kotak karma

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From Farm to Foreign

Saga of Indian Textile & Apparel Sector

RITIKA JUNEJA • SULAKSHANA RAO • ASHOK GULATI
AYUSHI GUPTA • RIYA JAIN

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by Ritika Juneja, Sulakshana Rao, Ashok Gulati, Ayushi Gupta and Riya Jain

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Foreword

The story of India's textile industry is a vibrant tale rich in tradition, innovation, resilience, and global influence. As the second-largest sector in India after agriculture, textiles have been instrumental in driving the nation's economic growth, providing employment to millions, and shaping India's economic and cultural landscapes. The history of textiles in India is one of the oldest in the world, with the first known cotton threads dating back to around 4000 BC, and dyed fabrics documented as early as 2500 BC. India's textile legacy was so deeply ingrained in its identity that in ancient Greece and Babylon, the name 'India' became synonymous with 'cotton.' This report titled *"From Farm to Foreign: Saga of Indian Textile & Apparel Sector"* seeks to highlight the diverse and often overlooked facets of this legacy. The report traces the journey of India's textiles from the fertile fields where cotton and other natural fibres are cultivated by farmers, to the global markets and international runways where Indian textiles is making inroads and gaining recognition.

While cotton remains the cornerstone of the Indian textile and apparel industry, significant shifts have taken place with the rise of synthetic fibres that now dominate the global market. Advances in polymers and synthetic fibres have transformed the landscape, making these alternatives increasingly competitive. As a result, cotton's dominance has diminished, with man-made fibres now accounting for more than 70 percent of global fibre consumption. This shift presents a unique challenge for India, where cotton still holds a 60 percent share. Despite these advancements, India's textile industry faces critical challenges in moving up the value chain. Although significant progress has been made in cotton cultivation in recent years, much of the industry remains decentralized and heavily reliant on exporting raw cotton or low-value-added products such as yarn and fabric. As a result, much of the potential economic value of India's cotton sector remains untapped, especially in the high-value garment manufacturing and fashion segments. This report explores the achievements and challenges of this dynamic sector. It also analyses how countries like China, Bangladesh, and Vietnam have been able to capture more value from the cotton-to-fashion process, while India has yet to achieve similar results. Consequently, India's share in global garment exports and fashion items, remains limited. This report aims to lay the foundation for India to reclaim its competitive advantage in the global textile and apparel market.

As you progress through this report, you will find a comprehensive exploration of the various stages of the cotton value chain, alongside strategic recommendations to address existing gaps and to elevate India's standing in the global textile and apparel trade. I hope that this report will stimulate valuable policy discussions and encourage the streamlining of value chains within the industry. This evidence-based research can serve as a vital resource for policymakers, industry experts, and stakeholders, facilitating informed decision-making, and improved practices throughout the value chain.

Deepak Mishra

Director & Chief Executive, ICRIER

Preface

India is the world's second-largest producer of textiles and apparel and ranks sixth globally in textile and apparel exports. With a robust, end-to-end manufacturing capability across the entire value chain, India exports textile products to over 100 countries (IBEF, 2025). The sector provides employment to approximately 45 million people, including 3.5 million handloom weavers.

Despite its scale and economic importance, the industry continues to face significant structural and competitive challenges. These include low cotton productivity, limited value addition in garment manufacturing, fragmented and decentralized production systems, tariff barriers, and intense competition from countries like Bangladesh and Vietnam. Additionally, the global shift toward synthetic fibres has further eroded India's competitive edge. The importance of addressing these challenges cannot be overstated.

Textiles are made from two primary categories of fibres: natural and man-made. Natural fibres include cotton, wool, silk, and flax. Man-made fibers (MMF) are further classified into two main categories - synthetic and cellulosic fibers. Synthetic MMFs comprise materials like viscose (rayon), nylon, polyester, acrylic, and polyolefin. Cotton had been the most demanded fibre globally till 1990s, after which polyester, driven by its durability, easy care, low production costs, and changing consumer preferences, surpassed cotton in demand. Within the synthetic fibre category, polyester is the most widely used globally, comprising 81.2 per cent of all synthetic fibres in 2023. It is followed by polypropylene at 10.4 per cent, nylon at 6.7 per cent, and acrylic at 1.7 per cent. In comparison, cotton now represents only 28 per cent of global fibre consumption. With MMFs continuing to dominate over 70 per cent of the global fibre consumption the demand for these fibres is expected to grow, posing a challenge to cotton's global market share. While India now accounts for 9.4 per cent of global MMF production but remains far behind global leaders like China, Vietnam and Taiwan (Economic Survey, 2025). This growing dominance of MMFs in the global textile trade is critical for India's future exports, as MMF products are expected to continue driving demand in the coming years.

India remains internationally recognized for its cotton and cotton-based products. However, in the key textile export category of apparel, India only held a 2.8 per cent share of the global market in 2023. This is significantly lower than major competitors such as China (29.8 per cent), Bangladesh (9.6 per cent), and Vietnam (5.8 per cent). India's apparel industry has focused largely on basic manufacturing, lacking a strong, fashion-driven approach (Economic Survey, 2025). This focus on low-margin, traditional production rather than high-margin, design-led, fast-fashion manufacturing has limited India's ability to capitalize on shifting global trends. The Survey also emphasizes that India's textile production is highly fragmented, with a significant portion of the industry consisting of small and medium-sized enterprises (SMEs) operating independently or in clusters across the country. This fragmentation presents challenges, particularly within the cotton segment, as it limits economies of scale, reduces efficiency, and drives up logistical costs.

This report examines these multifaceted challenges facing India's textile value chain, providing a detailed analysis of the underlying causes and the far-reaching impacts of these issues. It offers actionable solutions that can help India regain and strengthen its position in the global textile and apparel market. By addressing these systemic challenges, India has the potential to unlock new growth opportunities, expand its market share, and enhance the livelihoods of millions of workers across the country—especially farmers and those employed in the cotton and textile industries. This will not only elevate India's role in the global economy but also pave the way for more sustainable and inclusive growth.

The report is structured into six chapters, each focusing on a distinct segment of the value chain, from farm to fibre, fabric, fashion, and finally, foreign trade. Each chapter builds on the previous one, providing a comprehensive understanding of the sector's dynamics and offering policy recommendations for improvement. Chapter 1 outlines the objective and rationale behind the study, highlighting the urgency of addressing the systemic challenges facing the cotton value chain in India. It provides an overview of the global context and India's position within it. Chapter 2 takes a deep dive into the role of technology and genetically modified organisms (GMO) seeds in transforming India's cotton production. It examines the breakthroughs in cotton yield, particularly the adoption of Bt cotton, which promised to boost productivity and reduce pesticide usage. It evaluates implications of these technological challenges on the entire value chain, offering a detailed look at how innovation—or the lack thereof—affects every stage of cotton production. Chapters 3 and 4 focus on yarn and fabric manufacturing, respectively, covering key aspects of their structure and global presence. Both chapters analyse the role of government interventions, such as subsidies, trade policies, and infrastructural support, and assess their effectiveness in helping India compete globally. Chapter 5 takes a closer look at the structural constraints within India's apparel industry. It compares India's position against key competitors like Bangladesh and Vietnam, analysing the reasons behind their success and India's comparative disadvantages. This chapter explores the significant policy interventions needed to enhance the competitiveness of India's apparel sector. Chapter 6 synthesises the findings from the previous chapters and offers a set of strategic recommendations aimed at revitalizing the Indian textile value chain farm to factory to fabric to fashion to foreign.

Authors

Executive Summary

India's textile sector, encompassing the entire value chain from farm to factory (yarn), fabric, fashion, and foreign markets (the "5Fs"), is a cornerstone of the national economy. Contributing 2.3 per cent to India's GDP, employing over 45 million people, and generating 12 per cent of total export revenues, the sector's significance cannot be overstated. Despite its vast potential, India faces challenges in competing with key global players such as China, Vietnam, and Bangladesh, in export competitiveness, operational efficiency, and value addition. This report examines the multifaceted challenges across each segment of the cotton value chain and offers actionable insights to enhance India's global competitiveness. It also outlines a path forward to achieve the ambitious target of USD 100 billion in textile exports by 2030.

While India is the second-largest producer of cotton, after China, contributing 22 per cent to global output, the country has yet to capitalize on this advantage to maximize its potential in the textile sector. This report looks at the structural and policy challenges that have hindered the growth of India's cotton and textile industries. The report addresses the pressing concerns of stakeholders throughout the cotton value chain, including farmers, ginners, spinners, textile manufacturers, and garment exporters. To position India as a global standing in the textiles sector, a cohesive strategy that integrates farm-level reforms, modernized textile manufacturing, and supportive trade policies.

Key Highlights

The cotton value chain begins at the farm level, where a significant turning point occurred with the introduction of Genetically Modified (GM) Bt cotton hybrids in 2002. This policy shift resulted in a notable boost to cotton production and exports. India's cotton output surged from 13.6 million bales in 2002-03 to 39.8 million bales by 2013-14, marking an impressive 193 per cent increase over just 12 years. During this period, often referred to as the "gene revolution," cotton productivity also experienced a sharp rise—from 302 kg per hectare in 2002-03 to 566 kg per hectare in 2013-14, reflecting an 87 per cent improvement. The area under cotton cultivation expanded by 56 per cent, with Bt cotton responsible for nearly 90-95 per cent of this growth. However, since 2014, productivity gains have stalled due to pest resistance (pink bollworm, whiteflies), regulatory inefficiencies, and not permitting the use of next generation cotton seed technologies such as Herbicide Tolerant (HT) Bt cotton, etc, that ultimately contributed to a decline in cotton production and productivity. As of 2023-24, despite being the second-largest cotton producer globally, India's productivity remains low at just 435 kg per hectare—well below the global average of 770 kg per hectare (TE 2023-24) (International Cotton Advisory Committee (ICAC), 2024). This productivity gap at the farm level has a cascading effect across the entire cotton value chain, impacting subsequent stages such as processing, manufacturing, and the export of finished cotton products. Cotton output is also projected to fall to 30 million bales in the marketing year (MY) 2024-25, the lowest in 15 years! India is likely to become a net importer of cotton, with imports reaching 2.6 million bales, surpassing exports of just 1.5 million bales in MY 2024-25. This marks a significant decline from the

peak exports of 11.7 million bales in FY14. This debacle is largely caused by not allowing the next generation - HT Bt seeds to come into India, despite clearance by apex Genetic Engineering Appraisal Committee (GEAC) under the Ministry of Environment, Forest, and Climate Change.

After cotton is harvested, cleaned, and processed to extract and align the fibres, which are then spun into yarn through a process of drawing and twisting. This process is a crucial link between raw materials like cotton and MMFs and the final fabric used in garments. Despite India's vast cotton production, the sector faces significant challenges, including outdated technology and inefficiencies. Many cotton mills operate with outdated machinery, limiting their ability to scale up and meet international standards. India's spinning capacity utilization is also limited 70-75 per cent. The yarn manufacturing industry is heavily reliant on micro, small and medium enterprises (MSMEs), which often lack the resources for modernization. Once heavily reliant on China for yarn exports (42 per cent of exports in 2013, ~USD 4 billion market), India lost its edge after China granted duty-free access to Pakistan (2007) and Vietnam (2010), reducing India's share to 22 per cent by 2020. The withdrawal of the Technology Upgradation Fund Scheme (TUFS) subsidies and export incentives further stalled modernization. Insights from the field visits revealed raw cotton contamination and inconsistent fibre length as key challenges, leading to discounted pricing compared to USA, Australia, and Brazil. Indian spinning mills have over 15 million spindles older than 20 years that are in need of urgent modernisation (Indian textile magazine, 2020). On the other hand, synthetic yarn segment faces policy barriers such as Quality Control Order (QCO) for polyester fibres and yarns. Due to this, the raw materials polyester staple fibre (PSF) and viscose staple fibre (VSF) are 10–15 per cent costlier than global competitors like China, Indonesia, or Vietnam. Raw material affordability for non-integrated firms is essential in synthetic yarn segment.

At the fabric manufacturing stage that serves as a crucial link between yarn production and garment manufacturing, India encounters similar issues. While the country's fabric manufacturing sector is large, it remains highly decentralized, accounting for around 80 per cent of production. Small-scale power looms and hosiery units dominate fabric production, hindering efforts to standardize production, implement economies of scale, and compete globally. Similarly, the fabric processing sector, which includes dyeing, finishing, and printing, suffers from fragmentation and technological stagnation. Despite a large domestic production base, India struggles to meet the quality and efficiency standards required to tap into high-value markets. While schemes like Amended Technology Upgradation Fund Scheme (ATUFS), Scheme for Integrated Textile Parks (SITP), and Pradhan Mantri Mega Integrated Textile Region and Apparel (PM MITRA) parks aim to modernize the sector, their implementation has been slow, with low financial support and capital subsidies. In case of fabric exports Vietnam (one of the leading importers globally) provided preferential tariff rates to China due to its participation in the Regional Comprehensive Economic Partnership (RCEP) at 3.03 per cent for woven fabric and 1.43 per cent for knitted fabric, whereas India's rates are higher at 4.87 per cent for woven fabric and 2.41 per cent for knitted fabric, making Indian exports more expensive in the Vietnamese market.

The fashion and garment manufacturing stage forms a critical link in the cotton value chain, where value addition peaks and global competitiveness is truly tested. India, with its vast labour pool and a sizable garment manufacturing infrastructure, holds enormous potential in this space. Yet, it has not fully leveraged the opportunity presented by China's gradual retreat from global garment exports. The global apparel market, valued at USD 516.3 billion in 2023, is projected to grow exponentially to USD 2.37 trillion by 2030—a window India cannot afford to miss.

In FY24, India's textile and apparel exports stood at USD 34.8 billion, with apparel contributing USD 14.5 billion (42 per cent of India's T&A exports). India's apparel exports rose from USD 5.5 billion in FY01, peaking at USD 17 billion in FY16, and then marked a 14 per

cent decline reaching USD 14.5 billion in FY24. Although, India's global market share in apparel remains stagnant at <3 per cent since 2000s, competitors like Bangladesh and Vietnam have surged ahead. Bangladesh's global share has grown from 2.2 per cent to 9.6 per cent, while Vietnam's share jumped from 1 per cent to 5.8 per cent between 2000 and 2023. India's apparel industry is fragmented and cotton-centric, MSME dominated with lack of scale, technology, and design capabilities. While the global apparel market is increasingly driven by fast fashion, synthetic fibres, and integrated supply chains. Countries like Bangladesh, Vietnam, and China, benefit from larger factory setups, better trade access, and stronger integration with global brands. India's apparel exports face three interlinked bottlenecks. First, the supply chain is highly fragmented-cotton is grown in Gujarat and Maharashtra, etc, yarn is spun in Tamil Nadu, fabric is processed in Gujarat or Maharashtra, and garments are stitched across various states. This geographic disaggregation raises logistics costs, delays production, and weakens efficiency. Second, regulatory hurdles like pre-shipment inspections and component-wise documentation make exports compliance-heavy; an Indian garment order takes 63 days on average from placement to delivery, compared to 50 days in Bangladesh (BGMEA, 2021). Third, India's share in global MMF production is just 9.2 per cent, despite MMF accounting for over 70 per cent of global fibre consumption. Policy distortions such as an inverted Good and Services Tax (GST) structure and restrictive QCOs on key raw materials like PSF and push domestic prices significantly above global levels. Adding to this, Indian garments face 9–12 per cent tariffs in the EU (which accounts for 37 per cent of exports), while Bangladesh and Vietnam enjoy duty-free access.

Policy Recommendations and Way Forward

India's textile sector requires a cohesive and strategic approach across the '5Fs-Farm, Factory (Yarn), Fabric, Fashion, and Foreign' to overcome challenges such as fragmented production, high costs, outdated technology, and trade barriers. Strengthening each segment through targeted reforms and infrastructure development will enhance global competitiveness and help drive India's textile exports toward the target of USD 100 billion by 2030. Else, this target will remain a mere dream.

1. Integrate the 5F supply chain and fast-track PM MITRA

India's fragmented value chain must be vertically integrated to boost efficiency, reduce costs, and compete with fast-moving global supply chains. The study recommends two of the seven PM MITRA Parks, that is in Navsari (Gujarat) and Virudhunagar (Tamil Nadu), be operationalised on a priority basis, in close partnership with the respective state governments. These hubs should be export-focused, SEZ-driven, and ideally linked to the PLI scheme to incentivise value-added exports. This strategic push is the need of the hour for India to plug into disrupted global supply chains and seize emerging opportunities. With the United States imposing 125 per cent tariffs on Chinese textile and apparel imports, India is uniquely positioned to capture a greater share of the global market. India must push the apparel and made-up sector and focus on value-added products that align with global fashion trends (for ex. technical textiles), sustainability standards, and the growing demand for high-quality textiles.

2. Reform MMF policy and correct GST inversion

MMF products dominate global demand, but India lags due to policy distortions. The inverted GST structure on MMF must be corrected to reduce production costs. QCOs should be rationalised to enable cheaper imports of essential raw materials like PSF and VSF. Liberalising input sourcing and simplifying export documentation especially under advance authorisation will boost India's textile export competitiveness.

3. Expand market access in key markets

With the EU and US accounting for 66 per cent of India's apparel exports, India must negotiate bilateral agreements to match the preferential access enjoyed by Bangladesh and Vietnam.

Simultaneously, emerging export destinations - Japan, Russia, Brazil, South Korea offer untapped potential in niche segments like women's wear and technical textiles.

4. Boost cotton productivity and quality

India's cotton productivity (435 kg/ha) trails far behind China (1,945 kg/ha) and Brazil (1,839 kg/ha).

Expanding irrigation, promoting High-Density Planting, and investing in precision farming will help bridge the productivity gap, enabling India to maximize its cotton potential and support the domestic textile sector with a consistent, high-quality supply of raw material. Streamlining the approval process for GM cotton varieties and establishing a single-window clearance system will speed up the adoption of high-yield, pest-resistant cotton crops.

By aligning policy reforms, infrastructure development, and trade facilitation, India can unlock the full potential of its T&A sector. A strategic push to integrate the 5F value chain, fast-track the PM MITRA parks, and reform MMF taxation will enhance competitiveness and scale. Simultaneously, simplifying export procedures, rationalising Quality Control Orders, and correcting the GST inversion are low-hanging fruits that can immediately reduce costs and ease operations for exporters. To seize emerging global opportunities, especially the US-China trade war, India must double down on value-added products and secure preferential market access through bilateral trade agreements. With focused execution across these fronts, India can reach close to its ambitious USD 100 billion T&A export target by 2030.

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List of Abbreviations

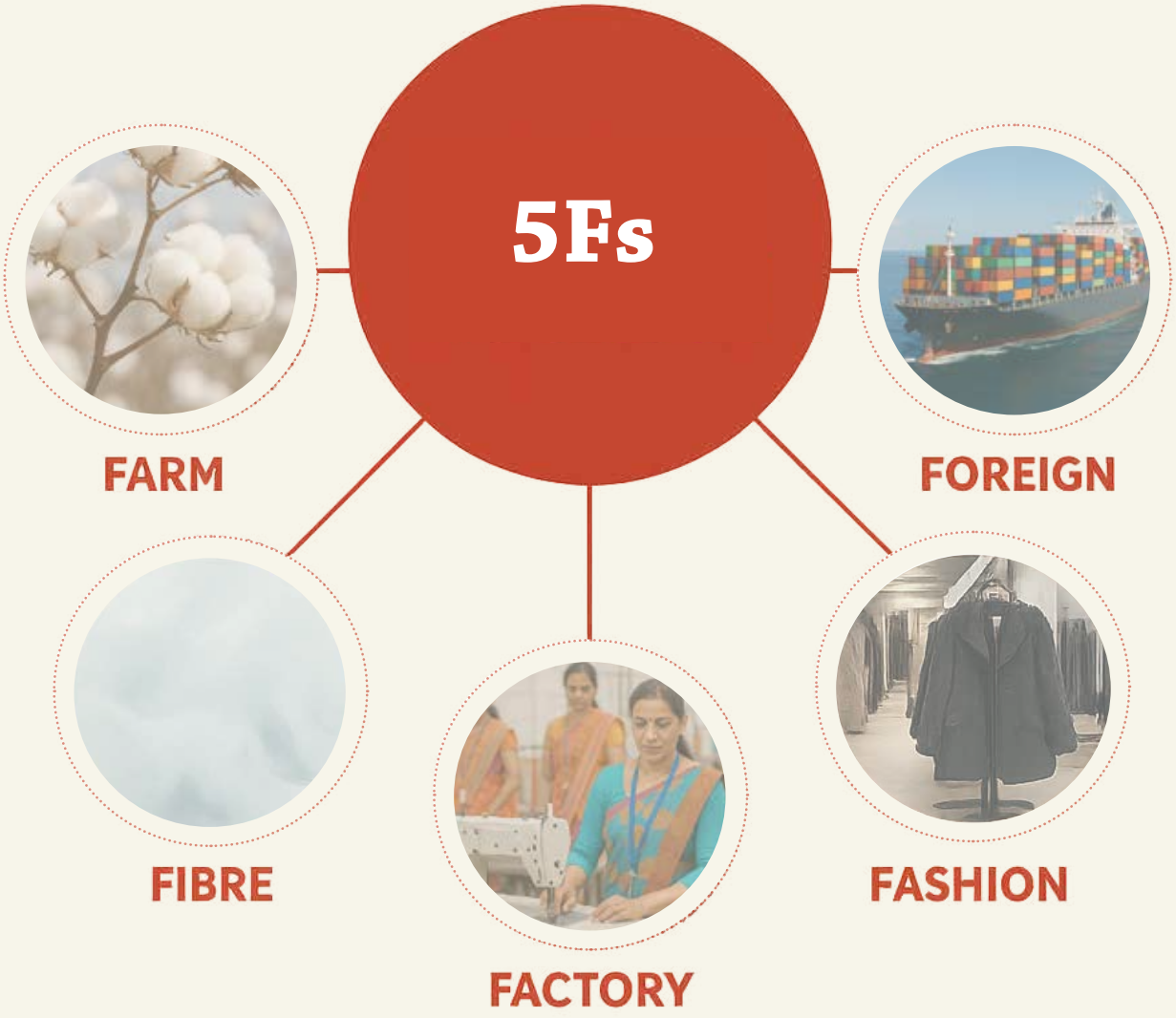
AAGR	Average Annual Growth Rate
AHS	Applied Harmonized System
AIDC	Agriculture Infrastructure and Development Cess
ASCM	Agreement on Subsidies and Countervailing Measures
ATUFS	Amended Technology Upgradation Fund Scheme
BCD	Basic Customs Duty
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
CAFTA	China-ASEAN Free Trade Agreement (CAFTA)
CAG	Comptroller and Auditor General of India
CBITC	Central Board of Indirect Taxes and Customs
CETPs	Common Effluent Treatment Plants
CICR	Central Institute for Cotton Research
CIF	Cost, Insurance, and Freight
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
DCD	Directorate of Cotton Development
DBT	Department of Biotechnology
DCTS	Developing Countries Trading Scheme
DEPB	Duty Entitlement Passbook Scheme
DLCs	District Level Committee
EVFTA	EU-Vietnam Free Trade Agreement
FDI	Foreign Direct Investment
FMS	Focus Market Scheme
FSSAI	Food Safety and Standards Authority of India
FTP	Foreign Trade Policy
FTAs	Free Trade Agreements
GCC	General Certificate of Conformity
GEAC	Genetic Engineering Appraisal Committee
GI	Geographical Indication
GM	Genetically Modified
HSN	Harmonized System of Nomenclature
IBSCs	Institutional Biosafety Committees
IGST	Integrated Goods and Services Tax
IPDS	Integrated Processing Development Scheme
ITMF	International Textile Manufacturers Federation
KVKs	Krishi Vigyan Kendras
LDC	Least Developed Country
MAFW	Ministry of Agriculture and Farmers' Welfare

MEG	Monoethylene Glycol
MEIS	Merchandise exports from India Scheme
MFN	Most Favoured Nation
MLFPS	Market Linked Focus Product Scheme
MMBL	Mahyco-Monsanto Biotech (India) Limited
MMF	Man-Made Fibre
MOEFCC	Ministry of Environment, Forest, and Climate Change
MSME	Micro, Small and Medium Enterprises
MY	Marketing year
NHD	National Handloom Development
NHDC	National Handloom Development Corporation
NTTM	National Technical Textiles Mission
PBW	Pink Bollworm
PFCE	Private Final Consumption Expenditure
PLI	Production-Linked Incentive
PM MITRA	Pradhan Mantri Mega Integrated Textile Region and Apparel
PMMY	Prime Minister MUDRA Yojana
PSF	Polyster Staple Fibre
PTA	Purified Terephthalic Acid
QCO	Quality Control Order
RCEP	Regional Comprehensive Economic Partnership
RCGM	Review Committee of Genetic Manipulation
RoDTEP	Remission of Duties and Taxes on Exported Products
RoSCTL	Rebate of State and Central Taxes and Levies
SBCCs	State Biotechnology Coordination Committees
SEZ	Special Economic Zones
SITP	Scheme for Integrated Textile Parks
SITRA	South India Textile Research Association
SME	Small and Medium Enterprises
SPCO	Seed Price Control Order
SWC	Social Welfare Surcharges
T&A	Textiles and Apparel
TCDS	Textile Cluster Development Scheme
TUFS	Technology Upgradation Fund Scheme
UKVFTA	UK-Vietnam Free Trade Agreement
UIN	Unique Identification Numbers
USITC	US International Trade Commission
VSF	Viscose Staple Fibre
WITS	World Integrated Trade Solution
ZLD	Zero Liquid Discharge

1

Introduction

ASHOK GULATI AND RITIKA JUNEJA



Introduction

ASHOK GULATI AND RITIKA JUNEJA

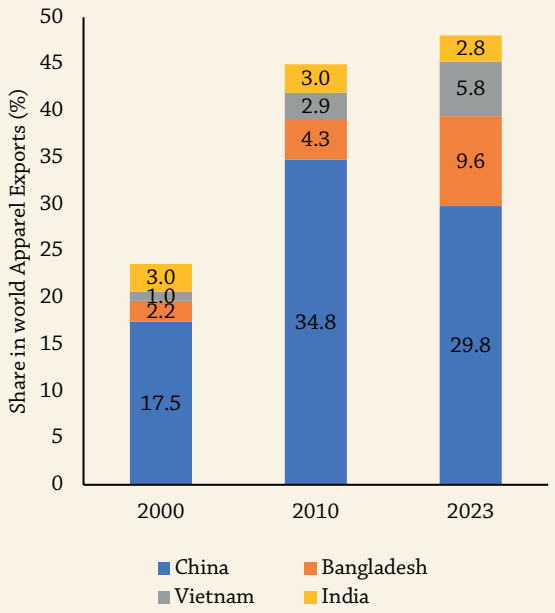
1.1 Context

Cotton, once hailed as the "King of Fibers," has long held a prominent place in human history, serving as the cornerstone of global textile production. Its soft, breathable texture has made it a favoured choice for clothing across the world for centuries. From the luxurious robes of Egyptian Pharaohs to the elegant garments of Greek and Indian kings, cotton's versatility transcended class, offering comfort to royalty and commoners alike. Its ability to regulate body temperature in warm and cool climates made it an essential material for clothing in diverse environments, cementing its status as the go-to fabric. Yet the 20th century marked a dramatic shift in the textile industry. With the rise of industrialization and advancements in chemical engineering, the early 1930s saw the dawn of synthetic fibres. This era of innovation brought forth the creation of polymers and new spinning technologies, culminating in the invention of Nylon in 1938 by Carothers and his team at DuPont (Morgan, 1981). This momentous discovery revolutionized the fabric industry, giving rise to a slew of synthetic fibres such as polyester, acrylic, and spandex. These fibres quickly gained global popularity, driven by their cost-effectiveness, durability, and ease of maintenance (Gulati and Jose, 2023).

India has historically played a vital role in the textile value chain—from fibre to yarn to fabric to garments. Despite this rich legacy and the quality of its textile production, India's share in the global apparel market has remained stagnant at around 3 per cent for the past three decades (Figure 1.1). In contrast, countries like Bangladesh and Vietnam have made significant strides. Between 2000 and 2023, Bangladesh's global market share rose from 2.2 per cent to 9.6 per cent, while Vietnam's grew from 1 per cent to 5.8 per cent. Much of this shift occurred after 2010, as China's dominance in the global apparel trade began to wane. China's share in apparel trade dropped from 34.8 per cent in 2010 to 29.8 per cent in 2023 (Figure 1.1). This was partly due to trade tensions with the U.S, one of the world's largest apparel importers.

FIGURE 1.1

Share of Selected Countries in Global Apparel Exports



Source: UNComtrade and ITC Trademap.

This realignment presents an opportunity for India, but the question remains: why has India struggled to capitalize on it?

This report explores the underlying factors that have limited India's potential in the global T&A sector. It takes a holistic look at the value chain through the lens of the '5Fs'—Farm, Factory, Fabric, Fashion, and Foreign (exports). From cotton cultivation and ginning to spinning, weaving, garment production, and export, each link in the chain contributes to India's overall competitiveness. Yet systemic inefficiencies, technological shortfalls, and policy misalignments continue to undermine progress.

A key emphasis of this study is the fashion segment—where design, branding, and retail activities generate the highest value and margins. While India is globally recognized for cotton cultivation and textile manufacturing, its limited presence in these premium, brand-driven segments curtail the country's economic potential. By unpacking the constraints at each stage and highlighting actionable opportunities, this report seeks to chart a roadmap for India's strategic repositioning in the global T&A value chain. The goal is to transition from commodity-led exports to high-value, design-intensive products—and in doing so, strengthen India's role in global trade, boost export competitiveness, and unlock greater value across the ecosystem.

To understand the T&A value chain, it is essential to first examine the broader textile sector and how it has transformed over time. The next section explores key global trends—shifts in fibre consumption, the expansion of textile and apparel trade, and changes in T&A's share of global exports. Building on this, the following section turns to India's position within this global context, analysing how its exports have evolved over time and highlighting the major segments that make up its T&A export basket.

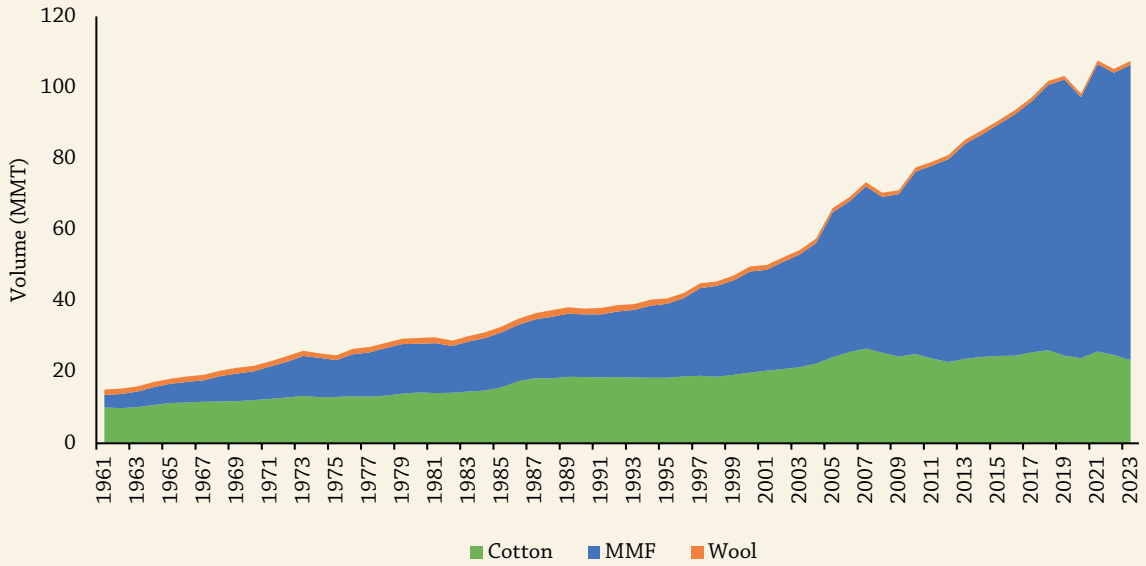
1.2 Textile and Apparel: Global Landscape

Despite its rich heritage and continued relevance, cotton's share in global fibre consumption has steadily declined since the mid-20th century. In the 1960s and 1970s, cotton accounted for approximately 56.7 per cent of global fibre consumption. However, this share declined to 46.9 per cent in the 1980s and 1990s, and further dropped to 37.9 per cent in the 2000s. By 2012, cotton's market share had fallen to a historic low of 28.2 per cent. The downward trend continued, with cotton's share decreasing to 22.3 per cent in 2023, according to the International Cotton Advisory Committee (ICAC, 2024). This decline is primarily attributed to the meteoric rise of synthetic and MMF, which have overtaken cotton to account for more than 70 per cent of global fibre consumption in 2023 (ICAC, 2024). What began as a technological innovation has now become the dominant force in the textile industry, reshaping global fibre dynamics and leaving cotton to navigate an increasingly competitive and synthetic-driven market landscape. While cotton retains its legacy as a natural, biodegradable, and culturally significant fibre, it now faces the urgent challenge of reinventing its relevance in an era defined by performance-based, cost-efficient, and versatile synthetic alternatives (Figure 1.2).

The global T&A trade was valued at USD 509.8 billion in the year 2005 (calendar year) and grew steadily to USD 830.7 billion by 2014, reflecting an average annual growth rate (AAGR) of 6 per cent over the decade. Between 2014 and 2020, the sector experienced a downturn, recording a negative AAGR of -0.6 per cent, reflecting broader challenges in global trade and shifting market dynamics. The situation worsened in 2020, as the COVID-19 pandemic disrupted global supply chains and dampened demand, causing T&A exports to contract sharply to USD 739 billion. However, with a rebound in global consumer spending, particularly in advanced economies, the sector recovered strongly in 2021, surging to USD 907.6 billion—a 15.8 per cent increase year-on-year, according to the IMF's World Economic Outlook. By 2023, global T&A exports stabilized at USD 881.6 billion, reflecting a moderate AAGR of 4.4 per cent during the 2021–2023 period (Figure 1.3). A closer look at the trade composition reveals a gradual shift towards apparel: the apparel segment's share in total T&A trade rose from 53 per cent in 2005 to 59 per cent in 2023,

FIGURE 1.2

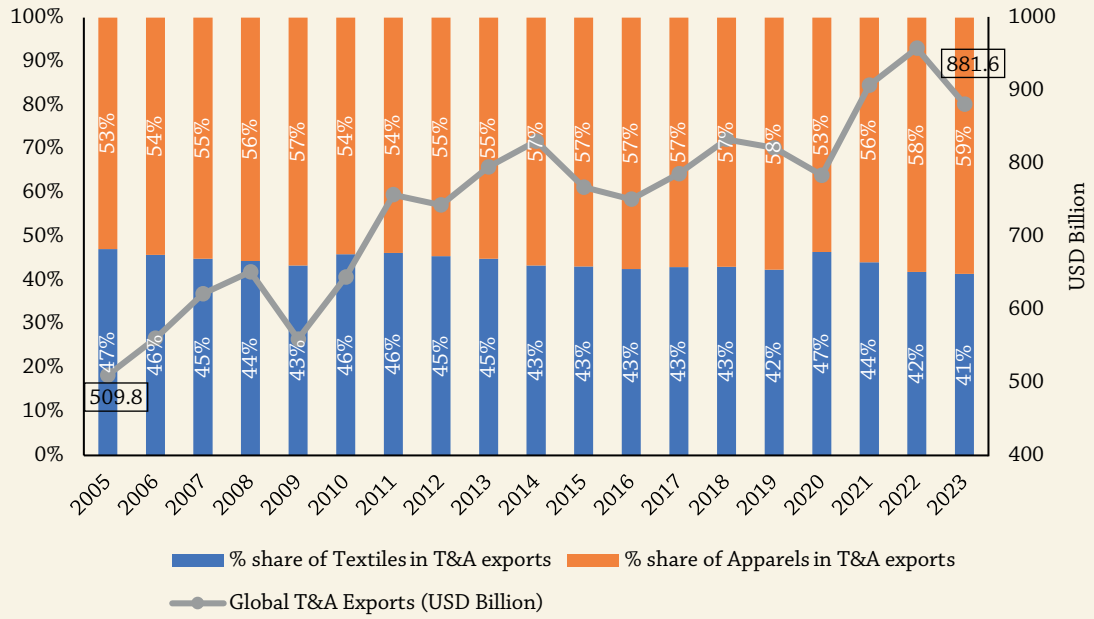
Global Consumption of Major Textile Fibre



Source: ICAC, World textile demand report, 2024.

FIGURE 1.3

Global Textile & Apparel (T&A) Exports



Source: ITC Trademap.

while the textile segment's share declined from 47 per cent to 41 per cent over the same period (Figure 1.3).

In 2023, China remained the dominant player in global T&A exports, commanding a 33 per cent share of the total exports, followed by Bangladesh (6 per cent), Germany (4.8 per cent), Italy (4.6 per cent), Vietnam (4.6 per cent), India (4 per cent), and Turkey (3.7 per cent). Collectively, these seven countries

accounted for approximately 60 per cent of the total global T&A exports, valued at USD 881.6 billion. On the import side, the United States, Germany, France, Japan, Italy, China, and the United Kingdom emerged as the leading T&A importing nations in 2023. Combined, these countries represented 42 per cent of global textile and apparel imports, which totalled USD 768.4 billion during the year.

1.3 Textile and Apparel: India's Scenario

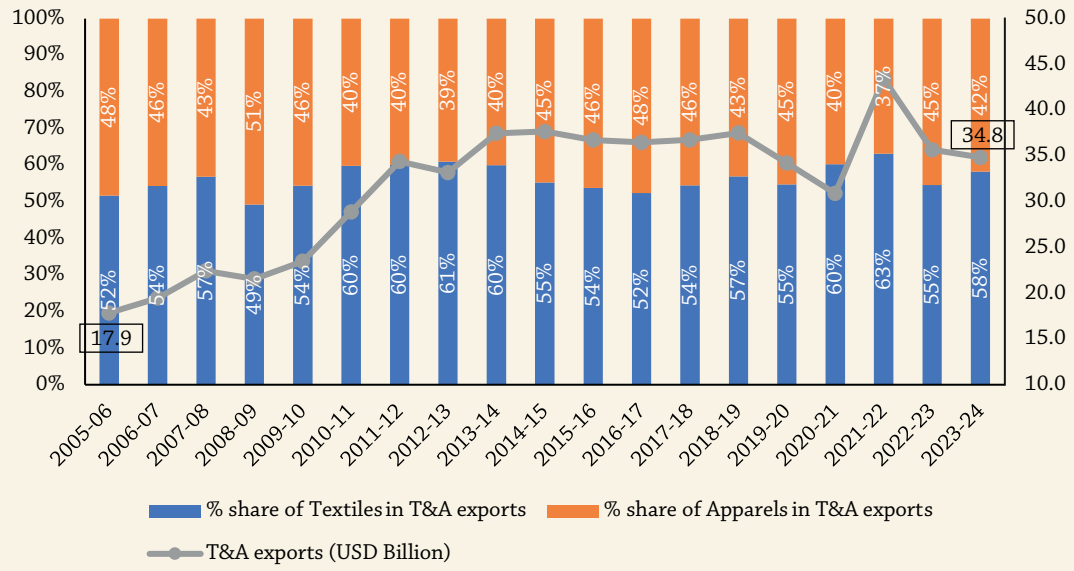
India's textile and apparel sector plays a vital role in India's economy, accounting for 2.3 per cent of the GDP, 13 per cent of industrial output, and 12 per cent of total exports (Economic survey, 2024-25). In 2023-24, India exported USD 34.8 billion in Textiles and Apparel, making it the 6th largest exporter of T&A in the world with around 4 per cent share of the global textile and apparel market. Smaller countries like Bangladesh and Vietnam (who are dependent on imports of raw material for their textile industry) are ahead of India, which used to be the 2nd largest exporter of T&A in the world till 2017 (Indian Textile Journal, 2024). The main destination of textiles exports from India are: Europe and the US consuming nearly 66 per cent of India's apparel exports, 58 per cent of finished non-apparel goods and 12 per cent of raw materials/semi-finished materials. Other prominent destinations include the UK (8 per cent of apparel exports) and the UAE (7 per cent) (Economic Survey, 2024-25).

An analysis of export performance across 24 major product groups (HS codes 50 to 63) over the period 2005–06 to 2023–24 reveals a two-phase trend. Between 2005–06 and 2013–14, exports surged from USD 17.9 billion to USD 37.4 billion. However, since then, the sector has lost momentum, with exports declining to USD 34.8 billion by 2023–24 (Figure 1.4). This slowdown is especially evident in apparel exports (HS codes 61 and 62), whose share in total T&A exports fell from 48 per cent in 2005–06 to around 42 per cent in 2023–24. The underlying factors contributing to this decline are explored in the subsequent chapters.

Despite this backdrop, the government has set an ambitious target of achieving USD 100 billion in T&A exports over the next five years. However, reaching this goal will require bold structural reforms, enhanced competitiveness, and a sharper focus on value addition—raising valid concerns about the feasibility of this vision without significant policy intervention.

FIGURE 1.4

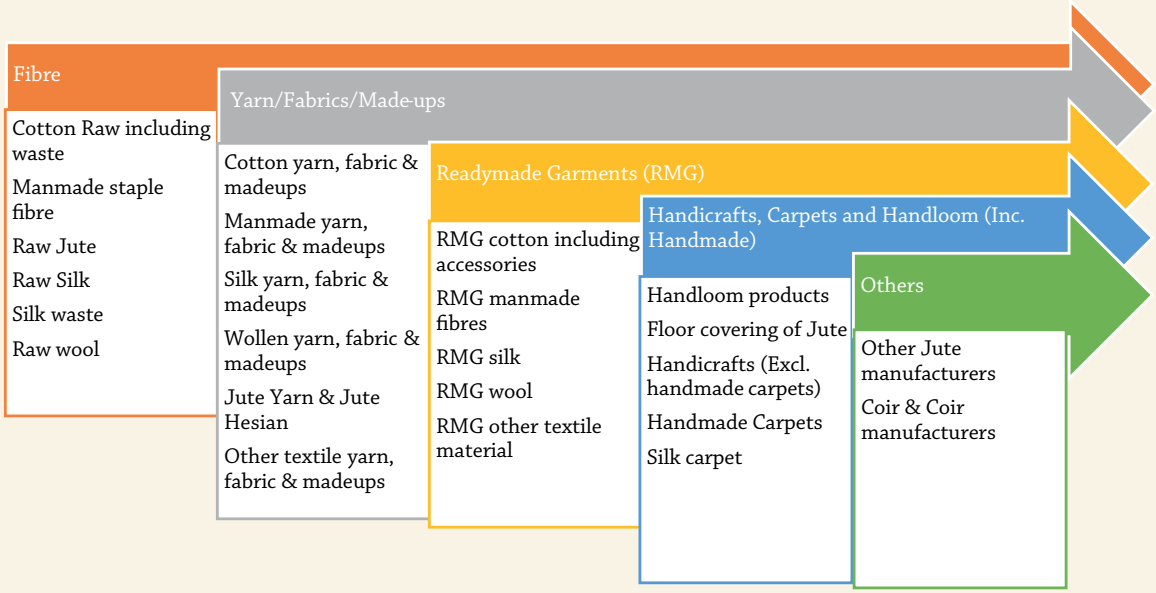
India's T&A Exports



Source: DGCIS.

FIGURE 1.5

Broad Segments of Indian Textile Industry



Source: Author's compilation from DGCIS database.

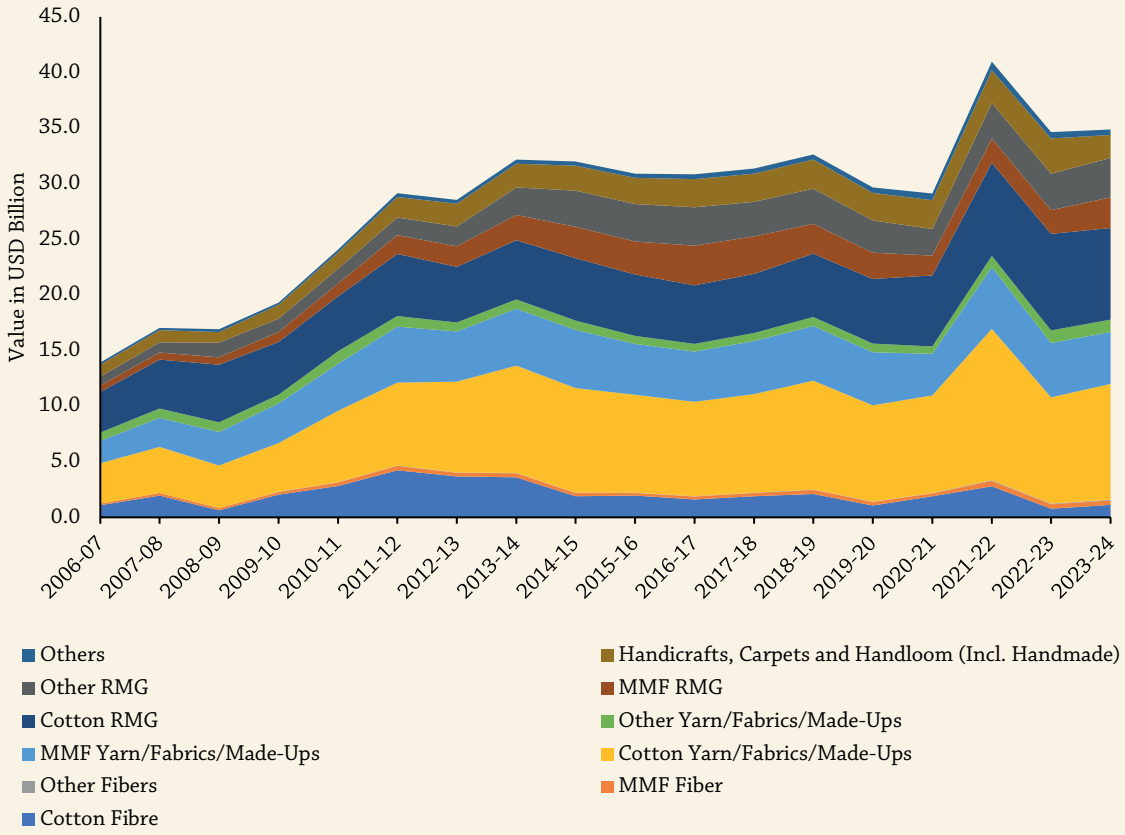
It is widely known that Indian textile industry is highly diverse, ranging from traditional hand-spun and hand-woven textiles at one end of the spectrum to modern, capital-intensive mills at the other. The decentralised power loom, hosiery, and knitting sectors constitute the largest segment of the industry. What makes India's textile sector unique is its deep connection to agriculture—particularly in the sourcing of raw materials like cotton—as well as its strong ties to the country's rich cultural heritage and traditional design aesthetics. India also holds a competitive advantage by hosting the entire textile value chain domestically—from the production of natural fibres to yarn, fabric, and finished garments (IIFT, 2018). A broad categorisation of the Indian textile industry based on principal commodity data from DGCIS is presented in Figure 1.5.

Cotton still holds an important place in India's agricultural and textile sectors, where it is a critical component of the economy and employment. As of the triennium ending (TE) 2023-24, India produces about 22 per cent of the world's cotton, making it the second-largest producer globally, after China. The cotton industry provides livelihoods to around 6 million farmers and creating employment for an additional 40-50 million people in related industries, including cotton processing, trade, and textile manufacturing (Ministry of Textiles, 2024). Cotton even holds a significant position in international trade. Figure 1.6 illustrates value of exports of different segments of T&A from India as classified in Figure 1.5 over a period of 18 years (from 2006-07[1] to 2023-24). The combined export value of these products covers on an average 80-85 per cent of total T&A exports from India as presented in Figure 1.4. It is worth noting that, cotton yarn, fabric and made ups account for the majority share, which has almost tripled from USD 3.6 billion in 2006-07 to USD 10.4 billion in 2023-24. This is followed by cotton garments including accessories, which has more than doubled from USD 3.6 billion in 2006-07 to USD 8.3 billion in 2023-24. This is further followed by MMF fibre, yarn, fabric, which has increased from USD 2 billion in 2006-07 to USD 4.7 billion in 2023-

1. Data before 2006-07 at principal commodity level is not available from DGCIS website.

FIGURE 1.6

Composition of T&A Exports from India



Source: DGCIS (various issues).

24. Overall scenario also reveals that India has overwhelmingly relied on cotton for most of its textile product exports, while the world is moving on to MMF based products.

Also, within global apparel exports of USD 516.3 billion in 2023, MMF apparel exports are USD 240 billion which forms about 46 per cent. But India's share in the global MMF apparel exports is a mere 2 per cent. This presents two critical questions that the following chapters seek to explore: First, what is holding India back from capitalizing on the shifting global apparel trade and filling the space left behind by China? Second, how can India build a robust synthetic fibre ecosystem while continuing to lead in cotton-based textiles? While these challenges are not insurmountable, reaching the ambitious target of USD 100 billion in T&A exports by 2030 will require focused, strategic effort—and a significant shift in approach.

1.4 Organisation of the Report

This report is structured into six chapters, each focusing on a distinct aspect of India's cotton value chain, from Farm to Factory (Yarn) to Fabric to Fashion to Foreign. Below is a detailed overview of the content and structure of each chapter.

The introductory chapter-1 provides an overview of the report's main objectives, which is to find out why India lagged behind even Bangladesh and Vietnam in garment exports when it had some revolutionary changes in cotton production at the farm level through adoption of Bt cotton during 2002-03 to 2012-13? But to answer this basic question, one has to understand the evolution and structure of each part of the value chain, starting with cotton farms to making of yarn and fabric in the factories to fashion and exports of garments. Accordingly, we pick up each of these segments of garments

value chain in subsequent chapters for deep dive.

In chapter-2, we delve into the transformative impact of the gene revolution on cotton production and productivity at the farm level. The chapter estimates the gains in production directly attributed to the adoption of Bt cotton. Despite early successes, the report addresses the downturn in the GM cotton revolution after 2014, investigating the factors that led to the stagnation of Bt cotton adoption. It identifies the challenges hindering the adoption of advanced GM traits in India and presents a thorough analysis of the regulatory landscape surrounding GM crops. The chapter concludes by discussing the urgent need for policy reforms to revive the cotton sector.

In Chapter-3, we deep dive into the first stage of cotton processing, analysing India's production efficiency, export competitiveness and market shifts in Yarn sector. Central to the discussion is how India's cotton yarn export market has evolved, particularly in terms of the shift in the primary importer from China to Bangladesh (only one-third the size of China) of Indian cotton yarn. Once dominated by China, this market has seen Bangladesh rise as the leading importer from India in recent years. This shift is examined in the broader context of global demand and competition. It would also be interesting to see that with the regime change in Bangladesh in 2024, whether this trade gets disrupted, and what implications it is likely to have on the Indian yarn industry.

In addition to this, the chapter addresses the increasing global demand for MMF yarn due to their durability, widespread availability, affordability, and ease of maintenance and the implications of increased competition from synthetic alternatives for the cotton yarn industry. The chapter also analyses domestic production constraints, including quality inconsistencies, outdated technology, lack of targeted policy support, and tariff disadvantages India faces against competitors like Vietnam and Pakistan. Additionally, the chapter highlights critical policy gaps that are limiting the sector's growth and competitiveness. These include the need for better infrastructure, technological advancements, and government support in addressing industry-specific challenges. It outlines strategic measures to strengthen India's competitiveness in the cotton yarn market, linking this to the broader objectives in fabric and garment production.

In Chapter 4, we cover the stage of cotton processing where yarn is transformed into fabric. It examines the structural composition of India's fabric manufacturing sector and addresses the challenges it faces due to fragmentation, need for technological innovations and modernization. Approximately 80 percent of the fabric manufacturing sector operates in the decentralized sector. The fragmentation severely limits the industry's ability to scale, standardise, and compete effectively with global leaders such as China and Vietnam as well as its access to high-margin export markets. The chapter discusses strategic interventions required to improve India's market access and export competitiveness. Understanding the complexities of India's fabric manufacturing ecosystem will allow for a better evaluation of the measures needed to enhance India's role in the global textile value chain.

In Chapter 5, we look at the export potential of apparel sector. This chapter investigates why India, despite having abundant raw materials, a large labour force, and extensive infrastructure, has struggled to capture market share in global apparel exports (stagnant at around 3 percent since 2000) following a decline in China's share. It explores the structural constraints within India's garment industry and compares India's competitive disadvantages with those of other major players, such as Bangladesh and Vietnam. The chapter also outlines potential policy interventions to enhance India's competitiveness in the apparel sector, such as the establishment of trade agreements, and implementing effective branding and marketing strategies. Finally, it proposes potential strategies to improve India's access to foreign markets and boost its garment exports.

In the last chapter, Conclusion and Way Forward, we summarise the key findings presented throughout the report. It consolidates insights on the challenges and opportunities

within India's cotton, textile and apparel industries, offering strategic recommendations for policy reforms and industrial improvements. The chapter also reflects on the need for coordinated efforts across government, industry stakeholders, and international partners to ensure comprehensive and forward-looking policy framework that stimulates investment, improves productivity, and transforms India's yarn, fabric, and garment manufacturing sector into a hub for high-value textile exports, driving both domestic and international growth.

Through this structure, the report offers a comprehensive overview of India's textile and apparel industry, tracing the journey from cotton cultivation to its processing into bales and yarn, its blending, fabric production, apparel manufacturing, and ultimately, export to global markets. At each stage of the value chain, the report highlights the critical role of policy interventions, technological advancements, and institutional frameworks. By weaving these elements together, it presents a forward-looking roadmap aimed at enhancing the sector's productivity, competitiveness, and global relevance.

References

DGCIS portal.

Gulati, A. and Jose, S. (December, 2 2023). Resurrecting Cotton-'King' of Fibres. ICAC'S 81ST Plenary Meeting.

IIFT. (2018). Challenges and Strategies to Promote India as a Sourcing Destination. New Delhi. Accessed from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://texmin.nic.in/sites/default/files/IIFT%27s%20-%20Textile%20Project%20Report%2020th%20March%20%281%29.pdf

ILO. (2016). World Employment and Social Outlook: Trends 2016. ISBN: 978-92-2-129632-4.

Indian Textile Journal. (February, 15 2024). $ 100 billion T&A exports: Mission possible?

ITC Trademap portal.

Morgan, P. W. (1981). Brief history of fibres from synthetic polymers. *Journal of Macromolecular Science—Chemistry*. 15 (6):1113–31. Retrieved from doi:10.1080/00222338108066456 (accessed on March 13, 2025).

Ministry of Finance. (2024). *Economic Survey 2024-25*. Government of India.

Ministry of Textiles. (2024). Annual report 2023-24. Ministry of Textile, GoI. Retrieved from https://texmin.nic.in/sites/default/files/MOT%20Annual%20Report%20English%20%2807.11.2024%29.pdf (accessed on March 13, 2025).

PIB. (2025). India is the sixth-largest exporter of textiles and apparels: Economic Survey. Government of India.

Uncomtrade portal.

WTO. (2023). World Trade Statistical Review.

Gene Revolution in Agriculture: Case of Cotton in India

2

RITIKA JUNEJA, AYUSHI GUPTA, AND ASHOK GULATI

Gene Revolution in Agriculture: Case of Cotton in India

RITIKA JUNEJA, AYUSHI GUPTA, AND ASHOK GULATI

2.1 Introduction

Cotton, often referred to as the "king" of fibres, has been at the heart of the global textile industry since the 1700s, playing a pivotal role in the Industrial Revolution. Originally a wild perennial, cotton is now cultivated as an annual plant, growing to a height of 1–2 meters. It produces bolls that contain both fibre and seeds, with the latter processed for cottonseed oil and meal, while the cotton lint is spun into yarn for fabric production (Voora et al., 2023).

Although numerous cotton varieties are cultivated globally, approximately 90 per cent of the world's cotton production comes from *Gossypium hirsutum* (upland cotton), which yields shorter fibres for various applications. *Gossypium barbadense* (Pima cotton), accounting for 8 per cent of global cotton production, is native to South America and produces extra-long fibres used in high-quality fabrics. *Gossypium arboreum* (tree cotton) and *Gossypium herbaceum* (levant cotton), together comprising less than 2 per cent of global production, are used in items such as fabrics and medical gauze (Barnhardt Purified Cotton, 2019).

Cotton varieties can also be categorised into GM and non-GM types, with GM varieties becoming dominant in major cotton-producing countries such as India, China, Pakistan, and the United States (Canadian Biotechnology Action Network, 2022). India's adoption of Bt cotton began in response to a severe pest infestation between 1992-93 and 2001-02. During this period, none of the existing cotton varieties were resistant to the pest, leading to heavy pesticide use, which increased cultivation costs, caused environmental pollution, and harmed human and animal health. The Central Institute for Cotton Research (CICR) estimated that production losses due to cotton bollworm infestations during this time were as high as 50 per cent (Suresh et al., 2014). In response, the then Prime Minister Atal Bihari Vajpayee made the landmark decision to commercially introduce Bt cotton in 2002. Engineered to resist pests, Bt cotton was hailed as a breakthrough, resulting in a 88 per cent increase in cotton yields, a 56 per cent increase in the area under cotton cultivation, and a 193 per cent rise in production between 2002-03 and 2013-14. This period marked India's "gene revolution" in cotton, with 90-95 per cent of cotton areas dedicated to Bt cotton.

While Bt cotton's success offers valuable lessons for policymakers, it is not without controversy. Concerns raised by NGOs, civil society groups, and farmers' associations include the increased damage from sucking pests, the rise of secondary pests such as mirid bugs and *Spodoptera*, the emergence of pest resistance, environmental and health risks related to toxicity and allergenicity that could cause hematotoxin reactions in humans, and the potential monopoly of seed businesses. However, most of these claims remain largely unproven fears, shared by ideologues across the political spectrum. As a result, the commercial release of HtBt cotton, along with other GM crops like Bt brinjal and GM mustard, has been placed under mora-

torium, despite clearance from the country's biotech regulator, the GEAC. Timidity in policymaking and ideological opposition have created an environment where scientific advancements are stifled, depriving farmers access to advanced agricultural technologies that could enhance productivity, resilience, and sustainability.

This chapter aims to examine the implications of Bt cotton adoption in India, analysing both its successes and limitations. By exploring the technological, economic, and environmental impacts of Bt cotton, the chapter seeks to evaluate the potential benefits and challenges associated with this innovation. Additionally, it investigates the role of policy and institutional frameworks in enabling India to maximize the advantages of GM cotton technology, while ensuring biosafety, safeguarding human health, and optimizing socio-economic and environmental outcomes.

The chapter is structured as follows: first, it outlines the global evolution and adoption of GM crops. Next, it reviews available impact studies and assesses the potential effects of Bt cotton on production and pest management in India. The chapter then delves into the controversies surrounding GM technology, highlighting the barriers that hinder its success. Finally, it provides recommendations for overcoming these challenges.

2.2 Expanding Footprint of GM Crops – Global Experience

GM crops are plants that have been genetically altered through genetic engineering to enhance their DNA with beneficial traits. For example, genetic modifications can improve crop yields, resulting in increased production. Scientists can create pest-resistant crops, helping farmers better withstand environmental challenges that could potentially destroy an entire season's harvest. Crops can be engineered to improve their nutritional value, providing essential vitamins to populations facing deficiencies in key nutrients for a healthy life. GM crops play a critical role in addressing the growing pressures on global agriculture, including climate change, soil degradation, and limited arable land.

By 1983, researchers had introduced transgenes into plants, marking the advent of transgenic crops. In 1988, China became the first country to grow a commercial GM crop: tobacco, modified to resist tobacco mosaic virus (Tianjie, 2008). In the United States, the first GM crop was released in 1994 (tomatoes), however in 1996 significant GM crops were planted (Brookes, 2022). Since their commercialisation in the 1990s, GM crops such as herbicide-tolerant soybean and insect-resistant Bt cotton are pivotal for modern agriculture.

Over the past two decades, GM crops have expanded rapidly, becoming integral to agricultural practices in developed and developing nations. The area under biotech crops has increased from 1.7 Mha in 1996 to 206.3 Mha in 2023, registering a 120-fold increase and becoming the fastest adopted crop technology in the world (ISAAA Biotech updates, 2024). This rapid adoption is attributed to its significant benefits, including increased yields, reduced dependency on chemical pesticides, and improved resistance to pests and diseases, which collectively enhance profitability for farmers. As of 2024, 32 countries approved GM crops (ISAAA, 2024). The basket of biotech crops is expanding beyond the big four crops i.e., corn, soybean, cotton, and canola and now includes rice, wheat, sugar beet, papaya, squash, eggplant, banana, cow pea, mustard, sugarcane and potatoes, etc. (Figure 2.1).

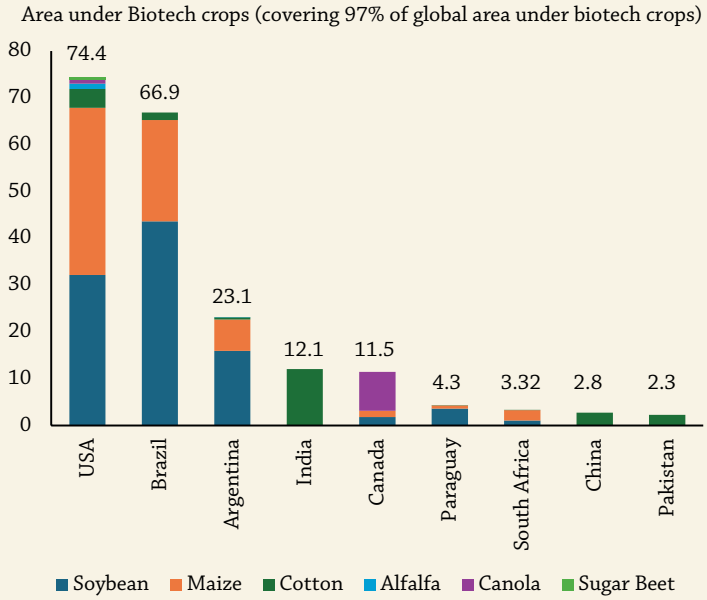
In 2023, 27 countries planted biotech crops on 206.3 Mha. The top five countries accounted for 91.1 per cent of the global biotech crop area, with three developing nations—Brazil (66.9 Mha), Argentina (23.1 Mha), and India (12.1 Mha)—and two industrialised nations—the United States (74.4 Mha) and Canada (11.5 Mha) (Figure 2.2). Within the Asia-Pacific region, India had the largest area dedicated to biotech crops, with 12.1 Mha of cotton, followed by China[1] (2.8 Mha) and Pakistan (2.3 Mha of cotton). In Africa, the number of countries cultivating GM crops doubled from three in 2018 to six in 2019, with further expansion likely. Emerging nations like South Africa and Sudan have adopted biotech crops, with South Africa plant-

1. Cotton in China is grown only in three regions – Xinjiang, Yellow River region, and Yangtze River region.

FIGURE 2.1
Countries Approving GM Crop Cultivation

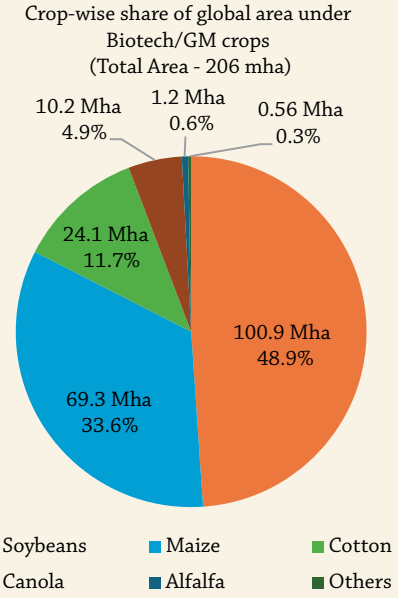
Source: ISAAA, 2024.

FIGURE 2.2
Area Under Biotech Crops



Source: AgbioInvestor GM Monitor, 2025.

FIGURE 2.3
Major GM Crops Under Cultivation



Source: AgbioInvestor GM Monitor, 2025.

ing 3.32 Mha (maize, soybeans, cotton) and Sudan cultivating 196,000 hectares of IR/Bt cotton.

A breakdown of global GM crop adoption reveals significant trends in crop preferences. The primary biotech crop globally is soybean that accounts for 48.9 per cent of the total biotech crop area (206.3 Mha). Following soybean, maize occupies 33.6 per cent area, cotton 11.7 per cent and canola is planted in 4.9 per cent of the area (Figure 2.3). These four crops dominate the GM crop landscape (AgbioInvestor, 2025).

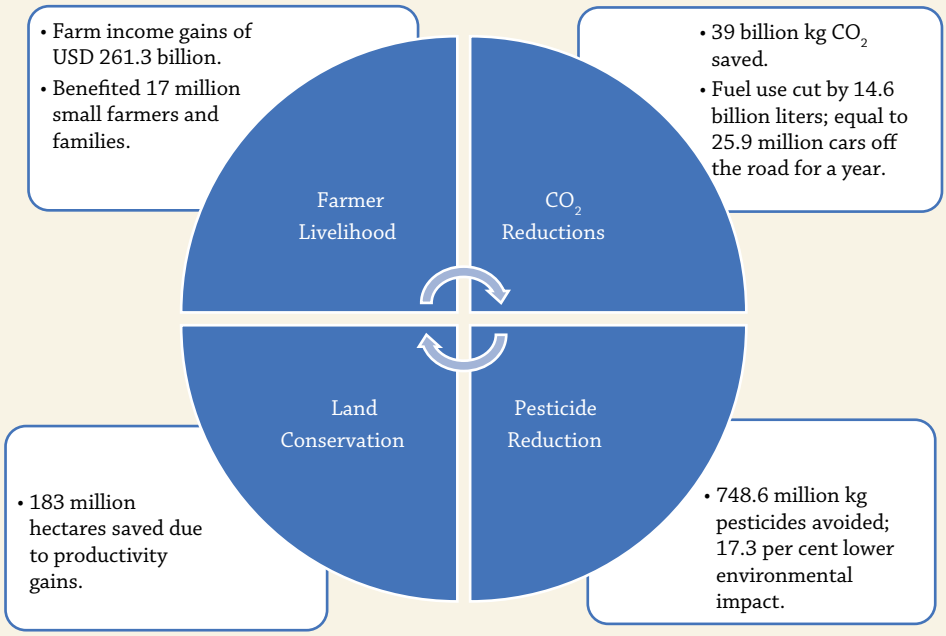
Despite the widespread adoption of GM crops globally, India is slow in approving new biotech events. The country has granted approval for Bt cotton which is the only GM crop approved for cultivation. The last approval for a GM crop in India was in 2006, marking a stagnation in the regulatory process. India has not approved any GM food crops for cultivation, despite the growing global trend and the benefits of biotech crops for food security and agricultural sustainability. This regulatory delay is in contrast to countries like Brazil, Argentina, and the USA that have made significant strides in expanding the range of approved GM crops.

Impact of GM Crops: Economic and Environmental Gains

Biotech crops have an impact on global agriculture by addressing food security, sustainability, and climate change challenges. Since their introduction, they have increased crop productivity by USD 261.3 billion, translating to an average income boost of USD 112 per hectare for farmers. The higher productivity of these crops has conserved 183 Mha of land, preserving biodiversity by reducing the need to convert natural habitats into farmland. Biotech crops have contributed to a healthier environment by preventing the release of 748.6 million kilograms of active ingredient pesticides into ecosystems and have reduced CO_2 emissions by 39 billion kilograms. This is equivalent to removing 25.9 million cars from the road for a year. These advancements have uplifted the livelihoods of over 17 million small-scale farmers and their families, benefiting more than 65 million of the world's poorest people. Biotech crops exemplify the potential of innovation in achieving a sustainable and equitable agricultural future (ISAAA, 2024).

FIGURE 2.4

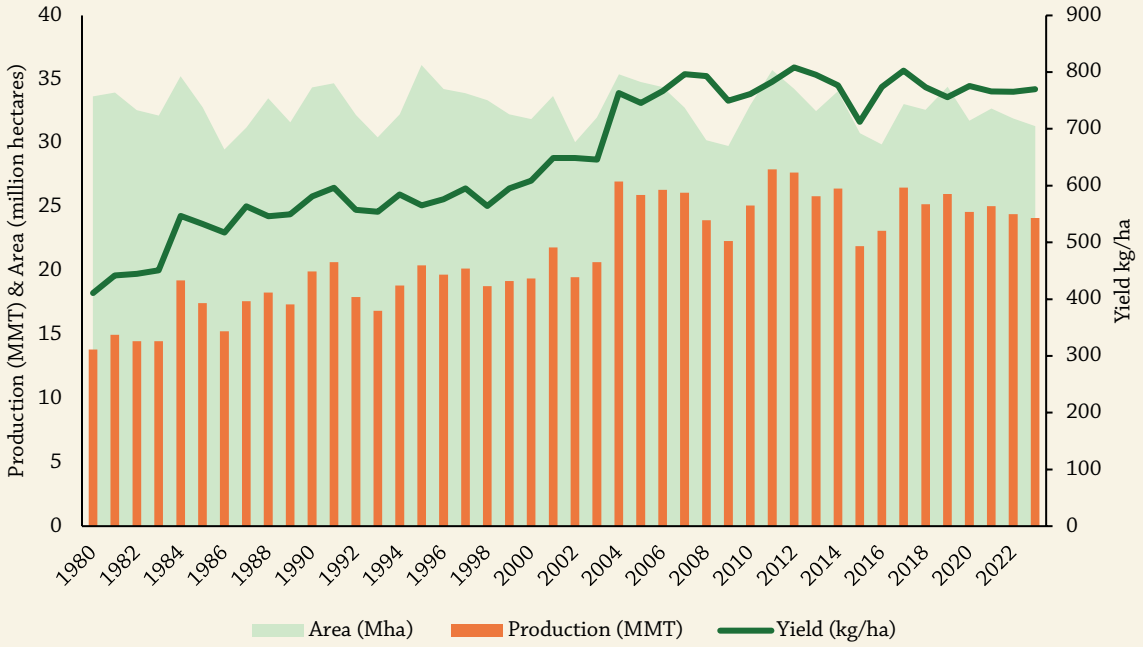
Economic and Environmental Contributions of Biotech Crops: 1996 – 2020



Source: ISAAA, 2024.

FIGURE 2.5

Global Trends in Cotton: Area, Production, and Yield



Source: ICAC.

The remarkable achievements of biotech crops in enhancing agricultural productivity and sustainability pave the way for a deeper exploration of their impact. However, this report examines introduction of Bt cotton and its transformative effect on cotton farming in various countries, with an emphasis on India. The following sections are essential for understanding the global landscape of Bt cotton and the specific dynamics of cotton production in India.

2.3 Global Scenario of Cotton Production

Cotton, often referred to as "white gold," is a cornerstone of global agriculture, serving as a vital raw material for the textile industry and is a significant contributor to rural economies. Global cotton production has witnessed reasonable increase in production from 13.8 MMT in 1980 to 24.1 MMT in 2024[2]. However, there has been a decline from its peak of 27.9 MMT during 2011 and 2012, due to increasing unfavourable weather patterns, rising labour costs, competition from synthetic fibres, and a rise in pest infestation in major cotton producing nations over the years. Cotton yields have also shown considerable jump from 410.86 kg/ha in 1980-81 to 770 kg/ha in 2023-24. This reflects technological advancements, particularly the adoption of GM cotton. Over the 44-year period from 1980 to 2023, the global cotton area averaged 32.8 Mha. The highest recorded acreage was 36 Mha in 1995. Cotton area remained relatively stable at around 34 Mha during the late 1980s and late 1990s. More recently, global acreage stood at 31.3 Mha in 2023-24, reflecting a slight decline from the 32.7 Mha recorded in 2021-22 (Figure 2.5).

Country wise analysis show that globally, six countries China, India, USA, Brazil, Pakistan, and Australia — dominate cotton production, accounting for 80 per cent share. Of these China is the largest producer with a share of 24 per cent, followed by India (22 per cent); USA (13 per cent), Brazil (11 per cent), Pakistan (5 per cent), and Australia (5 per cent) during TE 2023-24 (Figure 2.6).

2. Note: 1 MMT = 5.8 Bales of 170 kg each.

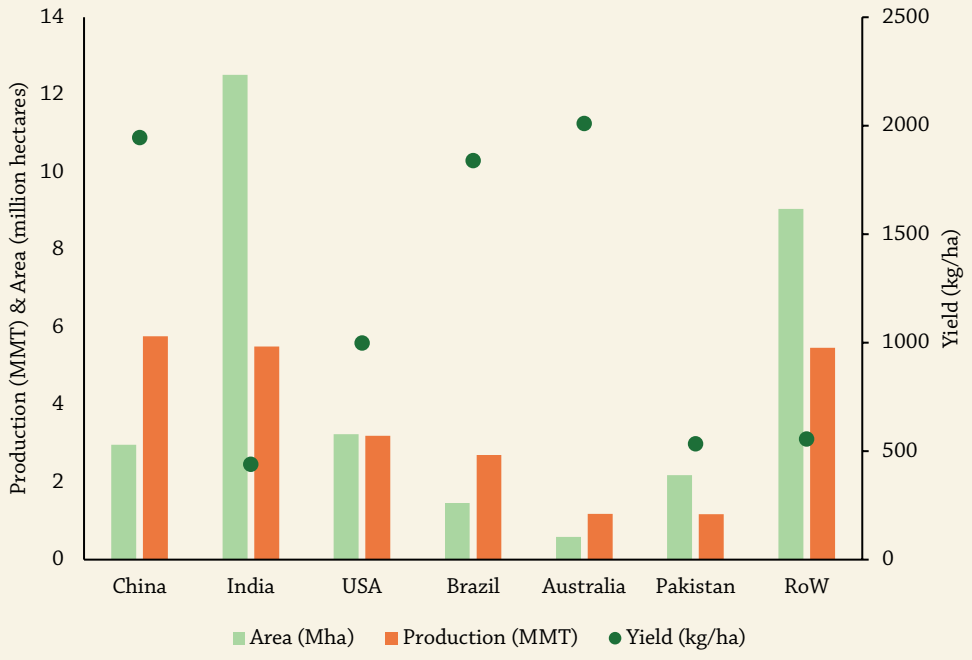
The global area under cotton cultivation is 31.9 Mha (TE 2023-24), with India accounting for the largest share. India has 12.6 Mha of land under cotton cultivation, contributing to 39 per cent of global cotton acreage in TE 2023-24. It is followed by the USA (10 per cent), China (9 per cent), Pakistan (7 per cent), and Brazil (5 per cent), respectively. However, there is a significant disparity in yield between countries, driven by varying levels of mechanisation, irrigation, adoption of new seed varieties, and pest management capabilities. While China and India lead the world in cotton production, Australia has led in yield for the past 20 years. Australia's cotton yield is 2010 kg/ha for TE 2023-24. Optimal water management is one of the key factors that resulted in significant yields in Australia (Cotton Australia, n.d.).

China presents a classic example of a smallholder economy that successfully more than doubled its cotton yield, rising from 761 kg/ha in TE 1990-91 to 1,945 kg/ha in TE 2023-24, marking a 61 per cent increase. In contrast, India's cotton yield grew from 276 kg/ha in TE 1990-91 to only 435 kg/ha in TE 2023-24. Despite both India and China achieving a 90-95 per cent adoption rate of GM cotton—the two largest cotton-producing countries—the gap in yield growth is striking. China's impressive yield improvement is attributed to genetic advancements and enhanced farming practices. The country has approved GM cotton cultivation across three agroecological zones: Xinjiang, the Yellow River Basin, and the Yangtze River Basin (USDA, 2023).

Brazil, too, has seen remarkable improvements in cotton yield, rising from 342 kg/ha in TE 1990-91 to 1,839 kg/ha in TE 2023-24. This more than five-fold increase is largely due to the adoption of advanced agricultural practices and technological innovations in high-tech seeds, fertilisers, and land use. Precision agriculture tools such as georeferencing, soil mapping, and targeted pesticide through sprayers and drones, have minimised losses and improved input use efficiency while mechanical harvesting has improved cotton collection and reduced fibre contamination (Cotton Brazil, 2022). Brazil leads the world in cotton yields in non-irrigated areas, with the Brazilian Cotton

FIGURE 2.6

Major Cotton Producing Countries in TE 2023-24



Source: ICAC (various issues).

Producers Association estimating that up to 92 per cent of the country's cotton production comes from rainfed areas. The use of technology in Brazilian agriculture has also enabled 60 per cent of cotton-planted areas to support a second crop within the same agricultural year (USDA, 2024).

2.4 Gene Revolution in Indian Agriculture

India is unique in being the only country that cultivates all four species of cotton: *Gossypium arboreum* and *G. herbaceum* (Asiatic cotton), *G. barbadense* (Egyptian cotton), and *G. hirsutum* (American upland cotton) (Directorate of Cotton Development, 2009). Additionally, India has the largest area under cotton cultivation in the world, covering 12.6 million hectares in 2023-24, with around 36 per cent of this area irrigated and the remainder rain-fed (Ministry of Textiles, 2018). This as well as the following sections explore the evolution of Bt cotton in India. It highlights the Gene Revolution and its impact, estimating the financial gains from Bt cotton in terms of higher incomes, as well as the broader economic benefits for the country through net foreign exchange earnings from cotton trade. These sections address the challenges, concerns, and controversies surrounding Bt cotton, along with the way forward.

According to the Directorate of Cotton Development (DCD), Government of India (2017), partition in 1947 led to imbalances in demand and supply of cotton and made India dependent on imports for years. A large portion of the irrigated cotton growing areas went to Pakistan, while most of the mills (90 per cent) remained in India (Directorate of Cotton Development, 2017). In 1950-51, India introduced special schemes through successive five-year plans aimed at increasing the area under cotton cultivation and sowing hybrid varieties.

In the 1970s, when insecticide use began in India, bollworm and whitefly were considered minor pests in cotton cultivation. However, over time, the vulnerability of cotton crops to these pests, along with others like jassids and aphids, grew significantly, and infestations became a major challenge. The resulting yield losses led to the widespread and indiscriminate use of highly toxic pesticides. By the 1990s, about 40-50 per cent of the total pesticide usage in the country was directed solely at cotton crops. This escalating crisis led to frequent crop failures, decline in production, ongoing bollworm infestations, declining yields, and an increasing reliance on imports. The unchecked use of fertilisers and pesticides led to the development of resistance in bollworm populations, which caused massive pest outbreaks and had severe ecological and human health consequences.

To protect farmers from these recurring losses, on March 26, 2002, Prime Minister Atal Bihari Vajpayee approved the commercial use of Bt cotton through the GEAC, established by the Ministry of Environment and Forests. The first Bt cotton hybrids, developed by Mahyco-Monsanto Biotech (MMB)—a joint venture between Maharashtra Hybrid Seeds Company (Mahyco) and Monsanto—were released following GEAC's approval. These hybrids incorporated the cry1Ac Bt gene, owned by Monsanto and licensed to MMB. This made India the 16th nation to commercialise transgenic cotton seeds. In an inaugural speech at IIT Kanpur on October 1, 2003, Prime Minister Vajpayee stated, "The next big revolution that is unfolding in the world is the biotechnology revolution. This is going to touch the lives of ordinary people in ways that we cannot even fully imagine today. We must not lag behind others in this revolution. India should aspire to be one of the leaders of this revolution. We must plant its healthy saplings in different parts of the country so that we can reap their fruits soon" (Government of India, 2003).

Since then, GEAC has approved six biotech events expressing different versions of cry genes, such as Bollgard I (MON531) in 2002, which carried the cry1Ac gene, and Bollgard II (MON15985) in 2006, which incorporated both cry1Ac and cry2Ab genes. Both were developed by Mahyco-Monsanto. Bollgard II offered enhanced resistance against the Spodoptera caterpillar, contributing to higher yields. These innovations solidified Bt cotton as a dominant force in India's cotton sector, improving yields,

TABLE 2.1

Bt Cotton Varieties in India

Name/Variety & Event Name	*Year Approved*	*Developer*	*Genes Introduced*	*Traits*
Bollgard I – MON531	2002	Mahyco Monsanto	cry1Ac	Resistance to bollworms.
Bollgard II – MON15985	2006	Mahyco Monsanto	cry1Ac, cry2Ab	Enhanced resistance to a broader range of bollworms.
Cry1Ac – Event 1	2006	JK Agri Genetics	cry1Ac	Resistance to bollworms.
Cry1Ab and Cry1Ac – GFM	2006	Nath Seeds	cry1Ac, cry2Ab, nptll, uidA	Resistance to bollworms.
Cry1C – Event MLS 9124	2009	Metahelix Life Sciences Pvt. Ltd	cry1C, nptll	Resistance to bollworms.
HtBt Cotton Variants	Not approved but illegal cultivation in some regions.	–	–	Combines pest resistance with herbicide tolerance.

Source: ISAAA, 2025.

pest resistance, and overall crop resilience. In 2006, GEAC also approved additional biotech events: Cry1Ac – Event 1, developed by JK Agri Genetics Seeds Ltd.; Cry1Ab and Cry1Ac – GFM, developed by Nath Seeds (sourced from China); and Cry1C – Event MLS 9124, developed by Metahelix Life Sciences Pvt. Ltd.

Impact of Bt Cotton in India

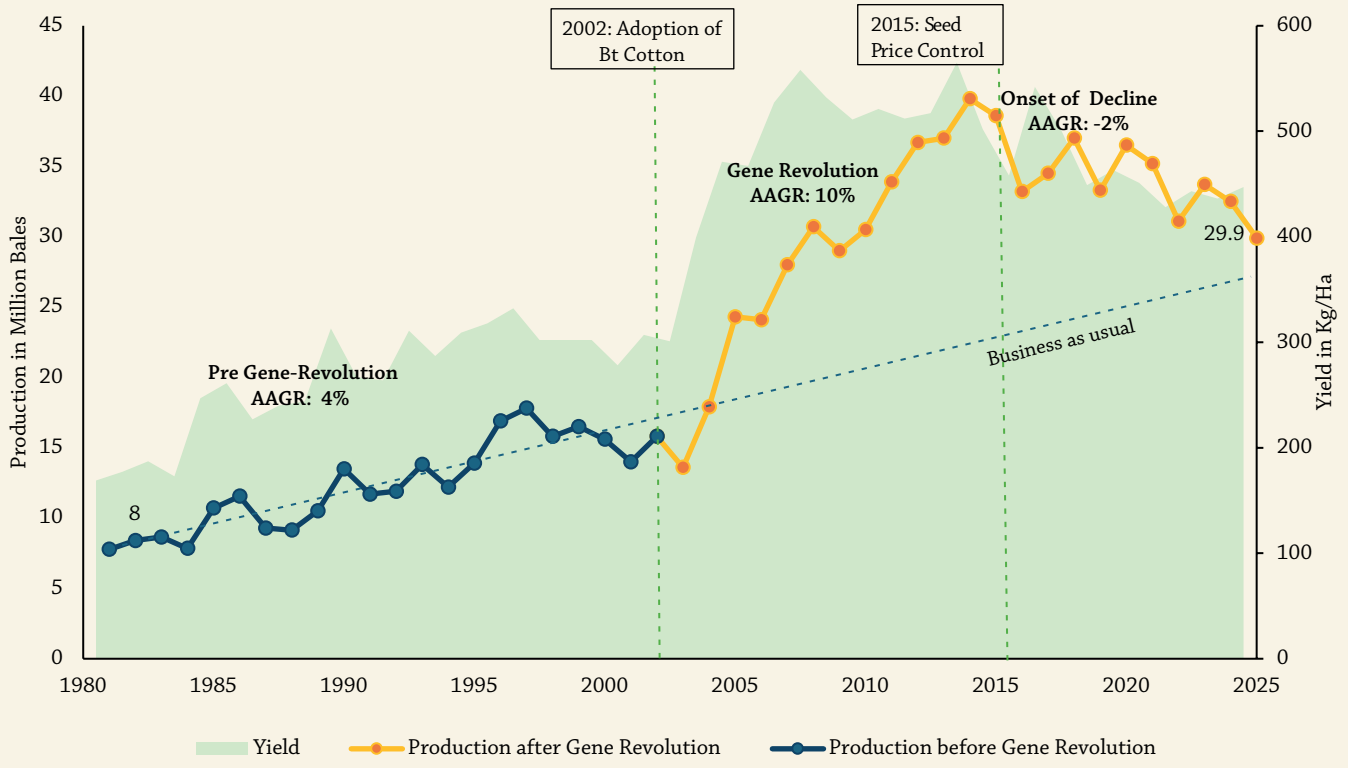
The accelerated transfer of Bt technology among farmers and coordinated development efforts by the Government and private companies transformed the cotton value chain and drove the success of innovative technology and policy in the form of the "Gene Revolution". Despite policy and regulatory oppositions and uncertainties, farmers across the key cotton growing states aggressively adopted Bt cotton, as it benefitted millions through increased production and yield, reduced pesticide use and vulnerability.

The commercial adoption of Bt cotton in 2002-03 resulted in a remarkable increase in cotton production, rising from 13.6 million bales in 2002-03 to 39.8 million bales in 2013-14, a 193 per cent rise. The AAGR during this period was 10 per cent, compared to just 4 per cent before Bt cotton introduction. By 2006-07, India surpassed the USA to become the second-largest cotton producer, and by 2013-14, it overtook China to become the world's largest producer (Directorate of Cotton Development, 2017). The area under cotton cultivation grew by 56 per cent, from 7.6 Mha in 2002-03 to 11.9 Mha in 2013-14, while yields improved by 88 per cent, from 302 kg/ha to 566 kg/ha (Cotton Corporation of India Ltd., 2016-17). As a result, India transitioned from being a net importer of cotton between 1998-99 and 2004-05 to a net exporter in 2005-06. India's raw cotton exports soared from a modest 0.09 million bales to 12.9 million bales in 2011-12 and 11.7 million bales in 2013-14, marking a 130-fold increase in just 12 years (Cotton Corporation of India Ltd., 2016-17). This success can be attributed to the innovation of Bt cotton technology, sound policy decisions, access to critical infrastructure (irrigation, power, roads), foreign market opportunities, and the persistent efforts of the private sector to provide high-quality seeds since 2002-03.

However, following 2013-14, the growth in cotton production was arrested, with an average annual decline of 2 per cent from 2013-14 to 2023-24. By 2023-24, production had dropped to 32.5 million bales (Figure 2.7).

FIGURE 2.7

Production and Area of Cotton in India



Source: Authors' calculations using data from Cotton Corporation of India (CCI).

State-Level Scenario of Cotton Production

In India, cotton cultivation is concentrated in nine major states divided into three distinct agro-ecological zones based on their geographic and climatic conditions:

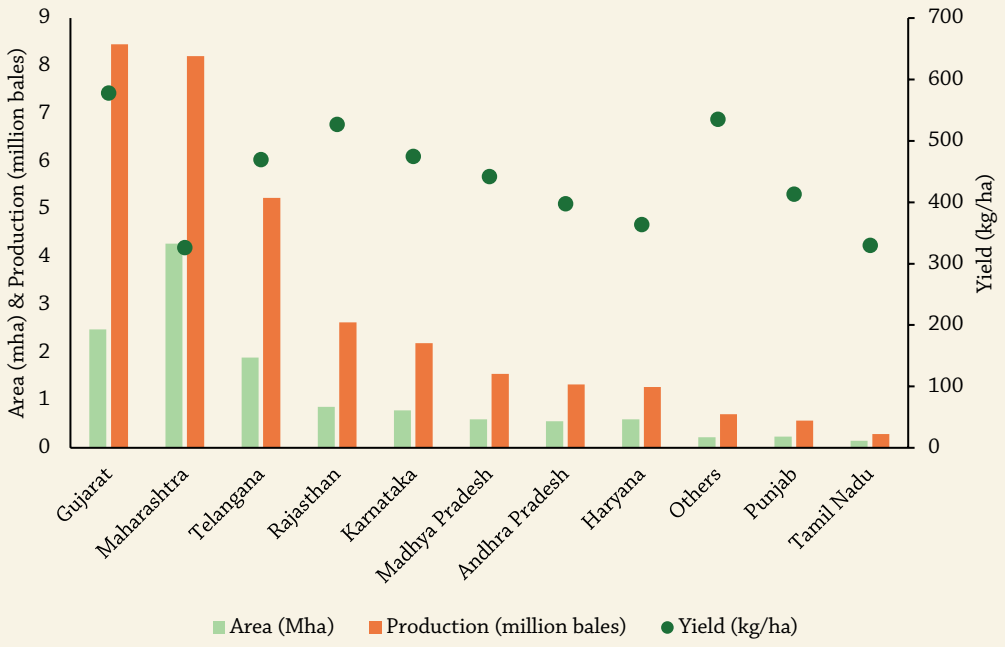
1. Northern Zone: Punjab, Haryana, and Rajasthan.
2. Central Zone: Gujarat, Maharashtra, and Madhya Pradesh.
3. Southern Zone: Telangana, Andhra Pradesh, and Karnataka.

Apart from these regions, cotton is grown in Odisha and Tamil Nadu.

In India, Gujarat, Maharashtra, and Telangana are the largest cotton-producing states. However, in terms of acreage, it is Maharashtra that tops the list, followed by Gujarat and Telangana (as of TE 2023-24) (Figure 2.8). In yield, Gujarat leads the country with a productivity of 578 kg/ha, followed by Rajasthan at 527 kg/ha and Karnataka at 475 kg/ha—well above the national average of 435 kg/ha for TE 2023-24. Maharashtra, which has the largest area under cotton cultivation at 4.3 Mha, records significantly lower productivity at 326 kg/ha. This disparity is largely due to the limited irrigation coverage in Maharashtra, with only 2.7 per cent of its cotton crop being irrigated. In contrast, Gujarat (75.7 per cent) and Rajasthan (97.5 per cent) have far higher percentages of irrigated cotton areas (Agricultural Statistics at a Glance, 2023). Maharashtra, despite leading in cotton cultivated area (32 per cent in TE 2023-24), lagged in production efficiency, reflecting structural challenges such as dependency on rainfed farming, poor input management, and pest pressure. While Brazil, the largest cotton producer in rainfed climates, has thrived under similar conditions, it has successfully tackled these challenges through advanced strategies. Brazil has adopted high-tech seeds tailored to its environment, implemented no-till planting to reduce soil erosion and improve water

FIGURE 2.8

State Level Area, Production, and Yield: TE 2023-24



Source: Cotton Association of India.

retention, and embraced precision agriculture for better input management and pest control. Additionally, Brazil has incorporated bio-inputs for integrated pest management and used high-tech pesticide application systems (Cotton Brazil, 2022).

In recent years, India's cotton sector has been experiencing a decline in acreage, particularly in the northern cotton belt comprising Punjab, Rajasthan, and Haryana. In TE 2020-21, Punjab had the highest productivity in cotton in the country with 653 kg/ha. Repeated outbreaks of Pink Bollworm (PBW) have caused devastating losses, forcing many farmers to either reduce their Bt cotton cultivation area or abandon the crop altogether. Cotton growers in some villages in Mansa, Fazilka and Bathinda are replacing the cotton crop in their fields with paddy (Hindustan Times, 2024). The pest attacks have undermined state-led crop diversification initiatives in Punjab and Haryana, which sought to promote cotton as a less water-intensive alternative to paddy.

The national average yield grew from 274 kg/ha in TE 1990-91 to 435kg/ha in TE 2023-24. Maharashtra and Gujarat account for 60 per cent of India's cotton cultivation area (Figure 2.8), making them the leading producers. The productivity of these two states differs significantly due to irrigation disparities. Maharashtra, where only 2.7 per cent of the cotton crop is irrigated, relies on rainfed agriculture, resulting in persistently low yields and farmer distress. Despite a larger area under cotton cultivation, Maharashtra's yield remains half of that of Gujarat, due to poor irrigation infrastructure and water management practices. Gujarat benefits from higher irrigation coverage and better farming practices, achieving higher production. Maharashtra can take valuable lessons from Brazil, which leads the world in cotton yields in rainfed areas, demonstrating remarkable improvements despite lower rainfall. For instance, the main cotton-producing state of Mato Grosso in Brazil received an annual rainfall of 1,981 mm in 2023 (USDA, 2023), compared to Maharashtra's cotton-growing regions, Marathwada and Vidarbha, which received 677 mm and 1,102 mm, respectively, in the same year (Agriculture Statistics, 2023).

Role of Irrigation in Cotton Cultivation: Case of Maharashtra

Cotton cultivation requires four to six irrigations, depending on the soil type and rainfall conditions. The first irrigation, typically applied 4-6 weeks after sowing, is crucial for root establishment. Irrigation at 2–3-week intervals ensure optimal growth, particularly during the flowering and fruiting stages. A final irrigation can help hasten boll opening, facilitating timely harvest. Water stress can lead to significant shedding of flowers and bolls, drastically reducing yield.

The ICRIER-NABARD Report (2018) highlights that water productivity in cotton cultivation varies significantly across India. The national average Physical Water Productivity (PWP)—the amount of cotton produced per unit of water—is 0.46 kg/m^3, but regions with better irrigation infrastructure achieve up to 0.57 kg/m^3, demonstrating the role of irrigation efficiency in yield improvements. Tamil Nadu leads with a PWP of 0.87 kg/m^3, followed by Gujarat, Punjab, and Andhra Pradesh. From an economic standpoint, Economic Water Productivity (EWP)—which factors in water use, production, and farm prices—also varies widely. Tamil Nadu achieves the highest EWP at INR 26.17/m^3, followed by Haryana and Punjab at INR 24.13/m^3, owing to higher productivity and favourable market prices.

It is worth mentioning that Maharashtra which holds the largest acreage under cotton cultivation (4.3 Mha), faces the challenge of lowest yield (326 kg/ha) in the country. This due to the limited irrigation coverage in Maharashtra - only 2.7 per cent of its cotton crop is irrigated. Given that Maharashtra currently has a relatively low irrigation ratio, there is a pressing need to implement cost-effective irrigation solutions that can significantly improve agricultural output. One such solution is the adoption of micro-irrigation technologies, like drip and sprinkler systems, which can optimize water usage and boost cotton productivity. As per the empirics, drip irrigation achieves over 95 per cent water use efficiency compared to 60 per cent in traditional systems. When combined with fertigation (a method of delivering soluble fertilisers through the irrigation system), even nutrient use efficiency can reach upto 90 per cent. A program such as "DRIP in Cotton" could be incentivised to encourage farmers to adopt these technologies (Sankaranarayanan et al., 2010).

An evaluation in Aurangabad district showed that adopting drip irrigation increased cotton productivity by 29.5 per cent while reducing water use by 38 per cent. Additionally, drip irrigation saved 228.03 HPh/ha of water and reduced electricity consumption by 171.03 kWh/ha compared to flood irrigation (Ajgaonkar & Patil, 2018). Another study by Bhaskar et al. (2005) reported yield improvements of 5-10 per cent due to micro-irrigation adoption in Maharashtra. An in-depth assessment conducted by ICAR-National Institute of Agricultural Economics and Policy Research (2019) examined the efficiency of micro-irrigation systems (MIS) across various crops in Maharashtra. The study found that adopters of MIS saw an 18.64 per cent increase in cotton yields, alongside notable reductions in chemical and pesticide costs, which varied between 5.08 per cent and 50 per cent. These findings underscore the economic and environmental benefits of micro-irrigation, particularly in water-stressed regions.

Despite this strong evidence supporting micro-irrigation, adoption rates remain low. In Maharashtra, only 11.2 per cent of the crop area (all crops) is under micro-irrigation, whereas Karnataka fares at 21.6 per cent (PIB, 2024). These figures highlight the untapped potential of water-efficient irrigation methods in improving agricultural productivity and sustainability, particularly in water-stressed regions.

Estimated Gains in Production Post Introduction of Bt Cotton

The period between 2003-04 (soon after the introduction of Bt cotton in 2002) and 2023-24 is considered to assess production gain. Using the data from 1980-81 to 2002-03, and applying minimised least squared distances with a linear trend, production estimates in a business-as-usual (BAU) production scenario are calculated. The difference between actual

production and production in case of BAU scenario is reported as the gain. According to calculations, if Bt cotton was not adopted in 2002 in India, the cumulative production between 2003-04 and 2023-24 in a BAU scenario would have been 411.3 million bales of 170 kg each. Whereas, the actual production during the same period is 622 million bales. A cumulative gain of 210.7 million bales was achieved, which is attributed to the technology adoption. The estimation method does not involve any rigorous econometric modelling to ascertain the exact contribution of the technology towards the production boom, it is clear from the production data that after 2002-03, there is a jump in production of cotton that was not observed between 1980-81 and 2002-03. Brookes and Barfoot (2018) estimated that India enhanced farm income from Bt cotton by USD 21.1 billion in the 13-year period 2002 to 2016, and USD 1.5 billion in 2016 alone.

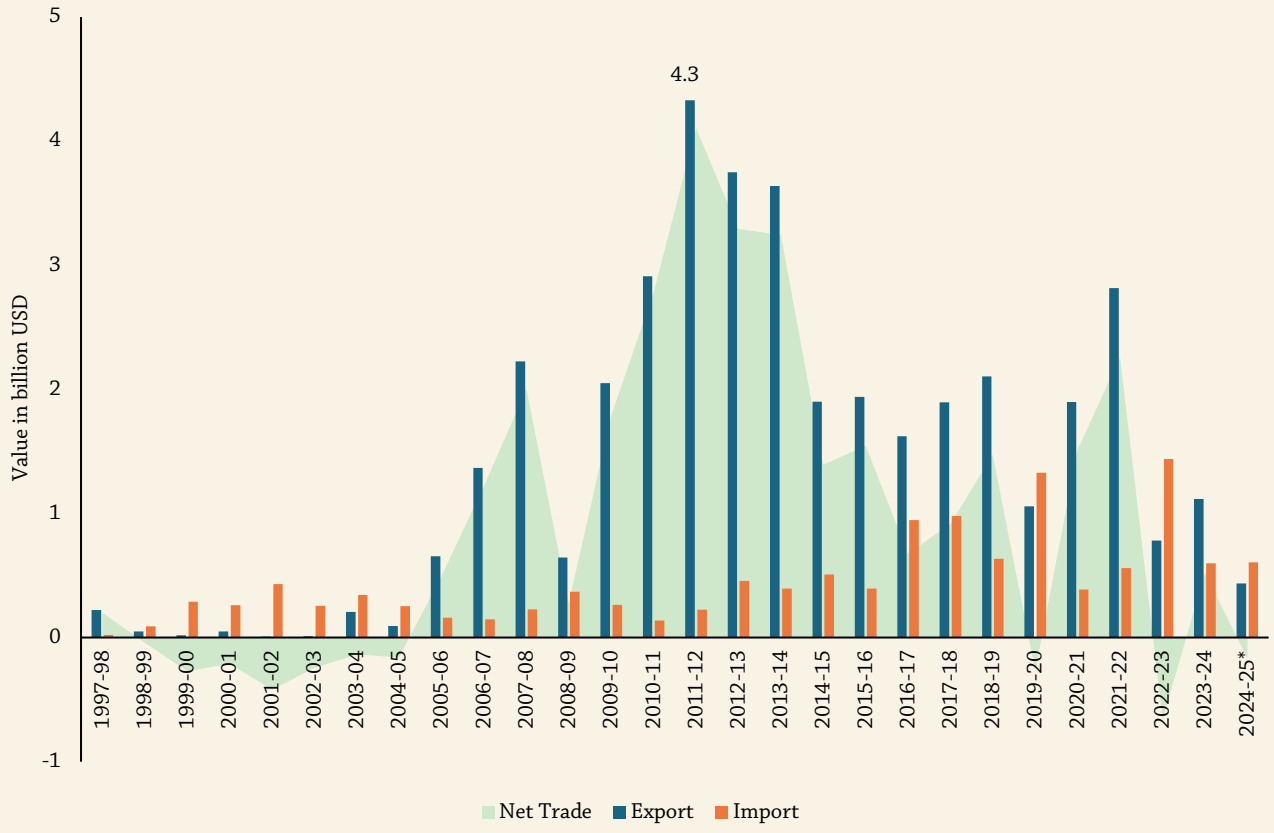
Export Gains Post Introduction of Bt Cotton

With increased production of raw cotton, India became a significant net exporter of cotton (Figure 2.9). Top cotton export destinations in 2023-24 are Bangladesh (57 per cent), Vietnam (15 per cent), and China (10.8 per cent). India transitioned from a net importer to a leading exporter within a decade. In the late 1990s India was a net importer, but this changed post-2005 as production surged allowing the country to become a net exporter. By 2013, net exports peaked at 10.5 million bales (170 kgs), valued at USD 3.3 billion. The period of increase in export of raw cotton overlaps with the years of increasing cotton production.

India's raw cotton export performance has declined significantly since 2013-14, when exports peaked at 11.7 million bales (170 kg each). By 2023-24, exports had dropped to 2.8

FIGURE 2.9

Trend in India's Cotton Trade: 1997-2025



Source: DGFT (various issues).

million bales, reflecting a broader downward trend. Net exports, which peaked at 10.5 million bales in 2013-14, have also steadily declined, shrinking to 1.3 million bales in 2023-24. Over the past five years, India's average imports of raw cotton stood at 2.6 million bales annually whereas exports stood at 4.2 million bales.

The latest USDA report (December 2024) projects a significant shift, with India projected to become a net importer of raw cotton for the first time in two decades. For FY 2024-25, exports are estimated at just 1.5 million bales, while imports are projected at 2.6 million bales. This shift poses serious implications for India's position in the global raw cotton trade, marking a departure from its long-standing role as a net exporter.

India, as the second-largest consumer of cotton, contributed to 21 per cent of global consumption in TE 2023-24. However, with high domestic consumption and increasing production challenges, the nation's raw cotton trade is entering a critical phase, as reflected in the recent projections for FY 2024-25.

In 2020-21, India briefly became the third-largest exporter of cotton, contributing 13 per cent to global exports of 10.7 MMT. India has been unable to maintain this position. Several factors contributed to the surge in exports during 2020-21. Domestic consumption weakened due to COVID-19, leading to reduced demand by apparel manufacturers. The Cotton Corporation of India's (CCI) procurement in 2019-20 was at a record high of 10.5 million bales, with a closing stock of 12 million bales. This created a massive exportable supply. Indian ex-gin prices remained 8-10 cents (5.93 INR – 7.43 INR) lower than the Cotlook A-Index, making Indian cotton competitive in international markets. This price advantage was enhanced by the depreciation of the Indian Rupee against the US Dollar (from 73.2 to 74.2 INR/USD) and a rise in global cotton prices during the same time leading to a rise in demand for Indian cotton in international markets (USDA, 2020; Cotton Outlook, 2020).

The remarkable economic contributions of Bt cotton, from its significant role in bolstering exports to its impact on production gains, underscore its transformative potential. These achievements must be viewed against the backdrop of a stagnating trajectory. While Bt cotton revolutionised India's cotton sector, the subsequent years reveal a slowdown that demands attention.

From a Revolution to a Decline

Bt cotton which is acclaimed as a transformative innovation is now struggling with pest resistance, stagnant yields, and limited technological upgrades. Since 2014-15, production of cotton is declining at an AAGR of 2 per cent while cotton yields have dwindled to around 435 kg/ha in TE 2023-24 — far below other countries' yields such as China 1945 kg/ha, Australia 2010 kg/ha and Brazil 1839 kg/ha. Even the latest estimates for FY 2025 released by the Ministry of Agriculture, projected cotton production at 29.9 million bales of 170 kilograms — the lowest ever during the decade (2015-16 to 2024-25). This poses a significant risk to India's raw cotton trade. While India has been a net exporter of cotton since 2005-06 and the second-largest consumer globally, the declining production levels threaten its ability to meet domestic consumption demand and maintain its export position.

Bt cotton was hailed as a solution to India's pest woes, particularly against the American bollworm. However by 2008, signs of resistance in the pink bollworm (PBW) were evident (Mohan, Ravi et al., 2015). PBW has evolved into a formidable adversary, with widespread infestations reported in Maharashtra, Punjab, and Rajasthan by 2023. An outbreak of PBW in Maharashtra during the 2017-18 cotton season highlighted the growing resistance problem.

The pest's lifecycle exacerbates its impact. Infesting the cotton bolls from within, PBW remains elusive during the early stages, rendering traditional pesticide applications ineffective. Unlike the American bollworm that causes up to 40 per cent yield losses, PBW damage can exceed 100 per cent of a farmer's investment, including the additional costs of replanting and land preparation (Nitnaware, 2023).

PBW resistance in Bt cotton is due to poor pest management practices. Many farmers

ignored the refuge strategy, a critical measure to delay resistance development. The cultivation of long-duration Bt cotton hybrids provided a continuous food source for PBW, accelerating resistance. Practices like ratooning and extended crop cycles increased pest pressure. Use of unauthorised and low-quality Bt seeds contributed to the loss of pest resistance. These factors combined have reduced the effectiveness of Bt cotton against PBW (ISAAA, 2018, Fand, Nagrare et al., 2019: Singh, Pathania et al., 2019).

Farmers' challenges with stagnant yields and rising labour costs have led to the widespread, illegal adoption of HtBt cotton that allows herbicide use for weed control. In 2017, the Field Inspection and Scientific Evaluation Committee found that 15 per cent prevalence of unapproved Ht cotton in major states like Andhra Pradesh, Telangana, Maharashtra and Gujarat, and about 5 per cent in Punjab. By 2023, HtBt cotton covered nearly 20 per cent of India's cotton acreage, despite lacking regulatory approval (FSII, April 2022). This unregulated spread has several implications. Environmentally, excessive herbicide use, and unapproved traits pose risks to soil health and biodiversity.

The decline of India's cotton revolution can be traced back to two critical factors that stifled its growth and innovation. First, 2006 marked the last approval of GM technology in the form of Bollgard II, while the global cotton industry has since advanced with newer versions featuring stacked traits, such as Bollgard 3 XtendFlex, which combines Bt resistance with herbicide tolerance. Meanwhile, India stagnated. Second, the introduction of cotton seed price controls in Andhra Pradesh in 2006, followed by their nationwide implementation in 2015, further exacerbated the situation. Seed companies that had invested years of research to develop new varieties were left vulnerable. Developing proprietary Bt genes is an expensive and lengthy process that requires substantial investment in both research and bio-safety regulatory compliance. The price caps have restricted the introduction of new traits and innovations. The result has been a clear stifling of progress—private investment in the sector has been discouraged, and companies have found it financially unfeasible to introduce the new, high-quality seeds needed to combat rising pest resistance. These strict price controls and regulatory measures have effectively strangled innovation, leaving the market vulnerable to unregulated and substandard solutions, while denying farmers access to the technological advancements needed to sustain the cotton revolution in India.

It is time for a new technological breakthrough in Indian cotton farming. Introducing advanced strategies and innovations is essential to improve crop yields or lower cultivation expenses, paving the way for a new cotton revolution, but this can not be achieved unless price controls on best seeds are removed.

2.5 Existing Regulatory Framework for GM Crops in India

India's regulatory framework for GM crops has struggled to keep pace with the evolving agricultural needs. The framework was established under the Environment Protection Act of 1986, with the GEAC as the apex regulatory body. The GEAC, operating under the Ministry of Environment, Forest, and Climate Change (MoEFCC), under 'Rules for Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells 1989', oversees the approval of GM crops for environmental release and cultivation. The regulatory system includes multiple authorities, such as the Institutional Biosafety Committees (IBSC), Review Committee of Genetic Manipulation (RCGM), State Biotechnology Coordination Committee (SBCC), and District Level Committee (DLC), each responsible for different aspects of GM crop regulation. Refer to Annexure Table 2.2 for an overview of the roles of various authorities in regulation of GM crops in India.

Complementing this is the Food Safety and Standards Authority of India (FSSAI) which regulates GM foods under the Food Safety and Standards Act of 2006. While MoEFCC and GEAC handle the environmental and agricultural dimensions, FSSAI ensures the safety of GM-derived foods intended for human consumption.

Despite its rigor, this regulatory framework is a bottleneck for technological progress in Indian agriculture. Approvals for new GM traits, such as HtBt cotton, have been delayed or withheld, creating a vacuum that unregulated and illegal seed markets have filled.

India's regulatory framework must evolve to address these gaps. Streamlined approval processes, transparent decision-making, and better enforcement against illegal seed proliferation are essential for restoring the sector's growth trajectory. A robust and responsive regulatory system enables farmers to access cutting-edge technologies, ensuring productivity gains and environmental sustainability.

Investments, Intellectual Property, and the Cost Involved

Private sector involvement in the cotton seed market was encouraged by policy reforms, such as the New Policy on Seed Development (1988) and the New Industrial Policy (1991), which opened the industry to private participation. The 1990s economic liberalisation—through the removal of industrial licensing and the relaxation of foreign direct investment (FDI) restrictions—enabled foreign companies to enter India's seed industry. Since 2002, the private seed industry has expanded rapidly, focusing on developing hybrid crops and licensing biotech traits, particularly for Bt cotton, which transformed India's cotton sector (Gulati, Ferroni & Zhou, 2018).

Global agribusiness giants such as Monsanto, Syngenta, Bayer, DuPont, BASF, and Dow collectively invested USD 7.3 billion in agribusiness R&D between 2010 and 2015, amounting to 10 per cent of their total agribusiness sales. The R&D expenditure by these six firms grew at a compound annual rate of 6.6 per cent between 2002 and 2015, underscoring the private sector's commitment to agricultural innovation. In contrast, public sector investments in India remain significantly lower. For instance, in 2014-15, the Indian Council of Agricultural Research (ICAR) allocated INR 48.4 billion (USD 0.8 billion) for agricultural research and education, whereas Monsanto alone spent USD 1.73 billion on agri-R&D in 2014—nearly USD 1 billion more than the entire Indian central government's research budget for agriculture (Gulati, Ferroni & Zhou, 2018).

It is important to note that private companies would actively invest in long-term agri R&D and bring innovative seeds and technologies on the table as long as they are incentivised and protected legally through transparent Intellectual Property Rights (IPR) laws.

Until 2005, Mahyco-Monsanto Biotech dominated the market for cotton hybrids, either directly through the sale of hybrid seeds or indirectly via sublicensing agreements with private seed companies. Indian seed companies that licensed the Bt trait from MMB were required to pay a one-time licensing fee as well as ongoing royalties for access to the gene However, National Seed Association of India (NSAI), the industry lobby body, had urged the government to address the high cost of Bt cotton seeds, which they believed could limit access to this technology for resource-poor farmers (The Economic Times, 2015). Responding to these concerns, in 2006, the state of Andhra Pradesh under the then Chief Minister Y.S. Rajasekhar Reddy imposed a price ceiling of INR 750 per packet (including the technology fee) on Bt cotton seeds. Other states across India subsequently followed suit, implementing similar price caps.

In 2015, the Government of India issued a Cotton Seed Price Control Order (SPCO) via a gazette notification under Section III of the Essential Commodities Act 1995. The order set the Maximum Sale Price (MSP) for seeds, fixed licensing guidelines, and regulated seed value, including any royalties or trait fees. A March 2016 gazette notification reduced the price of Bollgard-II seeds from INR 905.5 to INR 800 per 450 grams, cutting the royalty from INR 186.95 to INR 49, lowering prices for farmers by 11.65 per cent and for domestic licensees by 74 per cent. In 2018, the price was further reduced to INR 740 per packet, with the trait value dropping from INR 49 to INR 39 per packet (Arora and Malik, 2019).

On May 18, 2016, the government issued another notification mandating GM technology licensing guidelines. This required licen-

sors to grant licenses to eligible seed companies within 30 days and capped trait fees at 10 per cent of the MSP for five years, with annual 10 per cent reductions thereafter. By 2020, the government eliminated the 10 per cent annual increase in trait fees, further limiting financial incentives for innovators.

For biotech firms, these price controls and mandatory licensing provisions represented a counter-IPR movement, directly challenging the IPR framework that traditionally incentivises innovation in agricultural biotechnology. IPR exist to reward R&D efforts by granting exclusive rights to innovators, allowing them to recoup their investment. However, by enforcing compulsory licensing and capping royalties, the government undermined the ability of biotech firms to recover R&D costs, discouraging further investment in new trait development. This served as a death blow to innovators. India is now left with poor quality seeds being multiplied by domestic players, and no wonder cotton productivity is falling.

It is important to recognise that developing proprietary Bt genes requires substantial investment in research and development (R&D), as well as bio-safety regulatory compliance, making the approval process both costly and time-consuming. For domestic seed companies, this has led to mixed outcomes. While price caps helped reduce licensing costs, they also limited the introduction of new traits, restricting companies' ability to diversify their offerings and remain competitive. For farmers, the benefits of lower seed prices were minimal and did little to accelerate the adoption of new technologies or improve overall welfare (Arora and Bansal, 2011).

Overall, challenges such as unfair government interference in private contracts, stringent price controls, and delays in technology approvals continue to hinder India's biotech-driven agricultural development. These strict measures have stifled innovation and discouraged private investment, while exacerbating concerns about GM crop adoption. Policymakers should act as enablers, not obstacles, to innovation, by streamlining processes and ensuring greater accountability within the private sector.

2.6 Controversy and Debate

The regulatory and licensing hurdles are a part of the broader debate surrounding GM crops in India. Bt cotton's success in India is accompanied by scepticism from NGOs and civil society, over enhanced sucking pest damage in Bt cotton; increase in secondary pests such as mired bugs and spodoptera; emergence of pests' resistance; environment and health implications in terms of toxicity and allergenicity; and farmers' exposure to greater risk of monopoly in seed business (Seetharaman, 2018; Kathage & Qaim, 2012).

However, most of these claims are largely unsubstantiated fears, shared by ideologues from across the political spectrum. Therefore, there is no scientific justification for rejecting the release of advanced Bt cotton seeds and other GM crops in India based solely on rumours and ideological beliefs.

To address the issue, a structured change in theory could play a key role (Reddy, 2024), wherein targeted solutions are provided that bridges the gap between stakeholder apprehensions and the benefits of GM technology. Ethical concerns are mitigated by enforcing strict biosafety protocols and promoting awareness campaigns to counter misinformation. Regulatory institutions such as GEAC should share all relevant information with stakeholders to dispel ambiguity and address the ongoing debates about the safety, efficacy, and adoption of GM crops in India. By addressing these concerns, GM crops can transition from a debatable issue to a cornerstone of India's agricultural future.

- *Stalled Progress of Advanced GM Traits:* After Bollgard II (containing two genes cry1Ac and cry2Ab), Mahyco-Monsanto Biotech (India) Limited (MMBL) introduced the next generation of Bollgard II with Roundup Ready Flex (RRF) and Bollgard III with additional pest-resistant proteins (containing three genes cry1Ac, cry2Ab and Vip3A), with Herbicide Tolerant (HT) RRF traits to protect crops from enhanced pest resistance. Due to widespread opposition by NGOs, political ideologues, and some domestic seed compa-

nies, these varieties were not released for commercial cultivation.

Bt cotton was introduced with a single gene, cry1Ac, but newer versions have stacked traits, combining Bt resistance with herbicide tolerance. Bollgard 3 XtendFlex, launched in Brazil in 2024, provides resistance to select insect pests and tolerance to multiple herbicides, including glyphosate, glufosinate, and dicamba.

Since the first planting of GM cotton in 1996, the USA has consistently increased its adoption of GM varieties, and by 2020, 96 per cent of the cotton area was GM. In 2000, about 26 per cent of total cotton acres were HT only, 15 per cent were Bt, and 20 per cent used stacked seeds. The share of cotton planted with stacked gene varieties has also grown steadily, rising from 20 per cent in 2000 to 86 per cent in 2023 (Dodson, 2020).

Brazil has emerged as a major player in GM cotton cultivation, with an adoption rate reaching 99 per cent. Brazil's adoption of GM cotton, including varieties with stacked genes, has significantly boosted the country's cotton production and exports. In Colombia, stacked gene varieties were introduced in 2007, and they make up the majority of cotton grown in the country today, with Bollgard and Roundup Ready being the traits approved for cultivation. Australia has seen near-total adoption of GM cotton, with 99.9 per cent of its cotton area planted with GM varieties since 2014. The dominant varieties in Australia are Bayer's Bollgard 3 XtendFlex, with a small proportion planted with Roundup Ready and Liberty Link varieties.

Thus, an unbiased re-examination of agriculture policy is required to address farmer concerns and provide them access rather than penalising them for being pro-technology.

- *Irony of GMOs in the Indian Food System:* India's reluctance to embrace advanced GMOs, despite clear evidence of their benefits, complicates the agricultural landscape. The cases of Bt Brinjal and GM Mustard illustrate the failures of the regulatory framework and highlight the hypocrisy of opposing GM crops domestically while relying heavily on imported GM-derived edible oils.

After cotton, Bt Brinjal remains under moratorium. Although the GEAC recommended its release for commercial cultivation, the Ministry of Environment and Forests halted it on safety grounds. Experts argue that the benefits of Bt Brinjal are significant, even with low adoption rates (Kumar et al., 2011). Studies show that a 15 per cent to 60 per cent adoption of Bt Brinjal led to substantial increases in brinjal production, savings on insecticide use, and higher net profits for farmers (Kumar et al., 2011). Unfortunately, while India delayed its adoption, Bangladesh moved forward with Bt Brinjal, enjoying reduced chemical use and improved farmer incomes.

Similarly, GM Mustard, although cleared by GEAC, is still awaiting approval for commercialisation. Like cotton and brinjal, opposition to its commercialisation is based on unfounded claims about environmental and health risks. This is particularly ironic, as GMOs are already embedded in India's food system. The country heavily relies on imported edible oils, with 55-60 per cent of its domestic requirement being imported from countries like Argentina, Brazil, Canada, and the US, all of which use GM technology (in soybean and canola). Additionally, India consumes its own cottonseed oil (which comes from GM cotton), and about 90-95 per cent of the cotton grown is GM. Cottonseed is also fed to cattle, contributing to the fat content in milk, and GM soy and corn are imported for poultry feed. Clearly, GMOs are already part of the Indian food chain, and have been for some time. Food crops are often subject to more rigorous scrutiny than commercial crops used for industrial purposes, which leads to longer approval times. For commercial crops like cotton, the approval process can be expedited

more easily. Innovations like Bt Cotton, Bt Brinjal, and GM Mustard are waiting for policy change, and without that change, these innovations may not reach their full potential.

India's future requires a shift toward evidence-based policymaking. Decisions regarding GM crops must be guided by scientific data rather than baseless claims or ideological opposition. Farmers should have access to the latest technologies and the freedom to make informed decisions. By addressing regulatory bottlenecks and embracing innovation, India can reduce its dependence on imports, empower its farmers, and build a foundation for a self-sufficient agricultural future.

2.7 Conclusion and Way Forward

India's cotton production experienced a remarkable transformation with the introduction of Bt cotton in 2002, resulting in a 193 per cent increase in production, rising from 13.6 million bales to 39.8 million bales by 2013-14. Yields, which had remained stagnant at 302 kg/ha, saw an impressive 87 per cent boost, reaching 566 kg/ha in 2013-14. This technological advancement also drove India's raw cotton exports to an all-time high of 12.9 million bales in 2011-12, solidifying the country's position as a net exporter and a key player in the global cotton market. The revolution not only strengthened the raw material base for India's textile and apparel industries but also significantly reduced pesticide use.

However, this technological leap brought by Bt cotton has plateaued. Without advancements in next-generation seed technologies, farmers are increasingly grappling with rising pest infestations, such as pink bollworm and whiteflies, which have developed resistance to first-generation Bt traits. As a result, cotton production is declining at an AAGR of 2 per cent, and is projected to hit a low of 29.9 million bales in FY 2025, marking a sharp decrease in India's cotton exports from 12.9 million bales in 2011-12 to just 2.8 million bales in 2023-24. While global competitors have embraced advanced seed technologies like stacked traits and herbicide-tolerant varieties, Indian farmers are still struggling to access these innovations. The lack of regulatory clarity and policy inertia has stifled innovation and left farmers at a disadvantage.

In light of this downturn in cotton production, the recent announcement of a five-year Cotton Mission in the Union Budget 2025-26, with an allocation of INR 500 crore, is a timely and positive step. However, doubts remain about how effectively it will address the challenges faced by the cotton sector, especially at the farm level, which desperately needs reforms and innovation. Without significant changes to the current policy framework, including stringent price controls and mandatory licensing, private sector investment in agricultural biotechnology will continue to be limited. Private players need a level playing field to bring advanced technologies to the field.

The following section outlines policy recommendations to tackle these challenges:

1. Policy Framework for GM Crops in India: A Call for Coordination and Streamlining

One of the primary causes behind these delays is the fragmented governance structure for GM crops in India, which involves too many layers of approval. Currently, the GEAC under the MoEFCC handles GM crop approvals, while the FSSAI oversees GM-derived food products. Bodies like the Review Committee on Genetic Manipulation (RCGM) and Institutional Biosafety Committees (IBSCs) are involved in assessing biosafety and efficacy, while SBCCs and DLCs monitor field trials and ensure compliance. Although each of these bodies play an important role, their lack of coordination leads to delays and inefficiencies. Such inefficiencies undermine the credibility of the regulatory process and highlight the need for a unified governance structure. Policymaking must prioritise science-backed decision-making. The government should establish an integrated framework that aligns the functions of central, state, and district-level authorities. A single-window clearance mechanism under the leadership of the GEAC can streamline approvals, while defining the roles of State Biotechnology

Coordination Committees (SBCCs) and District Level Committees (DLCs) to ensure effective implementation at the local level.

The issue of illegal cultivation highlights the gaps in the regulatory framework. In 2023, HtBt cotton, an unapproved GM trait, accounted for nearly 20 per cent of India's cotton acreage. This reflects a strong demand for new technologies among farmers, who resort to illegal markets due to the lack of formal approvals. The expansion of unauthorised seeds poses economic risks, such as inflated prices and reduced tax revenues, while also introducing unregulated traits into the environment. These challenges call for a transparent and efficient policy framework that addresses farmers' needs while safeguarding economic and environmental interests.

India's current regulatory inefficiencies not only delay the adoption of advanced GM technologies but also jeopardise the livelihoods of millions of farmers and the competitiveness of its agricultural sector. A cohesive policy approach, driven by science and focused on seamless coordination, is imperative to unlock the full potential of GM technology and ensure sustainable agricultural growth.

2. *Strengthening IPR Regulations in Agriculture*

The transformative success of cotton cultivation in India can be attributed to innovations in seed technology brought forth by the private sector. High-tech seeds have revolutionised agricultural practices by improving productivity and reducing pest-related losses. Most of the Bt cotton hybrids in India are derived from two Monsanto (now Bayer) events—Mon 531 and Mon 15985. The licensing rights for these events in India are held by MMB. It has sublicensed the two events to 45 Indian seed companies, including major players like Rasi Seeds, Nuziveedu Seeds, Kaveri Seeds, Ajeet Seeds, and JK Agri Genetics, enabling the development of a wide range of cotton hybrids tailored to regional needs (USDA, 2023).

However, seeds are the result of intensive R&D efforts and are highly susceptible to replication, making IPR crucial for sustaining innovation. Without strong IP protections, the incentive for private sector investment diminishes, limiting India's ability to address its pressing agricultural challenges. The Cotton Seed Price Control Order emerged as a significant obstacle to fostering an innovative seed industry in India. By regulating the maximum sale price of cotton seeds—including the seed value, license fee, and royalties—the government has restricted the private sector's ability to recover its investments. As of 2020, even the trait fee was abolished, further reducing incentives for new seed development.

Developing new seed varieties is inherently risky, resource-intensive, and time-consuming. It takes years of investment in modern plant breeding, biotechnology, and trait research to bring a new seed variety to market. Without a stable and balanced policy framework that ensures adequate returns, private companies have little incentive to engage in such endeavours. A functioning and trusted IPR framework is essential for fostering innovation. Strong IP protections provide the confidence needed for private companies to invest in R&D, enabling the development of seeds that boost yields, improve crop resilience, and enhance stress resistance.

If the government does not want the domestic seed companies to pay royalty or trait fees to original innovators, the Government of India should invest in public sector research infrastructure. Unfortunately, the government budget for agri-R&D is very limited (less than 0.5 per cent of agri-GDP), and expecting public sector to do wonders, which the global companies have already achieved, is perhaps expecting too much from the government institutions.

To enhance cotton yields and boost productivity, it is essential to not only provide access to advanced seed technologies but also to equip farmers with knowledge of effective agricultural practices. Techniques like the Akola model of high-density cropping and drip irrigation have proven effective in improving yields by optimising land use and reducing water and fertiliser consumption. Research shows that drip fertigation can save 20-30 per cent of fertiliser and 50-60 per cent of water (Vaddula and

Singh, 2023), while AI-powered pest management, such as the use of pheromone traps by the Center for Cotton Research (CICR), offers real-time monitoring and targeted control. To scale such innovations, agricultural extension services, including Krishi Vigyan Kendras (KVKs) and public-private partnerships, are crucial in training farmers on best practices, managing pest resistance, and addressing misinformation about GM crops. Government initiatives like the Cott-Ally mobile app, the National Food Security Mission's Special Cotton Project, and pilot projects by CCI are also facilitating the spread of knowledge and resources. Aligning policy and fostering collaboration across stakeholders will drive sustainable growth, improve farmer livelihoods, and strengthen India's position as a global cotton leader.

References

AgbioInvestor GM Monitor. (2024). Retrieved from https://gm.agbioinvestor.com/

Ahmed, S. (2024). HDPS cotton project to cover 50k hectares in Akola: Giriraj. *The Times of India*.

Ajgaonkar, S. S., & Patil, S. S. (2018). Adoption of drip irrigation and impact on cotton productivity of Aurangabad district of Maharashtra. *Journal of Cotton Research and Development, 32*(1), 146-152.

Arora, A., & Malik, D. P. (2019). *An overview of cotton seed industry in India: Policy implications and perspectives*. Journal of Cotton Research and Development, 33(2), 303-313.

Arora, A. and S. Bansal (2011). Diffusion of Bt Cotton in India: Impact of Seed Prices and Technological Development Agricultural & Applied Economics Association's 2011 AAEA & NAREA Joint Annual Meeting. Pennsylvania.

Barnhardt Purified Cotton. (2019). Types of cotton. https://barnhardtcotton.net/blog/types-ofcotton/

Bera, S. (2018). High-level committee blows the lid off illegal cotton seed business. *Mint*.

Brookes, G. (2022). "Genetically Modified (GM) Crop Use 1996–2020: Environmental Impacts Associated with Pesticide Use Change." *GM Crops & Food* 13(1): 262–289.

Brookes, G., & Barfoot, P. (2008). Global Impact of Biotech Crops: Socio-Economic and Environmental Effects, 1996-2006. AgBioForum, 11(1).

Brookes, G., & Barfoot, P. (2018). GM crops: global socio-economic and environmental impacts 1996 - 2016. PG Economics Ltd.

Brookes, G., & Barfoot, P. (2020). GM crop technology use 1996-2018: farm income and production impacts. *GM Crops & Food*, *11*(4), 242–261. https://doi.org/10.1080/21645698.2020.1779574

Canadian Biotechnology Action Network. (2022). GM cotton. https://cban.ca/gmos/products/on-the-market/cotton/

Cotton Australia. (n.d.). *The Australian cotton industry*. Retrieved from Educational_Kit_Cotton_Australia_Chapter01.pdf

Cotton Brazil. (2022). *Brazilian cotton technologies*. Retrieved from https://cottonbrazil.com/brazilian-cotton-technologies/

Cotton (2024). Ministry of Textiles, Government of India.

Cultivation of Genetically Modified crops. (2024). Ministry of Agriculture & Farmers Welfare, Government of India. Retrieved from https://pib.gov.in/PressReleasePage.aspx?PRID=2042234

Directorate of Cotton Development. (2017). *Status paper of Indian Cotton*. Nagpur: Ministry of Agriculture and Farmers' Welfare, Government of India.

Directorate General of Foreign Trade (DGFT). (2024). Trade Statistics & Analytics. Retrieved from Directorate General of Foreign Trade | Ministry of Commerce and Industry | Government of India.

Directorate of Economics and Statistics, Department of Agriculture Cooperation and Farmers Welfare. (2025). *Agricultural statistics at a glance*. Ministry of Agriculture and Farmers Welfare, Government of India. Retrieved from: https://desagri.gov.in/document-report-category/agriculture-statistics-at-a-glance/

Dodson, L. (2020). "Use of Genetically Engineered Cotton Has Shifted Toward Stacked Seed Traits." from https://www.ers.usda.gov/amber-waves/2020/december/use-of-genetically-engineered-cotton-has-shifted-toward-stacked-seed-traits/.

Fand, B. B., et al. (2019). "Widespread infestation of pink bollworm, Pectinophora gossypiella (Saunders) (Lepidoptera: Gelechidae) on Bt cotton in Central India: a new threat and concerns for cotton production." *Phytoparasitica* 47: 313–325.

FSII (April 2022). "Seed Connect - A monthly Newsletter of FSII." from https://fsii.in/newsletter/.

Global GM Crop Area Review. (2024). AgbioInvestor. https://gm.agbioinvestor.com/downloads

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Pretty, J., Robinson, S., Thomas, S. M., & Toulmin, C. (2010). Food security: the challenge of feeding 9 billion people. *Science*, *327*(5967), 812-818. https://doi.org/10.1126/science.1185383

Gulati, A., Ferroni, M., & Zhou, Y. (2018). *Supporting Indian Farms the Smart Way*. Academic Foundation.

Huang, J., Hu, R., Fan, C., Pray, C. E., & Rozelle, S. (2002). Bt cotton benefits, costs, and impacts in China. *AgBioForum*, *5*(4), 153-166.

ICAR - National Institute of Agricultural Economics and Policy Research. (2019). *Efficiency of micro-irrigation in economising water use in India: Learning from potential and under-explored states*

International Cotton Advisory Committee (ICAC). (2024). ICAC Open Data Dashboard. Retrieved from icac.shinyapps.io/ICAC_Open_Data_Dashboaard/

IRRI. (2018). *Golden Rice*. Retrieved January 9, 2025, from irri.org: https://irri.org/golden-rice

ISAAA (2018). Brief 53: Global Status of Commercialized Biotech/GM Crops in 2017. International Service for the Acquisition of Agri-biotech Applications International Service for the Acquisition of Agri-biotech Applications

ISAAA (2019). Brief 55: Global Status of Commercialized Biotech/GM Crops: 2019, International Service for the Acquisition of Agri-biotech Applications.

ISAAA (2020). Pocket K No. 5: Documented Benefits of GM Crops. (2020).

ISAAA (2021). Brief 56: Breaking Barriers with Breeding: A Primer on New Breeding Innovations for Food Security, International Service for the Acquisition of Agri-biotech Applications.

ISAAA (2024). "Countries Approving GM Crop Cultivation."

Ismael, Y., Bennett, R., & Morse, S. (2002). Farm-Level Economic Impact of Biotechnology: Smallholder Bt Cotton Farmers in South Africa. *Outlook on Agriculture*, *31*(2). https://doi.org/10.5367/000000002101293949

Kesireddy, R. R. (2015, October 14). Royalty payments: Indian seed makers to take on Monsanto. The Economic Times. Retrieved from: https://economictimes.indiatimes.com/news/economy/agriculture/royalty-payments-indian-seed-makers-to-take-on-monsanto/articleshow/49347160.cms

Lalitha, N., Pray, C. E., & Ramaswami, B. (2008). The Limits of Intellectual Property Rights: Lessons from the Spread of Illegal Transgenic Seeds in India. *Gujarat Institute of Development Research Working Paper No.182*, *Ahmedabad*.

Mohan, K. S., et al. (2015). "Field resistance to the Bacillus thuringiensis protein Cry1Ac expressed in Bollgard® hybrid cotton in pink bollworm, Pectinophora gossypiella (Saunders), populations in India." *Pest Management Science* 72(4).

Nitnaware, H. (2023). "Cotton Curse: How pink bollworm evolved to be the biggest threat for Bt cotton." from https://www.downtoearth.org.in/agriculture/cotton-curse-how-pink-bollworm-evolved-to-be-the-biggest-threat-for-bt-cotton-92458.

PIB. (2024). Micro Irrigation. Accessed from Press Release: Press Information Bureau.

Pray, C. E., Huang, J., Hu, R., & Rozelle, S. (2002). Five years of Bt cotton in China – the benefits continue. *The Plant Journal*, *31*(4). https://doi.org/10.1046/j.1365-313X.2002.01401.x

Qaim, M. (2009). "The Economics of Genetically Modified Crops." *Annual Review of Resource Economics* 1: 665-693.

Raising Agricultural Productivity and Making Farming Remunerative for Farmers. (2015). NITI Aayog, Government of India.

Ramamurthy, V., Patil, H. G., Venugopalan, M. V., & Challa, O. (2009). Effect of drip irrigation on productivity and water-use efficiency of hybrid cotton (Gossypium hirsutum) in Typic Haplusterts. *Indian Journal of Agricultural Sciences*, *79*(2), 118-121.

Reddy, A. A. (2024). Two Decades of Bt Cotton in India: Experience, Impact, and policy imperatives. https://ssrn.com/abstract=

Sankaranarayanan, K., praharaj, C. S., nalayini, P., Bandyopadhyay, K. K., & Gopalakrishnan, N. (2010). Low cost drip as a precision irrigation tool in Bt cotton {Gossypium hirsutum) cultivation. *Indian Journal of Agronomy*, *55*(4).

Shagun. (2024). AI to the rescue: Cutting-edge tech to help cotton farmers fight pink bollworm. *Down To Earth*.

Sharma, B. R., Gulati, A., Mohan, G., Manchanda, S., Ray, I., & Amarasinghe, U. (2018). Water Productivity Mapping of Major Indian Crops, NABARD and ICRIER.

Singh, S., et al. (2019). "Genetically modified (GM) cotton: Its past, present and future: A review" *Journal of Entomology and Zoology Studies* 7(3): 683-691.

Stone, G. D. (2010). The Anthropology of Genetically Modified Crops. *Annual Review of Anthropology*, *39*, 381-400. https://www.jstor.org/stable/25735118

Suresh, A., P. Ramasundaram, Josily Samuel, and Shwetal Wankhade. (2014). Cotton Cultivation in India Since the Green Revolution: Technology, Policy, and Performance.

Tianjie, M. (2008). Wielding the Double-Edged Sword: The Chinese Experience with Agricultural Genetically Modified Organisms China Environment Forum.

Tilman, D., Balzer, C., Hill, J., & Befort, B. L. (2011). Global food demand and the sustainable intensification of agriculture. *Proceedings of the National Academy of Sciences*, *108*(50). https://doi.org/https://doi.org/10.1073/pnas.1116437108

UNICEF. (2024). *Vitamin A deficiency*. Retrieved January 9, 2025, from UNICEF: https://data.unicef.org/topic/nutrition/vitamin-a-deficiency/

United States Department of Agriculture (USDA). (2023). Brazil: Cotton and Products Annual. Retrieved from: DownloadReportByFileName

United States Department of Agriculture (USDA). (2024). *Brazil cotton and products update*. Retrieved from https://fas.usda.gov/data/brazil-cotton-and-products-update-16

USDA. (2024). *India: Agricultural Biotechnology Annual*. https://www.fas.usda.gov/data/india-agricultural-biotechnology-annual-7

USDA. (2024). *India: Cotton and Products Update*. https://fas.usda.gov/data/india-cotton-and-products-update-47

Vaddula, Y., & Singh, K. (2023). Progression of drip irrigation and fertigation in cotton across the globe and its future perspectives for sustainable agriculture: an overview. *Applied Water Science*, *13*. https://doi.org/https://doi.org/10.1007/s13201-023-01986-3

Vivek Voora, Steffany Bermudez, Johanna Joy Farrell, Cristina Larrea, and Erika Luna. (2023): Global Market Report - Cotton Prices and Sustainability. IISD-SSI.

WHO (2014). "Food, genetically modified." https://www.who.int/news-room/questions-and-answers/item/food-genetically-modified.

Witjaksono, J., Wei, X., Mao, S., Gong, W., Li, Y., & Yuan, Y. (2014). Yield and economic performance of the use of GM cotton worldwide over time : A review and meta-analysis. *China Agricultural Economic Review*, *6*(4). https://www.emerald.com/insight/content/doi/10.1108/caer-02-2013-0028/full/html

ANNEXURE

Annex Table 2.1: Role of Various Authorities in the Regulation of GM Crops in India

Authority	*Role/Responsibility*
Ministry of Environment, Forest and Climate Change (MOEFCC)	Houses the GEAC, the nodal agency responsible for implementing the Biotech Rules of 1989 under the Environmental Protection Act (EPA), 1986.
Department of Biotechnology (DBT)	Provides guidelines and technical support to GEAC. Responsible for evaluating and approving biosafety assessments of GE products during research and development.
Ministry of Agriculture and Farmers' Welfare (MoAFW)	Evaluates and approves the commercial release of transgenic crop varieties after conducting field trials to assess agronomic performance. Also oversees post-approval monitoring.
Food Safety and Standards Authority of India (FSSAI)	Evaluates and approves the safety of GE crops and products for human consumption. FSSAI is yet to establish dedicated regulations for this, and GEAC currently handles this responsibility.
Review Committee of Genetic Manipulation (RCGM)	Operates under DBT to oversee biosafety research and field trials, ensuring compliance with national biosafety guidelines during the early stages of GE product development.
Institutional Biosafety Committees (IBSCs)	Established within research institutions to monitor laboratory research involving GE products and ensure adherence to biosafety protocols at the institutional level.
State Biotechnology Coordination Committees (SBCCs)	Monitor safety measures at biotech research facilities within states, assess any potential environmental damage, and oversee field trials and compliance with GEAC-approved safety protocols.
District Level Committees (DLCs)	Ensure on-ground implementation of safety measures during field trials, monitor community engagement, and provide feedback on compliance with biosafety standards.
Various State Governments	Approve field trials and commercial cultivation of GE crops as cleared by GEAC. Support R&D in agricultural biotechnology through state agricultural universities and research institutions

Source: USDA, 2023.

From Farm to Factory: Journey of India's Yarn Industry

3

SULAKSHANA RAO, AYUSHI GUPTA, AND ASHOK GULATI

From Farm to Factory: Journey of India's Yarn Industry

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3.1 Introduction

Yarn is a fundamental intermediate in the textile value chain, serving as the backbone of downstream processes such as weaving, knitting, and nonwoven fabric production. Produced primarily in spinning mills, yarn is formed by twisting together natural or man-made fibres to create a continuous strand (Backer, 1972). Based on the origin of fibres, yarns are typically classified as natural (e.g., cotton, wool), man-made (e.g., polyester, viscose), or blends of both. They can be distinguished by fibre length: staple yarns (short fibres) and filament yarns (long, continuous filaments). All natural fibres except silk are staple in nature, while man-made fibres can be manufactured as either staple or filament (See Box 3.1 for details)

Within the global textile ecosystem, yarn not only determines the quality and functionality of end-use products, but also influences cost, trade competitiveness, and sustainability outcomes. Over the past two decades, the yarn industry has been shaped by shifting consumer preferences, cost structures, and technological advancements. (Gulati and Jose, 2022). Man-made fibres (MMF), which include both synthetic fibres (like polyester and nylon) and artificial or cellulosic fibres (such as viscose and modal) have gained dominance due to their durability, affordability, and adaptability, with global fibre production reaching an all-time high of 124 MMT in 2023, more than double the 58 MMT recorded in 2000. In 2023, MMFs accounted for approximately 73 per cent of total global fibre production, underscoring their dominance in the textile and apparel industry. Among these, polyester remains the most widely used fibre globally, with an estimated production of 71 MMT, commanding a 57 per cent share of the global fibre market (Materials Market Report, 2024).

The evolving composition of global fibre production marked by the rise of MMFs and the relative stagnation of cotton has direct implications for yarn manufacturing, trade patterns, and competitiveness across producing nations. As fibre preferences shift, so does the structure of yarn demand, challenging traditional cotton yarn exporters to adapt.

In this context, India's yarn industry, particularly its cotton yarn segment, has historically played a pivotal role in global markets. The country has long been the largest exporter of cotton yarn, contributing USD 3.45 billion in exports in TE 2022, representing 26.2 per cent of global trade. In 2023, India accounted for around 25 per cent of global cotton yarn exports, totaling 1.2 MMT (ICAC, 2024). However, India's dominance is under pressure. Rising domestic production costs, limited trade advantages, outdated policy frameworks, and increasing competition from countries like Vietnam with modern infrastructure and stronger trade linkages have eroded India's share in global trade.

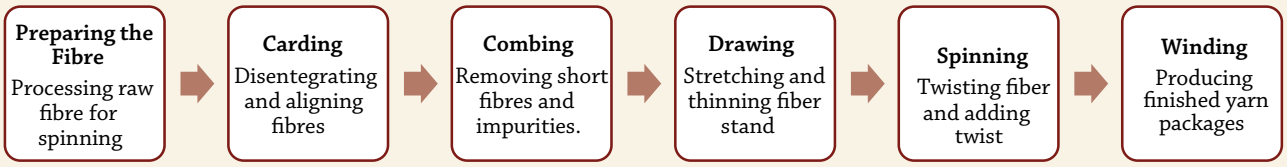
Against the backdrop, this chapter examines the transformation of India's yarn industry, and the emerging challenges that have contributed to the decline in India's cotton yarn

BOX 3.1

Yarn & its Production Process

Yarn is made by grouping or twisting together several strands of fibres to make a continuous length of interlocked fibres. Basically, Yarn is the basic element with which fabric is made. Further yarn are woven or knitted together to make fabric. The process of making yarn from fibre is called spinning. Spinning involves twisting fibres together to form a continuous thread or yarn. This process can be done manually using tools like a spindle or spinning wheel, or mechanically using advanced spinning machines.

Process of producing yarn



Yarns are classified into three main types based on the fibers used: natural fiber yarn, synthetic fiber yarn, and blended fiber yarn.

1. Natural fiber yarns are made from fibers derived from plants, animals, or minerals. These fibers are renewable, biodegradable, and often breathable. Such as Cotton Yarn, Wool Yarn, Linen Yarn, Silk Yarn.
2. Synthetic fiber yarns are manufactured from chemical compounds, often petroleum-based. They are designed to mimic or improve upon the properties of natural fibers Such as Polyester Yarn, Nylon Yarn, and Acrylic Yarn.
3. Blended fiber yarns combine natural and synthetic fibers to balance their advantages. For example; Cotton-polyester blends offer softness with durability, Wool-acrylic blends provide warmth with reduced cost.

exports. It delves into India's current position in global trade, the performance of key competitors, and analyses structural and policy-related constraints affecting growth. The chapter also highlights the opportunities within MMF yarn production and presents a roadmap for reviving India's competitiveness across the yarn value chain by leveraging both cotton and MMF segments.

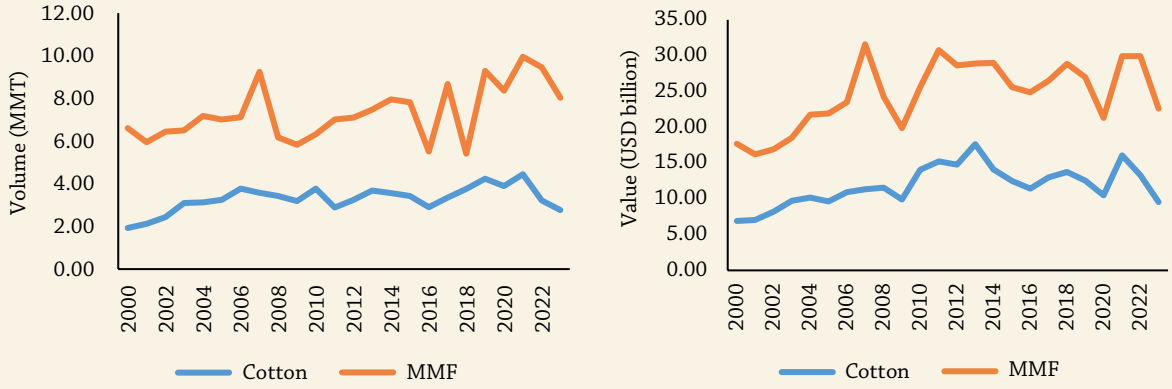
The chapter is structured as follows: Section 3.2 explores global yarn trade patterns, illustrating the growing preference for synthetic yarns. Section 3.3 provides an overview of the global cotton yarn market, covering production, trade flows, and price dynamics. Section 3.4 examines India's yarn industry, highlighting production, domestic use, export patterns, and structural shifts. Section 3.5 presents a comparative analysis with global competitors, spotlighting tariff disadvantages and market diversification opportunities. Section 3.6 outlines key challenges in India's yarn sector from fibre quality and outdated machinery to PTA supply disruptions. Section 3.7 proposes strategic interventions to enhance competitiveness in both cotton and MMF yarn. Finally, Section 3.8 summarizes key insights and outlines a forward-looking policy agenda for strengthening India's position in the global yarn market.

3.2. Global Yarn Trade Trends

Over the past two decades, the global yarn trade has evolved in tandem with changes in fibre consumption patterns. As MMFs have grown in prominence, the composition of yarn trade has shifted notably in favour of synthetic-based yarns, posing challenges for traditional cotton yarn exporters. In value terms, total global yarn exports (combining cotton and MMF yarns) increased from USD 24.6 billion in 2000 to USD 32 billion in 2023 (Figure 3.1). Within this, cotton yarn exports rose from USD 6.9 billion in 2000 to USD 9.5 billion in 2023, although the peak was observed in 2013 at USD 17.6 billion. Meanwhile, MMF yarn exports maintained a consistently higher share, growing from USD 17.7 billion in 2000 to USD 22.6 billion in 2023. In volume terms as well, MMF

FIGURE 3.1

World Exports of Cotton and Manmade Yarn (Volume and Value)



Source: UN Comtrade database, 2024.

yarn trade expanded from 6 MMT to 8 MMT over this period, outpacing cotton yarn both in value and volume terms.

The drivers of this shift are multi-fold. MMF yarns, particularly polyester, offer significant cost advantages, durability, and ease of maintenance, making them increasingly popular across fast fashion, sportswear, and athleisure segments. Stable global oil prices and improvements in production technology have further enhanced the competitiveness of MMF yarns in global trade (ICAC, 2024).

India is the second largest producer of cotton and man-made fibre yarn (MMF yarn)[1], after China. In Financial Year (FY) 2022, India's total yarn produced, including cotton, MMF, and blended yarn was 7.83 MMT. It contributes to 1.98 per cent of the country's GDP at current prices Indian Rupees and accounts for 3.93 per cent of the total employment (USFDA, 2024). Textile industry consumes a diverse range of fibres and yarns and the ratio of use of cotton to non - cotton fibres in India is around 60:40 whereas it is 30:70 in the rest of the world (Ministry of Textiles, 2024).

While the global consumer trend is leaning heavily towards the synthetic mix, India continues to have strong domestic preference for cotton. This helps Indian cotton farmers, but restricts our growth in global markets, which are predominantly based on MMF. The challenge for India is to balance its cotton legacy with MMF-led global demand growth. While continuing to support its vast cotton farming community, India must also accelerate the expansion of its MMF and blended yarn capabilities. As per the ICAC textile demand model, countries with rising GDP per capita tend to witness a more than proportional increase in demand for non-cotton fibres. This suggests that as India's economy grows, domestic MMF consumption is likely to rise as well.

Given the rise in preference for MMF, policy makers need to employ targeted interventions to produce more blended yarn and capture bigger share of global markets. This will help sustain livelihood of our cotton farmers as also move in line with changing demand patterns in export markets.

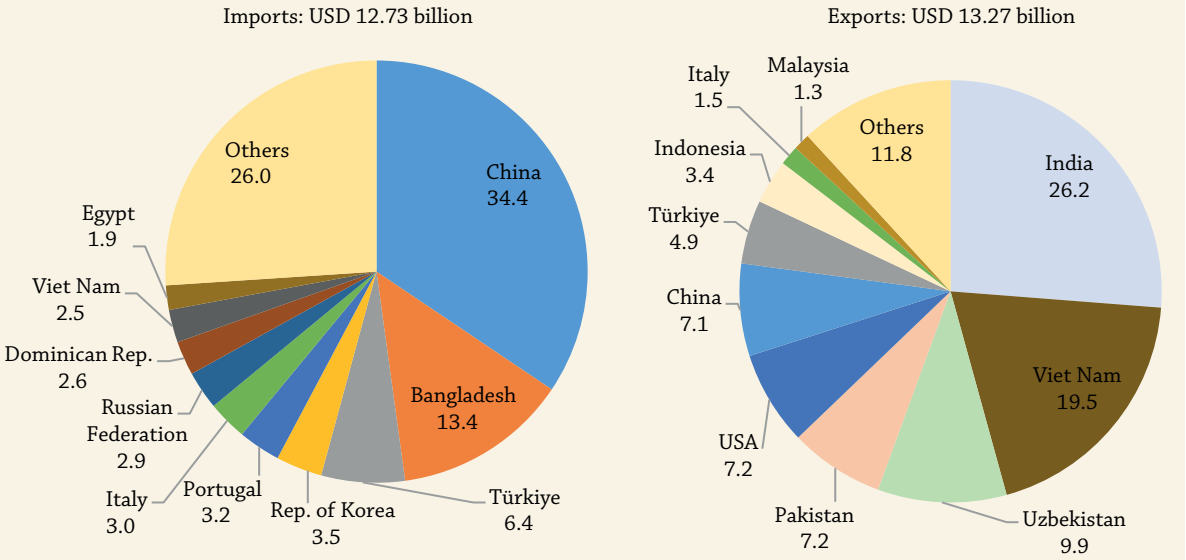
3.3 Global Cotton Yarn Scenario

Globally, India is the second largest producer as well as consumer of cotton fibre, and leading exporter of cotton yarn. In 2023, India's cotton yarn exports were 1.2 MMT of which 33 per cent were exported to Bangladesh, primary destination of India's cotton yarn exports. Figure 3.3 (major importers and exporters) depicts major players in cotton yarn globally.

1. MMF yarn includes both man-made fibre yarn and man-made filament yarn. Manmade fibres are classified into two main categories: synthetic and cellulosic fibres.

FIGURE 3.2

Major Global Cotton Yarn Importers and Exporters for TE 2022 (Value)



Source: UNCOMTRADE; Export Promotion Bureau (EPB) HS codes: 5204, 5205 & 5207.

In TE 2022, globally, the total cotton yarn exported was 13.27 billion US dollars and the top 5 cotton yarn exporters in the world were India, Vietnam, Pakistan, Uzbekistan and USA. The total cotton yarn imported in TE 2022 was USD 12.73 billion and the top five cotton yarn importers during the same period were China, Bangladesh, Turkiye, Republic of Korea and Portugal.

Major Cotton Yarn Importers

Since 2009, China has been the world's largest importer of cotton yarn, accounting for 34.4 per cent of global imports in TE 2022 (ICAC, 2024). Factors such as its vast spindle capacity, expanding textile industry, cotton reserve policy, high labour costs, and a favourable tariff system for yarn imports have driven this demand. While China imposes a Tariff Rate Quota (TRQ) on cotton imports, yarn imports remain quota-free and face lower tariffs. With 90 per cent of China's cotton production concentrated in Xinjiang, rising domestic raw material and labour costs have further incentivized yarn imports. Vietnam (49.05 per cent), Pakistan (13.74 per cent), and India (13.57 per cent) are China's top suppliers. US sanctions on Xinjiang cotton in 2020-21 pushed Chinese manufacturers to import more yarn to reduce costs and mitigate trade barriers.

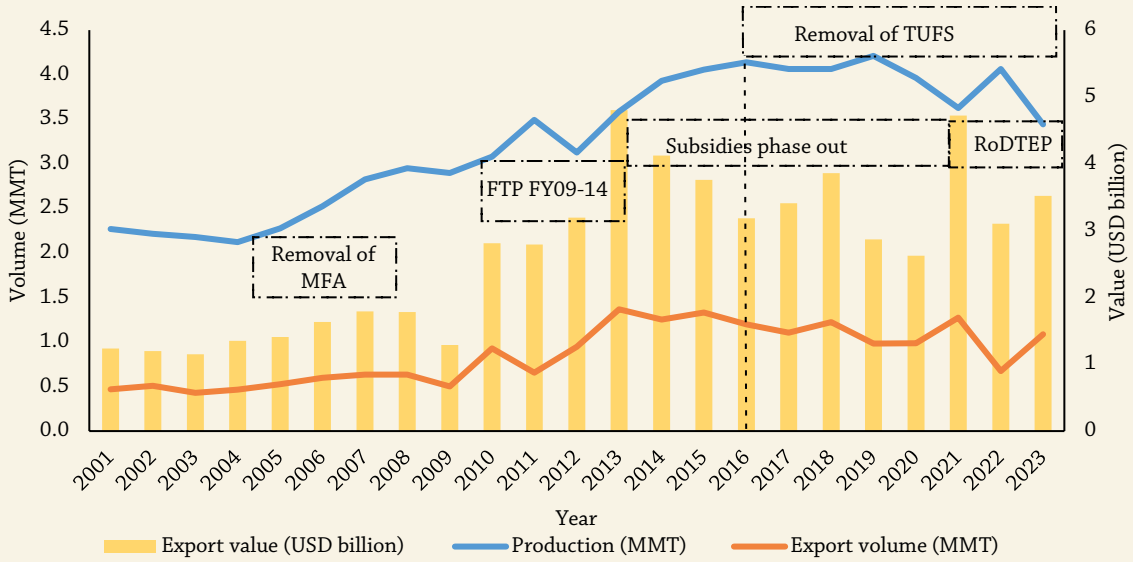
Bangladesh is the second largest importer of cotton yarn in 2015 (ICAC, 2024). The rise in cotton yarn imports is majorly driven by the expansion of garment industry; lower logistics and short shipment times from India; and the duty draw back initiatives of the Government of Bangladesh to the export-oriented garment firms to import duty free fabrics and yarn. The total imports of cotton yarn by Bangladesh accounted for USD 1.71 billion, holding 13.4 per cent market share of the total cotton yarn imports, in TE 2022. Turkiye, Republic of Korea and Portugal, the other countries in top five major importers of cotton in the world accounting for 6.4 per cent, 3.5 per cent and 3.2 per cent of the total cotton yarn imports respectively, in TE 2022 (Figure 3.2).

Major Cotton Yarn Exporters

India became the largest exporter of cotton yarn in 2010 and accounted for 26.2 per cent of the total cotton yarn exports in TE 2022 (Figure 3.2). The major factors responsible for this domestically were the adoption of Bt cotton

FIGURE 3.3

India's Cotton Yarn Production and Exports



Note: MFA stands for Multi-Fibre Agreement, FTP is Foreign Trade Policy, TUFS is Technology Upgradation Fund Scheme & RoDTEP is Remission of Duties or Taxes on Export Products.

Source: Compendium of Indian Statistics 2016-17; Ministry of Textiles and UNCOMTRADE.

technology, modernization and surge of spinning mills in India; coupled with the elimination of Multi Fibre Agreement (MFA) in 2004 and growing demand for cotton yarn in neighbouring countries China and Bangladesh. The major export destinations for India in TE 2022 are Bangladesh, China and Egypt accounting for 35.9 per cent, 15.6 per cent and 4.8 per cent respectively.

In Vietnam, the growth in cotton yarn exports had been driven by the availability of cheap labour, rise in investments of China in the spinning mills of Vietnam and their engagement in China-ASEAN Free Trade Agreement (CAFTA) in 2010. Vietnam imports cotton majorly from the United States and the imported cotton price is cheaper than that of China's domestic cotton price. Compared to China, the labour cost is cheaper in Vietnam. To take advantage of this, the Chinese invested in the spinning mills of Vietnam and produce more cotton yarn. China being the largest importer of cotton yarn, with the effect of CAFTA, cotton yarn exported from Vietnam, enjoys zero duty all these years since 2010, increasing their export share of cotton yarn in the global trade (Vietnam: Surprising Strength In Cotton Spinning Benefits U.S. Exports, 2017). The total cotton yarn exports by Vietnam in TE 2022 was USD 2.59 billion accounting for 19.5 per cent of the total cotton yarn exports. Uzbekistan, Pakistan and USA, the other major countries in top five cotton yarn exporters of the world, accounted for 9.9 per cent, 7.2 per cent and 7.2 per cent respectively, of the total cotton yarn exports in TE 2022.

3.4 India's Yarn Industry

India has been a major producer of yarn, with its production trend determined by domestic raw material availability, export demand and technology advancements. Over the last two decades the total yarn[2] production has grown from 3.43 MMT to 6.65 MMT. Along these years, the average share of cotton yarn production has been 64 per cent, with a production of 4.06 MMT in 2022. The textile sector in India is concentrated in key states such as Tamil Nadu,

2. Total yarn production, includes, cotton and MMF yarn, but excludes blended and yarn of other natural fibres.

Maharashtra, Gujarat, Andhra Pradesh and Punjab where spinning mills benefit from raw material proximity, established industry clusters and access to skilled labour.

India's cotton yarn export performance has shown a fluctuating trend over the last two decades (Figure 3.3). From 2001-13, exports show a steady rise and attained a peak between 2009-13. India became the largest exporter of cotton yarn in 2010 and accounted for 26.2 per cent of the total cotton yarn exports in TE 2022. The major factors responsible for this domestically were the adoption of Bt cotton technology, modernization and surge of spinning mills in India; coupled with the elimination of MFA[3] in 2004 and growing demand for cotton yarn in neighbouring countries China and Bangladesh.

Understanding the Market Dynamics and Policy Scenario in Shaping the Export Trends

The trends in India's yarn production and exports have been influenced by various policy interventions and global market dynamics over the years.

The relaxation of restrictions on the import of modern machinery and yarn exports, through National Textile Policy 1985 and delicensing of yarn industry in the 1990s, have modernized and increased the Indian spinning mill numbers (Maurice Landes, 2005; Bedi, 2003). In tandem with this, the availability of cheap raw cotton and labour in the domestic market, India also has been having a competitive edge over its global competitors (Maurice Landes, 2005; Agarwal, 2009; IPCC, 2018). This led to the oversupply of cotton yarn and upon the removal of Multi Fibre Agreement (MFA), further increased the exports (Grandhi, 2007). In the early 2000s, the TUFS, launched in 1999 and revised in 2005-07, played a crucial role in modernizing textile mills, leading to steady growth in both production and exports. On top of that, the Foreign Trade Policy (2004-09) promoted duty-free imports of raw materials, making Indian yarn more competitive in global markets. However, the 2008 global financial crisis caused a dip in exports due to reduced global demand, particularly from key importers like China and Bangladesh.

One of the primary reasons for the strong export performance between 2009 and 2013 was the introduction of export promotion policies under the Foreign Trade Policy (FTP) (Jha, 2022). The cotton yarn exports during this period grew at an AAGR of 24.83 per cent. India became the largest exporter of cotton yarn in 2010 and has been the largest exporter of cotton yarn since then. A major turning point in 2010-11 was when global cotton prices surged, making Indian cotton yarn highly competitive. This, combined with the removal of export restrictions on cotton yarn in 2010, led to a sharp rise in exports and a peak in production. Incentives such as the Focus Market Scheme (FMS), Market Linked Focus Product Scheme (MLFPS), 2 per cent Interest Subvention (IS) Scheme, Duty Entitlement Passbook Scheme (DEPB), and the Duty Drawback Scheme supported Indian yarn exports, making them competitive in the global market.

The cotton yarn exports from India, reached its peak in 2013, exporting cotton yarn value of USD 4.8 billion. However, after 2013, India had to phase out many of these incentives to comply with the WTO regulations on subsidies under the Agreement on Subsidies and Countervailing Measures (ASCM). This withdrawal increased export costs, reducing India's competitiveness in key markets. Withdrawal of export promotion schemes increased the export price of Indian cotton yarn by 5-6 per cent (TEXPROCIL) and led to a downturn in cotton yarn exports after 2013. The declining cotton yarn exports poses a serious concern to the cotton yarn production in India. The cotton yarn production in India had been growing at

3. Multi Fibre Agreement (MFA) was sanctioned in 1974 imposed quota restrictions on the textiles and clothing imported from developing countries to developed countries, in order to protect the domestic industries of the developed countries. In 1995, Uruguay Round, an Agreement on Textiles and Clothing (ATC) was endorsed to phase out the quantitative import barriers on textiles and clothing from developing countries in next 10 years' time period with full elimination of MFA by the end of 2004. Countries like China, India and Pakistan were affected as they were low-cost producers under MFA. India's cotton products, in which India has a comparative advantage, was discriminated under MFA.

a diminishing rate since 2013 and stagnated recently. A primary reason for this stagnation has been the decline in export demand, which declined from 37 per cent of domestic availability[4] in 2013 to 16 per cent of domestic availability in 2022, while domestic demand remained unchanged at 72 per cent[5], over the last two decades. It is observed that cotton yarn production has stabilized at about 3.5 to 4 MMT in the past decade. However, yarn exports have not increased beyond 1.5 MMT as a large part is consumed domestically. In general, domestic consumption of cotton yarn accounts for 70 per cent of the total production. However, FY2024 was exceptional as yarn exports accounted for 32 per cent of the total production (ICRA Ratings, 2024).

Another major challenge has been the tariff disadvantages India faces in key importing nations. China, the largest buyer of cotton yarn, had Free Trade Agreements (FTAs) with other major exporters i.e., Pakistan and Vietnam. China's China-Pakistan Free Trade Agreement (CPFTA-I) came into effect in July 2007, followed by CPFTA-II in January 2020, granting duty-free access to Pakistani cotton yarn until 2024. Similarly, the China-ASEAN Free Trade Agreement (CAFTA), in effect since 2010, provided duty-free access to Vietnamese cotton yarn. These agreements gave Pakistan and Vietnam a competitive edge over India, as they could supply yarn at lower tariffs. In 2013, 31 per cent of China's total cotton yarn imports came from India, but within three years, this fell to 22 per cent in 2016. India, which once exported 42 per cent of its total cotton yarn to China in 2013, saw this share decline to 22 per cent in 2020. While Bangladesh emerged as an alternative export destination, its market size remains one-third of China's. In TE 2022, India's major export destinations were Bangladesh (35.9 per cent), China (15.6 per cent), and Egypt (4.8 per cent).

By 2013-14, policies such as the revised TUFS scheme, duty drawback incentives, and the Interest Equalization Scheme helped stabilize production and boost exports. However, in 2014-15, the introduction of the Foreign Trade Policy (2014-19) shifted the focus toward value-added textile products, which affected the growth of raw yarn exports. The removal of some export incentives also reduced India's competitiveness in global markets. The sector saw gradual recovery post-2017, supported by GST implementation and incentives under the Merchandise Exports from India Scheme (MEIS).

Recovery began in 2022-23, driven by initiatives such as the Production Linked Incentive (PLI) Scheme for Textiles (2021), which encouraged investment in man-made fibre (MMF) and technical textiles. In 2021, Remission of Duties and Taxes on Exported Products (RoDTEP) was also introduced, to reimburse the taxes levied by the State and Centre on exported goods with an intention to enhance export competitiveness. At the same time, India's decision not to join the Regional Comprehensive Economic Partnership (RCEP) in 2020 placed the country at a competitive disadvantage against Vietnam and Bangladesh, as these countries gained preferential access to key export markets.

Policy shifts have played a defining role in shaping India's yarn industry. While production has been consistently supported through schemes like TUFS and PLI, export performance has been highly sensitive to tariff structures, trade agreements, and global price fluctuations. To regain export momentum, India needs to focus on securing tariff reductions, reducing production costs, and diversifying its export base. Addressing these structural challenges will be crucial for strengthening India's position in the global cotton yarn market.

Over the years, the composition of yarn production has undergone changes, with cotton yarn share gradually declining and taken over by the MMF yarn due to shift in global demand (as discussed in section 3.2). Economic survey 2024 backed the need to simultaneously focus on MMF along with cotton textiles moving forward, as MMF is dominating globally.

4. Domestic demand and export demand are calculated from domestic availability of the i^{th} year. Domestic availability$_{(i)}$ = Opening stock$_{(i)}$ + Domestic production$_{(i)}$ + Yarn imported$_{(i)}$ - Yarn Exported$_{(i)}$ - Closing stock$_{(i)}$; Closing stock of i-1th year becomes the opening stock of i^{th} year.

5. Calculated from the "Stock of Spun Yarn (SSI & Non-SSI) in India" reports. Ministry of Textiles.

MMF Industry in India

In MMF yarn, India has a share of 9.2 per cent in global production (ICAC, 2024). Over the decade from 2013 to 2023, India's manmade fibre production has risen by 55.0 per cent, reaching 7.6MMT. However, India's policy has historically favoured natural fibres especially cotton. Given the dominance of MMF rising in the global textile industry, targeted initiatives are introduced to support synthetic fibre production.

The PLI Scheme for Textiles, launched in 2021, aims to enhance the production of high-value manmade fibre (MMF) fabrics, garments, and technical textiles. With an outlay of INR 106.83 billion over five years, the scheme targets INR 190 billion in investments and a projected turnover of over INR 3 trillion, while also creating more than 7,50,000 direct jobs. Complementing this effort, the National Technical Textiles Mission (NTTM) has been allocated INR 14.8 billion to support R&D, market expansion, education, and exports in technical textiles (PIB, 2024, ICAC, 2024). Amended Technology Upgradation Fund Scheme (ATUFS) provides financial assistance for technology upgrades in the textile sector, with a focus on MSMEs and high-employment segments like technical textiles. Collectively, these initiatives seek to enhance India's competitiveness in synthetic fibres and position the country as a major global player in the MMF sector.

From the India perspective, MMF yarn sector is capital intensive and comprises both small and large manufacturing units. Polyester accounts for the largest share of the manmade yarn industry, and competes directly with the cotton due to the substitutability. The main difference between cotton yarn spinning mill and manmade yarn spinning mill is that manmade spinning mills do not encounter seasonal variations. In addition, manufacturers capable of producing finer MMF yarns can access high-end markets, where demand remains relatively inelastic, allowing for higher profitability. If the challenges of the cotton yarn (fluctuating raw material availability, contamination issues, inefficiencies in processing) are not addressed, more manufacturers may shift towards MMF yarn production, thereby reducing demand for cotton fibre and adversely impacting cotton farmers' incomes. To counter this trend, India must actively promote cotton textiles by leveraging their environmental benefits, such as lower energy intensity in production compared to synthetic fibres. An effective policy response would focus on improving cotton yarn competitiveness while ensuring that its sustainability advantages are effectively marketed in global trade. However, if the global trends are moving fast towards MMF yarn, India could innovate in blending cotton with MMF yarn and create value chains of more sustainable and convenient yarn.

3.5. Competitor Analysis in Cotton Yarn

India's competitiveness, in cotton yarn production, is not very weak as compared with its competitors- Vietnam and Pakistan. The major difference is the tariff rates that are being imposed on cotton yarn, on different countries by the importing nations. Around 72 per cent of the total cotton yarn exports from India is to China, Bangladesh, Egypt, Peru, Portugal, Vietnam and Korea (Annex Figure 3.2). Bangladesh has become the largest importer of cotton yarn from India, accounting for 36 per cent of the total cotton yarn exports of India in TE 2022. In this section, we analyse the tariff rates imposed by the importing countries[6] on their major cotton yarn exporters and percentage share of imports made by the importing countries from the exporters.

India faces a competitive disadvantage in major cotton yarn export destinations due to higher tariff barriers compared to key competitors like Vietnam and Pakistan. A detailed analysis of tariff structures across major markets can be found in Annex Table 3.2.

In China, the largest importer of cotton yarn, India faces tariffs of 3.5 per cent and 4.5 per cent, whereas Vietnam and Pakistan enjoy

6. The analysis considers ten import markets, China, Bangladesh, Turkey, Republic of Korea, Portugal, Italy, Vietnam, Egypt, Russian Federation and Dominican Republic, extended to Peru, as it is one of the major export destinations of India in cotton yarn.

duty-free access under preferential trade agreements (Annex Figure 3.2). This places Indian exporters at a cost disadvantage, impacting their ability to compete on price. Similarly, in Bangladesh (India's largest export market for cotton yarn) Indian shipments attract a 3 per cent tariff, while Pakistan enjoys the same tariff level but benefits from closer trade ties. In Korea, India's second-largest market, Indian yarn incurs a 4 per cent tariff, while Vietnam, Indonesia, and China enjoy tariff-free access or lower duties. In the European market, India faces tariffs of 4 per cent to 5 per cent in Portugal and Italy, where Turkey and Pakistan benefit from zero duties. South Korea and Portugal present opportunities but require better trade agreements. Russia, where India currently has a small share, could be explored through diplomatic efforts and competitive pricing. Given the production cost competitiveness of India, Italy and Dominican Republic can be a potential newer market. To stay competitive, India must secure lower tariffs, enhance value-added processing, and improve supply chain efficiency.

3.6. Challenges in Domestic Yarn Industry

The Indian domestic yarn industry faces multiple challenges that hinder its global competitiveness, particularly in cotton yarn exports. While India has a cost advantage in cotton yarn production, factors such as fibre quality issues, outdated machinery, labour shortages, policy limitations, and the lack of FTAs negatively impact its competitiveness. This section discusses the challenges faced by the cotton yarn industry in the following subheads.

1. Quality Constraints in Cotton Fibre

According to the International Textile Manufacturers Federation (ITMF) survey, India's cotton is ranked as the most contaminated cotton in the world. Contamination occurs throughout the post-harvest value chain—from the initial collection of seed cotton to storage, and later at the ginning and pressing stages. The primary reason for this widespread contamination is the manual harvesting and handling practices prevalent across most cotton-growing regions in India. Farmers typically collect seed cotton in used fertilizer bags made from High-Density Polyethylene (HDPE) or Polypropylene (PP). These materials shed particles and fibres that mix with the cotton during handling. During the mechanical ginning process, these foreign particles multiply as the cotton is processed, further degrading quality. As a result, Indian cotton often contains visible impurities such as plastic shreds, colour threads, jute fibres, hairs, and even feathers, which are difficult to remove completely (Jain, 2020). This contamination significantly affects the value of Indian cotton in the global market. On average, Indian cotton is discounted by around 10 per cent compared to cotton from leading producers like the USA, Australia, and Brazil, where cotton is machine-picked and handling systems are far more controlled. Despite India's cotton having excellent fibre properties in terms of strength and fineness, contamination offsets these advantages, making it less attractive to international buyers. For spinning mills, this also means higher input costs due to the need for additional contamination removal processes—raising the cost of yarn production.[7]

In addition to contamination, Indian cotton also faces issues related to inconsistent fibre length, which can vary widely across regions. This inconsistency is largely due to variations in seed quality and agricultural practices. Different cotton-growing zones often use different seed varieties, which leads to uneven fibre characteristics, even within the same crop batch. Fibre length is a critical determinant in the spinning process, especially for finer yarn counts. Inconsistent length makes the yarn prone to breakage during spinning, reducing productivity and quality. For high-value textile applications especially those destined for export markets buyers demand uniform and predictable fibre properties. The lack of consistency in Indian cotton reduces its reliability, forcing mills to either blend it with imported cotton or downgrade the end-use of the yarn.

7. Dhuria, I. J. (22.05.2018), Issues confronting the Indian Textile Industry, Cotton Statistics and News, Cotton Association of India.

2. *Outdated Machinery and Productivity Gaps*

A major structural challenge facing India's yarn industry particularly in the cotton segment is the persistent use of outdated machinery and low levels of modernization in spinning mills. Lack of modernisation in spinning mills is affecting the productivity and profitability of yarn producers[8]. Spinning mills in India are running below their full potential, using only about 70 to 75 per cent of their capacity (Indian Textile Journal, 2024). While India introduced the Technology Upgradation Fund Scheme (TUFS) in 1999 to modernize textile machinery, subsequent modifications of the scheme have reduced its benefits for spinning mills. The latest version, Amended TUFS (ATUFS) (2016-2022), excludes spinning mills from subsidies, reducing their ability to invest in new technology. State-level schemes in Tamil Nadu, Gujarat, Maharashtra, and Andhra Pradesh do not match the financial support provided under previous versions of TUFS, leaving the spinning industry at a disadvantage. Tamil Nadu, being the major hub for spinning mills in India, with 46 per cent of the total installed capacity, around 68 per cent of the country's machinery, that is more than 10 years old, is in Tamil Nadu[9]. According to the South India Textile Research Association (SITRA), while productivity has increased across the years, gap between the best and worst performing mills is widening. Inefficiency of many spinning units drags down the overall industry competitiveness. There is a higher power cost also associated with the old machinery that affects the profitability.

3. *Disruptions in PTA Supply and the Impact on Polyester Yarn Competitiveness*

A significant structural challenge in India's yarn industry, particularly in the polyester segment, stems from disruptions in the supply of Purified Terephthalic Acid (PTA), a key raw material used in the manufacture of polyester fibre and filament yarn. After 2010, growth in domestic PTA production began to decline by 2014 it was stagnant, even as demand for polyester-based products remained strong. To meet rising needs, polyester manufacturers initially turned to imports, with PTA imports increasing by over 140 per cent between 2008 and 2013. However, this import trend was soon reversed due to a series of policy interventions.

In 2013, the Government of India imposed anti-dumping duties on PTA imports from key supplier countries including China, South Korea, Thailand, and the European Union, in response to petitions filed by domestic producer companies. These duties ranged from USD 24 to USD 117 per tonne, making imported PTA substantially more expensive. The move was followed by a second wave of anti-dumping duties in 2016, this time on PTA imports from Taiwan, Malaysia, Indonesia, and Iran, with duties ranging from USD 84 to USD 168 per tonne. Together, these eight countries accounted for nearly 90 per cent of India's total PTA imports, and the cumulative effect of these measures was a 35 per cent contraction in PTA imports between 2014 and 2019. In addition to anti-dumping duties, the government further increased the basic customs duty on PTA from 7.5 per cent to 10 per cent in 2018, further raising the cost of imported PTA. These interventions disproportionately affected polyester producers that relied on open-market PTA, as they were forced to operate with significantly higher input costs compared to vertically integrated firms, which could use their in-house PTA at lower effective costs. This price differential created a competitive imbalance within the domestic polyester industry, leading to reduced capacity utilisation and a decline in productivity among non-integrated players. Ultimately, the higher cost structure made Indian polyester yarn and

8. (n.d) Sustainability solutions for spinning Industry by operational excellence, Wazir Advisors (https://wazir.in/sustainability-solutions-for-spinning-industry-by-operational-excellence/#:~:text=Lack%20of%20Modernization,Upgradation%20Fund%20Scheme%20(TUFS)).

9. (n.d) Department of Handlooms, Department of Textiles, Government of Tamil Nadu (https://www.tnhandlooms.tn.gov.in/english/sectortext.php?t=1#:~:text=Still%2C%20many%20Spinning%20Mills%20in,State%2Dof%2Dart%20machinery).

fibre less competitive in export markets, just as global demand for MMF-based textiles was accelerating (Thomas and Anand, 2023). In 2020, the government finally rolled back anti-dumping duties on PTA. While protectionist measures may support large integrated firms, they also hinder broader industrial development by limiting access to competitively priced raw materials (See chapter 6). Given the high concentration of production upstream in the polyester value chain, it is imperative to lower trade barriers on the import of polyester fibre intermediates as well as staple fibre and filament yarn. Doing so would level the playing field, enhance cost-efficiency, and encourage value addition and employment generation in downstream industries such as spinning, weaving, and apparel manufacturing—sectors with strong export potential and large-scale job creation capacity.

3.7. Way ahead for India's Yarn Industry

India's yarn industry has been an important segment in India's textile value chain. The segment needs policy measures that have to be undertaken range from assuring quality raw material, stabilizing the PTA supply chain to make polyester yarn production more competitive, providing financial aid to modernize spinning mills, reducing the rent on capital and power, to skilling up labour and increasing wage rates.

1. Assuring Quality Raw Material

India's cotton fibre has natural strength and fineness, yet its global potential is dragged down by one glaring issue contamination. According to the ITMF, India ranks as the most contaminated cotton supplier globally, with contamination levels as high as 30 per cent in some cases, compared to less than 5 per cent in countries like the US or Australia. Addressing this requires a farm-gin-mill value chain integration. The government and industry must work jointly to incentivize mechanical picking, HDPE-free collection practices, and standardized ginning infrastructure, especially in states like Maharashtra and Telangana where contamination is high. Without quality assurance protocol with traceability and grading, Indian mills will continue paying a 10 per cent premium just to clean what should have been clean to begin with. This undermines both productivity and export competitiveness.

2. Reviving PTA Supply Chains to Boost Polyester Yarn Competitiveness

India's polyester yarn industry faced heavy policy protectionism. Between 2014 and 2019, PTA imports contracted by 35 per cent, while anti-dumping duties raised input costs by USD 84–168 per tonne which affected non-integrated spinning mills as they lost market share. Though duties on PTA were lifted in 2020, downstream manufacturers still face a steep 10 per cent basic customs duty on polyester staple fibre yarn and 5 per cent on viscose yarn. Policy barriers like QCO make Indian MMF raw materials 10-15 per cent costlier than global competitors like China, Indonesia, or Vietnam. A Policy reset rooted in raw material affordability is essential for India to capture this growing market of global synthetics.

3. Modernising Spinning Infrastructure

Lack of modernization in spinning mills is hindering yarn productivity and profitability. Tamil Nadu, major hub for spinning mills in India, with 46 per cent of the total installed capacity, around 68 per cent of the country's machinery, that is more than 10 years old, is in Tamil Nadu, leading to energy inefficiencies and output variability. Despite the launch of TUFS in 1999, policy dilution through ATUFS (2016–2022) effectively excluded spinning mills from subsidy support, impeding modernization. Without fiscal intervention, India's spinning productivity will remain capped at 70–75 per cent capacity utilization (Indian Textile Journal, 2024), while global competitors like China and Vietnam operate at over 90 per cent efficiency. A shortage of skilled labour in India's spinning mills also affects production efficiency. Upskilling workers and increasing wages are necessary steps. Strategic skilling programs under government initiatives (Ex. Samarth scheme) can address the labour shortage and improve productivity in India's cotton yarn industry.

3.8. Conclusion

In this chapter, we discussed from 'Farm' to Factory (yarn); first stage of value addition in the cotton value chain. Global trends indicate a shifting global preference towards MMF. In case of cotton yarn exports from India, major share was going to China (USD 4 billion market) and lately to Bangladesh (USD 1.71 billion). Cotton yarn export trends from 2009, surged gradually and peaked in 2013, exporting 1.37 MMT cotton yarn, worth USD 4.80 billion. In 2013, around 42 per cent of the total cotton yarn exports from India were to China. Since 2007 and 2010 respectively, China, signed FTAs with Pakistan and Vietnam. The then existing export promotion policies between FY 2009 and FY 2014, under the FTP were aiding Indian cotton yarn manufacturers, to compete with Pakistan and Vietnam (with tariff-free market access) in Chinese import market. Once, the policies were withdrawn, India's cotton yarn lost its price competitiveness, in comparison to Vietnam's and Pakistan's cotton yarn in China. Post 2013, the cotton yarn exports have constantly seen a downturn. By 2020, only 22 per cent of the total cotton yarn exports from India was exported to China. Partially, over dependence of Indian cotton yarn exports on the China's cotton yarn market has led to the down fall of cotton yarn exports in India. Along with this, the TUFS scheme, which was aiding the spinning mills in modernizing the machinery and reducing the capital cost has been withdrawn now. ATUFS, the amended version of TUFS scheme, rolled out between 2016 and 2022 have been exempted for spinning mills in India. In case of synthetic yarns, Government introduced the Quality Control Order (QCO) for polyester fibres and yarns. The raw materials polyester staple fibre (PSF) and viscose yarn face policy protectionism which makes it 10–15 per cent costlier than global competitors like China, Indonesia, or Vietnam. A policy reset embedded in raw material affordability for non-integrated firms is essential in synthetic yarn. In the medium to long run, it is pertinent to develop cotton varieties of high strength and quality, modernize the spinning mills in India, skill-up labourers to increase labour productivity, increase labour wages is necessary.

References

Agarwal, O. P. (Ed.). (2009, October 20). World Cotton Prices May Harden Slightly in 2009-10 - ICAC Forecast. Cotton Statistics and News(29), pp. 1-4.

Backer, S. (1972). YARN. Scientific American, 227(6), 46-57. Retrieved from http://www.jstor.org/stable/24922936

Bedi, J. S. (2003). Production, Productivity and Technological Changes in Indian Spinning Sector. Indian Economic Review, 205-233. Retrieved from https://www.jstor.org/stable/29793791

Chattopadhyay, R. G. (2013). Indian Cotton and the needs of Spinning Industry. Cotton Research Journal, 5(2).

Gale, E. C. (2022). Shift in Geography of China's Cotton Production Reshapes Global Market. Economic Research Service. Retrieved from https://www.ers.usda.gov/amber-waves/2022/december/shift-in-geography-of-china-s-cotton-production-reshapes-global-market#:~:text=Part%20of%20this%20shift%20can,its%20imports%20of%20raw%20cotton.

Grandhi, V. S. (2007, October). Price volatility in the yarn industry: Lessons from India. International Institute for Sustainable Development.

Jain, S. K. (2020, March 17). Present Status of Indian Cotton Industry and its key issues.

Jha, C. P. (2022). An Empirical Analysis of India's Apparel and Textile Export Policies and Trade Agreements. Productivity, 63(2), 177-186.

M. Furqan Khurshid, M. A. (2012, June). Investigation of Specific Energy Consumption and Possible Reduction Measures of Textile Spinning Mills. Journal of American Science, 8(6), 535-542.

Maurice Landes, S. M. (2005, June). Growth Prospects for India's Cotton Textile Industries. Economic Outlook Report.

Muraleedharan, G. M. (2016, February). Impact of Multi Fibre Agreement (MFA) Phase out on Indian Textile Exports. Pacific Business Review International, 8(8).

Rungta, B. N. (2014). The Journal of Applied Economic Research. Export Subsidy Reforms and Productivity Improvements: The Case of the Indian Textile and Clothing Sector, 8(3), 327-352.

TEXPROCIL Welcomes MEIS and RoSL Rate Increase for Made ups. (n.d.).

Thomas J.T. and Anand A. (2024) https://thewire.in/labour/years-of-neglect-and-series-of-wrong-policies-badly-hit-indias-promising-textile-apparel-sectors

UN Comtrade Database. (n.d.). Retrieved from Trade Data: https://comtradeplus.un.org/TradeFlow

Vietnam: Surprising Strength In Cotton Spinning Benefits U.S. Exports. (2017, February 1).

Retrieved from Foreign Agricultural Service USDA: https://www.fas.usda.gov/data/vietnam-surprising-strength-cotton-spinning-benefits-us-exports

(1992-2002). Stock of Spun Yarn (SSI & Non-SSI) in India. Ministry of Textiles.

(2005-2009). Stock of Spun Yarn (SSI & Non-SSI) in India. Ministry of Textiles.

(2007-2018). Stock of Spun Yarn (SSI and Non SSI) in India. Ministry of Textiles.

(2018). International Production Cost Comparison. International Textiles Manufacturers Federation.

(2021-2022). Annual Survey of Industries. Retrieved from https://www.mospi.gov.in/sites/default/files/asi_results/ASI%20Volume%20I%202021-22%20Final_compressed.pdf

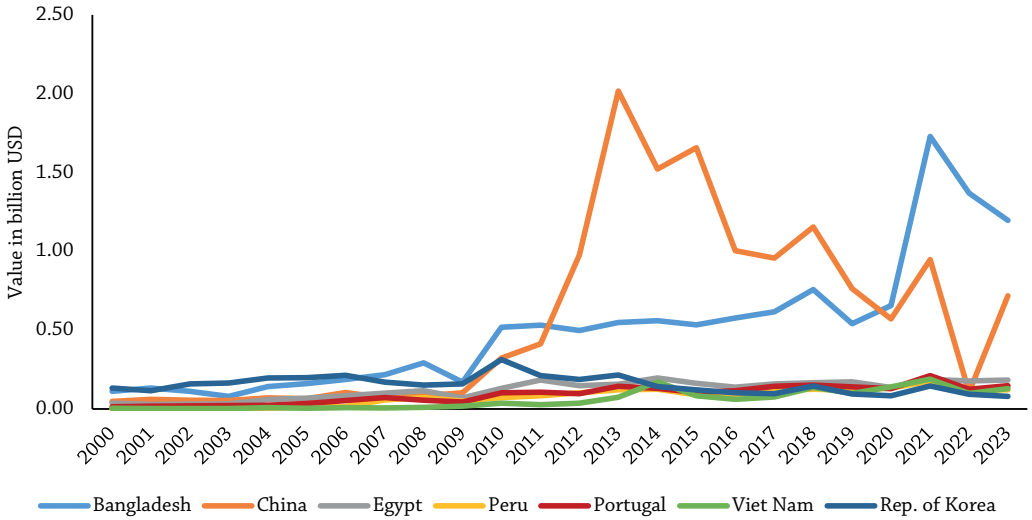
(2024). World Textile Demand Report. International Cotton Advisory Commitee.

ANNEXURE

Annex Table 3.1: HSN codes for cotton and MMF yarn

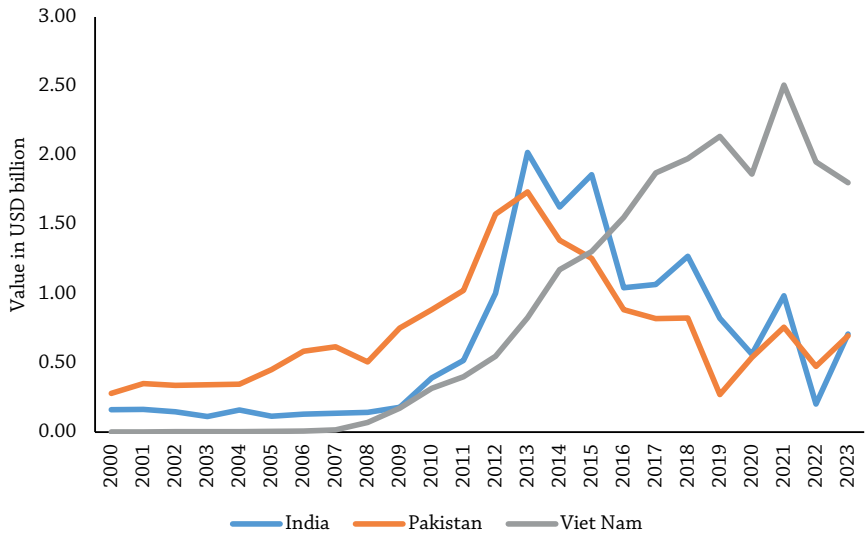
Cotton yarn	5204, 5205, 5207
MMF yarn	5401, 5402, 5403, 5406, 5508, 5509, 551011, 5511, 551012

Annex Figure 3.1: Major cotton yarn export destinations of India



Source: UNCOMTRADE; HS codes: 5204, 5205 & 5207.

Annex Figure 3.2: Major exporters of cotton yarn to China (India, Pakistan and Vietnam)



Source: UNCOMTRADE; HS codes: 5204, 5205 & 5207.

Annex Table 3.2: Tariff rate analysis to major cotton yarn export destinations

Exporters	*Value (Bn USD)*	*Percentage share of total imports*	*Tariff rates*	
			MFN	*Pref. TR*
China: 4.30 Bn USD				
Vietnam	2.11	49.06	-	0%
Pakistan	0.59	13.74	-	0% & 3.6%
India	0.58	13.57	-	3.5% & 4.5%
Uzbekistan	0.44	10.14	5%	-
Indonesia	0.20	4.73	5%	0%
Bangladesh: 1.71 Bn USD				
India	1.25	73.19	-	3%
China	0.17	9.80	5% & 10%	-
Pakistan	0.10	5.99	-	3%
Indonesia	0.07	4.28	5% & 10%	-
Vietnam	0.06	3.35	5% & 10%	-
Turkey: 0.76 Bn USD				
Uzbekistan	0.40	52.33	-	3.2% & 4%
Turkmenistan	0.12	15.66	4% & 5%	-
India	0.11	14.82	-	3.2% & 4%
Pakistan	0.03	4.19	-	3.2% & 4%
Azerbaijan	0.03	3.97	4% & 5%	-
Republic of Korea: 0.4 Bn USD				
Vietnam	0.19	47.54	-	0%
India	0.11	27.98	-	4%
China	0.03	8.34	-	0% & 2.6%
Indonesia	0.03	6.97	-	0%
Pakistan	0.02	5.84	8%	-
Portugal: 0.4 Bn USD				
India	0.17	41.48	4% & 5%	-
Turkey	0.13	31.55	-	0%
Pakistan	0.05	11.67	-	0%
Italy	0.01	3.19	-	0%
Germany	0.01	2.28	-	0%
Vietnam: 0.29 Bn USD				
China	0.15	51.98	-	0% & 5%
India	0.10	33.26	-	0% & 5%
Indonesia	0.01	3.02	0%	
Malaysia	0.01	2.40	-	0%
Republic of Korea	0.01	2.32	-	0%
Egypt: 0.24 Bn USD				
India	0.15	60.74	5%	-
Turkey	0.04	16.71	-	0%
Uzbekistan	0.02	9.03	5%	-
China	0.01	2.90	5%	-
Indonesia	0.01	2.30	5%	-

Peru: 0.21 Bn USD				
India	0.16	75.06	6% & 11%	-
Vietnam	0.01	5.00	6% & 11%	-
Indonesia	0.01	4.11	6% & 11%	-
China	0.01	3.03	6% & 11%	-
Uzbekistan	0.01	2.74	6% & 11%	-
Dominican Republic: 0.33 Bn USD[10]				
USA	0.30	88.39	0%	
Indonesia	0.01	3.59	0%	
India	0.01	2.11	0%	
Mexico	0.005	1.37	0%	
Pakistan	0.004	1.13	0%	
Italy: 0.28 Bn USD				
Turkey	0.13	88.39	-	0%
India	0.05	3.59	4% & 5%	-
China	0.05	2.11	4% & 5%	-
Pakistan	0.03	1.37	-	0%
Spain	0.003	1.13	-	0%
Russia: 0.30 Bn USD[11]				
Uzbekistan	0.2	77.4	-	0%
Turkmenistan	0.02	8.3	-	0%
Tajikistan	0.02	5.6	-	0%
Azerbaijan	0.01	2.2	-	0%
Kazakhstan	0.004	1.5	-	0%
India	0.003	1.1	5%	-

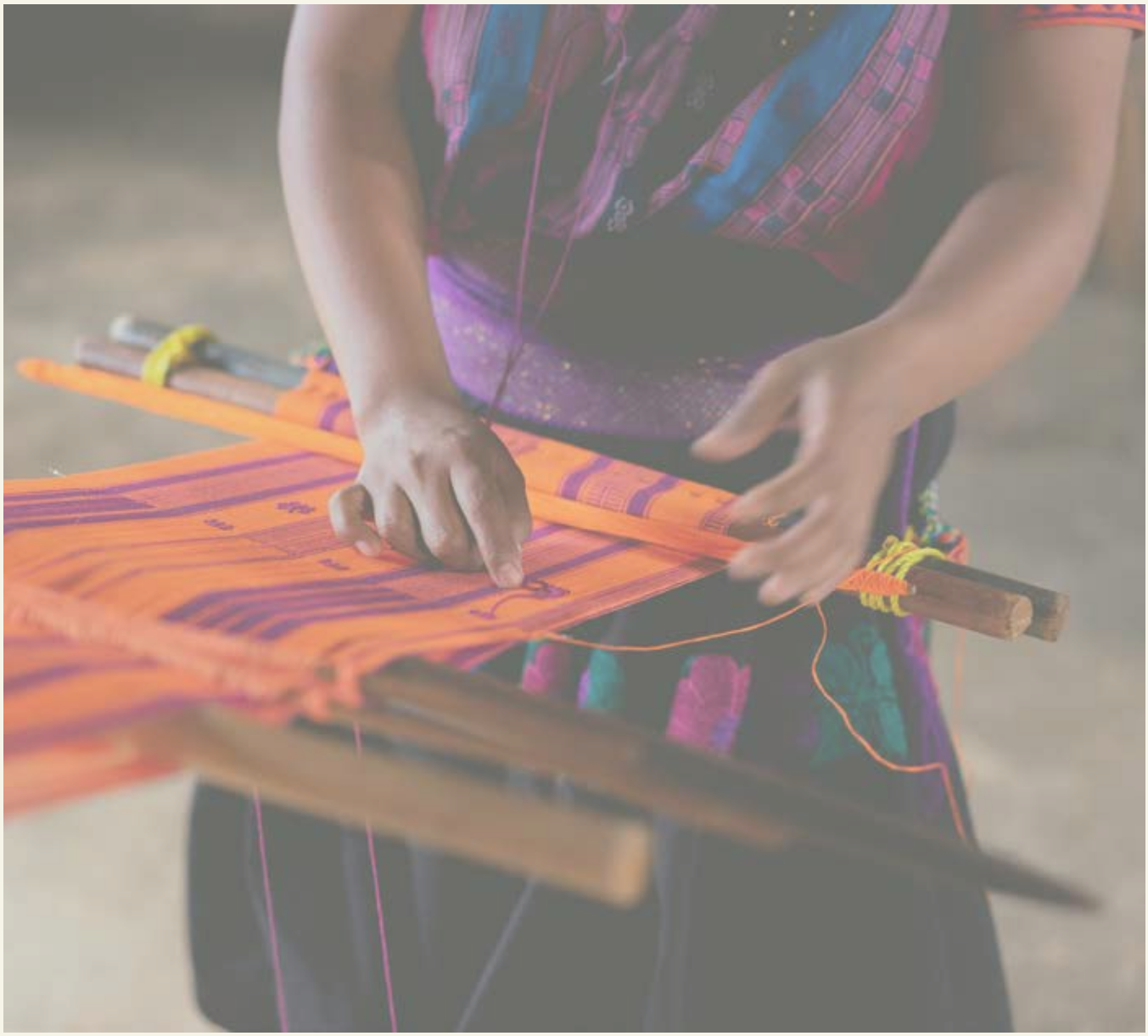
Source: ITC Market Access Map.

10. The cotton yarn value trade is reported for year TE 2023, as 2020 data NA
11. The cotton yarn value trade is reported for year TE 2021. For other countries, TE 2022 value is reported.

4

Weaving Yarn to Fabric

AYUSHI GUPTA, RITIKA JUNEJA, AND ASHOK GULATI



Weaving Yarn to Fabric

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4.1 Introduction

Fabric manufacturing is the crucial intermediary stage in cotton value chain that transforms spun yarn into woven or knitted fabric that undergoes processing through dyeing, finishing, and printing. Processing is a vital link enhancing the fabric's functional and aesthetic appeal while ensuring compliance with global standards. It determines the durability, texture, and final usability of textiles, making it a critical determinant of product competitiveness in domestic and international markets (Stark, Bamber & Couto, 2022).

The process of fabric production involves weaving and knitting, two distinct methods that define the structure and properties of the final textile. Weaving, the more traditional technique, interlaces two sets of yarn – warp and weft – at right angles to create strong, durable textiles used in formal wear, upholstery, and industrial applications. In contrast, knitting involves inter-looping yarns to form anelastic and breathable fabric, making it ideal for garments such as t-shirts, hosiery, and activewear (Adanur, 2000). In India, these processes, concentrated in industrial hubs like Surat (Gujarat), Bhiwandi (Maharashtra), Erode and Tirupur (Tamil Nadu), Ludhiana (Punjab), and Kolkata.

India's fabric manufacturing industry operates through a diverse production ecosystem, encompassing traditional handlooms, decentralised power loom clusters, knitting units, and large-scale composite mills. India has the world's highest installed loom capacity which includes 3.85 lakh power looms and 28 lakh handlooms (Ministry of Textiles, 2024). Despite this vast production capacity, India's fabric manufacturing sector faces challenges – low technology adoption, fragmented supply chains, and limited economies of scale. With 80 per cent of textile and apparel producers operating as micro, small, and medium enterprises (MSMEs), production remains largely unorganised, hindering scalability and global competitiveness (Economic Survey, 2024).

This chapter delves into the fabric segment of the cotton value chain, shifting our focus to explore its intricate production landscape, structural composition, and the critical challenges it faces. By examining the complexities of India's fabric manufacturing ecosystem, we aim to gain a deeper understanding of the factors that influence its performance and growth. This comprehensive analysis will enable us to identify key policy gaps and strategic interventions required to modernize the industry, improve its export competitiveness, and strengthen its position within the rapidly evolving global textile value chain.

4.2 Evolution of India's Fabric Industry

Drawing on insights from The Crafts and Capitalism: Handloom Weaving Industry in Colonial India (Roy, 2020), this section examines the historical evolution of India's cotton industry, tracing its transition from a dominant global exporter to a fragmented industry under colonial rule and its post-independence restructuring.

Colonial Decline of India's Textile Industry

India was a major exporter of textiles in the eighteenth century, supplying high-quality woven cloth to the global market. However, with the rise of British machine-made yarn and cloth between 1820 and 1880, India's prominence in global textile trade began to decline. The British industrial revolution led to mass production in the textile industry, and Indian handmade textiles struggled to compete with the cheaper, machine-made imports flooding the market. This shift caused a severe downturn for traditional handloom weavers and merchants in India, leading to widespread economic hardship in textile-producing regions.

The introduction of British policies worsened the crisis. High tariffs were imposed on Indian textile exports, while British cloth was imported duty-free, creating an uneven playing field. This marked the transformation of India from a textile-exporting nation to a raw material supplier, with its cotton being exported to feed the mills of Lancashire and Manchester while domestic weaving industries suffered. The Indian textile industry, which had flourished for centuries, was left fragmented and unable to compete on an industrial scale (Roy, 2020).

The Rise of Power looms and the Transition from Handlooms

By the early twentieth century, Indian weavers recognised the necessity of adapting to mechanisation. The boundary between hand-weaving and power-weaving was not rigid, and many weavers began investing in power looms as they sought ways to maintain their livelihoods. This transition was driven by their skills, access to markets, and the availability of capital. The first power looms appeared in India's major textile towns, such as Bombay, Ahmedabad, and Kanpur, at the turn of the century. Initially, these power looms were small-scale operations, producing sarees and other traditional fabrics (Roy, 2020).

Unlike the large cotton mills of Bombay and Ahmedabad, which were fully integrated, most power loom factories operated as independent weaving units. They purchased yarn from spinning mills and outsourced fabric processing to local firms. This system allowed them to operate as part of a decentralised industrial network rather than a centralised factory model. The shift of capital towards power looms began in the interwar period, accelerated in the 1960s and 1970s, particularly in urban clusters where hand-weaving had traditionally been strong. Textile hubs such as Sholapur, Salem, Bhiwandi, and Surat saw significant investments in power-weaving factories, funded by handloom weavers and new industrialists (Roy, 2020).

Government Intervention and Protectionist Policies

Following India's independence, the economic strategy prioritised self-sufficiency in industrial production. The government implemented policies that focused on domestic machinery, metals, and chemicals, often at the expense of the traditional textile sector. Cotton textiles, which had been India's strength for centuries, lost priority in industrial policy, and cotton mills struggled to obtain foreign exchange or investment licences to modernise. Consequently, many of the large cotton mills began declining in the 1970s (Roy, 2020).

To protect handloom weavers from the rise of mechanised production, the Indian government introduced the Handloom Reservation Policy as part of the 1950 Textile Policy. This policy restricted large mills from expanding their capacity and reserved certain product categories, such as sarees and *dhotis*, for handloom production. While this provided relief to handloom workers, it stifled industrial progress by preventing mills from scaling up and modernising. The restrictions remained in place until the 1985 Textile Policy that eased some of the earlier restrictions.

During this period, most new power loom factories emerged between 1950 and 1990, particularly in Maharashtra, Gujarat, and Tamil Nadu. The final blow to the traditional cotton mills came during the 1982–83 Bombay Textile Strike that led to widespread mill closures in Bombay, Ahmedabad, Kanpur, and Madras. This collapse created an opportunity for power loom factories to expand, taking over the production of fabrics previously made by mills, such as grey and bleached sheets. Additionally,

the emergence of synthetic fabrics like polyester and rayon allowed power looms to cater to the mass market with printed sarees and synthetic textiles capturing the traditional handloom sector's market share.

By the mid-1990s, Maharashtra, Gujarat, and Tamil Nadu had become India's primary textile-producing regions. However, their industrial structures varied significantly. In western India, power loom operations were concentrated in urban centres, with trade, processing, and manufacturing occurring within the same cities. In contrast, southern India's textile industry developed a semi-rural model, where production was dispersed across small towns while trade and processing were managed in specialised urban centres. Tamil Nadu's superior rural infrastructure facilitated this decentralised model, allowing power loom units to thrive outside major cities, unlike Maharashtra, where urban centres dominated the industry (Roy, 2020).

The evolution of India's textile sector, shaped by colonial policies and post-independence industrial strategies, laid the foundation for its modern structure. While government interventions provided necessary protection to traditional sectors like handlooms, they also influenced the development of the decentralised power loom and mill industries, leading to regional variations in industrial organisation. As a result, India's fabric manufacturing landscape today is characterised by a complex mix of organized, unorganised and decentralized segments.

4.3 Structure and Dynamics of India's Fabric Sector

India's fabric manufacturing sector is vast and diverse, shaped by its historical textile traditions, modern industrial advancements, and an extensive raw material base. India operates through a dual fabric production system – a highly fragmented and decentralised fabric production sector alongside a relatively smaller but technologically advanced, composite mill sector.

To understand this landscape, fabric manufacturing can be classified along two primary dimensions:

- *Segmentation by Mill and Decentralised Sector,* which categorises production based on industry structure, scale, and technology.
- *Segmentation by Fibre Types,* which classifies fabrics based on the raw materials used in their manufacturing.

By examining these classifications, we gain insight into the functioning, challenges, and growth potential of India's fabric industry.

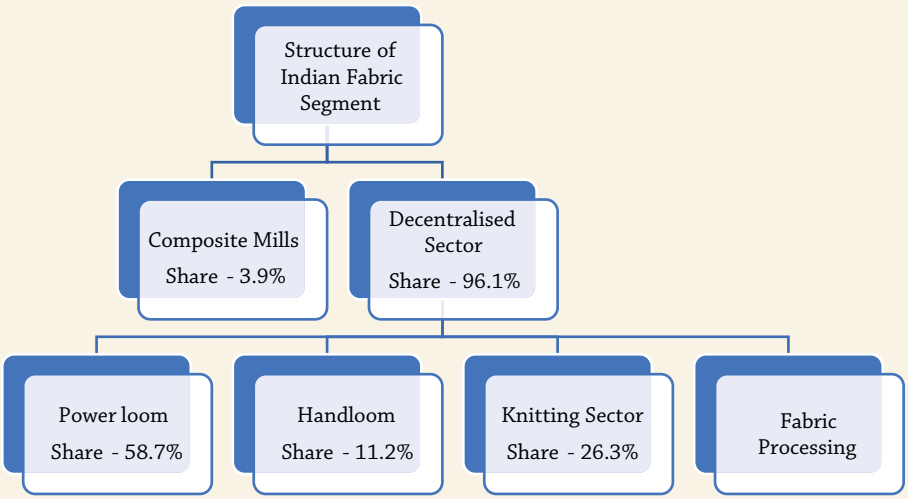
4.3.1 Segmentation by Mill and Decentralised Sector

The mill sector, often referred to as the organised sector (Ministry of Textiles, 2003) benefits from advanced technology, economies of scale, and stringent quality control, allowing for high-value fabric production. It accounts for only a small share of total output. In contrast, the decentralised sector dominates fabric production, relying on a wide range of small and medium-scale units that form the backbone of employment and regional economies (NITI Aayog, 2020). This segment includes power looms, handlooms, knitting units, embroidery workshops, home-based artisans, and independent textile processing businesses such as dyeing, printing, and finishing. Despite its significant contribution, the decentralised sector faces challenges in scalability, financial access, and regulatory compliance, limiting its ability to compete with technologically advanced global textile industries (Figure 4.1).

- *Composite Mill Sector:* Despite its technological edge and capability to produce high-end textiles, the mill sector contributes only about 3 per cent of India's total cloth production (Ministry of Textiles, 2023). This limited share is due to multiple factors, including high capital investment requirements and stringent compliance regulations. While power looms and handlooms cater to a large domestic market with cost-competitive production, the mill sector is instrumental in manufacturing premium, value-added fabrics that are in demand in domestic and international markets. Several major companies showcase how the mill sector works as an inte-

FIGURE 4.1

Structure of Indian Fabric Manufacturing



Note: The share of segments in total fabric production is based on disaggregated data for 2014-15. From 2015 onwards, data is available only in broad classifications between the mill and decentralised sectors.

Source: Author's Own.

grated system. Raymond operates across spinning, weaving, processing, and garmenting, making it a major player in high-quality suiting fabrics and a leading denim producer. Grasim Industries (Aditya Birla Group) has an end-to-end textile production chain, covering spinning, weaving, and finishing, with a strong focus on viscose and blended textiles. Arvind Limited follows a highly diversified model, integrating spinning, weaving, knitting, and in-house design, excelling in denim, technical textiles, and high-performance fabrics (Company websites).

- *Handloom Sector:* A cottage-based industry, predominantly rural, known for traditional, artisanal fabric production. In simple terms, handloom refers to a manually operated loom where skilled weavers interlace yarns without the use of electricity or automated machinery. The handloom sector is one of the largest unorganised economic activities in India, employing over 35 lakh people, including 25 lakh female weavers and allied workers (Ministry of Textiles, 2024). Handloom weaving is characterised by low capital investment, minimal energy consumption, eco-friendliness, and adaptability to small-batch production.

  As of 2023-24, India had 28 lakh handlooms, with major handloom export centres located in Karur (Tamil Nadu), Panipat (Haryana), Varanasi (Uttar Pradesh), and Kannur (Kerala). These centres produce a range of products, including bed linen, table linen, kitchen linen, toilet linen, embroidered fabrics, curtains, and floor coverings. Key importers of Indian handloom products include USA, UK, Germany, Italy, France, Japan, Saudi Arabia, Australia, the Netherlands, and UAE (Ministry of Textiles, 2024). To support the sector, the Government of India has implemented several central sector schemes, providing financial assistance to 715 handloom clusters between 2015-16 and 2023-24. Currently, nine mega handloom clusters are being developed across eight states, including Assam, Uttar Pradesh, Tamil Nadu, West Bengal, Jharkhand, Andhra Pradesh, Bihar, and Manipur. The government has allocated INR 14.28 crore for these clusters to enhance production and export capacity (Ministry of Textiles, 2024).

- *Power loom Sector:* The power loom industry accounts for 58.4 per cent of the total fabric production. It is the primary supplier of fabric for ready-made garments and home textiles, making it an essential segment within the industry. A power loom is a mechanised loom that uses electric power to automate the weaving process, significantly increasing speed, efficiency, and fabric uniformity compared to handlooms thus, enabling mass production of textiles at a lower cost (Roy, 2020). Power loom units manufacture a wide variety of fabrics, including dyed fabrics, grey fabrics, cotton textiles, printed fabrics, and blended fabrics with synthetic fibres. As of April 2022, India had approximately 3.85 lakh power looms, with Maharashtra leading at 39 per cent of the total power loom capacity. Other key states include Andhra Pradesh, Gujarat, Uttar Pradesh, Karnataka, and Tamil Nadu (Indian Trade Portal, n.d.). Despite its vast production base, India's power loom sector struggles with technological obsolescence. Most power loom units continue to operate on outdated technology, resulting in low productivity and inconsistent quality standards. The technological lag is evident in India's low adoption of shuttle-less looms, which are essential for high-speed, defect-free weaving. India holds just a 2 per cent share in global shuttle-less loom capacity, highlighting the urgent need for modernisation and automation to remain competitive in international markets (NITI Aayog, 2020).
- *Knitting Sector:* The knitting sector plays an important role in India's fabric manufacturing industry, producing soft, stretchable, and breathable textiles widely used in hosiery[1], sportswear, activewear, and casual wear. Knitted fabrics are popular in hot and humid conditions due to their breathability, moisture-wicking properties, and soft texture. Their snug fit, stretchability, and wrinkle-resistant qualities make them ideal for sportswear, leisurewear, and functional garments (Arya, 2017). India's knitting and knitwear industry has key production clusters in Tirupur (Tamil Nadu), Ludhiana (Punjab), Kolkata, Surat (Gujarat), and Bengaluru. Several leading domestic players have emerged as key manufacturers in India's knitting and knitwear segment, including Oswal Group, Kudu Knit Process, KPR Mill, Adonis Intex, Texcraft, Ace Knit, and Sel Group (Government of Gujarat, n.d.).

  Despite its growth, the sector faces challenges, primarily due to its fragmented and decentralised nature. The knitting industry's production is spread across small, independent units, which can result in inefficiencies in scale and inconsistency in production quality. Another challenge is the skills gap, as many companies struggle to find workers who are proficient in operating and maintaining modern knitting machinery. While larger players in the sector have invested in advanced technology, smaller units often rely on semi-automatic machines, leading to lower productivity and quality inconsistencies. Additionally, high capital investment requirements deter smaller players from upgrading to state-of-the-art knitting equipment, limiting India's ability to compete with leading global knitting hubs like China, Bangladesh, and Vietnam, which have aggressively adopted automation, digital production tracking, and sustainable textile innovations (Textile Magazine, 2024).
- *Fabric Processing & Finishing:* The fabric processing and finishing sector plays a pivotal role in India's textile industry, transforming raw textiles into market-ready fabrics through dyeing, printing, and advanced treatments that enhance quality, durability, and functionality. However, this segment remains largely fragmented and dominated by small-scale independent enterprises. One of the most significant challenge in the fabric processing and finishing sector is its significant

1. Hosiery refers to knitted fabrics used primarily in the production of undergarments, socks, stockings, and loungewear. The government of India often uses the term hosiery when reporting textile production data, particularly when measuring the output of knitted garments sector.

environmental impact, making it one of the most pollution-intensive segments of the textile industry. Pre-treatment, dyeing, printing, and finishing operations consume huge quantities of water, chemicals, and energy, generating large volumes of hazardous effluents that require proper treatment before disposal (Madhav et al., 2018). Many small and medium processing units lack access to advanced wastewater treatment facilities, exacerbating the issue. While Tamil Nadu and Maharashtra have enforced Zero Liquid Discharge (ZLD) policies, requiring complete water recycling, others mandate basic effluent treatment, leading to unequal compliance costs across different regions

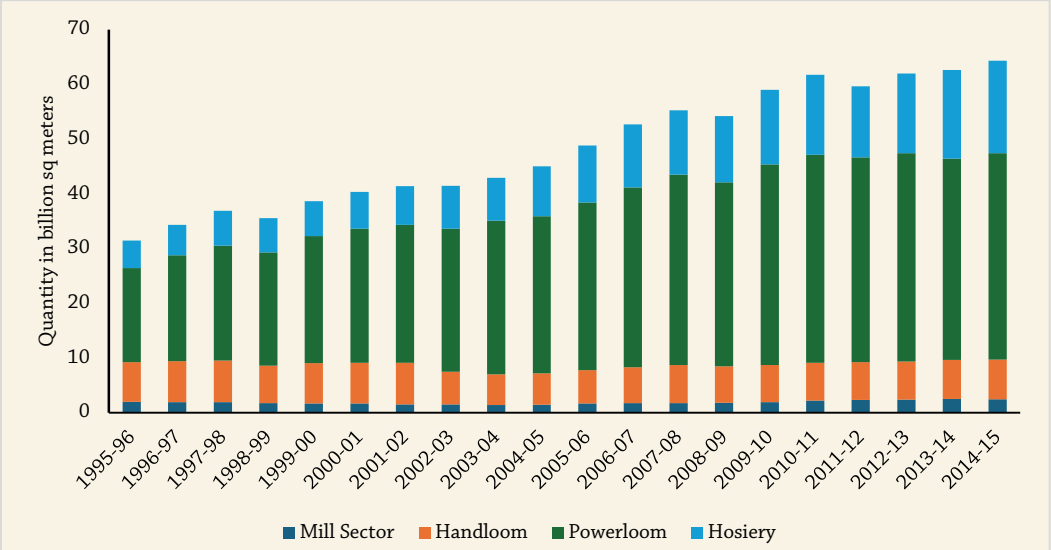
Another key challenge is the lack of technological upgrades. While large mills and export-oriented units have invested in automated dyeing machines, digital printing technology, and eco-friendly finishing processes, a significant portion of the sector still relies on outdated methods, leading to inconsistent fabric quality, higher production costs, and inefficiencies.

Sectoral fabric production data from 1995 to 2020 highlights the dominance of decentralised sector in fabric manufacturing. Whereas the composite mill sector registers a miniscule and declining share. In 1995-96, the mill sector contributed 6 per cent to total fabric production, which has declined to 2.7 per cent by 2019-20.

In contrast, the decentralised sector has been the primary driver of growth, doubling total fabric production from 31.5 billion square metres in 1995 to 63.3 billion square metres in 2019-20, with an AAGR of 3.5 per cent over this period. Within the decentralised segment, power looms have consistently maintained the largest share of fabric production, averaging 60 per cent during 1995-2014-15. In 2014-15, power looms accounted for 58.7 per cent of total fabric production, reflecting their continued dominance in the market. The AAGR of the power loom sector stood at 4.3 per cent (1995-2015), showing steady expansion in fabric manufacturing. There is a rapid expansion of the hosiery sector also, which accounted for 16 per cent of total fabric production in 1995, and by 2015, its share increased to 26 per cent,

FIGURE 4.2

Fabric Production by Sectors in India, 1995 to 2015



Note: From 2015-16 onwards, the classification of fabric production is made only between the mill sector and decentralised sector. The latest available data is for 2019-20, the mill sector produced 1.7 billion sq meters of fabric whereas the decentralised sector produced 61.6 billion sq meters of fabric.

Source: IndiaStat.

BOX 4.1

Fabric Production Clusters in India

India's fabric manufacturing is concentrated in nine key states – Gujarat, Maharashtra, Tamil Nadu, Punjab, Rajasthan, Karnataka, Haryana, Uttar Pradesh, and Telangana – accounting for nearly 90 per cent of the total looms (Textile Value Chain, 2018).

Gujarat – India's Synthetic Textile Hub: Surat and Ahmedabad are the largest weaving clusters in the state. Surat is the country's largest MMF fabric hub, specialising in polyester and nylon, while Ahmedabad has a strong base in cotton, denim, and polyester weaving.

Maharashtra – Power loom and Blended Fabric Industry: Bhiwandi, one of India's largest power loom clusters, produces cotton, MMF, and blended fabrics, while Ichalkaranji is known for high-quality cotton shirting and suiting fabrics. Mumbai and Nashik specialise in cotton-wool blends and polyester-based textiles.

Tamil Nadu – Cotton and Knitwear Manufacturing: Erode, Salem, and Madurai are key centres for cotton and viscose fabrics, while Tirupur, the "Knitwear Capital of India," is the country's largest knitted fabric and garment manufacturing hub.

Punjab and Haryana – Woollen and Hosiery Textiles: Ludhiana and Amritsar lead in hosiery, woollen textiles, and MMF-blended fabrics, while Panipat is India's home textile hub, producing carpets, curtains, and bed linens.

Rajasthan and Uttar Pradesh – Blended Textiles: Bhilwara and Jaipur focus on cotton, MMF, and denim fabrics, while Meerut is a major centre for cotton-based woven fabrics.

Source: Textile Value Chain, 2018.

demonstrating an AAGR of 6.8 per cent. This rise reflects changing consumer preferences, particularly the growing demand for stretchable, comfortable, and easy-care fabrics used in innerwear, sportswear, and casual clothing.

4.3.2 Segmentation by Fibre Type

While industry structure determines how fabric is manufactured, an equally important aspect is the raw materials that go into fabric production. India's diverse climate and agricultural base have made it one of the few countries capable of producing a wide variety of natural and MMF, which are further processed into an extensive range of fabrics. By analysing fabric production through industry structure and fibre types, we gain a comprehensive understanding of India's textile sector.

- Natural Fibre Based Fabrics: Natural fibre fabrics include textiles made from cotton, silk, wool, and jute. Cotton is the most widely used natural fibre in India (and also the focus of this report), with key cotton-producing states including Gujarat, Maharashtra, Telangana, and Punjab. Extensive cotton production supports (as raw material) a wide range of textiles, from traditional handloom fabrics to modern apparel. (Ministry of Textiles, 2023).
- MMF Based Fabrics: MMF has revolutionised fabric production by offering durability, cost-efficiency, and specialised performance characteristics. MMFs are broadly classified into two types: synthetic fibres and cellulosic fibres. Synthetic fibres, derived from crude oil, include polyester, acrylic, and polypropylene, whereas cellulosic fibres, obtained from wood pulp, include viscose, modal, and lyocell. Fabrics made from these fibres are collectively referred to as man-made fibre textiles, which are widely used across apparel, home textiles, industrial applications, and technical textiles. Surat (Gujarat), known as the synthetic textile capital of India, leads in polyester fabric production, while other major synthetic textile hubs include Vadodara and Ahmedabad (Gujarat) and Mumbai (Ministry of Textiles, n.d.).

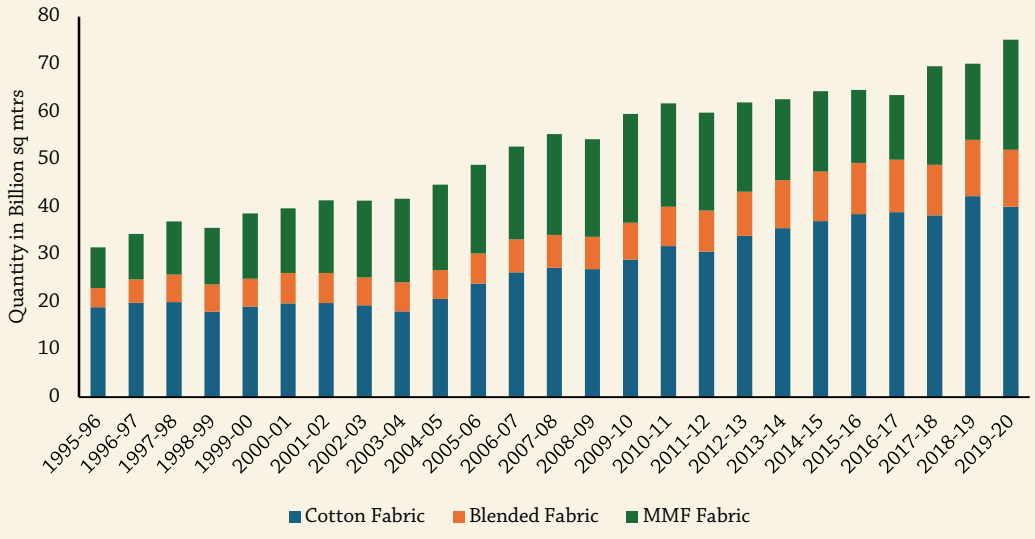
- Blended Fibre Based Fabrics: Blended fabrics merge two or more fibres to enhance comfort, durability, and functionality, making them a vital component of India's textile industry. This process balances the strengths and limitations of individual fibres, enabling manufacturers to create fabrics with better texture, resilience, elasticity, and moisture management. Blending is economically viable, as it helps address raw material shortages, particularly in cotton, by offering a low-cost alternative that meets the growing demand for textiles (Arya, 2017). Poly-cotton and wool-blend fabrics are extensively used in garment production. Key blended textile-producing clusters include Ichalkaranji and Bhiwandi (Maharashtra), and Erode (Tamil Nadu), where power looms play a crucial role in large-scale blended fabric manufacturing.

Despite significant technological advancements and shifting global trends, cotton-based fabrics continue to dominate India's textile industry, even as the world moves towards a MMF driven textile market[2]. The data from 1995-96 to 2019-20 reflects a gradual shift in India's fibre mix, but cotton remains the largest contributor to fabric production.

In 1995-96, cotton fabrics accounted for 60 per cent of total fabric production, but by 2004, this share had sharply declined to 43 per cent due to challenges in raw material base. However, with the introduction of Bt cotton in India in the early 2000s, domestic cotton production increased significantly, leading to a resurgence in cotton fabric production. As a result, cotton's share in total fabric output gradually rose again, reaching 57.2 per cent in 2019-20. This highlights the strong link between raw material availability and fabric production trends, where technological advancements in cotton farming helped stabilise and sustain the dominance of cotton textiles in India. In contrast, the share of blended fabrics increased from 12.8 per cent to 17.1 per cent, while MMF fabrics grew from 27.1 per cent to 33 per cent over the same period. The AAGR (during 1995-96 and 2019-20[3]) of cotton fabric production stood at 4.1 per cent, whereas blended fabrics grew at 3.7 per cent and MMF fabrics at 4.5 per cent, indicating that synthetic and mixed-fibre textiles have gained traction but at a slower pace compared to global trends.

FIGURE 4.3

Fabric Production by Fibre Type, 1995 to 2020



Source: USDA-Cotton and Products Annual, 2018 and Ministry of Textiles, 2020.

2. Currently MMF dominates global textile fibre consumption with 70:30 ratio i.e., MMF 70 per cent and 30 per cent is Natural fibre.

3. Latest available data is available only till 2019-20.

4.4 Global Fabric Trade Scenario and India's Positioning

The global fabric trade has seen consistent growth over the past two decades, with fabric exports increasing from USD 52 billion in 2001 to USD 92 billion in 2023[4] (ITC Trade Map).

Fabric exports can be further classified as cotton fabric and man-made fibre (MMF) fabric[5].

For TE 2022, global cotton fabric exports were valued at USD 33.4 billion, with China holding a dominant 48 per cent market share. While India ranked as the second-largest exporter with a 7 per cent share, the gap between the two nations remains vast. China's export volume is more than six times that of India's. India is followed by Pakistan (6 per cent), Türkiye (5 per cent), and Italy, Vietnam, and Korea (each 3 per cent). Other exporting nations collectively accounted for 18 per cent of the total (Figure 4.4). Major Exporting destinations for China are Vietnam (19 per cent), Bangladesh (13 per cent), and Cambodia (8 per cent).

For MMF fabric, global exports stood at USD 60.6 billion in TE 2022, with China further strengthening its position as the largest exporter, accounting for 59 per cent of the total exports. Other significant players included Republic of Korea (4 per cent), Turkiye and Italy (2.8 per cent), and Germany (2.6 per cent), while India contributed 2.1 per cent. The remaining 12 per cent of exports were distributed among smaller exporting nations (Figure 4.5). China's major export destinations include Vietnam (14 per cent), Bangladesh (6 per cent), Indonesia (4 per cent), and India (3 per cent). For cotton fabric, Bangladesh stands as the largest importer, accounting for 17 per cent of global imports. Vietnam follows, importing 13 per cent of total cotton fabric, reflecting its status as a key hub for garment exports to major global markets, including the US and EU. Other significant importers include Indonesia (5 per cent), the USA (4 per cent), Italy (4 per cent), and Hong Kong (3 per cent) during TE 2022, indicating steady demand from both apparel manufacturing nations and high-value textile-consuming countries (Figure 4.6). Vietnam leads in MMF fabric imports with a 14 per cent share (Figure 4.7), reaffirming its central role in garment manufacturing, particularly

FIGURE 4.4

Major Exporters of Cotton Fabric, TE 2022

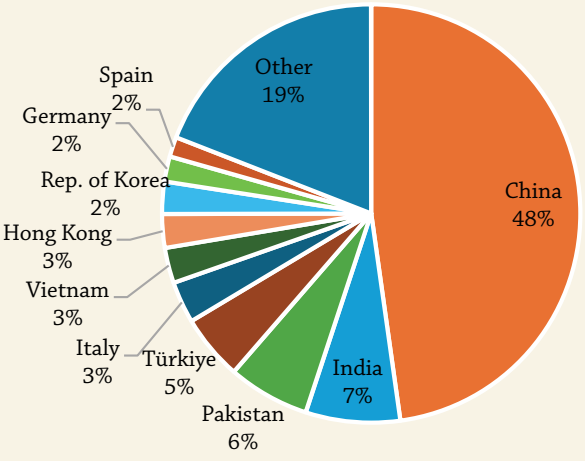
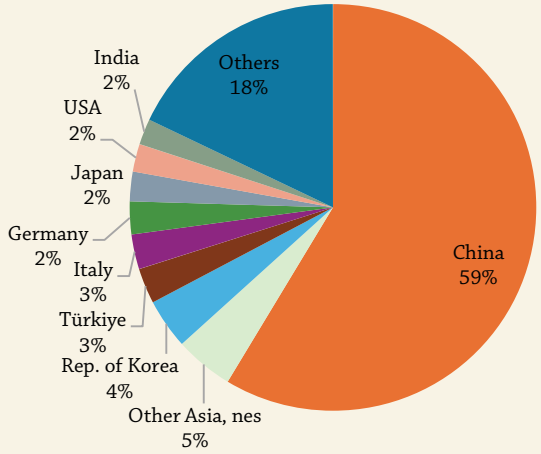


FIGURE 4.5

Major Exporters of MMF Fabric, TE 2022



Source: UN COMTRADE.

4. Including HS codes under 5208, 5209, 5407, and 5408 (Woven Fabric), and HS codes 6001–6006 (Knitted Fabric).
5. Refer Table 4.1 in the Annexure for list of HS codes included in this analysis

FIGURE 4.6

Major Importers of Cotton Fabric, TE 2022

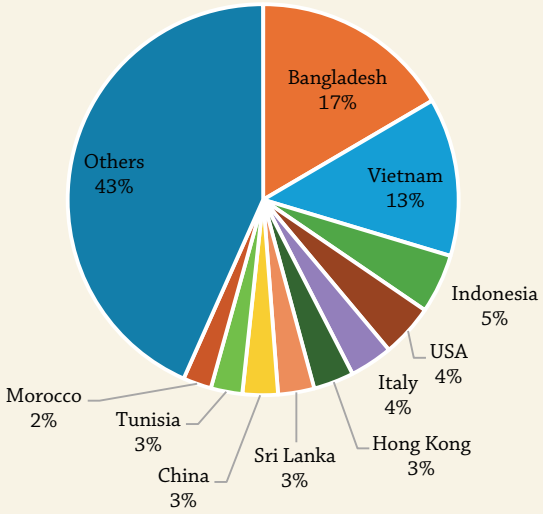
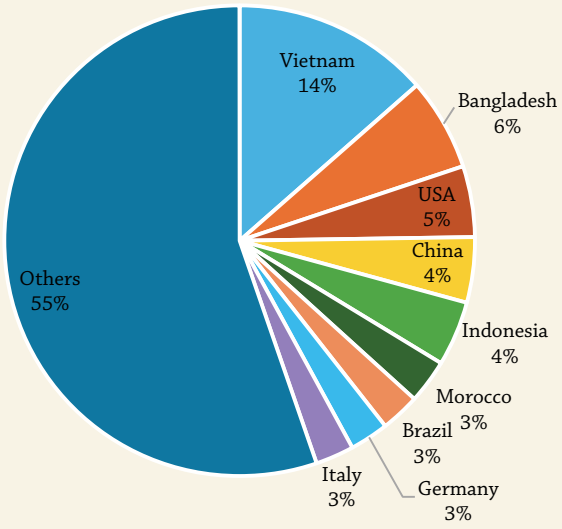


FIGURE 4.7

Major Importers of MMF Fabric, TE 2022



Source: UN COMTRADE.

for synthetic-based apparel such as sportswear and athleisure. Bangladesh, while still a major importer of MMF fabric, holds a comparatively lower share of 6 per cent, indicating a stronger reliance on cotton fabrics for its garment exports. Other key MMF importers include the USA (5 per cent), China and Indonesia (5.5 per cent).

India's cotton fabric exports in TE 2023 stood at USD 2.4 billion, with Bangladesh (21 per cent) being the largest importer, followed by Sri Lanka (12 per cent), the USA (8 per cent), Senegal (5 per cent), and the European Union (4 per cent). Other important destinations included the UAE (3.6 per cent), Nigeria (3.6 per cent), and the Republic of Korea (3.8 per cent), while Nepal (2 per cent) and Colombia (2.4 per cent) accounted for smaller shares (Figure 4.8).

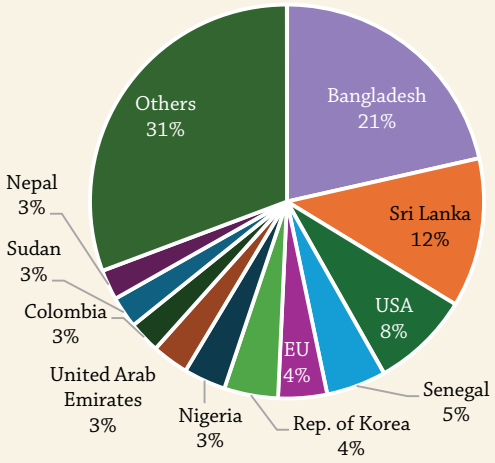
For MMF fabric, India exported USD 1.4 billion worth of goods in TE 2023. The UAE (14 per cent) emerged as the top importer, followed closely by Bangladesh (13 per cent), the USA (9 per cent), and the EU (6 per cent). Other key markets included Sri Lanka (5 per cent), Afghanistan (3 per cent), and Egypt (3 per cent), with a significant portion (39 per cent) of exports distributed among various smaller markets (Figure 4.9). Compared to cotton, India's MMF exports are lower in value, reflecting its stronger domestic focus on cotton textiles.

India is positioned as a net exporter in both segments, thus highlighting India's footprint in global textile trade, particularly in cotton fabrics. However, when viewed alongside import trends, a critical contrast emerges – while India is a leader in cotton fabric exports, it remains heavily dependent on imports for MMF fabrics, particularly from China.

This import pattern highlights China's continued dominance in cotton fabric exports, despite India being one of the largest cotton producers in the world. The presence of Vietnam and Bangladesh as key suppliers reflects their growing role in cotton textile processing and re-exporting, often benefiting from preferential trade agreements and cost efficiencies. The small but diverse contributions from European and East Asian countries suggest India's reliance on specific high-value or specialised cotton fabrics that are not widely produced domestically. Unlike cotton, where India has a strong local supply base, MMF fabrics require advanced processing technologies and raw materials, areas where China has developed a significant competitive edge.

FIGURE 4.8

India's Major Cotton Fabric Export Destinations, TE 2023



Source: UN COMTRADE.

FIGURE 4.9

India's Major MMF Fabric Export Destinations, TE 2023

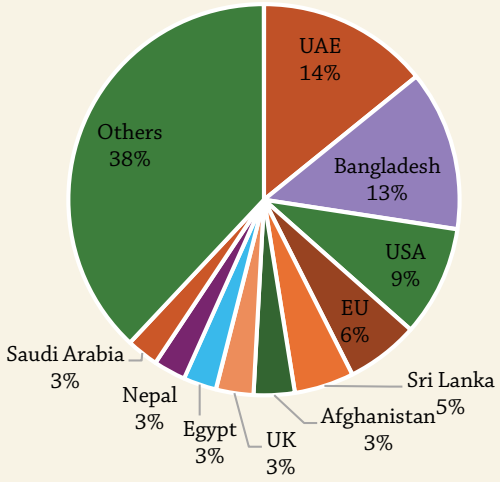
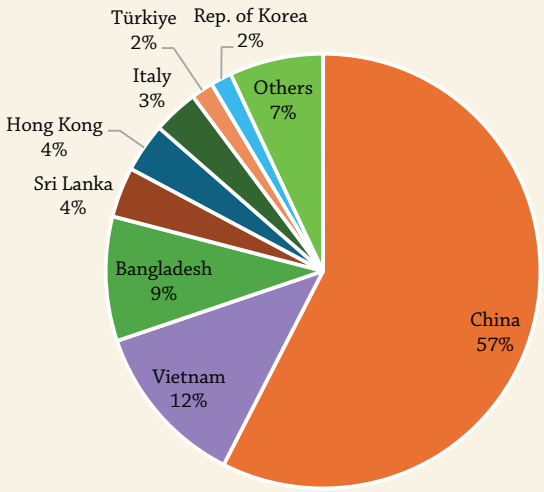


FIGURE 4.10

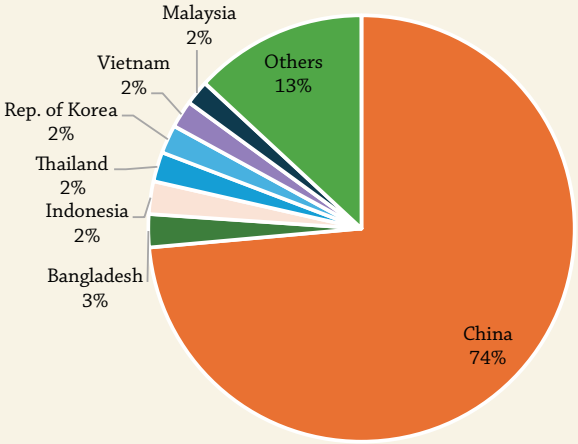
India's Major Cotton Fabric Import Destinations, TE 2023



Source: UN COMTRADE.

FIGURE 4.11

India's Major MMF Fabric Import Destinations, TE 2023



- *Tariff Analysis for Woven and Knitted Fabric*

  - Tariffs play a crucial role in shaping global trade dynamics, particularly in the fabric sector, where import duties influence the competitiveness of exporting countries. The tariff structures imposed by key importing nations – Vietnam, Bangladesh, and the USA – highlight both trade barriers and preferential access enjoyed by different suppliers, particularly India and China. Vietnam, a key hub in the global textile supply chain, applies a Most Favoured Nation (MFN) tariff rate of 12 per cent on both woven and knitted fabric imports from India and China. However, when it comes to preferential tariffs, China enjoys a clear advantage due to its

participation in the Regional Comprehensive Economic Partnership (RCEP), which provides better tariff concessions than India's existing bilateral arrangements with Vietnam. The preferential tariff rate for woven fabric imports from China stands at 3.03 per cent, while for knitted fabric, it is just 1.43 per cent. In contrast, India faces higher preferential tariffs—4.87 per cent for woven fabric and 2.41 per cent for knitted fabric—making Indian exports comparatively more expensive in the Vietnamese market.

- As a leading garment manufacturing nation, Bangladesh has implemented high MFN tariffs of 25 per cent on both woven and knitted fabric imports, aiming to protect its domestic textile industry. However, despite these high tariffs, India continues to be a key fabric supplier to Bangladesh.
- The United States, one of the largest finished apparel consumers, imposes MFN duties of 10.74 per cent on woven fabrics and 11 per cent on knitted fabrics, applying these equally to both India and China. Unlike Vietnam, where China enjoys preferential treatment, the USA offers no tariff concessions to either nation, ensuring that both compete on equal footing in the market. However, in the absence of tariff advantages, factors like quality, supply chain efficiency, sustainability compliance, and logistical competitiveness become decisive in market access. Given the increasing sustainability regulations and evolving consumer preferences in the US, India must focus on enhancing compliance, branding, and technological advancements to strengthen its position.

Although India is the second-largest exporter of cotton fabrics globally, the gap between India and China's export share remains vast. With China maintaining a dominant position in cotton and MMF fabric exports, there is a clear opportunity for India to capture a larger share of international textile trade, especially as global buyers seek to diversify their sourcing

TABLE 4.1

Tariff Structure for Woven Fabric Imports by Key Markets

Woven Fabric	*Importing Countries*		
Exporting Countries	Vietnam	Bangladesh	USA
India	MFN – 12 per cent Pref – 4.87 per cent	MFN – 25 per cent Pref – 22 per cent	MFN – 10.74 per cent Pref – None
China	MFN – 12 per cent Pref – 3.03 per cent	MFN – 25 per cent Pref – 25 per cent	MFN – 10.74 per cent Pref – None

Source: ITC Market Access Indicators.

TABLE 4.2

Tariff Structure for Woven Knitted Imports by Key Markets

Knitted Fabric	*Importing Countries*		
Exporting Countries	Vietnam	Bangladesh	USA
India	MFN – 12 per cent Pref – 2.41 per cent	MFN – 25 per cent Pref – None	MFN – 11 per cent Pref – None
China	MFN – 12 per cent Pref – 1.43 per cent	MFN – 25 per cent Pref – None	MFN – 11 per cent Pref – None

Note: HS Codes: Woven Fabric – 5209, 5208, 5407 & 5408. Knitted Fabric – 6001-06. Tariff Rates are calculated as averages.

Source: ITC Market Access Indicators.

under the China Plus One strategy. To make India more competitive in global markets, it is essential to enhance manufacturing capacity, modernise infrastructure, and provide policy-driven support to textile producers. As the global textile industry increasingly shifts towards synthetic and blended fabrics, India's dependence on MMF imports weakens its ability to compete effectively with textile-exporting nations. Strengthening domestic MMF production through technology adoption, investment incentives, and policy support is critical to reducing import dependency and ensuring self-sufficiency in high-value textiles.

Thus, recognising the strategic importance of the textile sector, the Indian government has introduced various initiatives and policy measures to boost production, improve industry competitiveness, and create a resilient supply chain. The next section explores the key government initiatives and policies.

4.5 Government Initiatives and Policy Support

The Government of India has introduced several initiatives as outlined in the Ministry of Textiles Annual Report 2023-24, to strengthen fabric and textile manufacturing in India. This includes schemes for technology upgradation, cluster-based industrial development, financial incentives, and environmental sustainability measures.

- *Technology Upgradation and Modernisation*

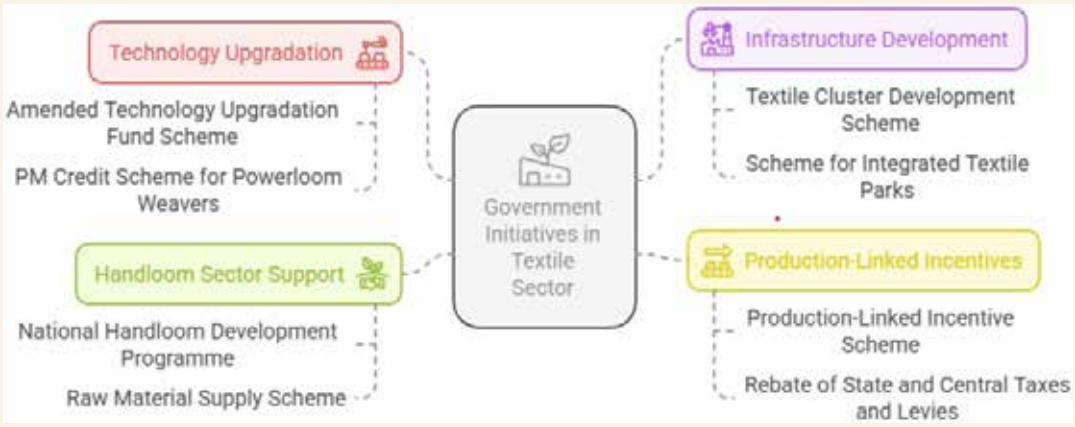
One of the most significant challenges for India's textile sector has been outdated machinery, particularly in the decentralised power loom and weaving clusters. To address this, the ATUFS was introduced in 2016 as a continuation of the TUFS, which had been in place since 1999. With an outlay of INR 17,822 crore, ATUFS provides credit-linked capital investment subsidies to incentivise textile enterprises in upgrading their equipment. By March 2022, 14,389 Unique Identification Numbers (UIDs) had been issued, covering projects worth INR 69,160 crore.

To further support the power loom sector, the PM Credit Scheme for Power loom Weavers provides financial assistance. Since 2014-15, 510 women entrepreneurs have set up modern units equipped with shuttle-less looms under this scheme.

Additionally, the In-Situ Upgradation Scheme for Plain Power looms focus on enhancing productivity by upgrading existing plain looms with semi-automatic features. Since 2014-15, 2,09,748 power looms have been upgraded under this scheme.

FIGURE 4.12

Government Initiatives for the Textile Sector



Source: Author's Own.

- *Infrastructure Development and Cluster-Based Growth*

To modernise India's textile hubs, the Textile Cluster Development Scheme (TCDS) was launched in 2021 with an INR 853 crore outlay, providing integrated workspaces for textile units. The Comprehensive Power loom, Knitwear, and Silk Mega Cluster Development Scheme has targeted key textile hubs such as Bhiwandi, Erode, Bhilwara, Surat, Ichalkaranji, and Mysore, with 60 per cent of project costs (up to INR 50 crore per cluster) covered under government assistance. While some clusters have flourished, others – such as those in Bhiwandi and Bhilwara — were cancelled due to land availability issues. Despite this, the Mega Cluster model has enhanced competitiveness in regions where it has been successfully implemented, particularly in Surat and Ichalkaranji, enabling higher-value production and export competitiveness.

To address environmental compliance, the Integrated Processing Development Scheme (IPDS) was introduced with an INR 275 crore allocation, supporting Common Effluent Treatment Plants (CETPs) and cleaner production practices in textile clusters.

- *Production-Linked Incentives and Export Promotion*

To strengthen India's global positioning in MMF and technical textiles, the Production-Linked Incentive (PLI) Scheme for Textiles was introduced in 2021, with an outlay of INR 10,683 crore. The scheme provides direct financial incentives based on incremental production for manufacturers of MMF fabrics, MMF apparel, and technical textiles.

Tax incentives such as the Rebate of State and Central Taxes and Levies (RoSCTL) continue to support fabric and apparel exports, improving India's cost competitiveness in global markets. Additionally, the government has removed

BOX 4.2

GI – Tagged Handloom Products in India

India boasts over 150 textile-related Geographical Indication (GI) tags, preserving traditional craftsmanship and ensuring economic benefits for artisans. Tamil Nadu has the highest number of GI-tagged textiles, followed by Uttar Pradesh, Maharashtra, and West Bengal. These GI tags authenticate origin, protect against imitation, and enhance marketability, allowing artisans to command premium pricing in domestic and global markets.

Notable GI-Tagged Handloom Textiles by Region

- Tamil Nadu – Salem Fabric, Kancheepuram Silk, Kovai Kora Cotton Sarees.
- Uttar Pradesh – Banarasi Sarees, Chikankari Embroidery, Mau Sarees.
- West Bengal – Baluchari Sarees, Banglar Muslin, Dhaniakhali Cotton.
- Maharashtra – Paithani Sarees, Solapur Terry Towel.
- Karnataka – Mysore Silk, Ilkal Saree, Udupi Saree, Molakalmuru Sarees.
- Madhya Pradesh – Maheshwar Sarees and Fabrics, Chanderi Fabric.
- Odisha – Gopalpur Tussar Fabrics, Kotpad Handloom Fabric, Sambalpuri Sarees.
- Telangana – Gadwal Sarees, Narayanpet Handloom Sarees.
- Assam & Northeast – Muga Silk, Bodo Eri Silk, Moirang Phee, Chakhesang Shawls.

The Ministry of Textiles supports the registration of handloom products under the Geographical Indications of Goods Act, 1999, providing financial assistance to artisans and cooperatives. GI recognition offers legal protection, enhances global competitiveness, and fosters sustainable livelihoods, ensuring the survival of India's rich textile heritage.

anti-dumping duties on key raw materials like purified terephthalic acid (PTA) and viscose fibre to lower input costs for synthetic fabric manufacturers.

- *Handloom Sector Support Initiatives*

To sustain and modernise the handloom sector, the government has introduced schemes focusing on weaver welfare, market access, and raw material availability. The revised National Handloom Development Programme (NHDP), launched in April 2023, supports technology upgrades, design inputs, and market access, along with permanent infrastructure like Urban Haats and marketing complexes to help artisans sell their products effectively. The Raw Material Supply Scheme (RMSS), running from 2021-22 to 2025-26, ensures affordable yarn supply by providing freight reimbursement and subsidies, in collaboration with NHDC, state governments, and cooperatives. Additionally, the Handlooms (Reservation of Articles for Production) Act, 1985, protects handloom weavers by reserving certain products for exclusive handloom production, with enforcement offices in Delhi, Chennai, and Ahmedabad overseeing compliance to prevent encroachment from power looms and mills. To assist the weavers in sales, government also implemented Handloom Marketing Assistance, the scheme benefited 10 lakh weavers across the country, generating INR 8.4 billion in sales between 2016-17 and 2018-19 (PIB, 2019).

4.6 Challenges of India's Fabric Manufacturing Sector

India's fabric manufacturing sector remains a critical part of the country's textile industry, but despite its strong domestic base and export presence, it has been unable to match the efficiency, scale, and competitiveness of global leaders like China. While government policies have aimed to strengthen the sector, long-standing structural inefficiencies, outdated technology, high production costs, regulatory rigidities, and supply chain fragmentation continue to impede growth. The dominance of the decentralised power loom and handloom sectors, coupled with restrictive policies in the organised mill sector, has further slowed modernisation, preventing India from achieving a globally competitive position.

- *Industry Fragmentation and Lack of Scale*

Unlike China and Vietnam, where vertically integrated models allow for seamless production from fibre to finished fabric, India's textile ecosystem is decentralised across multiple independent clusters. Cotton is cultivated in Gujarat, Maharashtra, and Madhya Pradesh, but it must be transported to Tamil Nadu for spinning and then to Maharashtra and Gujarat for weaving. This lack of localisation increases transportation costs, extends lead times, and creates inefficiencies at various stages of the value chain. In contrast, China's fully integrated "fibre-to-fashion" model allows it to produce at lower costs while ensuring faster turnaround times and higher quality consistency. The Economic Survey 2024-25 points out this supply chain complexity and how it makes Indian textiles more expensive and limits their ability to compete with fast-moving global apparel markets.

Adding to this challenge is the dominance of small-scale power loom and handloom units. Government regulations prohibit composite mills from laying off workers, even if a mill is unprofitable, forcing companies to pay wages even when operations are suspended. In contrast, the decentralised sector benefits from favourable tax treatment, exemptions from labour laws, and subsidies for energy and water, allowing it to operate at lower costs (Shetty, 2001). Unlike China's textile parks that integrate large-scale production with technology-driven efficiency, India's industry remains dominated by small, scattered units that struggle to meet bulk orders or guarantee standardised quality.

A major policy intervention aimed at addressing this issue was A key policy intervention to address this issue was the Scheme for Integrated Textile Parks, introduced in 2005 and extended several times, most recently until 2025-26 to complete projects already sanctioned. Under this scheme, INR 1592 crore has been released.

However, a 2023 report by the Comptroller and Auditor General of India (CAG) revealed that the scheme met only 30 per cent of its employment targets, 50 per cent of projected investment, and 37 per cent of planned textile units across the 56 completed and ongoing textile parks. Additionally, 43 per cent of the total sanctioned parks were cancelled, and many of the completed parks failed to provide end-to-end supply chain integration, instead consisting of isolated production segments that did not lead to a reduction in costs.

- *Outdated Technology*

A critical challenge holding back India's fabric sector is its slow pace of technological adoption. The power loom industry, which contributes over 58 per cent of India's total fabric output, still relies on outdated shuttle looms, leading to low-speed production, high maintenance costs, and inconsistent fabric quality. India holds just a 2 per cent share in global shuttle-less loom capacity, highlighting the urgent need for modernisation and automation to remain competitive in international markets (NITI Aayog, 2020). In contrast, China and Vietnam have aggressively modernised their weaving infrastructure, adopting high-speed shuttleless looms and automated fabric processing systems.

Beyond weaving inefficiencies, India's failure to invest in advanced finishing technologies has further constrained its competitiveness in value-added fabrics. The textile industry remains largely dependent on unprocessed grey yarn and grey fabric exports, whereas global competitors have moved towards high margin, dyed, finished, and coated textiles. Countries like China, Korea, Turkey, and Mexico have built state-of-the-art dyeing, finishing, and coating facilities, producing premium-quality fabrics that fetch higher prices in international markets. In contrast, India's lower realisation per unit value of textile exports is a direct reflection of its weak value-addition capabilities. The unit value realisation for woven cotton and blended fabrics is just USD 1.57 per sq. metre, significantly lower than that of competing nations (Aziz, 2020).

- *Regulatory and Compliance Hurdles*

The fabric processing segment faces some of the most stringent environmental and regulatory challenges, making it difficult for manufacturers – especially small and medium-sized enterprises – to remain compliant and profitable. The dyeing and finishing stages require significant amounts of water and energy, which makes them vulnerable to environmental restrictions.

In places like Pali, Rajasthan, where 700 textile processing factories operate, nearly 500 functions for only 60 hours a week instead of the standard 168 hours due to strict pollution control regulations (Bharat Tex, 2025). Many small processing units lack wastewater treatment plants, resulting in frequent shutdowns imposed by the Pollution Control Board. While compliance with sustainability regulations is necessary, limited financial and infrastructural support for sustainable processing technologies makes it challenging for small and mid-sized players to adapt.

Beyond national regulations, India's textile sector is also facing increased compliance pressure from global markets, particularly from the European Union and the United States, which have introduced stringent sustainability policies. The EU alone accounts for nearly 20 percent of India's textile exports, and its 16 legislative measures on sustainability, introduced between 2021 and 2024, are set to tighten environmental and social compliance requirements across the textile value chain (Economic Survey, 2024-25).

The global textile industry is demanding stricter traceability standards, ensuring that raw materials are ethically and sustainably sourced. While initiatives like Kasturi Cotton and the General Certificate of Conformity (GCC) are steps in the right direction, adoption remains low among smaller manufacturers. Without better digital tracking systems and supply chain transparency, India risks losing market access to sustainability-focused buyers.

With global textile buyers prioritising sustainability as a key purchasing criterion, non-compliance will directly impact India's export

competitiveness. The failure to modernise processing technologies, reduce environmental impact, and integrate traceability measures will restrict Indian fabric manufacturers from securing large international orders. Without policy-driven support for green technology adoption and structured financial incentives for sustainability transitions, India's textile sector will struggle to align with evolving global standards.

- *Limited Market Access & Visibility*

The unorganised textile sector, despite its significant contribution to fabric manufacturing, remains largely invisible to large buyers and formal markets. Over 125 small textile clusters operate across India, yet buyers struggle to access them due to their fragmented nature, lack of digital presence, and absence of a structured marketing ecosystem. Even when small manufacturers successfully connect with buyers, they often fail to secure orders due to inadequate compliance documentation, small production capacities, or lack of quality certification. This disconnect prevents many skilled artisans and manufacturers from scaling up their businesses, leaving them dependent on middlemen and wholesalers who take a significant cut of the profits (Bharat Tex, 2025).

4.7 Conclusion and Way Forward

India has one of the world's largest fabric production bases, but its textile industry faces deep-rooted inefficiencies, outdated technology, and fragmentation. With 80 per cent of the fabric manufacturing sector operating in a decentralised manner and contributing 97.3 per cent of the total fabric production, limiting the industry's ability to scale, standardise, and compete with global leaders like China and Vietnam. These systemic challenges impede efficiency, increase production costs, and restrict value addition, making it difficult for Indian fabric manufacturers to capture higher-margin export markets.

Government initiatives like ATUFS, SITP, and PM MITRA parks have attempted to address these issues, but delayed implementation, inadequate support, and poor execution have hindered progress. Technological stagnation, uncoordinated supply chains, and insufficient market integration have constrained the sector's potential. To strengthen India's position in the global textile value chain, a comprehensive policy framework focusing on large-scale modernisation, vertical integration, sustainability, and strategic trade measures is essential to drive investment, improve productivity, and position India as a global leader in high-value textile exports.

1. *Scaling Up Domestic Production and Encouraging Vertical Integration*

India's fragmented fabric manufacturing sector causes supply chain inefficiencies, higher production costs, and slower delivery times compared to global competitors. To address these issues, the government should focus on scaling up domestic production through vertical integration. The framework of mega textile hubs should be accelerated, with plug-and-play facilities that provide common infrastructure for spinning, weaving, processing, and finishing. SITP which was intended to create such hubs, has largely failed due to poor implementation and lack of complete value-chain integration. A revamped approach should focus on ensuring end-to-end production clusters, with dedicated zones for high-growth product segments such as performance fabrics, MMF textiles, and specialty fibres.

Due to the micro and small-scale nature of many textile enterprises, individual units struggle to meet bulk orders. Buyers often prefer working with large manufacturers who can guarantee consistent quality, timely delivery, and compliance with regulatory requirements, putting MSMEs at a disadvantage. To address this, a "Plug-and-Play" model must be introduced, offering shared industrial spaces for MSMEs equipped with modern machinery, quality control facilities, fabric testing units, and training centres. This would enable small manufacturers to collaborate on large orders, reduce overhead costs, and access technology upgradation schemes. Additionally, a centralised purchasing system within these industrial spaces would allow small producers to collectively contribute to fulfilling bulk orders, bridging the gap between buyers and MSME manufacturers.

Further, regional marketplaces should be set up across key textile clusters, enhancing logistical ease and creating structured domestic and international trade opportunities. By consolidating production and enabling MSMEs to scale efficiently, India can cut down delivery lead times, improve cost efficiency, and attract large buyers looking for stable and scalable suppliers.

2. *Technology Upgradation and Promotion of Future-Ready Textiles*

A large-scale push for technology upgradation and automation is required to address India's low productivity, poor value addition, and reliance on outdated fabric manufacturing processes. While ATUFS was introduced to modernise India's textile industry, its impact has been limited due to low capital subsidies for weaving and processing units, slow disbursement, and complicated bureaucratic processes (NITI Aayog, 2020).

A key concern is India's insufficient weaving, knitting, and processing capacities, which force a significant share of domestically produced yarn (approximately 35 per cent) to be exported rather than being converted into higher-value fabrics within India (NITI Aayog, 2020). To address this, downstream investments in weaving, knitting, and processing should be prioritised.

Offering tiered financial support based on the scale of enterprises may help to ensure smaller players to gradually transition to more advanced textile production technologies.

Beyond weaving and processing upgrades, domestic textile machinery manufacturing must be actively promoted to reduce India's dependence on imported textile equipment from China, Europe, and Japan. Currently, the inability to produce advanced textile machines results in high import costs for automated weaving and processing systems. Strengthening public-private partnerships in R&D for textile machinery will enable the development of state-of-the-art technologies within India. Encouraging joint ventures and FDI from European and Japanese textile machinery firms can facilitate technology transfer and local production. A specialised scheme offering long-term tax benefits, R&D funding, and liberal investment policies should be introduced to attract global manufacturers and strengthen India's domestic machinery ecosystem.

In parallel, India's fabric exports face high tariffs, while competing nations like Vietnam and Bangladesh benefit from FTAs. Securing duty-free access to key markets such as the EU, US, and UK should be a priority.

Simultaneously, India must align with global demand for sustainable textiles by adopting circular economy principles, focusing on eco-friendly materials, energy-efficient processes, and responsible sourcing. Despite initiatives like Kasturi Cotton and the General Certificate of Conformity, sustainability remains a challenge for MSMEs due to high costs and limited technical expertise. Financial incentives for green investments, particularly for small and medium enterprises, should be introduced, along with schemes under TUFS to promote eco-friendly practices like waterless dyeing, renewable energy, and textile waste recycling. Establishing sustainability training centres will help equip artisans and small manufacturers with necessary skills. GI tagging of sustainable textile clusters can enhance market positioning, while export incentives and branding can establish India as a leader in ethical fashion. A knowledge-sharing network among industry, policymakers, and researchers is essential to spread sustainable practices, alongside cross-border partnerships for best practices.

Overall, to stay competitive, India must invest in large-scale modernisation, focus on high-growth areas like MMF (man-made fibres), and build vertically integrated ecosystems that enhance production efficiency and minimise waste.

References

Adanur, S. (2000). Handbook of Weaving (1st ed.). CRC Press. https://doi.org/10.1201/9780429135828

Arya, N. (2017). Diversification of Hosiery Production to Cotton Blended Knitwear. Int.J.Curr.Microbiol. App.Sci., 6(12), 91-96. https://doi.org/https://doi.org/10.20546/ijcmas.2017.612.012

Aziz, A. (2020). Indian Garments Industry Export Performance: A Case of China & USA. EPRA International Journal Of Economic and Business Review, 8(7).

Comptroller and Auditor General of India. (2023). Audit report on Scheme for Integrated Textile Parks (SITP) presented in Parliament. Government of India.

Confederation of Indian Textile Industry (CITI). (2024). Annual Report 2023-2024. https://citiindia.org/pdf-uploads/Annual-Report/Annual-Report-2023-24.pdf

Exports of Indian Cotton Textiles Show Remarkable Growth in 2023. https://texprocil.org/e-newsletter/1716982395-ENews

Federation of Indian Chambers of Commerce & Industry (FICCI). (2024). Textiles and Technical Textiles. https://ficci.in/sector/textiles-and-technical-textiles

Fernández-Stark, K., Bamber, P., & Couto, V. (2022). Analysis of the textile and clothing industry global value chains - Summary. Inter-American Development Bank.

Indian Textile Journal. (2023). Weaving the future: India's textile and apparel sector amidst global challenges. Indian Textile Journal. https://indiantextilejournal.com/weaving-the-future-indias-textile-and-apparel-sector-amidst-global-challenges-2/

Indian Textile Journal. (2024). Transforming India's textile sector. Indian Textile Journal. https://indiantextilejournal.com/transforming-indias-textile-sector/

Madhav, S., Ahamad, A., Singh, P., & Mishra, P. K. (2018). A review of textile industry: Wet processing, environmental impacts, and effluent treatment methods. Environmental Quality Management, 27(3), 31-41. https://doi.org/https://doi.org/10.1002/tqem.21538

MATEXIL. (2024, November 21). MATEXIL News Updates. Retrieved from https://www.matexil.org/gallery/view/259691

Maurya, A. (2024). How Modern Machines and Innovations are Transforming India's Knitting Industry. The Textile Magazine. https://www.indiantextilemagazine.in/how-modern-machines-and-innovations-are-transforming-indias-knitting-industry/

Ministry of Commerce and Industry. (2024). Annual Report 2023-2024. Government of India.

Ministry of Finance. (2024). Economic Survey 2024-25. Government of India.

Ministry of Textiles. (2024). Annual Report 2023-2024. Government of India.

Ministry of Textiles. (n.d.). Indian manmade fibre textile industry. Government of India. Retrieved from https://texmin.nic.in/sites/default/files/Indian per cent20Manmade per cent20fibre per cent20textile per cent20industry_0.pdf

NITI Aayog. (2020). Impact assessment of Technology Upgradation Funds Scheme/Amended TUFS). Government of India

Press Information Bureau. (2019). Welfare schemes for handloom weavers. Government of India, Ministry of Textiles. Retrieved from: Press Information Bureau.

Press Information Bureau. (2022). Powerloom sector contributes nearly 58.4 per cent to total cloth production and more than 60 per cent of fabric meant for export in the country.

Roy, T. (2020). The crafts and capitalism: Handloom weaving industry in colonial India. Cambridge University Press. https://doi.org/10.4324/9780429346835

Shetty, S. A. (2001). India's Textile and Apparel Industry: Growth Potential and Trade and Investment Opportunities. Retrieved from. https://www.usitc.gov/publications/332/PUB3401.pdf

Textile Sector: Knitting. Government of Gujarat. Retrieved from https://indextb.com/files/2020/10/f1810052-8821-48b1-ae00-b76993336e65_6. per cent20Knitting_Textiles_Profile.pdf

Weaving Sector in India. (2018). Textile Value Chain.

Weaving the Way for Indian Textile Industry. (2020). NITI Aayog.

When every drop counts. (2024). The Indian Textile Journal. Retrieved from. https://indiantextilejournal.com/when-every-drop-counts/

ANNEXURE

Annex Table 4.1: HS Codes Included for Cotton and MMF Fabric Trade Analysis

Cotton Fabric
5208, 5209, 5210[6], 5211, 5212, 580121, 580122, 580123, 580124, 580125, 580126, 580127, 580210, 580631, 600121, 600191, 600242, 600292, 600320, 600521, 600522, 600523, 600524, 600621, 600622, 600623, 600624
MMF Fabric
5408, 540710, 540720, 540730, 540741, 540742, 540743, 540744, 540751, 540752, 540753, 540754,540760, 540761, 540771, 540772, 540773, 540774, 5512, 551511, 551512, 551521, 551599, 551611, 551612, 551613, 551614, 551621, 551622, 551623, 551624, 551691, 551692, 551693, 580131,551591,580132, 540769, 580133, 580134, 580135, 580136, 580137, 580421, 580632, 600122, 600192, 600243, 600293, 600330, 600340, 600539, 600541, 600542, 600543, 600544, 600631, 600632, 600633, 600634, 600641, 600642, 600643, 600644, 600531, 600532, 600533, 600534, 600535, 600536, 600537, 600538.

6. 5210 and 5211 are blended fabrics.

From Fabric to Fashion to Foreign: Story of India's Apparel Industry

5

SULAKSHANA RAO, RIYA JAIN, AND ASHOK GULATI

From Fabric to Fashion to Foreign: Story of India's Apparel Industry

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5.1 Introduction

Global apparel[1] market imports amounted to USD 447.1 billion and exports reached USD 516.3 billion in 2023 (UN Comtrade, 2023). The global apparel industry is expected to expand at a compound annual growth rate (CAGR) of around 8 per cent to reach USD 2.37 trillion by 2030 (IBEF, 2025) where other segments are also included. Apparel production is the final and the most value-adding step of textile value chain. Apparel is one of the fastest evolving segments in global trade. Apparel manufacturing is highly labour-intensive and most of the production occurs at developing nations due to lower labour costs involved. The production clusters are developing nations while the consumption area is in the developed countries. As of 2023, the highest apparel-importing areas were the European Union (USD 185.9 billion), the United States (USD 81.5 billion), Japan (USD 23.78 billion), the United Kingdom (USD 20.27 billion), and South Korea (USD 11.94 billion). As for exports, the highest countries were China (USD 153.8 billion), Bangladesh (USD 49.5 billion), Vietnam (USD 30 billion), Turkiye (USD 18.23 billion), and India (USD 14.4 billion) (ITC Trade map, 2024).

India is one of the world's biggest textile industries with a vast value chain—from cultivating cotton (Chapter 2), to yarn production and fabric-making (Chapters 3 and 4), to making high-value apparel. India's apparel retail has a major share in India's retail and the growth is attributed to emerging e-commerce, fast fashion etc. In terms of exports, India's apparel exports which constitutes 42 per cent of T&A exports (HSN codes 61 and 62) have shown a fluctuating growth trend over the years, rising from USD 5.57 billion in 2000-01 to USD 8.62 billion in 2005-06, USD 11.62 billion in 2010-15, peaking at USD 16.99 billion during 2015-20, before declining to USD 14.54 billion in 2023-24. It is important to highlight that India's apparel segment's share in total T&A exports fell from 48 per cent in 2005–06 to around 42 per cent in 2023–24 (DGCIS, 2024). This decline mirrors India's stagnant share in global apparel market, which has stubbornly stayed around 3 percent since 2000. Meanwhile, competitors like Bangladesh and Vietnam have surged ahead. Bangladesh's global share has grown from 2.2 percent to 9.6 percent, while Vietnam's share jumped from 1 percent to 5.8 percent between 2000 and 2023 (See Figure 5.1). A significant portion of this shift occurred post-2010 when China's global market share slipped from 34.8 percent to 29.8 percent partly due to its trade war with US. So, what is preventing India from seizing the opportunity to expand its T&A exports and capture the market space left behind by China?

India stands second only behind China in global cotton production with a contribution of 24 per cent to the global supply (Walia, 2025). But even with the benefits of the gene revolution in cotton, India has not yet exploited its textile potential and still lags behind China, Vietnam, and Bangladesh in apparel exports. According

1. HSN codes 61 and 62.

to Annual Textile & Apparel Report, India's production was estimated at 22 billion pcs in 2019-20, while made-ups production stood at approx. 2.4 billion kg.[2] The country has approximately 1,00,000 garment factories, yet only 20 per cent of its clothing production is exported, indicating substantial untapped potential (USITC, 2024). Bangladesh and Vietnam even with partial textile value chain capability and smaller geographical area, have significantly outpaced India in global apparel exports.

This chapter explores the structural constraints in India's garment and apparel industry, its comparative disadvantages against Bangladesh and Vietnam, and potential policy interventions to enhance its competitiveness.

5.2 Global Apparel Exports: An Overview

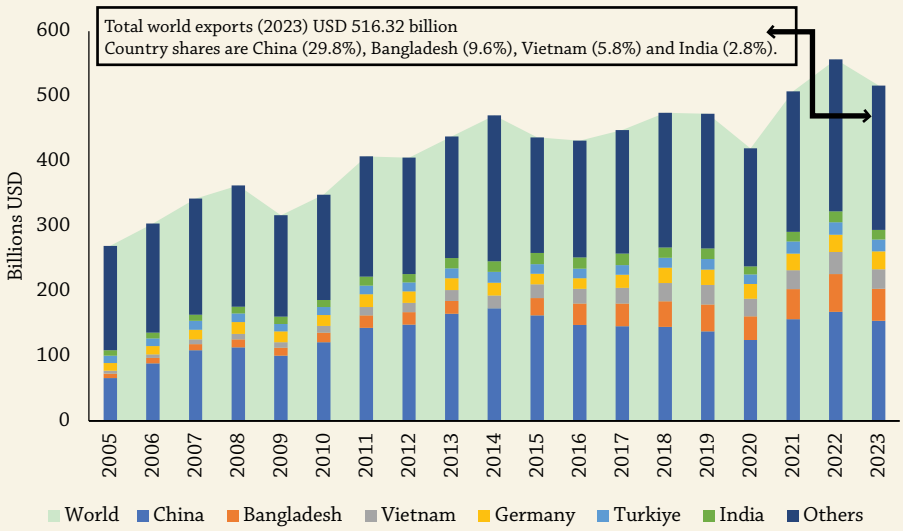
Global apparel export market across the world is rising from USD 269.48 billion in 2005 to USD 516.32 billion in 2023. The global apparel market is dominated by a few key players, with China leading by a significant margin. Historically, China led the apparel export market around the world, but Bangladesh and Vietnam have improved considerably (Figure 5.1).

China's apparel exports have consistently accounted for the largest share of global trade, reaching nearly USD 167 billion in 2022 before slightly declining in 2023. Despite some fluctuations, China has maintained its dominance due to its massive production capacity, advanced manufacturing technologies, and well-established supply chains. Bangladesh and Vietnam have emerged as strong competitors, steadily increasing their market share. Bangladesh's apparel export jumped over 600 per cent, from USD 6.8 billion in 2005 to USD 49.5 billion in 2023, whereas Vietnam's export increased from USD 4.5 billion to USD 30.07 billion. Their export performance is attributed to low production costs, preferential trade agreements, and government incentives that attract foreign investment. Other key exporters include Turkey and Germany, which have maintained a steady but comparatively smaller share, with exports in the range of USD 20-30 billion annually.

In contrast, India's performance in the global apparel market has been lower compared to its competitors. India's percentage of the world's readymade apparel exports has changed relatively little. India's apparel exports grew from

FIGURE 5.1

Major Exporting Countries of Articles of Apparel and Clothing Accessories (61 and 62)



Note: 2014 values NA for Banglades.

Source: ITC Trade map.

2. Latest data available is of 2019-20 from AEPC report.

USD 6.41 billion in 2004 to a peak of USD 17.35 billion in 2017, but later declined to USD 14.5 billion in 2023 (DGFT, 2023). Figure 5.1 also indicates that India has struggled to expand its presence, with its growth in exports not keeping pace with competitors. India's apparel exports are concentrated (Figure 5.4) in the USA (32 per cent share in 2023), the EU (37 per cent), the UK (9 per cent), and the UAE (9 per cent as of 2023 It is pertinent to note that while exports to Australia and the USA have grown, India has lost ground in key markets where Bangladesh and Vietnam have strengthened their presence. What could be the reasons behind this? Is it due to lower production costs in competing nations, better trade policies, or supply chain efficiencies? How can India regain its lost market share? To sustain and expand its market share, India must improve product quality, technological investment, and trade agreements.

5.3 Domestic Scenario: India's Apparel Sector

Clothing is a basic necessity and commands a substantial share of household expenditure, especially as disposable incomes rise. As incomes rise, food proportion of spending is stabilized, but clothing expenditure, which comes next in Engel's spending classes, rises disproportionately. In India between 2011-12 to 2021-22, the AAGR of Private Final Consumption Expenditure (PFCE) in clothing increased by 11.69 per cent[3] in nominal terms, even higher than national GDP growth at 10.49 per cent in nominal terms, at current prices (including the influence of pandemic years 2020-21). This rise highlights the increasing significance of the apparel industry in India's economy. With its potential for apparel manufacturing and export, India can help realize the 5F Vision from Farm to Factory (yarn) to Fabric to Fashion to Foreign of the Hon'ble Prime Minister. This vision encompasses innovation, cooperation, and the 'Make in India' movement with a view to strengthening India's presence in the global apparel industry.

India's apparel sector, a significant pillar of country's textile industry, contributes significantly to employment, industrial output, and exports. In the apparel sector, India benefits from a vast raw material base, a strong spinning and weaving infrastructure, and a skilled workforce. The sector contributes approximately 2 per cent to GDP accounting for over 12 per cent of total exports. India's garment export values increased significantly from USD 6.41 billion in 2004 to USD 16.54 billion in 2014. In 2023, India exported garments worth USD 14.51 billion to the world. Due to lack of production data, categorically, we see Index of Industrial production (IIP)[4], keeping 2011-12 as base. IIP for manufacturing of wearing apparel although has weight of only 1.32 compared to its counterpart manufacture of textiles have 3.29. For TE 2023-24, IIP was 125.3 for wearing apparel, where highest was seen in 2019-20 at 154.6 (MOSPI, 2023)

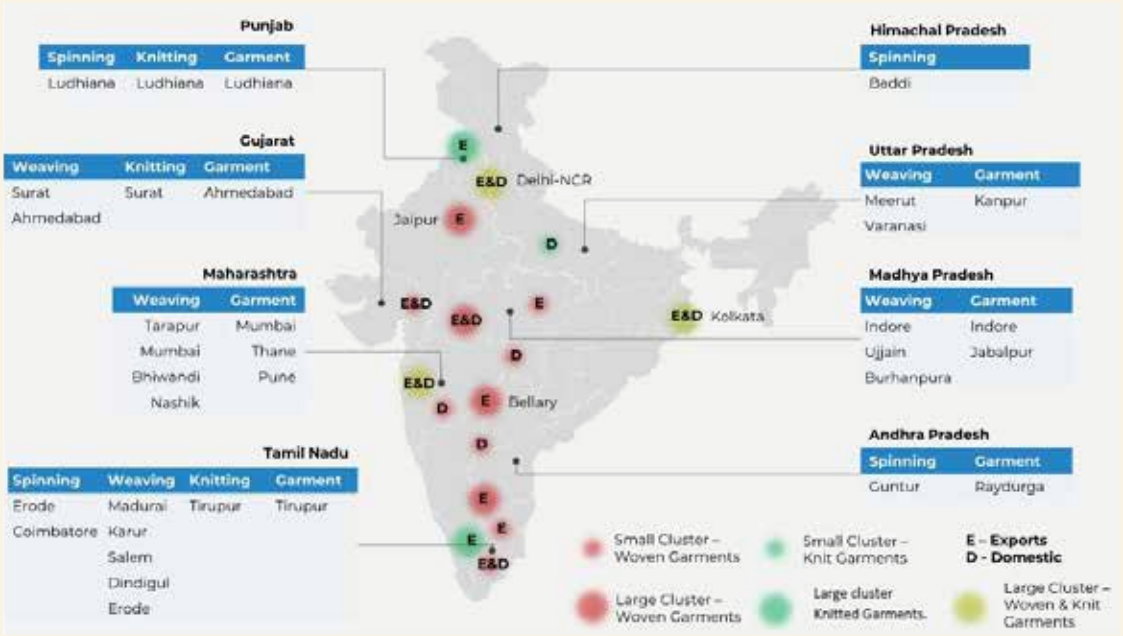
In India, the clothing production industry is largely concentrated in a few regions (Figure 5.2), and a number of important industrial estates and centres have a dominant position in India's textile and apparel exports. Some of the leading apparel production and export cities are Tirupur (Tamil Nadu), Bangalore (Karnataka), Delhi-NCR, Ahmedabad (Gujarat), and Ludhiana (Punjab). Tirupur, commonly called the 'knitwear capital of India,' is a stronghold of knitted apparel, particularly T-shirts and sportswear, and plays an important role in India's exports in the segment. Bangalore is famous for its technology-oriented textile production, with high-grade cotton and man-made fibre being the major thrust areas. Delhi-NCR and the surrounding areas are major players in garment export, with the focus on ready-made garments to both domestic and overseas markets. Ahmedabad is famous for its cotton textile expertise and boasts a number of large fabric mills, which are involved in weaving and dyeing. Ludhiana is the hub for woolen and hosiery products. These places, along with other small to medium-sized businesses (SMEs) within the

3. Author's own calculation using MOSPI data.

4. The Index of Industrial Production (IIP) compares current industrial production to a base period, with 100 as the base value. If the index is above 100, it means production has increased, and if below 100, it has decreased.

FIGURE 5.2

State-wise Apparel Clusters in India



Source: United States International Trade Commission.

sector, make India competitive in international markets, particularly in the apparel and textile industries. The Indian clothing sector has emerged as a centre for both conventional and contemporary clothing, fulfilling international demand while still innovating with emerging trends, like athleisure and MMF clothing.

The Indian garment industry is diversified, with a large number of Micro, Small, and Medium-sized enterprises (MSMEs) controlling the industry. One of the key challenges facing the Indian apparel industry is its fragmented yet clustered structure. While the industry is spread across the country, production is largely concentrated in 17 textile and apparel clusters (Figure 5.2), each with a sectoral and geographic focus. Of these, only eight are dedicated to apparel manufacturing, while the rest cater to other segments like yarns and fabrics. These clusters have evolved organically over time and often specialize in either knitting or weaving. However, the lack of uniform vertical integration poses difficulties some clusters are self-sufficient through in-house processes or local sourcing, while others rely heavily on inter-cluster supply chains, leading to inefficiencies and coordination challenges (USITC, 2024).

A US International Trade Commission (USITC) survey indicated that small companies supply either domestic or foreign markets, while all the large companies specialize in exports. USITC, 2024 estimates that only 20 per cent of India's clothing production goes out as export. But its potential could be higher. To facilitate increased exports as well as higher efficiency in production, there needs to be targeted policy interventions.

Addressing these challenges requires a strong policy framework that enhances cost competitiveness, supply chain efficiency, trade access, and manufacturing scale. Over the years, the Indian government has introduced multiple schemes under technology upgradation, cluster development, skill enhancement, and export promotion to boost apparel production and exports. While these policies aim to support the sector, their implementation and effectiveness remain key to achieving large-scale transformation. This section explores India's policy landscape for apparel promotion and its impact on overcoming industry bottlenecks.

The policy environment for facilitating apparel production and export in India has undergone a continuous evolution with schemes being introduced as well as revised and extended for long periods of time. These schemes fit within the categories of technology upgradation, cluster development, skill development, and export promotion. Table 5.1 presents the prevailing schemes for the apparels segment in India as of 2024. The classification of the scheme according to the type of intervention and the type of producer subsidy in table 5.1 is based on van Beers and van den Bergh (2000). Here, input oriented subsidies reduce the cost of raw material and output-oriented subsidies reduce the supply price of the product. Producer subsidies extended for apparels promotion in India take the form of capital cost subsidies which are input-oriented, public provision of goods and services below cost price (mostly through the establishment of parks) which are input oriented, and export subsidies which are output oriented. According to van Beers and van den Bergh (2000), producer subsidies can be classified further as on-budget and off-budget subsidies. The former refers to those which affect the government's budget directly and the latter refers to which do not directly affect government's budget (for example, requiring financial institutions to lend at a lower interest rate). As of 2024, the two main schemes which can be evaluated for performance are the TUFS and the Scheme for Integrated Textile Parks (SITP).

The TUFS consisted of interest reimbursement, capital cost subsidy, and margin money subsidy through Financial Institutions (FIs) identified by GoI and was mainly administered by the Ministry of Textiles. Launched in 1999-2000, it was revised in 2007 as M-TUFS, in 2011 as R-TUFS, and in 2013 as RR-TUFS. It was launched in 2016 as Amended-TUFS. The former four were evaluated by Comptroller and Auditor General (CAG) as of less consequence due to lack of data records on machine obsolescence and lack of segment-wise planning of the scheme. There was also evidence of incorrect calculation of the subsidy and excess payment to beneficiaries.

The SITP was launched by the GoI in 2005 for establishing integrated textile parks with world-class infrastructure facilities to promote the

TABLE 5.1

Policy Typology for Apparels Promotion in India (As of 2024)

Scheme	*Orientation*	*Category of Scheme*	*Type of intervention*	*Producer Subsidy type*	*Salient features*
TUFS (1999)	Production	Technology Upgradation	Capital cost subsidy	On budget and input oriented	Interest reimbursement and capital cost subsidy
Scheme for Integrated Textiles Parks (SITP) (in alliance with TUFS and Samarth) (2005)	Production	Cluster Development	Public provision of goods, and services below cost price	Off budget and input oriented	Provision of land, infrastructure
PM MITRA (2021)	Production	Cluster Development	Public provision of goods and services below cost price, capital cost subsidy, skill development	Off budget and on budget, input oriented	Provision of land, infrastructure, subsidies on capital, skill development, wages, power
Scheme for Capacity Building in textile Sector (Samarth) (2017)	Employment	Skill development (Worker Training)	Public provision of goods and services below cost price	Off budget and input oriented	Entry-level skilling, upskilling, and reskilling of employees engaged in apparels segment of the textile value chain

Rebate of State and Central Taxes and Levies (2020)	Export	Export Promotion	Export subsidy	On budget and output oriented	Reimbursement of central and state taxes paid during production
Interest Equalization Scheme (2015)	Export	Export Promotion	Export subsidy	Off budget and input oriented	Interest subvention on pre and post shipment export credit
Merchandise exports from India Scheme (MEIS) (2015)	Export	Export Promotion	Export subsidy	On budget and output oriented	Duty reward as a percentage of FOB value
Duty drawback scheme (2020)	Export	Export Promotion	Export subsidy	On budget and input oriented	Customs duty rebate on imported inputs used to manufacture exports

Source: Author's own Calculation based on van Beers and van den Bergh (2000) typology

setting up of textile units. It has been presently extended to 2025-2026 for the completion of its sanctioned projects. Initially, 98 parks were sanctioned but there were significant delays in the completion of the parks due delay in getting statutory clearances and there were several parks with only one or two segments of the textile value chain. About 43 per cent of the total sanctioned parks were finally cancelled. This performance evaluation obtained from CAG report implies that inappropriate implementation of the scheme nullified the purpose of the scheme.

The PM-Mega Integrated Textile Region and Apparel Parks scheme (PM-MITRA) proposed in 2021 aims to set up seven integrated parks (1000 acres each) with a total outlay of Rs 4,445 crores which will contain spinning, weaving, processing, dyeing, printing, and apparel manufacturing at one location. These mega parks will facilitate textile products production through market linkages, single window clearance, plug and play as well as commercial infrastructure, logistics connectivity, plug and play infrastructure, training, research and Innovation and housing. The key features of the scheme are laid keeping the vision of Farm to Fibre to Factory to Fashion to Foreign and to position India strongly on global textile landscape. The key features of the scheme include reduction of logistic cost by integrating value chain at one location, generation of employment (approx. 1 lakh direct and 2 lakhs indirect) per park. Seven sites were chosen for setting up of PM Mitra parks namely at Tamil Nadu (Virudhunagar), Telangana (Warangal), Gujarat (Navsari), Karnataka (Kalburgi), Madhya Pradesh (Dhar), Uttar Pradesh (Lucknow) and Maharashtra (Amrawati).The parks have been selected on the basis of good connectivity, distances from the nearest port/Dedicated Freight Corridor/Industrial Corridor/Textiles Cluster, Reliable Power Supply and Water availability and Waste Water Disposal system, Effective single Window clearance, etc.

5.4 India's Major Apparel Export Markets

The sections deal with India's major export apparel items and major export destinations for India. Section gives a comprehensive overview of India's apparel export landscape, highlighting both product-wise and market-wise export trends.

India's top ten apparel export items under HSN Chapters 61 and 62 account for approximately USD 6.57 billion around 45 per cent of India's total apparel exports valued at USD 14.5 billion. These include high-performing product lines such as women's cotton dresses (HSN 620442, USD 791.7 million), men's cotton shirts (HSN 620520, USD 706 million), synthetic fibre dresses for women (HSN 620443, USD 642.1 million), and cotton T-shirts (HSN 610910, USD 1,561.2 million), among others (Annex

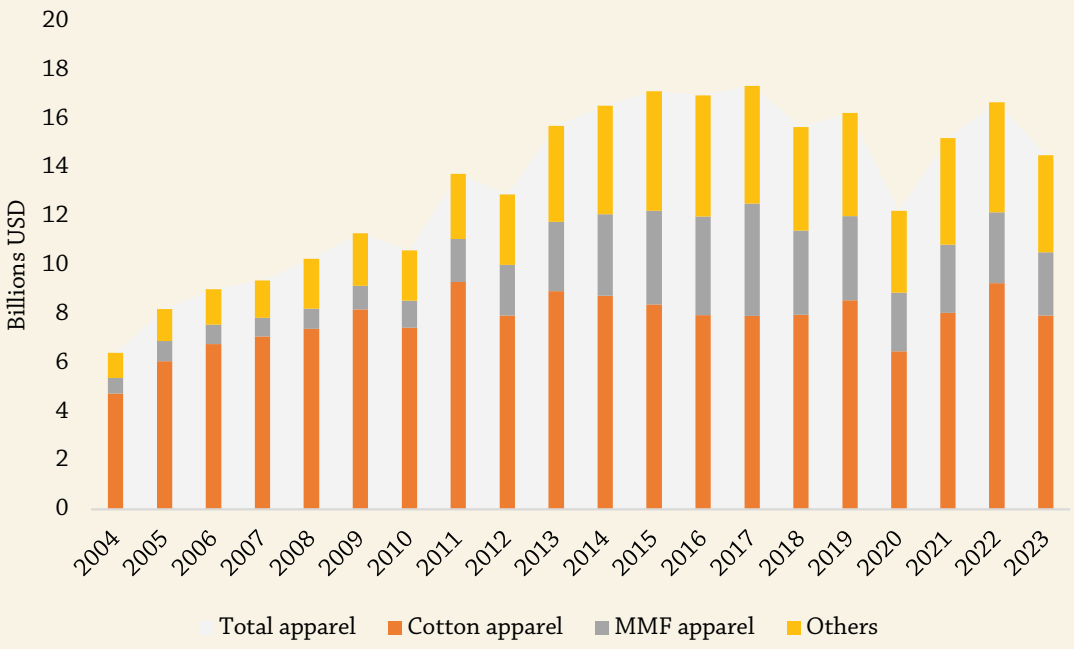
Table 5.1). The table also benchmarks these top ten items against exports from Bangladesh, Vietnam, and China, and provides insights into global import values and each country's market share. India shows relative strength in categories like women's cotton dresses (16 per cent global share), men's cotton shirts (8 per cent), and babies' garments (12 per cent). However, it has limited traction in large-volume categories such as cotton T-shirts (5 per cent) and synthetic fibre dresses (9 per cent), where China and Bangladesh command a larger share. Table highlights India's competitive advantages and priority segments with untapped export potential.

It is pertinent to highlight (Figure 5.3) that apparel made of cotton continues to account for the largest percentage of total apparel export from India, and its share has been consistent throughout the years. While the proportion of MMF apparel has been consistently rising between 2005 and 2024, it is primarily fuelled by the surge in demand for athleisure, activewear and apparel from blended material due to ease of maintenance and cost factor. Interestingly, four to five of the top ten garments exported from India over the past few years are MMF or synthetic-based garments, which is an indication of a growing trend towards MMF clothing and a market to tap in. This transformation offers a big chance for India to invest and develop its MMF apparel manufacturing to cater to international demand. The challenges faced in MMF raw material procurement is mentioned in the upcoming section. Next, we look into the major export destinations of Indian apparels. India's key export destinations for apparels are EU (37 per cent), USA (32 per cent), UK (9 per cent), UAE (8 per cent), Saudi (3 per cent), Australia and Canada (2 per cent) and Mexico (1 per cent) in 2023. Figure 5.4 shows India's major export destinations between 2004 and 2023, which represent major Indian apparel markets for the past few years along with total export value.

EU is the largest export destination of India, maintaining a relatively stable share between 33 per cent and 37 per cent across the years USA, the second largest export destination has witnessed growth in share from 28 per cent in

FIGURE 5.3

India's Total Apparel Exports with Classification as Cotton, MMF and Other Apparel



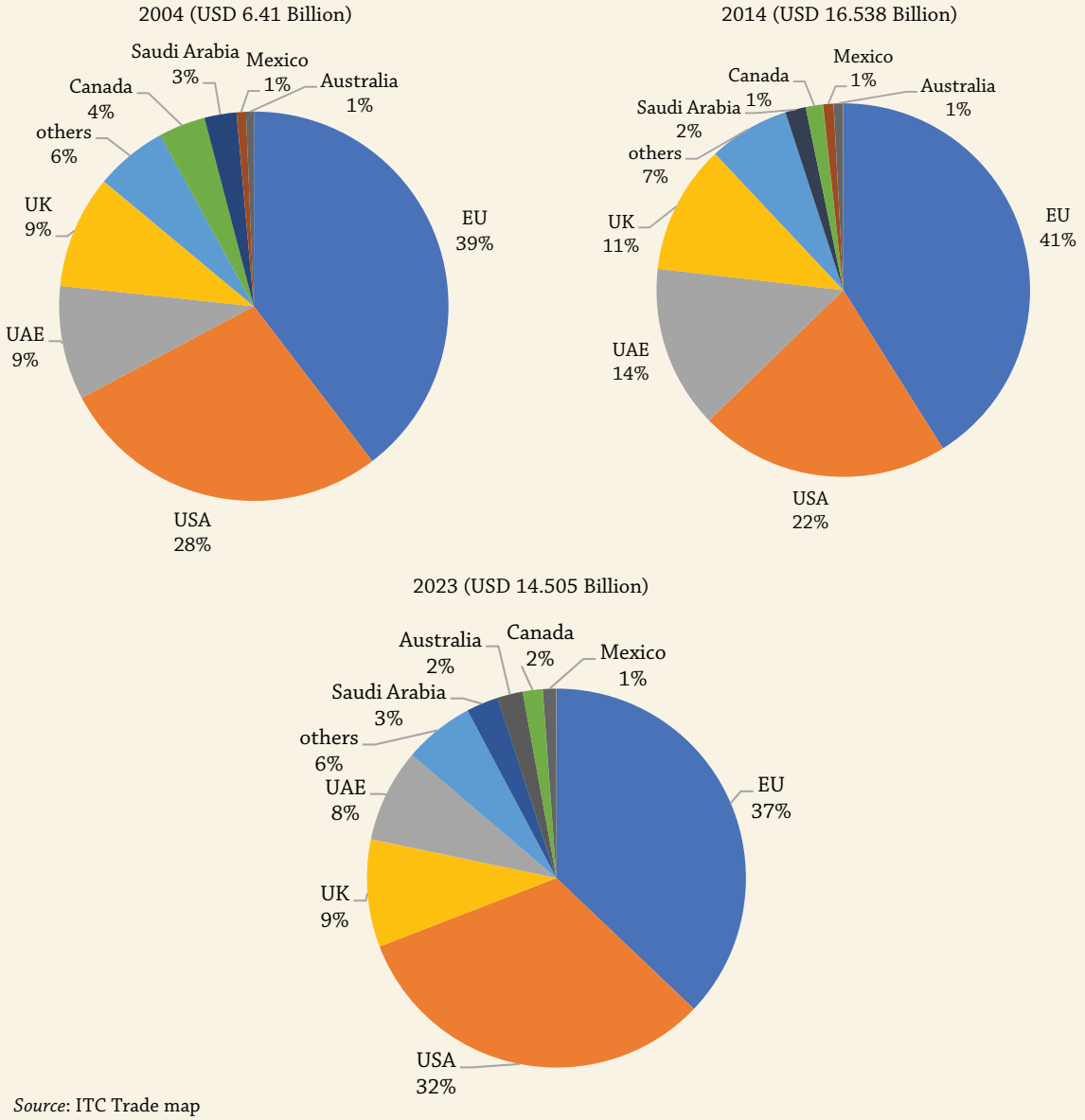
Source: UN Comtrade database

2004 to 32 per cent in 2023. However, there are observed fluctuations in the UAE market. It increased from 9 per cent in 2004 to 14 per cent in 2014, however, by 2023, its share declined to 8 per cent. This decline was attributed to import duties. India's apparel exports to UAE decline 33 per cent due to 5 per cent import duty on Indian apparel (AEPC, 2022). Australia, is also observed as an emerging market which showed slight growth, rising from 1 per cent in 2014 to 2 per cent in 2023, suggesting a market that could be developed with targeted strategies. In order to sustain and even expand its market share, India has to enhance its export strategies in terms of product quality, global demand, technology investment, and sustainable practices that conform to the global demand trends. While, India keeps fighting it out in this competitive scenario, it is essential to look at the large exporters to these nations and see how India can capitalize on its role in these prime markets.

Table 5.2 offers a comparison of India's two largest apparel export markets i.e., US and EU,

FIGURE 5.4

India's Major Export Destinations 2004-2023



Source: ITC Trade map

comparing India's market share with that of its competitors i.e., China, Bangladesh and Vietnam in these markets. In the United States, China is the largest apparel exporter, with exports rising from USD 18 billion in 2005 to USD 17.7 billion in 2023. China's percentage of US apparel imports as of 2023 is 21 per cent, highlighting its dominance. Bangladesh, however, has experienced significant growth, with exports increasing from USD 2.33 billion in 2005 to USD 7.4 billion in 2023, showing a growth rate of 217 per cent. Bangladesh's share in US apparel imports in 2023 is around 9 per cent. Vietnam has recorded the greatest growth among the competitors, and its exports increased from USD 2.7 billion in 2005 to USD 14.66 billion in 2023, an impressive 443 per cent growth rate. Vietnam now accounts for 18 per cent of US imports, ranking it the second-largest clothing exporter to the US after China. Compared to this, Indian apparel exports increased from USD 3.2 billion in 2005 to USD 4.64 billion in 2023, a growth rate of 45 per cent, though its percentage share in US imports has been constant at 6 per cent, which points towards a slower growth rate than the competition.

Looking at the European Union (EU), China remains the leader in apparel exports, with 18 per cent of the EU's apparel imports in 2023. China's exports to the EU increased from USD 19.65 billion in 2005 to USD 34.1 billion in 2023, representing a growth rate of 74 per cent. Unlike the US market, the EU has experienced notable import shares from Turkey and Bangladesh. India's percentage of the EU apparel market was consistent at 3 per cent during 2023, with exports going up from USD 3.52 billion in 2005 to a USD 6.04 billion in 2023. Yet, India's market share in the EU has not improved to the same extent as its competitors. One of the key factors influencing India's limited progress is trade barriers, particularly the high tariff rates imposed on Indian garment exports compared to competitors who enjoy duty-free access through preferential trade agreements. To better understand India's export challenges in key global markets, the next section examines the tariff structures applied to Indian garments and compares them with those imposed on competing countries like Bangladesh, Vietnam, and China.

TABLE 5.2

India's Major Exporting Markets vis-à-vis its Competitors (USD billion)

*United States of America**					
Exporting country	*2005*	*2014*	*2023*	*Growth rate in exports from 2005-2023 (%)*	*Percentage of total imports by US in 2023*
China	18	31	17.7	0%	21%
Bangladesh	2.33	4.8	7.4	217.6%	9%
Vietnam	2.7	9.5	14.66	442.9%	18%
India	3.2	3.5	4.64	45%	6%
European Union					
Exporting country	*2005*	*2014*	*2023*	*Growth rate in exports from 2005-2023 (%)*	*Percentage of total imports by EU (27) in 2023*
China	19.65	39.6	34.1	74%	18%
Vietnam	0.821	3.356	6.66	711%	4%
Turkiye	8.59	11.6	14.98	74%	8%
Bangladesh	3.92	15.11	26.91	586%	14%
India	3.52	5.94	6.04	72%	3%

Note: *US has recently announced a reciprocal tariff policy (April 2,2025) which changes the tariff policy drastically. A detailed analysis is given as Box item.

Source: ITC Trade map.

5.5 Import Tariff Comparison in Key Apparel Markets

The apparel markets in developed economies for apparel exports from India are a major source of foreign exchange. Apparel exports are subject to different tariff rates in different countries and exports from India are no exception. We use the Effectively Applied (AHS) rate which is the lowest tariff – it takes on the value of the preferential rate in case a preferential treatment exists. If a preferential treatment does not exist, the MFN rate which is the highest rate member countries of World Trade Organization (WTO) charge is used[5]. We calculated the mean AHS rates from World Integrated Trade Solution (WITS) from the simple average (of minimum and maximum rates in that year) reported over all HS codes related to cotton garments exports by year, exporting, and importing country. Figure 5.5 shows the AHS applied to cotton garment exports from India, Bangladesh, China, and Vietnam in key apparel markets in developed countries such as the EU, United Kingdom (UK), and United States (US).

Tariff rates on India's garment exports

Since 2000, India was subject to about 10-12 per cent AHS rate in the EU. At present, the rate has been stable at 9-10 per cent. India was subject to AHS of 10-12 per cent in export of cotton garments to UK until 2023 when the Developing Countries Trading Scheme (DCTS)[6] came into effect on June 19, 2023 which granted zero duty access. However, this grant was suddenly suspended until December 2025 for India while Bangladesh continued to be granted zero duty access[7]. In US, the AHS rate applied to Indian cotton garment imports has been stable between 10-11 per cent.

Tariff rates on Bangladesh's garment exports

It can be seen from Figure 5.5 that in all the main apparel markets which also happen to be developed economies, Bangladesh has been given duty free access except in the US. The US removed Bangladesh from the Generalised System of Preferences (GSP)[8] which gives duty free access to imports in the US market from LDCs. This removal was because of the death of workers in Bangladesh due to the collapse of a factory which reflected inappropriate working conditions for workers [9].

Tariff rates on China's garment exports

China was subject to AHS rate of 10-12 per cent during 2000-2012 in the EU and this rate stabilized at 12 per cent thereafter. The EU has also maintained the stable range of AHS of 10-12 per cent and the UK has maintained the range of 9.5-12 per cent with respect to the import of Chinese cotton garments. During 2000 till date, the US has maintained a stable rate of 10-11 per cent for Chinese cotton garments.

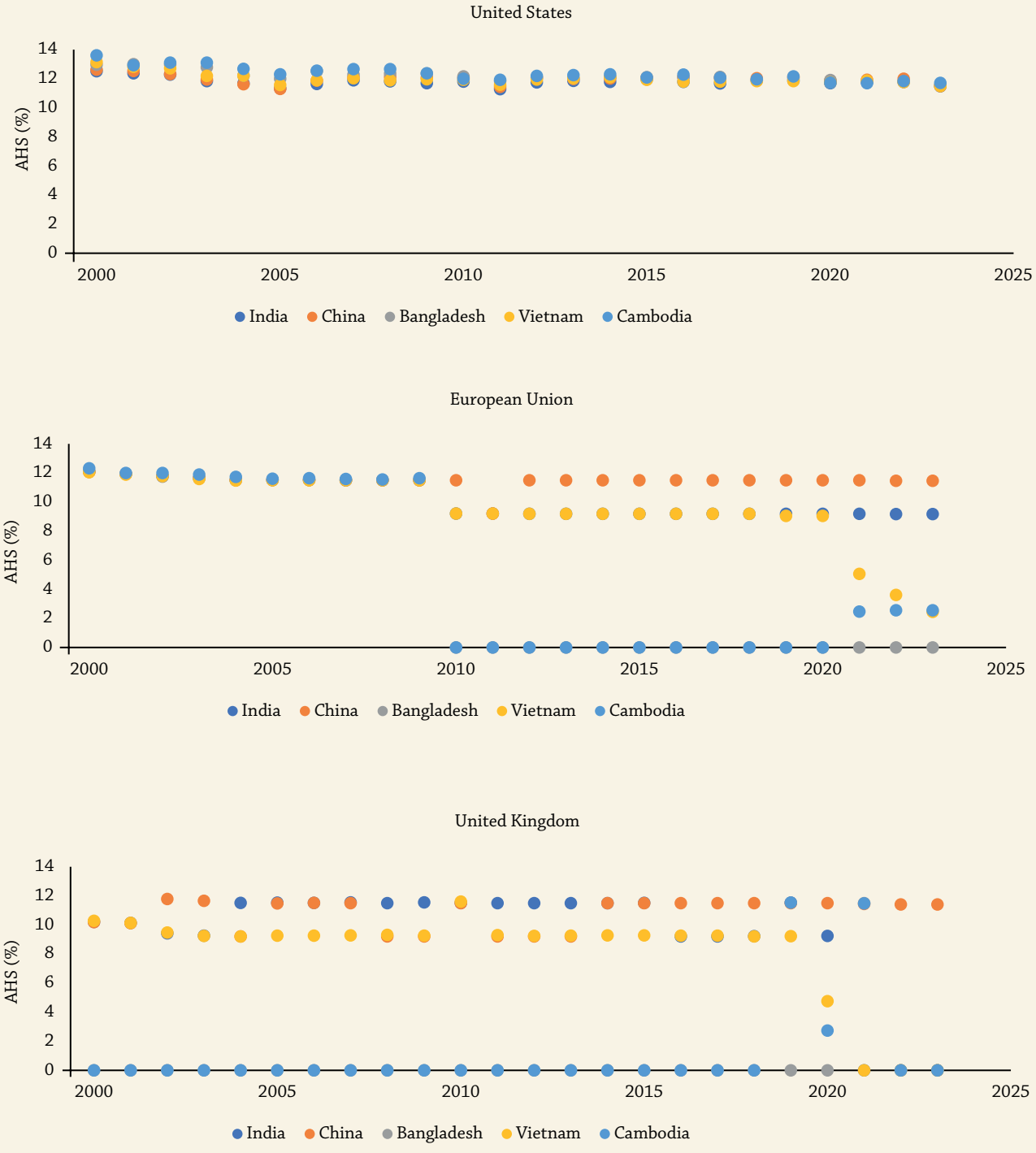
Tariff rates on Vietnam's garment exports

After being subject to 10 per cent AHS rate in EU during 2000-2020, Vietnam got zero duty access to the EU market as the EU-Vietnam FTA came into effect in August 2020. With an average AHS rate of about 10 per cent in the UK apparel market from 2000 to 2019, Vietnam also finally qualified for duty free access in the UK market with the UK-Vietnam Free Trade Agreement (UKVFTA) which was signed in December 2020.

5. https://wits.worldbank.org/wits/wits/witshelp/content/data_retrieval/p/intro/c2.types_of_tariffs.htm
6. https://www.gov.uk/government/collections/trading-with-developing-nations
7. https://economictimes.indiatimes.com/industry/cons-products/garments-/-textiles/textile-companies-fret-as-uk-lifts-zero-duty-sops/articleshow/101348259.cms?from=mdr
8. The Generalized System of Preference (GSP) is a unilateral scheme wherein custom duty preferences or concessions are granted by developed countries to export of specified products from developing countries. –nsez.gov.in
9. https://www.thedailystar.net/news/suspension-of-us-gsp-what-does-this-mean-for-bangladesh

FIGURE 5.5

Tariff Rates in Key Apparel Markets



Source: WITS, World Bank.

India's apparel sector in the light of the newly announced Trump's Reciprocal Tariff

From India's context, one of the major winners in Trump's reciprocal tariff gamble is T&A segment of India. India's major competitors in textile and apparel, China, Vietnam and Bangladesh, are all facing reciprocal tariff to the range of 125 per cent, 46 per cent and 37 per cent respectively[10]. This will create space for India which these textile giants vacate from the US due to higher tariffs. Especially in case of apparel (HSN 61 and 62), as per UN Comtrade, the US is the biggest market valued at $ 81.59 billion imports (2023). China, the textile giant is slapped a whopping 125 per cent tariff. If India plays its cards right, US could be a huge opportunity to achieve India's T&A export target of $100 billion by 2030 and apparels could be a major contributor to this. But India must be vigilant, as China has huge excess capacity and they may dump it to India. If India allows imports of Chinese products, our domestic manufacturing would be swiped off. Let us delve deeper into what are the top 10 export apparel items from India to US vis-a-vis share of competitors, alongside the import demand of these apparels at the US (Annex Table 5.2).

Annex Table 5.2 indicates top ten apparel items which are exported to US market vis-à-vis its competitors and how much US is importing of that particular commodity. Table also highlights the US's share of the commodity exported by the exporting country in parentheses. For example, India's share in exporting Women or girl's dresses of cotton (HSN 620442) is highest among its competitors in the US market. To increase these shares and remain dominant of atleast these top commodities, India needs to take strategic steps. To capitalize on this moment, India must urgently address structural inefficiencies in its textile value chain. A detailed strategy is given in the last section of this chapter.

A country can secure itself from high tariff rates in foreign markets through preferential trade agreements such as Vietnam or as in the case of Bangladesh, enjoy a special status with access to foreign markets due to its classification as a LDC. Despite no such preferential access in the US market, Bangladesh continues to be one of the highest suppliers of garments in the US market. What factors have enabled these countries to outperform India in the global apparel trade? Is it just preferential trade agreements, or are there deeper structural advantages that have driven their success? How have Bangladesh and Vietnam managed to scale up their industries, attract investments, and build strong global supply chain linkages? To explore these questions, Box 5.1 and 5.2 present case studies of Bangladesh and Vietnam.

BOX 5.1

What Vietnam did Right to become Favourite Importing Destination in Apparel Market?

Vietnam's emergence as a major player in the world apparel market is supported by staggering export growth and strategic industry development. Between 2005 and 2024, Vietnam's apparel exports grew from USD 2.39 billion to USD 17.04 billion, representing a staggering growth of 613 per cent. The increase is due to aspects like the competitive cost of labour, highly skilled workforce, and strategic trade deals of the country, namely the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the EU-Vietnam Free Trade Agreement (EVFTA). The agreements have granted Vietnam favourable access to principal markets like Europe and the United States, leading to increased exports of apparel. Vietnam's market share of the US apparel import market in 2024 was 18 per cent, making it the second-largest apparel exporter to the US, after China. Vietnam's investments in infrastructure, such as new textile zones and enhanced shipping facilities, have also contributed to this growth. Vietnam's capacity to keep up with evolving fashion trends, including the rising demand for sustainable fashion, has kept it competitive. By virtue of this, Vietnam has positioned itself well as a key and fast-developing exporter of premium quality clothing with the advantages of affordability and creativity.

10. The reciprocal tariff on non-retaliatory countries has been paused by US for 90 days. A baseline tariff of 10 per cent will be imposed on foreign goods. China will face a whopping tariff of 125 per cent.

Vietnam's Strategy	*Lessons for India*
Export-Oriented Industrial Policy through Doi Moi reforms (1986)	India needs a comprehensive export-focused policy with strong government support and incentives for global market integration
Trade Agreements for Market Access- Signed FTAs with major economies (EU, US, ASEAN, CPTPP) to gain duty-free access	India should accelerate FTA negotiations with key textile markets like the EU, UK, and US to reduce tariff disadvantages
Foreign Direct Investment (FDI) inflows into textile and apparel manufacturing	India must ease FDI regulations further, provide incentives, and develop SEZs for textile clusters
Maintained high productivity and low labour costs	India should focus on labour reforms, skill development, and productivity enhancement
Ease of Doing Business and Tax Benefits- Lower corporate tax, streamlined regulations, and business-friendly environment	India must simplify regulatory frameworks, reduce compliance burdens, and ensure stable tax policies for textile investors
Policy- Textiles and apparel designated as priority industry with clear policy roadmap	India should prioritize textiles in industrial policy, enhance budget allocations, and restore export credit refinance
Fashion, Technology and Infrastructure upgrades	India needs to incentivize modernization, support R&D, and improve textile parks for global competitiveness. Embedding fashion-forward strategies, design-led manufacturing, and aligning with global trends

Source: Economic Times, Lessons for India from Vietnam's textile story - The Economic Times

BOX 5.2

A Success Story of the Bangladesh Garment Sector

Bangladesh has emerged as a major player in the apparel industry due to ultra-low labour costs, preferential trade agreements, and well-developed garment clusters. The EU's 'Everything but Arms' initiative grants Bangladesh duty-free access to the EU market, providing a strong competitive edge. The country also benefits from government support through incentives and subsidized loans, attracting global fast-fashion brands looking for cost-efficient production hubs. Bangladesh has capitalized on flexible labour laws to develop large garment manufacturing units, achieving significant scale, whereas over 80 per cent of India's industry remains in the SME and unorganized sector due to restrictive labour regulations. These rigid laws limit India's ability to adapt to the seasonal nature of the garment industry. With only a few large manufacturers exceeding USD 100 million in turnover, Indian firms face longer turnaround times of 63 days compared to 50 days in Bangladesh. Shipments from Bangladesh reach ports in just one day, while in India, the process can take up to 10 days, further hindering scalability.

Source: Bangladesh Garment Manufacturers & Exporters Association (BGMEA), 2021

5.6 Challenges Hindering India's Apparel Sector

Despite being one of the world's largest textile producers, India's garment sector faces several challenges that hinder its global competitiveness. Issues such as rigid labor laws, fragmented manufacturing, high production costs, lack of large-scale factories, and logistical inefficiencies have limited its ability to compete with nations like Bangladesh and Vietnam. Absence of trade agreements, slower adoption of technology, and difficulties in securing raw materials further impact the sector's growth. India's garment and apparel sector also needs to embed the "Fashion "component.

Major challenges hindering India's apparel sector are synthesized below.

1. *Fragmentation in production and lack of economies of scale*

India's apparel manufacturing ecosystem is highly fragmented, comprising numerous Micro, Small and Medium Enterprises (MSMEs) that operate in isolation across various parts of the country. This dispersed structure impedes economies of scale and restricts the adoption of modern technologies, automation, and standardized quality control systems. India has only 3-4 large garment manufacturers with turnover exceeding USD 100 million. While leading apparel exporting countries such as China, Vietnam, and Bangladesh have developed vertically integrated fibre-to-fashion models that enable them to manufacture large volumes at lower unit costs while ensuring uniform quality and timely delivery (Economic survey, 2025).

Labor regulations further accentuate the fragmentation of the sector. The prevailing legal framework often rigid, state-specific, and compliance-heavy acts as a disincentive for firms to scale up their workforce. As several manufacturers note during the field visits, "Being bigger is a curse", given that exceeding certain employment thresholds triggers more complex and costly compliance requirements. Hence many firms intentionally limit their size, choosing to remain small and informal. This avoidance of scale not only reinforces the fragmented nature of the industry but also undermines productivity, investment, and formalization. The fragmented nature of Indian production also results in duplication of effort, low productivity, and coordination challenges, where achieving of economies of scale becomes difficult, particularly in aligning production with international buyers expectations of speed, scale, and consistency.

2. *Supply chain constraints*

The apparel value chain in India is characterized by logistical complexity and a lack of vertical integration. A lack of localisation and the complexity of the value chain, in turn, results in higher costs relative to global competitors. For example, in cotton apparel production, the raw material cotton may be cultivated in Gujarat, Madhya Pradesh, or Andhra Pradesh, but yarn production occurs in Tamil Nadu, and fabric processing takes place in Maharashtra or Gujarat before final apparels are manufactured elsewhere. This inter-state movement of inputs increases costs, delays production timelines, and reduces overall efficiency. India's regulatory and customs procedures create high compliance burden and erode competitiveness. Requirements such as pre-shipment inspection certificates, detailed documentation of every component (for ex. fabric, buttons, zippers) are few to mention. A typical Indian garment order takes approximately 63 days from placement to delivery, compared to 50 days in Bangladesh (BGMEA, 2021).

3. *Limited capacity in MMF and India's tariff disadvantages in apparel*

The limited capacity in the MMF apparel segment has constrained India's ability to diversify its apparel product basket and meet evolving buyer requirements particularly in fast-growing segments such as activewear, athleisure, and technical textiles. India's apparel is mostly cotton-based while global consumption demand has shifted decisively towards MMF. MMF accounted for 77 per cent of global fibre consumption in 2024, whereas India's share in global MMF production stood at only 9.2 per cent (Economic survey, 2024-25). What is holding back India's MMF sector? Our research implies that there are two major policy barriers- an inverted duty structure under the GST regime and Quality Control Orders (QCOs) on key raw materials like Polyester Staple Fibre (PSF) and Viscose Staple Fibre (VSF). These factors have made MMF-based products in India more expensive than those of global competitors. The inverted duty structure in synthetic fibres leads to higher taxes on inputs like fibre (18 per cent) and yarn (12 per cent) compared to lower GST on finished garments (5–12 per cent). On top of this, QCOs limit access to cheaper imported raw materials, pushing up domestic prices. Domestic manufacturers report that PSF and VSF prices are at least 20 per cent higher in India compared to interna-

tional markets (Walia, 2024). As of mid-2024, PSF prices in India were 38 per cent higher and VSF 19 per cent higher than in China, making Indian MMF products uncompetitive in export markets (Indian textile journal, 2024). With regard to the inverted duty structure under the GST regime, it acts as a structural disincentive for investment and expansion. Unlike the cotton value chain, which benefits from a uniform 5 per cent GST rate, the synthetic textile sector is subject to varying and higher tax rates across its production stages 18 per cent on fibre, 12 per cent on yarn, and 5 per cent on fabric and garments (below INR 1,000) (CBIC, 2025). This makes MMF-based products more expensive in the domestic market compared to international competitors, reducing their price competitiveness. India's apparel exports face tariff disadvantages in key market, especially EU (which constitutes 37 per cent of our apparel exports) due to the absence of bilateral trade agreements. Competitor countries such as Bangladesh, Vietnam benefit from preferential access to the EU and the UK.

India's garment and apparel sector lacks the seamless integration of the 'Fashion' component, which is essential in today's fast-paced global market. The 'Foreign' aspect of the textile value chain demands innovation and design-driven production to meet the expectations of international buyers. Competing nations have embedded fashionled strategies to create dynamic, trend-updated supply chains that align with the fast fashion and high-value apparel segments. India must also transition from being just a manufacturing hub to a fashion-driven textile powerhouse.

5.7. Summary and Policy Recommendations

India's textile and apparel exports stood at USD 34.1 billion in FY24, with apparel exports contributing USD 14.5 billion. However, its global market share in apparel remains stagnant at 2.8 per cent, far behind China (29.8 per cent), Bangladesh (9.6 per cent), and Vietnam (5.8 per cent). India's garment and apparel sector,

BOX 5.3

Insights from the Field: GIDC Apparel Park, Ahmedabad

During our conversation with the Secretary of the Gujarat Industrial Development Corporation (GIDC) Apparel Park in Ahmedabad, several on-the-ground challenges facing India's textile and apparel industry were highlighted. A key concern was the frequent changes in export promotion policies, particularly around SEZs, which were initially designed to encourage exports. According to him, policy revisions every 2–3 years create uncertainty for businesses and often reflect a disconnect between government-level planning and operational realities on the ground.

He stressed that India's manufacturing ecosystem lacks the scale and infrastructure required to compete globally. In comparison to countries like Bangladesh—where even smaller garment units may employ 3,000–4,000 workers and the largest can scale up to 50,000—Indian units tend to be more fragmented, with relatively smaller capacities.

Labour-related policies also emerged as a significant concern. While states like UP, Bihar, and Jharkhand offer a cost advantage in terms of labour, he pointed out that the current labour regulations, including rigid hour-based norms, can pose operational challenges for apparel manufacturers, especially in labour-intensive segments. He distinguished this from the yarn manufacturing sector, which is more automated and therefore less impacted by such regulations. Recognizing the sensitivity around worker rights, he underlined the need for a balanced approach—one that protects workers while allowing manufacturers operational flexibility.

Regarding industrial policy, he noted that schemes like PM MITRA, which require a minimum land plot of 100 acres, may unintentionally exclude small and mid-sized manufacturers, who form a significant share of the industry. He emphasized the importance of policy simplification, greater consistency, and inclusion of smaller players in large-scale schemes to make them truly transformative.

Finally, he flagged concerns around the inverted GST structure, which, in his experience, impacts cash flow and liquidity—particularly for firms that operate across multiple stages of the textile value chain.

despite being one of the world's largest, faces severe structural and policy-related challenges that have prevented it from keeping pace with China, Bangladesh, and Vietnam. The sector suffers from challenges such as fragmented production, lack of vertical integration, logistical inefficiencies, and limited access to MMF due to an inverted GST structure and restrictive import policies. India faces tariff disadvantages in key export markets like EU due to the absence of bilateral trade agreements, and lags in fashion innovation and branding, which are critical to competing in fast evolving global retail markets. Without targeted policy interventions, these bottlenecks will continue to undermine India's competitiveness and its ability to capture a greater share of global apparel trade. Emerging global opportunities, such as the US-China trade war and political instability in Bangladesh, present a window for India to expand. To capitalize on this, India must undertake deep structural reforms, strengthen its policy framework, and improve trade access to enhance its competitiveness in the global apparel market.

1. Address fragmentation and promote economies of scale: India's apparel manufacturing ecosystem is dominated by fragmented MSMEs that operate in isolation, small scale, productivity, and investment. This is further accentuated by rigid and compliance-heavy labour laws, which disincentivise workforce expansion. Firms often remain small and informal to avoid additional regulatory obligations. To overcome fragmentation, a structured approach to formalisation and consolidation of production is required. Labour codes should be simplified and harmonised across states to encourage firms to expand operations without fear of regulatory penalties. Plug-and-play infrastructure in textile clusters must be operationalised urgently. In particular, the two PM-MITRA Parks located in Navsari (Gujarat) and Virudhunagar (Tamil Nadu), with constructive partnership with state government must be made operational on a war-footing basis. These should be export-focused, Special Economic Zone driven with PLI to exports. This is not only essential for creating integrated value chain clusters but also for India to seize the emerging global opportunity. Countries and global brands should be targeted for attracting FDI. Focused SEZs and MITRA parks with tailored facilities to meet the global investor benchmarks should be developed. One of the most significant openings for India comes in the wake of the US administration's new tariff regime under President Trump's 2025 Executive Order on Reciprocal Tariffs. US imported over USD 81.5 billion in 2023 and has imposed a 125 per cent tariff on Chinese apparel, creating a space in global supply chains. If India is able to scale up production rapidly and plug into these disrupted markets, it could be a critical step toward achieving the ambitious target of $100 billion in textiles and apparel exports by 2030.
2. Resolve supply chain inefficiencies and improve logistics: The Indian apparel value chain suffers from logistical complexity and inter-state input movement, which increases costs and leads to production delays. From cotton cultivation in Gujarat or Madhya Pradesh to yarn production in Tamil Nadu and final garmenting elsewhere, the absence of vertically integrated clusters reduces efficiency. Moreover, India's export logistics face procedural delays due to documentation requirements, such as pre-shipment inspection certificates and component-level declarations. Policies must prioritise the development of vertically integrated value chains within unified textile parks to consolidate spinning, weaving, processing, and garmenting operations. India need to liberalise policies especially advance authorization in case of inputs. Reducing average export lead times from the current 63 days to international benchmarks (e.g., 50 days as in Bangladesh) must be set as a short-term target through logistics and regulatory reforms.

3. Revamp MMF policy framework and correct GST inversion: India's apparel exports remain predominantly cotton-based, while global demand has shifted decisively towards MMF-based products such as activewear, athleisure, and technical textiles. However, India's MMF sector faces two key policy-level constraints:

    - An inverted duty structure under the GST regime, where inputs like fibre and yarn are taxed at higher rates (18 per cent and 12 per cent) than finished gar ments (5–12 per cent).
    - QCOs on raw materials like PSF and VSF, which restrict access to cheaper imports and push up domestic prices. As of June 2024, PSF prices in India were 38 per cent higher and VSF 19 per cent higher than in China, making Indian MMF based garments uncompetitive in export markets.

The GST structure for MMF textiles must be rationalised to ensure uniform taxation across the value chain, similar to the cotton segment. QCO regime for MMF raw materials should be revised to allow for flexible and competitive sourcing. Removing these structural disincentives is essential to enable product diversification and price competitiveness in global markets.

4. Pursue preferential market access in key export destinations: India's apparel exports face tariff disadvantages in major markets like the European Union (EU) and the United Kingdom (UK) due to the absence of bilateral trade agreements. In contrast, Bangladesh and Vietnam enjoy preferential access to these regions, giving them a significant cost advantage. Expedited conclusion of FTAs with the EU and UK must be prioritised.

5. Strengthen integration of fashion, design, and innovation: India's apparel sector has traditionally operated as a low-cost manufacturing hub, with insufficient emphasis on innovation, design, and fast fashion. Vietnam and Bangladesh have created apparel ecosystem that respond rapidly to shifting consumer preferences and seasonal trends. India must transition towards a fashion led apparel strategy by investing in design institutions, trend research, and branding initiatives. Dedicated support should be provided for MSMEs to access design expertise and to develop niche, high-value segments such as occasion wear, sustainable fashion, and technical garments. Apparel export promotion councils should play a proactive role in connecting Indian manufacturers with global fashion trends and buyers.

India's garment apparel sector stands at a pivotal moment with emerging opportunities in global trade, MMF expansion, and sustainable fashion offer a clear roadmap for growth. By implementing supply chain integration, cost reduction measures, trade agreements, embedding 'Fashion into Foreign', sustainability initiatives, and stable policies, India can achieve an textile and apparel export target of USD 100 billion by 2030 and emerge as a global leader in textile and apparel exports.

References

Apparel Export Promotion Council (AEPC). (2025). India's RMG export data. https://www.aepcindia.aepcservices.in/system/files/India%27s%20RMG%20Export%20Data%20Jan%202025.pdf

Bangladesh Garment Manufacturers and Exporters Association (2021). BGMEA | A success story: The Bangladeshi garment sector has made remarkable progress in recent years

Government of Canada. (n.d.). Vietnam and the CPTPP trade agreement. Retrieved from https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/cptpp-ptpgp/countries-pays/vietnam.aspx?lang=eng

Government of India. (2025). Economic survey of India.

Gupta, A. (2021). How Bangladesh scripted a textile success story. Business India.

India Brand Equity Foundation (IBEF). (2024, November). Textiles and apparel. https://www.ibef.org/download/1737634450_Textiles-and%20-Apparel-Nov-24.pdf

Indian Textile Journal. (2024, July 23). Imports of fabrics from countries like China is expected to rise further. https://indiantextilejournal.com/imports-of-fabrics-from-countries-like-china-is-expected-to-rise-further/

International Trade Centre (ITC). (2025). Trade Map: Trade statistics for international business development. Retrieved from https://www.trademap.org

Jha, K. P. (2019). India's apparel exports to UAE decline 33% on higher import duty. Business Standard.

Ministry of Textiles (MoT). (2021). Indian textile and apparel industry: Annual report.

Noida Special Economic Zone (NSEZ). (n.d.). The Generalized System of Preference (GSP). Retrieved from https://nsez.gov.in

The Daily Star. (n.d.). Suspension of US GSP: What does this mean for Bangladesh? Retrieved from https://www.thedailystar.net/news/suspension-of-us-gsp-what-does-this-mean-for-bangladesh

The Economic Times. (2023). Textile companies fret as UK lifts zero duty sops. Retrieved from https://economictimes.indiatimes.com/industry/cons-products/garments-/-textiles/textile-companies-fret-as-uk-lifts-zero-duty-sops/articleshow/101348259.cms?from=mdr

UK Government. (n.d.). Trading with developing nations. Retrieved from https://www.gov.uk/government/collections/trading-with-developing-nations

United Nations. (2025). UN Comtrade database. Retrieved from https://comtrade.un.org

United States International Trade Commission (USITC). (2024). Apparel: Export competitiveness of certain foreign suppliers to the United States.

Walia, A. (2024). Synthetic textile makers seek relief from QCOs amid supply chain woes. The Indian Express. https://indianexpress.com/article/business/synthetic-textile-makers-seek-relief-from-qcos-amid-supply-chain-woes-9447957/

Walia, A. (2025). Leader in fibre production, but growth, exports lagging: What ails India's textile industry. Leader in fibre production, but growth, exports lagging: What ails India's textile industry | Explained News - The Indian Express

World Bank. (2025). World Integrated Trade Solution (WITS) database. Retrieved from https://wits.worldbank.org

World Bank. (n.d.). Types of tariffs. Retrieved from https://wits.worldbank.org/wits/wits/witshelp/content/data_retrieval/p/intro/c2.types_of_tariffs.htm

Annexure

Annex Table 5. 1: India's Top ten commodities exported in Apparel vis-à-vis its competitors and showing Global Imports and respective market share (Value in USD million)

HSN	*Description*	*India's exports*	*Bangladesh's exports*	*Vietnam's exports*	*China's exports*	*Global Imports*
'620442	Women's or girls' dresses of cotton (excl. knitted or crocheted and petticoats)	791.73 (16%)	191.3 (4%)	106.81 (2%)	1178.2 (24%)	5007.22
'620520	Men's or boys' shirts of cotton (excl. knitted or crocheted, nightshirts, singlets and other ...	706.00 (8%)	1926.12 (22%)	614.74 (7%)	1268.1 (14%)	8881.00
'620443	Women's or girls' dresses of synthetic fibres (excl. knitted or crocheted and petticoats)	642.12 (9%)	99 (1%)	244.70 (3%)	3605.9 (50%)	7212.47
'620630	Women's or girls' blouses, shirts and shirt-blouses of cotton (excl. knitted or crocheted and ...	546.37 (13%)	322.8 (7%)	155.98 (4%)	612.24 (14%)	4310.99
'620342	Men's or boys' trousers, bib and brace overalls, breeches and shorts, of cotton (excl. knitted ...	428.26(2%)	6178.8 (27%)	701.01 (3%)	4649.3 (20%)	22843.6
'610910	T-shirts, singlets and other vests of cotton, knitted or crocheted	1561.2 (5%)	7395.6 (23%)	1401.6 (4%)	4334.4 (13%)	32649.2
'611120	Babies' garments and clothing accessories of cotton, knitted or crocheted (excl. hats)	694.45 (12%)	1010.09 (18%)	260.24 (5%)	1202.2 (21%)	5677.58
'610990	T-shirts, singlets and other vests of textile materials, knitted or crocheted (excl. cotton)	532.08 (4%)	890.6 (7%)	1066.9 (8%)	4767.1 (37%)	12902.3
'610510	Men's or boys' shirts of cotton, knitted or crocheted (excl. nightshirts, T-shirts, singlets ...	457.54 (8%)	1205.5 (21%)	269.69 (5%)	497.39 (9%)	5702.43
'610831	Women's or girls' nightdresses and pyjamas of cotton, knitted or crocheted (excl. T-shirts, ...	214.12 (13%)	367.8 (23%)	41.67 (3%)	361.89 (23%)	1607.51

Source: ITC Trade map

Annex Table 5.2: India's top ten apparel exports to US vis-à-vis its competitors in 2023 (Value in million)

	HSN Code	*Product Label*	*India's export to US*	*China's export to US*	*Bangladesh's export to US*	*Vietnam's export to US*	*US Import (Total)*
1	'620442	Women's or girls' dresses of cotton (excl. knitted or crocheted and petticoats)	364.2 (43%)	142.5 (17%)	27.9 (3%)	97.3 (11%)	853.6
2	'620520	Men's or boys' shirts of cotton (excl. knitted or crocheted, nightshirts, singlets and other ...	262.3 (13%)	138.7 (7%)	572.5 (29%)	313.2 (16%)	1994.3
3	'620443	Women's or girls' dresses of synthetic fibres (excl. knitted or crocheted and petticoats)	126.8 (11%)	538.0 (47%)	9.822 (1%)	136.2 (12%)	1155.6
4	'620630	Women's or girls' blouses, shirts and shirt-blouses of cotton (excl. knitted or crocheted and ...	260.4 (35%)	86.02 (11%)	64.12 (9%)	77.1 (10%)	754.3
5	'620342	Men's or boys' trousers, bib and brace overalls, breeches and shorts, of cotton (excl. knitted ...	123.2 (3%)	296 (7%)	1493.2 (34%)	429.8 (10%)	4425.8
6	'610910	T-shirts, singlets and other vests of cotton, knitted or crocheted	367.9 (8%)	277.3 (6%)	417.2 (9%)	294.5 (6%)	4881
7	'611120	Babies' apparels and clothing accessories of cotton, knitted or crocheted (excl. hats)	256.2 (21%)	239.1 (19%)	105.1 (8%)	170.8 (14%)	1239.4
8	'610990	T-shirts, singlets and other vests of textile materials, knitted or crocheted (excl. cotton)	21.4 (1%)	307.7 (15%)	32.2 (2%)	134.1 (7%)	2049.9
9	'610510	Men's or boys' shirts of cotton, knitted or crocheted (excl. nightshirts, T-shirts, singlets ...	212.5 (20%)	44.9 (4%)	133.6 (13%)	130.2 (12%)	1044.3
10	'610831	Women's or girls' nightdresses and pyjamas of cotton, knitted or crocheted (excl. T-shirts, ...	55.4 (20%)	42.6 (16%)	11.55 (4%)	50.1 (18%)	272.2

Source: ITC Trade map

6

Conclusion and Way Forward

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Conclusion and Way Forward

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6.1 Overview

India's textile and apparel sector holds a pivotal place in the national economy, contributing 2.3 per cent to the GDP, 13 per cent to industrial output, and 12 per cent to total exports (Economic Survey, 2024–25). As the second-largest source of employment after agriculture, it provides direct livelihoods to over 45 million people including a significant proportion of women and rural workers (Ministry of Textiles, 2024). Characterised by a decentralised yet inclusive structure, nearly 80 per cent of the sector's output originates from MSME clusters across the country (Economic Times, 2025). Despite its economic and social significance, India's textile industry has struggled to sustain its global competitiveness. This report has examined the sector across the entire value chain what may be described as the '5Fs': Farm, Factory (Yarn), Fabric, Fashion, and Foreign. Through this lens, the study has identified key structural challenges and bottlenecks, from low farm productivity and outdated spinning technology to fragmented garment production and weak supply chain integration.

This concluding chapter synthesises the key insights from the preceding analysis and presents a strategic roadmap for revitalising India's textile sector. By addressing policy gaps and operational inefficiencies across the 5Fs, and by amplifying stakeholder perspectives from cotton growers and ginners to textile manufacturers and exporters, the chapter outlines actionable recommendations aimed at enhancing India's export competitiveness, value addition, and long-term resilience in the global textile market.

6.2 India's Gene Revolution in Cotton

The textile value chain in India begins at the farm level, where a variety of natural fibres such as cotton, silk, jute, and wool are cultivated. Among these, cotton stands out as the cornerstone of the country's textile sector, accounting for over 50 per cent of the raw materials used in textile production. A significant turning point came in 2002 with the introduction of genetically modified (GM) Bt cotton hybrids—a policy shift that spurred a dramatic transformation in cotton cultivation. Between 2002–03 and 2013–14, India's cotton production surged from 13.6 million bales to 39.8 million bales, reflecting a remarkable 193 per cent increase. This era, often referred to as the "gene revolution," also saw productivity leap by 87 per cent, from 302 kg per hectare to 566 kg per hectare. The area under cotton cultivation expanded by 56 per cent during this period, with Bt cotton accounting for 90–95 per cent of the total coverage.

Despite these early gains, the sector has experienced a gradual decline since 2014. Cotton cultivation in India continues to grapple with persistent challenges such as limited technological innovation, stagnant seed development, vulnerability to pests like the pink bollworm, dependency on erratic rainfall, and inadequate

adoption of modern agronomic practices. As of 2023–24, while India remains the world's second-largest cotton producer after China, its productivity hovers around 435 kg per hectare significantly below the global average of 770 kg per hectare. This productivity gap at the farm level has ripple effects throughout the cotton value chain, undermining the efficiency, cost-effectiveness, and global competitiveness of India's textile and apparel exports.

Alarmingly, as per USDA estimates, India's cotton production is projected to decline to 30 million bales in the 2024–25 marketing year (MY) its lowest level in 15 years. India is now poised to become a net importer of cotton, with imports expected to reach 2.6 million bales, surpassing projected exports of just 1.5 million bales. This is a sharp fall from the peak export figure of 11.7 million bales in FY14. The key factors behind this downturn have been: (a) excessive state government interventions in capping the trait fees to be paid by domestic seed companies to the Mahyco-Monsanto company that provided the original Bt cotton seeds under a licensing arrangement with domestic seed companies; (b) the delay in releasing the next generation of herbicide-tolerant (Ht) Bt cotton seeds by the government, despite their approval by the GEAC under the Ministry of Environment, Forest and Climate Change. The lack of timely access to advanced seed technology is now proving to be a significant constraint on the sector's growth and resilience.

6.3 From Farm to Factory: Journey of India's Yarn Industry

India's yarn industry represents the first critical stage of value addition in the textile value chain, playing a vital role in both domestic and export markets. As highlighted in Chapter 3, India's cotton yarn exports have stagnated primarily due to global demand shifts towards MMF, loss of price competitiveness, outdated technology, and policy constraints. India's cotton yarn exports peaked at USD 4.3 billion in 2013, declined sharply to USD 2.2 billion by 2016, and have since stagnated between USD 1.5–2.5 billion till 2023. Historically India's cotton yarn exports were heavily dependent on China (biggest market for cotton yarn imports ~USD 4 billion market), which accounted for 42 per cent of total exports in 2013. However, with China signing FTAs with Pakistan (2007) and Vietnam (2010), India's price competitiveness weakened, leading to a sharp decline in exports (post 2013). By 2020, only 22 per cent of India's cotton yarn exports were exported to China and remaining to Bangladesh, Egypt, Peru, Korea etc. While Bangladesh emerged as an alternative export destination, its market size remains one-third of China's. The phase out of export promotion subsidies and the withdrawal of the TUFS for spinning mills have added to the stagnation.

From the field visit, it was observed that a major concern affecting the cotton yarn industry is the quality of raw cotton, particularly contamination and inconsistent fibre length, which increase production costs and reduce international competitiveness. India's cotton has one of the highest contamination rates globally, leading to discounted pricing compared to competitors like the USA, Australia, and Brazil. Outdated machinery in the spinning sector has resulted in productivity gaps across states. Another issue is skilled labour shortage along with attrition rates averaging 20 per cent per year, affecting production capacity. While the rise of MMF in global textile demand presents new opportunities, there are policy barriers to fully capitalize on it (Section 6.5). However, in recent years, there has been a growing recognition of the need to shift towards MMF and yarn including polyester, viscose, and nylon, given their rising global demand and applications across fast fashion, technical textiles, and activewear. Globally, MMF accounts for nearly 70 per cent of total fibre consumption, whereas in India, it remains underutilized, contributing only around 40 per cent. The sector faces stiff competition from countries like China, Indonesia, and Vietnam, which have well-developed MMF ecosystems. High dependence on imported raw materials (like PTA and MEG, raw material for producing polyester fibres, yarns and films), limited innovation in product design, and fragmented manufacturing are further hurdles.

6.4 Weaving Yarn to Fabric

The fabric sector serves as a crucial link between yarn production and garment manufacturing, yet it remains one of the most fragmented and underdeveloped segments of India's textile value chain. As outlined in Chapter 4, this sector includes both weaving and knitting processes, which together produce a wide range of textile fabrics for diverse applications. Despite having the largest installed loom capacity in the world, India's fabric sector is largely decentralised, dominated by MSMEs, and operates with outdated technology. This fragmentation hampers economies of scale, inhibits quality standardisation, and limits cost competitiveness—especially when compared to global leaders like China and Vietnam.

Approximately 80 per cent of India's fabric production is concentrated within MSMEs operating in unorganised clusters, which often lack access to modern equipment, skilled labour, and integrated value chains. One of the key constraints is the slow adoption of advanced technologies and limited vertical integration, mirroring similar challenges seen in the yarn sector. While various government initiatives—such as ATUFS, SITP, and PM MITRA Parks—have been launched to modernise the industry, their impact has been muted due to delayed implementation, insufficient capital support, and low uptake of subsidies.

Additionally, the sector's heavy dependence on imported textile machinery drives up production costs and restricts innovation in fabric design and quality. Another critical barrier is India's limited preferential market access. Unlike competitors such as Vietnam and Bangladesh, which benefit from FTAs with key global markets, India's fabric (and yarn) exports face high tariff barriers, undermining its competitiveness on the international stage.

6.5 Fashion and Apparel Sector

The apparel segment represents the final and most value-added stage of the textile value chain. It transforms raw materials—fibres, yarn, and fabric—into finished garments and products that directly reach consumers. As such, apparel manufacturing not only drives demand backward through the value chain (for fibres, yarns, and fabrics) but also generates forward linkages to domestic and global retail markets. Global apparel market exports are valued at USD 516.3 billion (ITC Trademap, 2023). The global apparel market is projected to grow at a CAGR of 8 per cent, reaching USD 2.37 trillion by 2030 (IBEF, 2024), presenting a significant opportunity for India's garment sector. The apparel segment (HSN codes 61 and 62) comprises 42 per cent of India's T&A exports. India's apparel exports rose from USD 5.5 billion in FY01, peaking at USD 17 billion in FY16, only to drop suddenly to USD 14.5 billion in FY24, marking a 14 percent decline. However, India's global market share in apparel remains stagnant at less than 3 per cent since 2000s (as discussed in Chapter 5). Meanwhile, competitors like Bangladesh and Vietnam have surged ahead. Bangladesh's global share has grown from 2.2 percent to 9.6 percent, while Vietnam's share jumped from 1 percent to 5.8 percent between 2000 and 2023. A significant portion of this shift occurred post-2010 when China's global market share slipped from 34.8 percent to 29.8 percent partly due to its trade war with US. While the global apparel market is increasingly driven by fast fashion, synthetic fibres, and integrated supply chains, India's apparel industry remains fragmented and cotton-centric, dominated SMEs that often lack scale, technology, and design capabilities. This limits its ability to compete with agile manufacturing hubs like Bangladesh, Vietnam, and China, which benefit from larger factory setups, better trade access, and stronger integration with global brands.

As discussed in Chapter 5, India's apparel manufacturing ecosystem is dominated by MSMEs operating in silos across various regions. There are only 3–4 apparel firms in India with turnover exceeding USD 100 million, whereas competitor countries have large-scale, vertically integrated enterprises. This lack of scale limits the adoption of modern technologies, automation, and uniform quality standards. Labour regulations further exacerbate the problem. The legal framework, often rigid and compliance-

heavy, discourages enterprises from expanding their workforce, leading many firms to deliberately remain small and informal. This results in lower productivity, diminished investment appetite, and an inability to meet the demands of international buyers in terms of speed, scale, and consistency.

India's apparel supply chain is another major bottleneck. The value chain is dispersed across states, for example cotton production happens in Gujarat, Maharashtra, Andhra Pradesh etc, yarn spun in Tamil Nadu, fabric processed in Maharashtra or Gujarat, and garments manufactured all over India. This geographic disaggregation increases logistics costs, causes production delays, and lowers operational efficiency. Compounded by complex regulatory procedures such as pre-shipment inspection certificates and component-wise documentation, the export process becomes more cumbersome. For instance, an Indian garment export order takes an average of 63 days from placement to delivery, compared to 50 days in Bangladesh (BGMEA, 2021). Such delays erode competitiveness, particularly in the fast-fashion and quick-turnaround segments of the global apparel market.

Third is the major policy barrier on key synthetic raw materials in the MMF segment. While MMF accounted for more than 70 per cent of global fibre consumption, India's share in global MMF production stood at just 9.2 per cent. The limited capacity in MMF apparel restricts India's ability to cater to high-growth product categories such as activewear, athleisure, and technical textiles. Two key policy distortions hinder the MMF segment- an inverted duty structure (Figure 6.1) under the GST regime and the imposition of QCOs on essential raw materials like Polyester Staple Fibre (PSF) and Viscose Staple Fibre (VSF). On top of this, QCOs limit access to cheaper import raw materials pushing up domestic prices than our global counterparts. As of mid-2024, PSF prices in India were 38 per cent higher and VSF 19 per cent higher than in China (Indian Textile Journal, 2024). India also lacks preferential market access in major export destinations. EU, which accounts for 37 per cent of India's apparel exports-Indian garments face tariffs of 9–12 per cent, while Bangladesh and Vietnam enjoy duty-free or preferential treatment under trade agreements.

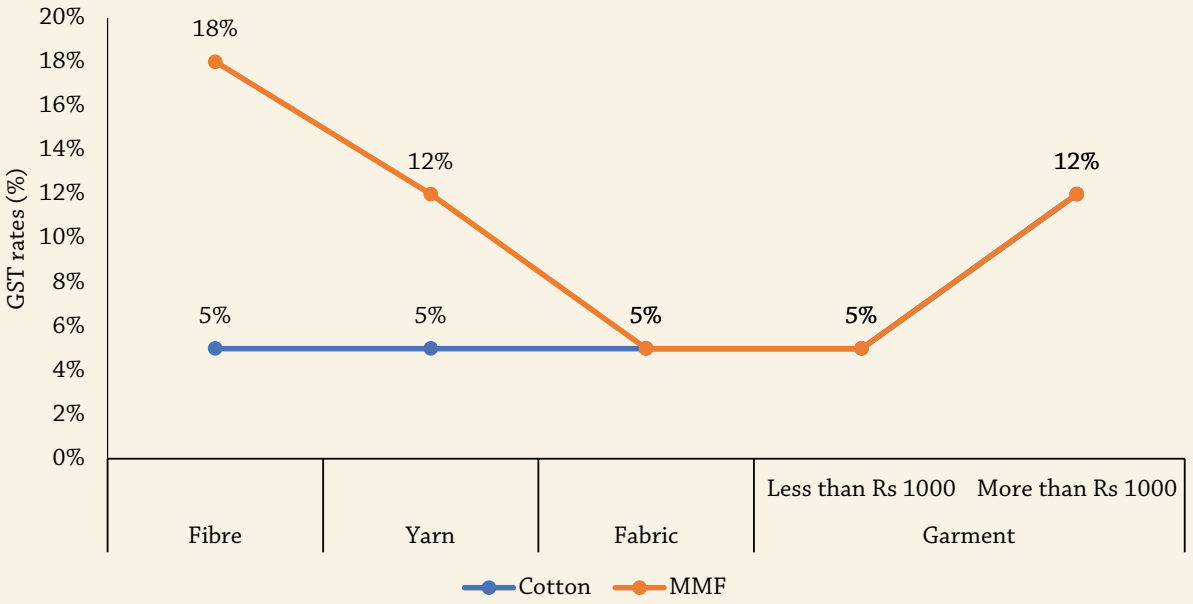
Table 6.1 outlines the duty structure across the textile value chain, comparing cotton and man-made fibres (MMF) at different stages—fibre, yarn, fabric, and garments. For cotton, the GST remains uniformly low at 5 per cent across the value chain, with Basic Customs Duty (BCD) ranging from 5 per cent on fibre to 10 per cent on yarn and fabric, resulting in a total duty burden of up to 17.7 per cent. In contrast, the MMF segment faces significantly higher and varying tax rates, with GST as high as 18 per cent on fibre and 12 per cent on yarn, while BCD ranges from 2.5 per cent to 20 per cent. The total tax incidence on MMF fabrics can reach up to 41 per cent, depending on the product.

This disparity reflects an inverted duty structure—a situation where intermediate inputs are taxed at a higher rate than the final product. This is particularly burdensome for the synthetic textile sector, where raw materials like fibre (18 per cent GST) are taxed more heavily than finished garments (5–12 per cent GST), distorting price competitiveness and reducing incentives for domestic manufacturing. In contrast, the cotton value chain benefits from a more coherent and linear tax regime. The table highlights a pressing policy concern that continues to hamper the growth and global competitiveness of India's MMF-based textile industry (See annexure for details).

Following the 45th GST Council meeting, the government notified a revised GST structure effective January 1, 2022, aiming to eliminate the inverted duty structure in the MMF segment by imposing a uniform 12 per cent tax across the entire value chain from fibre and yarn to fabric and garments regardless of fibre type (Ministry of textile, 2022); however, recent newspaper articles and reports indicate that the issue remains under deliberation, leading to tax accumulation (unutilized Input Tax Credit) across stages and working capital blockage for the industry.

FIGURE 6.1

Duty Structure Across the Textile Value Chain



Source: CBIC, 2025.

TABLE 6.1

Duty Structure Across the Textile Value Chain

	Product	*BCD*	*GST*	*Total duty$*
Cotton	Fibre	5%	5%	11%
	Yarn	10%	5%	17.7%
	Fabric#	10%	5%	17.7%
MMF	Fibre	2.5-5%	18%	24.8%
	Yarn	2.5-5%	12%	18-25%
	Fabric#	10-20%	5%	17-41%
Cotton/MMF	Garments <Rs1000	10-20%	5%	41.5%
	Garments>Rs1000	10-20%	12%	

Note: BCD is Basic customs duty; GST is Goods and Services Tax, # or per piece rate whichever is higher with a few exceptions. $Total duty includes SWC, AIDC and GST components, analysis is done for select HSNs across each category, detailed note on calculations are in Annexure.

Source: CBIC, 2025.

6.6 Way Forward

To overcome the challenges and achieve the ambitious target of USD 100 billion in T&A exports by 2030, India must adopt a strategic approach and implement bold policy reforms across Farm, Factory, Fabric, Fashion, and Foreign-the 5Fs of India's textile sector.

1. Vertical Integration of 5F Supply Chain and Fast-tracking the PM MITRA Scheme

To realise its full potential, India's textile and apparel industry must prioritise vertical integration across the entire value chain—from Farm (cotton production) to Fibre (spinning), Fabric (weaving and knitting), Fashion (design, branding, and retail), and Foreign (exports). Strengthening each link in this chain will enable seamless coordination, improve operational efficiency, and ensure consistent product quality. A more integrated approach will also drive innovation, reduce reliance on external intermediaries, and create a resilient, sustainable, and globally competitive industry. India must shift its focus from commodity-based textiles to fashion-driven products. India must push apparels and made-ups exports for which huge opportunities have opened up. To compete globally, India must innovate in product design, manufacturing technologies, and sustainability. The sector must focus on value-added products that align with global fashion trends (for ex technical textiles), sustainability standards, and the growing demand for high-quality textiles.

In this context, fast-tracking the PM MITRA scheme is imperative. The scheme aims to establish seven world-class integrated textile hubs that bring together fibre production, fabric processing, garment manufacturing, and export logistics in one ecosystem. Large-scale manufacturing clusters will allow firms to collaborate, share infrastructure, benefit from economies of scale, and adopt advanced technologies more efficiently. We strongly recommend that two of the seven PM MITRA Parks, that is in Navsari (Gujarat) and Virudhunagar (Tamil Nadu), be operationalised on a priority basis, in close partnership with the respective state governments. These hubs should be export-focused, SEZ-driven, and ideally linked to the PLI scheme to incentivise value-added exports. This strategic push is crucial for India to plug into disrupted global supply chains and seize emerging opportunities. With the United States imposing 125 per cent tariffs on Chinese textile and apparel imports, India is uniquely positioned to capture a greater share of the US market. China has already entered the era of 'dark factories'- fully automated, AI-powered production systems (for ex. Changping facility in electronics) setting new global benchmarks in speed, precision, and cost-efficiency; India must catch up by building integrated, tech-driven textile hubs that can compete at scale. But India also has to be extremely vigilant from the possible dumping by China or its proxy Vietnam, of cheap garments.

2. Revamp MMF Policy Framework and Correct Inverted GST Structure

The policy framework for MMF needs a significant revamp to make India more competitive in global markets. MMF-based apparel, including polyester, nylon, and viscose, should be incentivized to boost India's garment sector. The current GST inversion (where input tax credit is higher on MMF raw materials than on finished goods) is a critical issue that increases production costs for domestic manufacturers. Correcting this GST inversion will bring down costs for exporters, encourage the use of domestic MMF in production, and ensure greater market access for MMF-based products. In addition, QCOs push up the domestic prices and limit access to cheaper imported raw materials. Indian T&A exporters are also constrained with complex procedures accounting for every component used. Streamlining this policy and liberalising inputs for exports, especially advance authorisation is essential to boost India's competitiveness in the global textile and apparel market.

3. Market access in Key Export Destinations

Securing market access in key export destinations such as the EU and the US is crucial for India's growth in the global textile and apparel

industry. These two markets account for nearly 66 per cent of India's apparel exports. India faces tariff barriers of 9.7 per cent in the EU whereas competitors like Bangladesh (GSP Everything but Arms' arrangement signed in 2001) and Vietnam (EU-Vietnam FTA in 2020) enjoy preferential access. Expedited negotiations for bilateral trade agreements with these markets is essential. India should also explore markets like Japan, Russia, Brazil, and South Korea which offer significant growth prospects for products such as women's western wear, intimate wear, and swimwear.

4. Improve Cotton Productivity and Fibre Quality

India's cotton sector remains one of its key strengths, but it still underperforms relative to global leaders. Improving cotton productivity and fiber quality is essential for boosting India's competitiveness in textile manufacturing. India's current cotton productivity (435 kg/hectare) is significantly lower than that of China (1,945 kg/hectare) and Brazil (1,839 kg/hectare). Streamlining the approval process for GM cotton varieties and establishing a single-window clearance system will speed up the adoption of high-yield, pest-resistant cotton crops. Expanding irrigation, promoting High-Density Planting, and investing in precision farming will help bridge the productivity gap, enabling India to maximize its cotton potential and support the domestic textile sector with a consistent, high-quality supply of raw material.

Lastly, simplification, consolidation, and elimination of compliance-heavy processes for exporters is a low-hanging fruit for improving the efficiency of India's T&A sector. Addressing these priority areas can push India closer to its USD 100 billion T&A export target by 2030.

References

India Brand Equity Foundation (2024). Textiles and apparel. https://www.ibef.org/download/1737634450_Textiles-and%20-Apparel-Nov-24.pdf

Indian Textile Journal. (2024). Imports of fabrics from countries like China is expected to rise further. https://indiantextilejournal.com/imports-of-fabrics-from-countries-like-china-is-expected-to-rise-further/

Ministry of Finance. (2024). Economic Survey 2024-25. Government of India.

Ministry of Textiles. (2022). Impact Assessment of Direct and Indirect Taxes. Incentives extended to all the value chain of Textile Sector. Ministry of Textile, GoI. Retrieved from https://ministryoftextiles.gov.in/sites/default/files/Final%20Report%20on%20Direct%20and%20Indirect%20Taxes.pdf accessed on April 14, 2025.

Ministry of Textiles. (2024). Annual report 2023-24. Ministry of Textile, GoI. Retrieved from https://texmin.nic.in/sites/default/files/MOT%20Annual%20Report%20English%20%2807.11.2024%29.pdf (accessed on March 16, 2025).

Walia, A. (2024). Synthetic textile makers seek relief from QCOs amid supply chain woes. The Indian Express. https://indianexpress.com/article/business/synthetic-textile-makers-seek-relief-from-qcos-amid-supply-chain-woes-9447957/

Annexure

Duty Structure Calculations

The total duty levied on imported commodities in India is a layered structure comprising multiple components, each applied in a specific sequence. These include the Basic Customs Duty (BCD), which is the foundational levy on imported goods, along with additional charges such as the Agriculture Infrastructure and Development Cess (AIDC), the Social Welfare Surcharge (SWC), and the Integrated GST (IGST). The calculation of total import duty is not merely additive; it involves sequential computation where each component is applied to a progressively increasing base. This annexure provides a simplified breakdown of how these duties are calculated, based on data sourced from Central Board of Indirect Taxes and Customs (CBITC), Ministry of Finance, to enhance clarity and support informed analysis of commodity-level import costs.

The following calculation is based on a selected HS code from the Textiles & Apparel value chain, using an assumed CIF (Cost, Insurance, and Freight) value for illustrative purposes. The applicable duty rates such as BCD, AIDC, SWC, and IGST are actual and reflect the notified rates as per CBIC-ICEGATE data. This example is intended to demonstrate the step-by-step process of calculating the total import duty on a commodity. Similar calculations can be performed for other goods by referencing their respective HS codes and the corresponding duty structure. The following calculation has been done under the assumption of no exemptions applied.

Annex Table 6.1: Duty Structure for HSN 61032300

Assumed Value		*1,00,000*	
Description	*Duty (Tariff)%*	*Calculation*	*Value*
Basic Custom Duty (BCD)	20%	20% of Rs 1,00,000	20,000
Custom AIDC	20%	20% of Rs 20,000 (BCD Value)	4,000
Other Duties			
Social Welfare Surcharges	10%	10% of (20,000 + 4,000) i.e., (BCD+AIDC)	2,400
IGST	12%	12% of (1,00,000 + 20,000 +4,000+2400) i.e., (Assumed Value+ BCD+ Custom AIDC+SWC)	15,168
Total Duty (Rs)		(20,000 + 4,000 + 2,400 + 15,168) i.e., (BCD + Customs AIDC+SWC+IGST)	41,568
Total Duty %		(Total Duty/Assumed Value) * 100 i.e., Rs (41,658/Rs 1,00,000) *100	41.568%

Source: CBIC, Ministry of Finance.