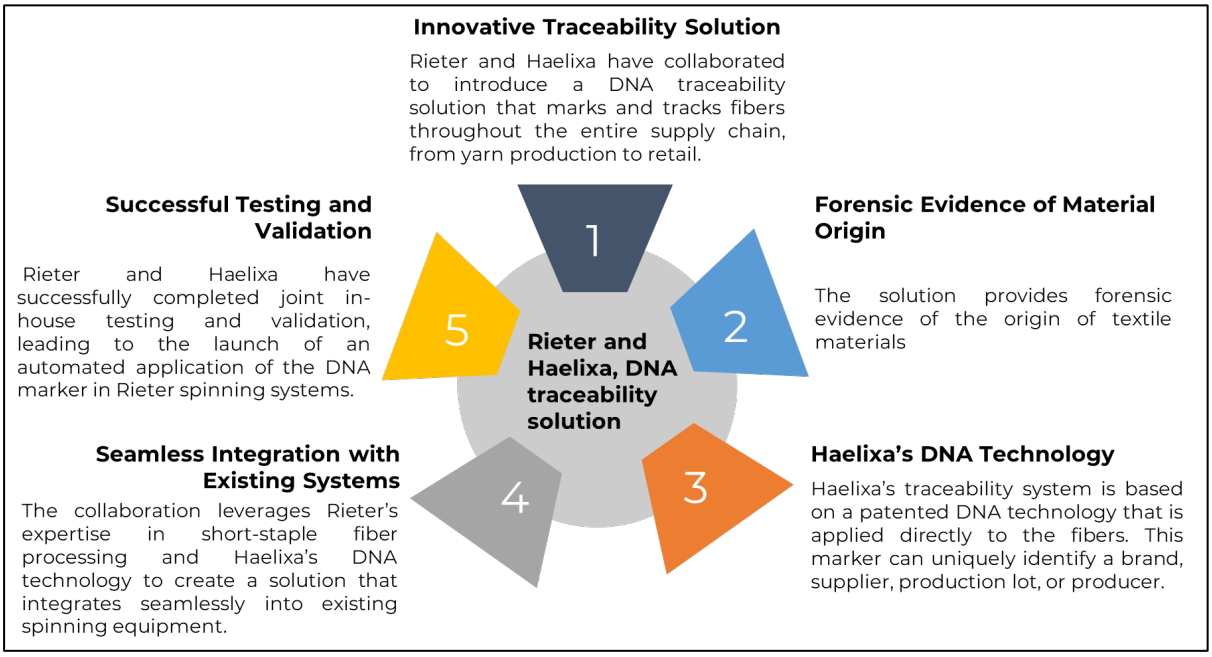
- **Revolutionizing Product Development**: 3D printing and virtual prototyping are transforming how products are developed in the textile and apparel industry. These technologies allow for the rapid creation of prototypes without the need for physical samples, reducing material waste.
- **Customization and Innovation**: 3D printing enables the production of highly customized garments and accessories, allowing brands to offer unique products tailored to individual customer specifications. It also opens up new possibilities for design innovation, as complex patterns and structures that were previously difficult to produce can now be easily manufactured.

Case Study of Digitalization

Rieter and Haelixa have introduced an advanced DNA traceability solution that enhances transparency and authenticity in the textile supply chain. This technology involves applying a unique, stable DNA marker to fibres at the start of production, which remains embedded throughout manufacturing stages like spinning, weaving, dyeing, and finishing. Integrated seamlessly into Rieter's spinning technology, this solution ensures traceability from the outset. The key strength of this system is its ability to provide verifiable proof of origin at any point in the supply chain. The DNA markers can be detected and authenticated using specialized equipment, offering irrefutable evidence of the fibbers' provenance. This is crucial for combating counterfeiting and verifying claims related to material origins, such as organic or sustainably sourced certifications.

Aligning with global sustainability initiatives, this technology allows brands and manufacturers to ensure their materials are genuinely sourced from certified origins. As consumer and regulatory demands for accountability increase, this solution provides a robust method for substantiating sustainability claims. For brands, offering such verifiable traceability enhances consumer trust and provides a competitive edge by demonstrating commitment to transparency and integrity. This DNA traceability solution significantly advances the security and sustainability of the textile supply chain.

Figure 9: Case study of Rieter and Haelixa, DNA traceability solution



Challenges of Digitalization

While digitalization offers numerous benefits, it also presents significant challenges:

1. **Investment Costs:** The integration of advanced digital technologies requires substantial financial investment. Companies need to invest in new machinery, software, and training for their workforce, which can be a significant barrier, particularly for small and medium-sized enterprises (SMEs).

2. **Skills Gap:** The adoption of digital technologies has exacerbated the skills gap within the industry. Workers need new skills to operate advanced machinery, analyze data, and manage digital platforms. This requires ongoing training and development programs, which can be costly and time-consuming.

3. **Data Security:** With the increasing reliance on digital platforms and data, the risk of cyber threats also rises. Companies must invest in robust cybersecurity measures to protect sensitive information and maintain consumer trust.

4. **Integration Complexity**: Integrating new digital technologies with existing systems can be complex and challenging. Companies may face difficulties in ensuring that different technologies work seamlessly together.

4.3. Innovation

Innovation as a Driver of Growth

Innovation is crucial for sustaining competitiveness in the textiles and apparel industry. As consumer demands evolve and market conditions shift, companies must continually innovate to stay relevant and profitable. This innovation encompasses the development of new materials, the adoption of cutting-edge technologies, and the creation of novel business models. By pushing the boundaries of what's possible, the industry can not only meet current consumer expectations but also anticipate and shape future trends. Innovation in textiles and apparel drives growth by improving product performance, enhancing customer experience, and opening up new market opportunities.

Global brands initiatives towards Innovation

Figure 10: Global Brands Initiatives towards Innovation

Nike's Dri-FIT technology utilizes specially engineered polyester fibers that wick moisture away from the body, keeping athletes dry and comfortable during intense physical activity	Lululemon's Silverescent® technology incorporates silver ions into polyester fibers to inhibit the growth of odor-causing bacteria. This technology is used in the brand's athletic wear.
Invista's Lycra® T400® technology incorporates a bi-component polyester that provides stretch and recovery while maintaining the shape and appearance of garments.	Under Armour uses a blend of polyester and cotton in its Charged Cotton® products. This blend combines the comfort of cotton with the quick-drying properties of polyester, offering enhanced performance for activewear.
DyeCoo has developed a waterless dyeing technology that uses supercritical CO2 instead of water to dye polyester fabrics. This method eliminates the need for water and harmful chemicals in the dyeing process.	Santoni's Seamless Knitting Machines are used by brands like Adidas to produce seamless garments. These machines knit entire garments in one piece, eliminating the need for cutting and sewing fabric panels together.
Levi's uses laser technology in its F.L.X. (Future-Led Execution) program to create distressed and faded looks on denim. This process replaces traditional hand-finishing methods that require large amounts of water and chemicals..	Gerber Technology's Paragon Cutting System is used by manufacturers like Ralph Lauren to automate the fabric cutting process. The system uses advanced software and cutting machines to precisely cut fabric pieces with minimal waste.

Emerging Innovations

Some of the emerging innovations are given below:

1. **Innovation in Material:**

- **Fiber:** Innovation in fiber refers to the development of new or enhanced fibers that offer improved performance, sustainability, or functionality in various applications. These innovations can involve the creation of entirely new types of fibers, the modification of existing ones, or the incorporation of advanced materials and technologies. Example: **Tencel**, a fiber made from sustainably sourced wood pulp.
- **Fabric:** Innovation in fabric refers to the development of new textiles or the enhancement of existing ones to offer improved properties, functionality, or sustainability. These innovations often involve the use of advanced materials, new weaving techniques, or the incorporation of technology into fabrics, leading to enhanced performance or entirely new applications. Example: **Lotus fabric** is one such innovation, inspired by the lotus leaf's natural ability to repel water and dirt due to its micro-structured surface.

2. **Innovation in Process**

- **Design:** Innovation in design refers to the creation of new and improved design concepts, processes, or aesthetics that enhance functionality, user experience, or sustainability. In the context of textiles and fashion, design innovation often involves rethinking traditional approaches to create more adaptable, efficient, or environmentally friendly products.
- **Finishes:** Innovation in finishes refers to the development of new techniques or treatments applied to fabrics after they are woven or knitted to enhance their performance, appearance, or functionality. These finishes can significantly improve the properties of textiles, such as durability, water resistance, or comfort. Example: **silver nanoparticle finishes** are widely used in medical textiles, activewear, and socks which prevents the growth of odor causing bacteria
- **Integration of Technology**: Smart textiles, also known as e-textiles, incorporate sensors, microcontrollers, and other electronic components directly into the fabric. These textiles can monitor various physiological parameters, such as heart rate, body temperature, and movement, making them ideal for applications in health monitoring, sports, and fitness.

3. **Sustainable Innovation**

- **Bio-based Materials**: The industry is increasingly focused on developing bio-based materials, such as fabrics made from algae, mushrooms, or recycled fibres, that offer a lower environmental impact compared to traditional textiles. These materials are not only biodegradable but also often require fewer resources to produce, making them a more sustainable option.
- **Eco-friendly Dyes and Finishes**: Innovations in dyeing technology are reducing the environmental footprint of textile production. Waterless dyeing techniques and the use of natural dyes derived from plants or microorganisms are becoming more prevalent. These methods reduce water usage and minimize the release of harmful chemicals into the environment, while still maintaining the quality and vibrancy of the fabric.

4. **Nanotechnology and Biotechnology**

- **Enhanced Fabric Properties**: Nanotechnology involves manipulating materials at the molecular or atomic level to create textiles with enhanced properties. For example, nanocoating's can be applied to fabrics to make them more durable, water-resistant, stain-resistant, or UV-protective. These enhancements do not alter the feel or appearance of the fabric but significantly improve its performance.
- **Creation of New Materials**: Biotechnology is being used to engineer entirely new types of fabrics with unique characteristics. For instance, spider silk proteins produced through genetic engineering are being used to create ultra-strong, lightweight, and biodegradable fibres that could replace conventional synthetic fibres like nylon or polyester.

5. **Customization and Personalization**

- **Digital Tools for Made-to-Order Apparel**: The rise of digital tools is making it easier for consumers to personalize their clothing. Technologies such as 3D body scanning, AI-driven design platforms, and online configurators allow customers to create custom garments that fit their exact preferences in terms of style, size, and material.
- **Consumer Engagement**: Personalized products not only meet the specific needs of consumers but also enhance customer loyalty and satisfaction. By offering a personalized shopping experience, brands can differentiate themselves in a crowded market.

Collaborative Ecosystems

Innovation in textiles and apparel thrives on collaboration.

1. **Industry-Academia Partnerships**: Universities and research institutions play a crucial role in advancing textile technology. Collaborations between academia and industry help bridge the gap between theoretical research and practical applications, leading to the development of innovative products that are ready for commercialization.
2. **Startups and Innovation Hubs**: Startups are often at the forefront of innovation, bringing fresh perspectives and disruptive technologies to the industry. Established companies are increasingly collaborating with or investing in startups to stay ahead of the innovation curve. Innovation hubs and incubators also provide a space where new ideas can be tested, refined, and scaled.
3. **Cross-Industry Collaboration**: The textiles and apparel industry is increasingly collaborating with other sectors, such as electronics, biotechnology, and materials science, to develop multifunctional textiles that meet the needs of various markets, including healthcare, sports, and fashion.

Challenges of Innovation

Below are the key challenges faced in making the textile industry more innovative:

1. **Balancing Costs with Market Demand**

    - **High Development Costs**: Innovation often requires significant investment in research and development (R&D), new technologies, and materials. Balancing these costs with market demand can be challenging, particularly in a price-sensitive industry like fashion.
    - **Market Readiness**: Not all innovations are immediately accepted by the market. Companies must carefully manage the timing of their innovations, ensuring that consumers are ready and willing to adopt new products and technologies.

2. **Scaling New Technologies**

    - **Quality Control**: Scaling innovative technologies while maintaining product quality can be difficult. For instance, producing smart textiles or bio-based materials at scale requires precision and consistency, which can be challenging to achieve.
    - **Sustainability Concerns**: As companies scale new technologies, they must also consider the environmental impact. Ensuring that innovations remain sustainable at scale is crucial for maintaining credibility and consumer trust.

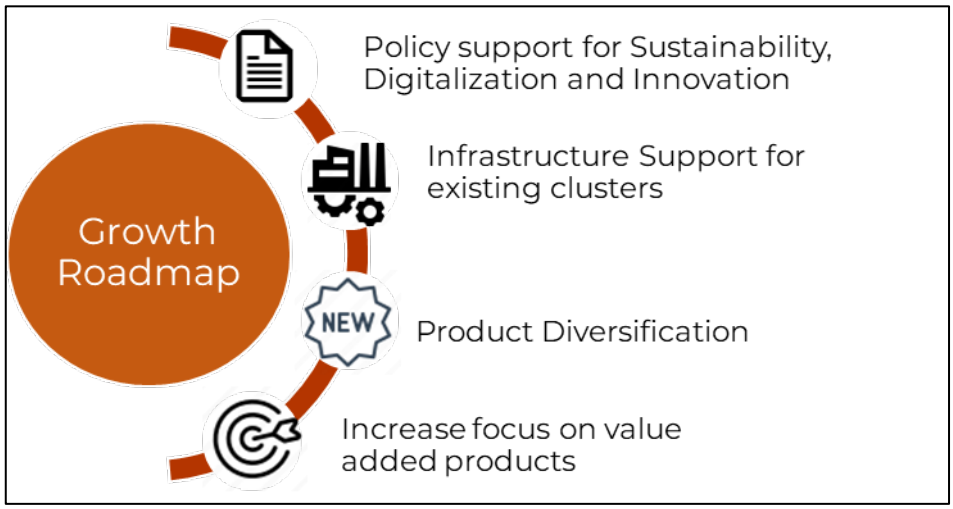
3. **Inadequate Research and Development (R&D) Facilities**

    Innovation in textiles and apparel requires significant investment in R&D, but India's investment in this area is relatively low compared to global standards. Many Indian companies lack dedicated R&D facilities, which limits their ability to develop new materials, processes, and products. The lack of strong industry-academia collaboration further exacerbates this issue, as there are fewer opportunities for knowledge transfer and joint innovation projects.

5. The Way Forward

To enhance Sustainability, Digitalization and Innovation in the textile and apparel industry some of key strategies and action needed are policy support, infrastructure support for existing cluster, product diversification and increase focus on value added products.

Figure 11: Growth Roadmap



1. **Policy support**
   Indian government can provide policy support to enhance the textile and apparel industry in achieving sustainability, digitalization and innovation. Some policies which can be considered are given below.

   Sustainability

   - **Incentives for Sustainable Production:** The government can introduce financial incentives such as tax breaks, subsidies, or low-interest loans for companies that adopt sustainable production methods, including the use of organic and recycled materials, waterless dyeing, and energy-efficient technologies.
   - **Mandatory Environmental Standards:** Establish stringent environmental standards for textile production, focusing on reducing water and energy consumption, controlling pollution, and managing waste.
   - **Facilitating Small Industries:** Government policies can play a crucial role in facilitating small industries' transition towards sustainability by providing the necessary support, incentives, rebates, training Programs, regulatory support & simplification, market access and public procurement policies.

   Digitalization

   - **Digital Infrastructure Development:** Invest in improving digital infrastructure which includes high-speed internet connectivity, promoting the adoption of Industry 4.0 technologies, and supporting cloud computing and big data analytics in the industry.
   - **Training and Skill Development:** Launch digital literacy and skill development programs tailored to the needs of the textile and apparel industry. This could involve public-private partnerships to provide training on digital tools such as AI, IoT, and blockchain for supply chain management and customer engagement.

Innovation

- **R&D Funding and Innovation Grants:** Establish a dedicated fund to support research and development (R&D) in the sector, particularly in areas such as new sustainable materials, smart textiles, and advanced manufacturing processes.
- **Industry-Academia Collaborations:** Encourage collaborations between industry players and academic institutions to foster innovation.

2. **Infrastructure support for existing cluster:**
    - **Common ETPs / ZLDs:** Implementing centralized ZLD systems across textile manufacturing clusters is crucial for providing necessary infrastructure support for the industry. These systems treat and recycle wastewater effectively, minimizing environmental impact and ensuring compliance with stringent regulations. These systems would reduce environmental concerns associated with textile manufacturing, such as water pollution, by treating and recycling wastewater. India can become more competitive in international markets by implementing environmental standards more strictly, improving its sustainability and possibly lowering manufacturing operating costs by implementing ZLD.
    - **Centralized Product Development Cell:** Emphasis on research and development in advanced materials and textile technologies is vital for India to compete globally. Centralized product development centers need to be created around the clusters to provide support for manufacturers to create high-value textiles and apparel with enhanced performance characteristics.

3. **Product Diversification:** India should add more products to his basket apart from cotton-based products. India should focus on synthetic textile and apparel due to their growing global demand and the advantages they offer in various applications. They are widely used in industries like fashion, automotive, and technical textile.
   In 2023, the global market for synthetic textile exports is valued at US$ 424 billion, while India's exports account for only US$ 10 billion, representing just 2.4% of the global trade in this sector. Focusing on synthetic textiles would allow India to tap into large and expanding markets, particularly in sectors like sportswear, outdoor gear, and industrial textiles where synthetic fibers are preferred for their performance characteristics, such as moisture-wicking, quick-drying, and resistance to wear and tear.

4. **Increase focus on Value-added products**

    - **Garmenting:** Focusing on garmenting, rather than just selling raw materials, offers significant advantages for the textile and apparel industry. By producing and selling finished goods, companies can capture more value within the supply chain, leading to higher profit margins. Finished garments typically have a higher market value compared to raw materials like yarn or fabric. Additionally, producing finished goods allows companies to build stronger brands, create customer loyalty, and differentiate themselves in a competitive market.
    - **Technical Textile:** The Indian textile and apparel industry should increasingly focus on technical textiles due to their immense growth potential and strategic importance in various sectors. Unlike traditional textiles, technical textiles are designed for specific functional uses across industries such as healthcare, construction, agriculture, and defense. This sector offers higher value addition, enabling manufacturers to command premium prices and enhance profitability.

Example of South Korea's new Textile and Fashion Industry Competitiveness Strategy

Some other countries are introducing specific policy to focus more on textile and apparel industry. For example, we can look into **South Korea's Textile and Fashion Industry Competitiveness Strategy**, where they have focussed to enhance sustainability, digitalization and innovation within their industry		
Sustainability	**Digitalization**	**Innovation**
The ministry plans to establish and distribute the 'Carbon Emissions Measurement Standardization Model' by 2026 and introduce the K-Eco Design Guidelines in 2025 (to be enforced in 2027) **to promote the recycling and use of eco-friendly materials in textile and apparel manufacturing.** **KRW 31 billion (US$ 23 Mn)** will be injected into developing technologies for **waterless dyeing, wastewater reduction and improving energy efficiency to support green and low-carbon** transition of textile production processes, and also go towards providing waste heat recovery facility to more than 200 small and medium enterprises by 2026.	**Automation facilities** will be supplied to over 250 companies by 2028 for processes that are repetitive and in severe lack of manpower. Raise the level of **digital transformation from the 35 per cent now to 60 percent** to develop Korea into a textile and fashion powerhouse.	**KRW-2.9 trillion (US$ 2 Bn)** policy funding will be used this year for supporting the technical consulting and facility investment efforts of apparel companies that incorporate industrial textiles in their product portfolio. The ministry will assist the **eco-friendly transition of the textile and fashion industry value chain**, for which the ministry aims to secure technologies on fibre-to-fibre textile recycling, plant-based vegan leather and such biomass fibres, and biodegradable (at least 90 per cent) fibre manufacturing by 2030.

Conclusion

The global textile and apparel industry is undergoing significant transformation, driven by shifting consumer preferences, economic changes, and technological advancements. Key markets like the U.S., EU, and China remain dominant, while emerging economies such as India and Vietnam are poised for growth. The challenges of 2023, including inflation and supply chain disruptions, highlight the need for resilience and innovation. India, with its rich textile heritage and growing economy, can enhance its global competitiveness by embracing sustainability, digitalization, and innovation. Strategic initiatives like product diversification, garmenting focus, and infrastructure support are vital for growth. Implementing forward-thinking policies will help India establish itself as a key player in the global supply chain, contributing to economic growth, job creation, and environmental sustainability.

About FICCI

The Federation of Indian Chambers of Commerce and Industry (FICCI) is an association of business organizations in India established in 1927. FICCI draws its membership from the corporate sector, both private and public, including SMEs and MNCs. The chamber has an indirect membership of over 2,50,000 companies from various regional chambers of commerce. It is headquartered in the national capital New Delhi and has presence in 12 states in India and 8 countries across the world.

FICCI is a non-government, not-for-profit organization involved in sector specific business policy consensus building, and business promotion and networking. It provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policy makers and the international business community. It organizes conferences, forums, exhibition, trade fairs, etc. bringing the industry insight forward.

About Wazir

Wazir Advisors is a Management Consulting assisting its clients in strategy formulation and implementation, forming alliances and joint ventures, investments and market understanding, sector analysis and due diligence-thereby providing end to end solution spanning the complete business cycle in textile value chain.

Having worked with leading Indian and International companies, public sector organizations, Government departments, development agencies, trade bodies etc., Wazir has a deep understanding of global textile sector dynamics and right connect with the people who matter.

Wazir's team of textile experts possess experience across function – projects, operations, sourcing and marketing in the sector. The team members have worked on strategy and implementation assignments in all major textile and apparel manufacturing and consumption base. Wazir leverages its body of knowledge, contact and combined expertise of its team to deliver value to clients.

Our Services

Strategy & Implementation	Business Transformation	Cross Border Alliances	Transaction Advisory Services
· Corporate Strategy · Market Opportunity Assessment · Location Analysis · New Factory Set- up · Operations re-engineering · Techno Commercial Due-Diligence	· Defining Business Strategy · Cost Transformation · Revenue Enhancement · Preferred Supplier Programme · Business Process Re-engineering	· Market Assessment · Market Feasibility · Market Entry Models · Partner/Target Screening & Shortlisting · Partnership Structuring · Implementation Support	· Due Diligence · Financial Modelling · Deal Structuring · Capital Raising · Potential target Identification

