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Technical and statistical report

Trends in natural and man-made fibres trade

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Note

References in the text to the United States are to the United States of America, and those to the United Kingdom are to the United Kingdom of Great Britain and Northern Ireland. The data for China do not include those for Hong Kong (Special Administrative Region), Macao (Special Administrative Region) and Taiwan Province of China. Reference to the European Union is to all 27 Member States of the European Union. The term “dollar” or the US$ symbol refers to the United States dollar unless otherwise stated. The term “billion” signifies 1,000 million; the term “tons” refers to metric tons. Exports are valued FOB (free on board) and imports CIF (cost, insurance and freight) unless otherwise specified. Use of an n-dash (–) between years signifies the full period involved, including the initial and final years.

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List of acronyms and abbreviations

ATC	Agreement on Textiles and Clothing
HS	Harmonized System (Harmonized Commodity Description and Coding System, in full) (World Customs Organization)
NTM	Non-tariff measure
UN COMTRADE	United Nations Commodity Trade Statistics (database)
UNCTAD	United Nations Conference on Trade and Development

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Key messages

- Global textile supply chains have undergone profound transformations over the past three decades, driven by shifts in consum er demand, fibre production, and trade, the development of global value chains, and market integration. The most striking trend has been the dominance of man-made fibres, which increased their share of global fibre production from 45 per cent in 1996 to nearly 73 per cent in 2023. This growth, fuelled by synthetic fibres derived from fossil fuel feedstocks, has outpaced the expansion of natural fibres, particularly cotton, which saw its market share decline from 39.5 per cent to 20.1 per cent over the same period.

- The international trade of fibres has evolved in response to these production shifts, with the total value of fibre trade nearly doubling from US$ 20 billion in 1996 to US$ 38 billion in 2023. While cotton has historically dominated fibre trade, 2023 marks a pivotal moment as man-made fibres overtook cotton in traded value. Trade in yarn and fabrics has remained consistently dominated by synthetic fibres, with man-made yarns accounting for approximately 65 per cent of yarn trade value and 70 per cent of fabric trade value.

- Tariff and non-tariff measures (NTMs) continue to shape global fibre markets. While tariffs have generally declined, tariff escalation persists, with higher tariffs applied to processed products such as yarns and fabrics compared to fibres. NTMs, particularly technical barriers to trade (TBTs) and sanitary and phytosanitary (SPS) measures, remain more prevalent for natural fibres, creating distinct market access challenges. Man-made fibres face fewer NTMs, reflecting a more uniform and less restrictive trade environment.

- The organization of fibre supply chains varies significantly across countries. China exemplifies an integrated pattern, maintaining dominance across all processing stages, from fibre production to fabric exports, serving both foreign and domestic brands. India follows a similar but more focused strategy, concentrating on cotton and jute. Countries such as Viet Nam and Türkiye have specialized in yarn and fabric production, relying heavily on imported raw materials, while Italy represents a high-value niche approach, excelling in premium fabric exports.

- Looking ahead, global textile markets will be shaped by the continued expansion of synthetic fibres, evolving trade policies, and efforts to address sustainability challenges. Policies promoting value addition in fibre-producing countries, improving trade transparency, and fostering supply chain resilience will be essential for ensuring a more equitable and sustainable future for the global textile industry.

- For developing countries seeking to enter or strengthen their position in the global fibre supply chain, productive development policies and strategic positioning are crucial. Countries with strong raw material bases, such as cotton or jute producers, should focus on expanding domestic processing to move beyond commodity exports. Those seeking to compete in synthetic fibre markets must invest in technological capabilities and industrial infrastructure to attract value-added manufacturing. Sustainability presents an opportunity, as growing environmental concerns over textile waste, microplastic pollution and shedding, may open new markets for eco-friendly alternatives, recycled textile innovations and niche product segments that capitalize on the unique benefits of natural fibres.

- Regional trade agreements and supply chain resilience will also play an increasing role in shaping competitive advantages. With textile production relying on a few key hubs, developing countries can enhance their role by leveraging regional partnerships, improving trade logistics, and strengthening intra-regional supply chains. Additionally, diversification strategies, such as strategic value addition or investing in alternative manufacturing hubs, can help mitigate risks related to geopolitical and logistical disruptions.

> *The sustainable production, consumption and use of natural plant fibres may contribute to broader efforts towards the implementation of the 2030 Agenda for Sustainable Development, as well as of outcome documents of other related major United Nations conferences and summits and multilateral environmental agreements.*
>
> ***United Nations General Assembly Resolution A/RES/78/169 on Natural plant fibres and sustainable development***

Chapter I

Introduction



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The termination of the global quota system in 2005, as outlined by the Agreement on Textiles and Clothing (ATC),[1] had profound effects on the global textile and garment industry.[2] Unsurprisingly, the upstream segments of the industry—fibres, yarn, and fabrics—[3] also experienced significant transformations over the past three decades.[4] This study explores these changes across different fibre types[5] and processing stages from 1996 to 2023.[6]

The most striking development has been the dramatic increase in man-made fibres, mostly synthetic ones produced using fossil fuel feedstock, which have grown from 22.2 million tons in 1996 to 89.6 million tons in 2023, increasing their global market share from 45 per cent to 72.7 per cent.[7] This growth contrasts with the modest increase in natural fibres production, with its leading fibre, cotton, increasing production from 19.6 in 1996 to 24.7 million tons in 2023. Despite this production growth, cotton's market share fell from 39.5 per cent to 20.1 per cent over the same period. During the same period, other natural fibres, both vegetable and animal-based, saw their combined share of world production fall from 15 per cent to around 7 per cent, despite a slight increase in production volumes. Between 1996 and 2023, global production of natural fibres grew by 24 per cent, whereas synthetic fibre production surged by over 300 per cent. As a result, the current output of man-made fibres is now more than four times greater than it was in 1996.

While global fibre production has been dominated by the rapid growth of synthetic fibres, trade patterns have shown distinct trends and shifts. The total value of trade in fibres grew from US$ 20 billion to US$ 38 billion in 2023. However, most of this increase occurred before 2010, when trade values peaked at US$ 38.8 billion. Since then, the value of trade has fluctuated, with notable variations throughout the 2010–2023 period. As to trade of yarn and fabrics, man-made fibres have consistently dominated both sectors, accounting for 64–65 per cent of yarn trade value and 65–70 per cent of fabric trade value during the period.

Between 1996 and 2023, complex dynamics in market access conditions,

1 See Box 1 for a succinct historical review of the Multi-Fibre Arrangement and its successor, the Agreement on Textiles and Clothing.

2 See for instance Yao and Whalley (2015), Fugazza and Conway (2010), Kowalsky and Molnar (2009), Harrigan and Barrows (2009), Conway (2009), Nordas (2004)

3 See Box 2 for a summary of the fibre-to-fabric transformation processes.

4 Textile Exchange (2024) offers a comprehensive analysis of production trends in most recent years for a wide range of natural and synthetic fibres, also drawing on industry information, although it does not address trade issues. Çeven and Karakan Günaydın (2023) provide a broader, long-term perspective. The CyclOpe (2024) report provides detailed discussions about production trends in several fibres based on primary insights from major industry actors. Regarding natural fibres, FAO statistics are the only source of production information used in this analysis to guarantee comparability and offer some long-term perspective.

5 See Box 3 for comprehensive classification of fibres.

6 Due to limited data availability, the analysis excludes policies affecting international trade in fibres beyond tariffs and non-tariff measures. Additionally, it does not address sectoral subsidies, incentives, or financial support programs. Due to the lack of intertemporal data, price information is not included in the analysis. Readers are referred to Discover Natural Fibres Initiative updates (e.g. DNFI (2024)) for a review of most recent trends in prices and employment for several natural fibres.

7 The statistics reported in this section are from UNCTAD secretariat calculations based on Industrievereinigung Chemiefaser e. V. / IVC (https://www.ivc-ev.de/de/weltproduktion-von-chemiefasern-balkendiagramm) and Textile Exchange (2024); FAOSTAT and OECD-FAO Agricultural Outlook OECD Agriculture statistics (database) at http://dx.doi.org/10.1787/agr-outl-data-en. Discover Natural Fibres Initiative https://dnfi.org/category/statistics.

involving both tariff and non-tariff measures (NTMs), have emerged. While there has been a general trend towards lower tariffs in all product categories, the study finds continued tariff escalation, with higher rates applied to processed products compared to raw materials. The implementation of NTMs varies significantly across fibre types and processing stages. Man-made fibres consistently face a lower number of NTMs at all stages, reflecting relatively uniform and moderate measures. In contrast, natural fibres, including cotton, other vegetable fibres and animal fibres, generally face a higher and more variable number of NTMs. Across processing stages, NTMs tend to be slightly higher for raw materials and fabrics than for yarn, especially for natural fibres. Additionally, diverse types of NTMs apply across processing stages: technical barriers to trade are particularly prevalent in trade in fabrics, while sanitary and phytosanitary measures play a key role in trade in raw materials, especially for natural fibres.

This study points to different production and trade integration approaches adopted by countries in the global fibre industry. China has integrated the textile and textile products industries, maintaining a strong presence at all processing stages, dominating fabric exports in most fibre types. China's predominance can be explained by its vast processing capacity, its domestic production of both natural and man-made fibres, which has allowed its textile and apparel industries to produce low-cost and versatile textile products as demanded inter alia by the fashion industry. India follows a similar but more focused approach, concentrating on sectors where it has a strong presence, particularly cotton and jute. In contrast, countries such as Viet Nam and Türkiye have adopted a process-oriented integration model, specializing in yarn and fabric production, and relying heavily on imported raw materials. Italy represents yet another approach, focusing on high-value segments and building competitive advantage through design and quality in high-end fabric exports.

The remainder of the analysis is organized as follows. First, it examines production and trade patterns for different fibre types and product categories, providing detailed data on volumes and values. Second, it analyzes market access conditions, including both tariff and NTMs, and their evolution over time. Third, it examines production and trade integration patterns.

Chapter II

Production


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Total fibre[8] production more than doubled between 1996 and 2023, growing from 49 million tons in 1996 to 124 million tons in 2023 (Figure 1a), The most dramatic growth was in man-made fibres, from 22.2 million tons in 1996 to 89.6 million tons in 2023. This represents a significant shift in total fibre production share from 45 per cent to 72.7 per cent over this 27-year period (Figure 1b). The fastest growth occurred between 2000 and 2015, when production more than doubled from 31.8 to 66.9 million tons.

The doubling of global fibre production between 1996 and 2023 reflects a combination of demographic, economic, technological, and industrial factors.[9] Yearly per-capita consumption almost doubled since 1996 to reach 13.5 kg in 2023.[10] The rise of synthetic fibres, driven by their cost-effectiveness and versatility, played a core role in this growth.[11] The expansion of the textile industry, particularly in developing countries,[12] the increasing demand for industrial and technical textiles, further fuelled production.[13]

Cotton production showed modest growth from 19.6 million tons in 1996 to 24.7 million tons in 2023. However, its relative importance in the fibre market declined significantly, with its share dropping from 39.5 per cent in 1996 to 20.1 per cent in 2023. This trend illustrates how the steady but slow growth of cotton was overshadowed by the rapid expansion of man-made fibres.

Other plant and animal fibres remained minor components throughout the period. Their combined share declines from about 15 per cent in 1996 to about 7 per cent in 2023, with animal fibres consistently representing the smallest segment at about 1-2 per cent of total production.

Due to inherent natural constraints (e.g. seasonality of growing, weather conditions, land availability) production of cotton, or of any other natural fibre, cannot grow indefinitely and may at best follow a linear progression over time. Possible sources of disruption being multiple adaptability to changes in demand remains limited as compared to man-made fibres.[14]

After cotton, jute is the second most produced natural fibre followed by coir, wool and flax.

8 In FAO production statistics, fibres refers to raw or processed fibres but not spun. This definition is in line with the HS nomenclature which is used in this study when considering trade flows. In the case of cotton, production refers to lint, ginned cotton. Figures for fibres production are available in FAOSTAT at https://www.fao.org/faostat/en/#data.

9 See Textile Exchange (2023) for a discussion.

10 Presentation by Lorena Ruiz at the 82nd plenary meeting of the ICAC in Tashkent Sept 29-Oct 3 2024. https://icac.org/Content/EventDocuments/PdfFilesf97500c9_ebbf_46b0_81f2_bdbcc3f824cd/Lorena_ICAC%20PM%20UZBEKISTAN%202024%20-%20LORENA%20RUIZ.pdf

11 See Gschwandtner (2022) for a quantitative analysis.

12 As shown in Tokatli (2008), the change in the culture of fashion from ready-to-wear to fast fashion started in the 1990s and has tilted the balance of competitive advantage towards firms in partially industrialized countries.

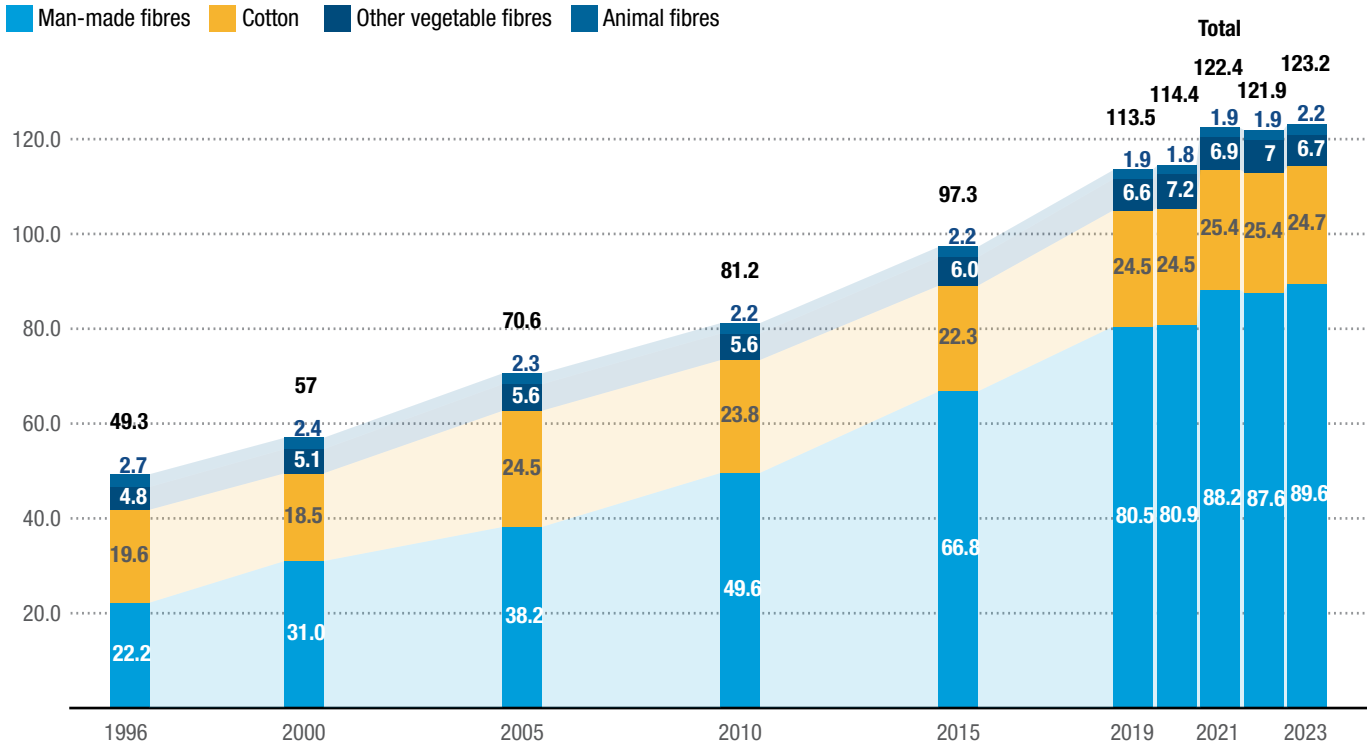
13 See for instance ICAC (2023) for detailed review and discussion of supply developments in the textiles industry.

14 See Rajkishore (2023) for a discussion.

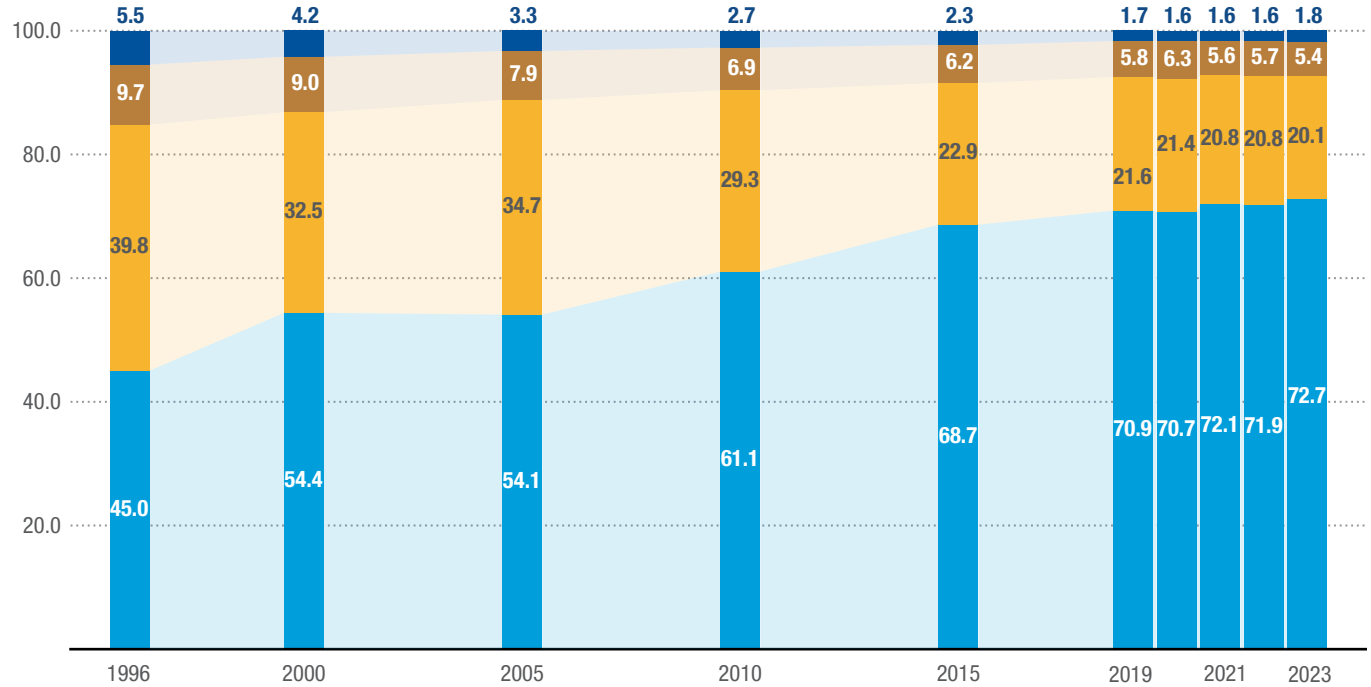
Figure 1

Man-made fibres drive steady growth in global fibre production

Global fibre production, selected years (1996-2023), millions of tons



Global fibre production, shares, selected years (1996-2023), percentage



Source: UNCTAD secretariat's calculations based on Industrievereinigung Chemiefaser e. V. / IVC (https://www.ivc-ev.de/de/weltproduktion-von-chemiefasern-balkendiagramm) and Textile Exchange (2024); FAOSTAT and OECD-FAO Agricultural Outlook OECD Agriculture statistics (database) at http://dx.doi.org/10.1787/agr-outl-data-en. Discover Natural Fibres Initiative https://dnfi.org/category/statistics.

Chapter III

Traded values and volumes



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Both values and volumes are reported for a selected set of fibre types and for three product categories according to processing (i.e., raw, yarn, and fabric). However, no analysis is provided for unit prices, as they may not accurately reflect price developments observed in specialized markets or at the transaction level.[15]

Fibres

Overall, trade in fibre nearly doubled from 1996 to 2023, mirroring production trends, growing from approximately US$ 20 billion in 1996 to US$ 38 billion in 2023, with significant fluctuations since 2010 (Figure 2a). Trade peaked at around US$ 47 billion in 2022 before experiencing a sharp decline in 2023.

Trade in fibres followed a different pattern compared to production, with cotton trade consistently aligning with trends in man-made fibres. The absolute value of cotton trade rose from US$ 8.0 billion in 1996 to a peak at US$ 21.6 billion in 2022. During the same period, its share in global trade grew from 36.1 per cent to 46.4 per cent in 2022 (Figure 2b). However, the value of cotton trade fell by more than a fourth in 2023 and its share in total trade fell by 5 percentage points compared to 2022.

This decline was partly due to reduced production in 2023 and weaker downstream demand, exacerbated by challenges faced by spinners in Bangladesh and Pakistan in securing Letters of Credit (LCs).[16] Spinners in both countries faced severe disruptions due to dollar shortages due to tensions on foreign exchange markets,[17] with banks delaying or rejecting LCs for cotton and machinery imports, forcing many mills to cut production or shut down. Additionally, international trade was disrupted by shipping delays, as attacks on vessels in the Red Sea forced many freight lines to reroute, increasing costs and further straining the already low returns for ginned cotton.[18]

[15] The list of products included in the analysis is reported in Table A.1 of the appendix.

[16] A Letter of Credit (LC) is a financial document issued by a bank that guarantees payment to a seller (exporter) once they deliver goods as agreed in the contract. It ensures security for both buyers and sellers in international trade by reducing payment risks. With a Letter of Credit, the seller is thus guaranteed payment if terms are met. The buyer avoids upfront payment until goods are shipped correctly. Generally speaking, LCs reduce risk in cross-border deals where trust may be limited. See Crozet et al. (2022) for some empirical evidence.

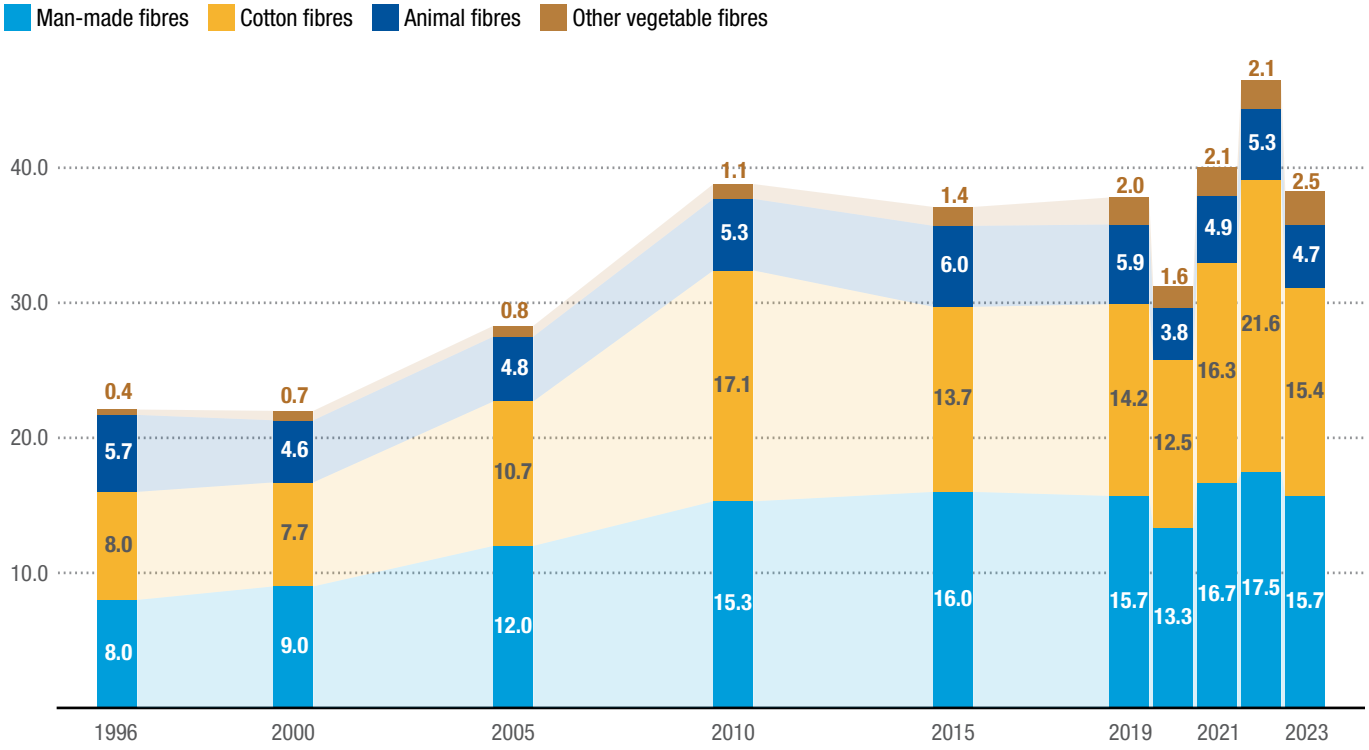
[17] See IMF (2023) and IMF (2024) for a discussion.

[18] See for instance the Cotton outlook market summary of December 2023 https://www.cotlook.com/information-2/cotlook-monthly/december-2023-market-summary/

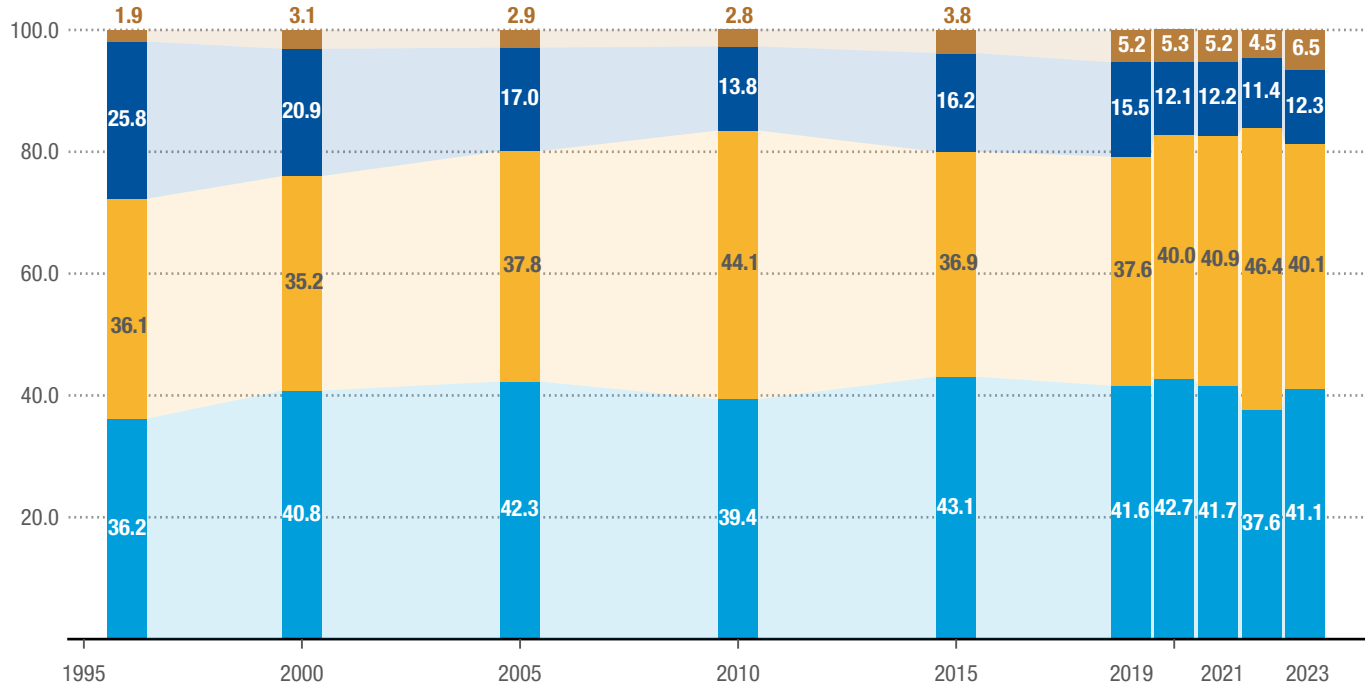
Figure 2

Cotton and man-made fibres drive total trade value in fibres

Selected years (1996-2023), billions of US$



Value share, selected years (1996-2023),percentage



Source: UNCTAD secretariat's calculations based on UN-COMTRADE.

Man-made fibres showed steady growth, rising from US$ 8.0 billion (36.2 per cent) in 1996 to US$ 15.7 billion (41.6 per cent) in 2023. Despite a 10 per cent decrease in their traded value, man-made fibres overtook cotton again in 2023.

Animal fibres decreased from 25.8 per cent in 1996 to 12.3 per cent in 2023, driven by a significant fall in wool fibres trade and mirroring production evolution. Other vegetable fibres remained constant, accounting for approximately 5-7 per cent of total trade throughout the period. In contrast to cotton and man-made fibres, animal and other vegetable fibres saw their trade value and share in total trade increase in 2023.

In terms of total trade volume, the increase was less pronounced in relative terms, rising from about 10 million tons in 1996 to 15.6 million tons in 2023 (Figure 3a). Additionally, trade volume trends in fibres did not align with production trends during the 2005-2010 period, which followed the end of the global quota system. This divergence was partly due to temporary restrictions on Chinese exports (Box 1) and the ability of major fibre producers to process domestically, reducing the need for outsourcing after the ATC expired. The differences between trade value and trade volume patterns are attributed to a significant price increase (close to 70 per cent), particularly for cotton, between 2005 and 2010.[19]

Nonetheless, cotton dominated trade volumes, maintaining the largest share during the 1996-2022 period (Figure 3b), growing from 4.3 to 7.8 million tons (41.9 per cent to 44.7 per cent). Man-made fibres showed consistent growth from 4.0 to 6.7 million tons, increasing their share from 39.3 in 1996 per cent to 40.2 per cent in 2022. Mirroring trade value patterns, both fibres groups saw a decline in their traded volume in 2023, but the decline was stronger for cotton and man-made fibres became the most traded fibre.

Other vegetable fibres experienced significant growth, rising from 5.7 per cent to 12.4 per cent share. Animal fibres declined notably, dropping from 13 per cent to 4.2 per cent of total trade volume.

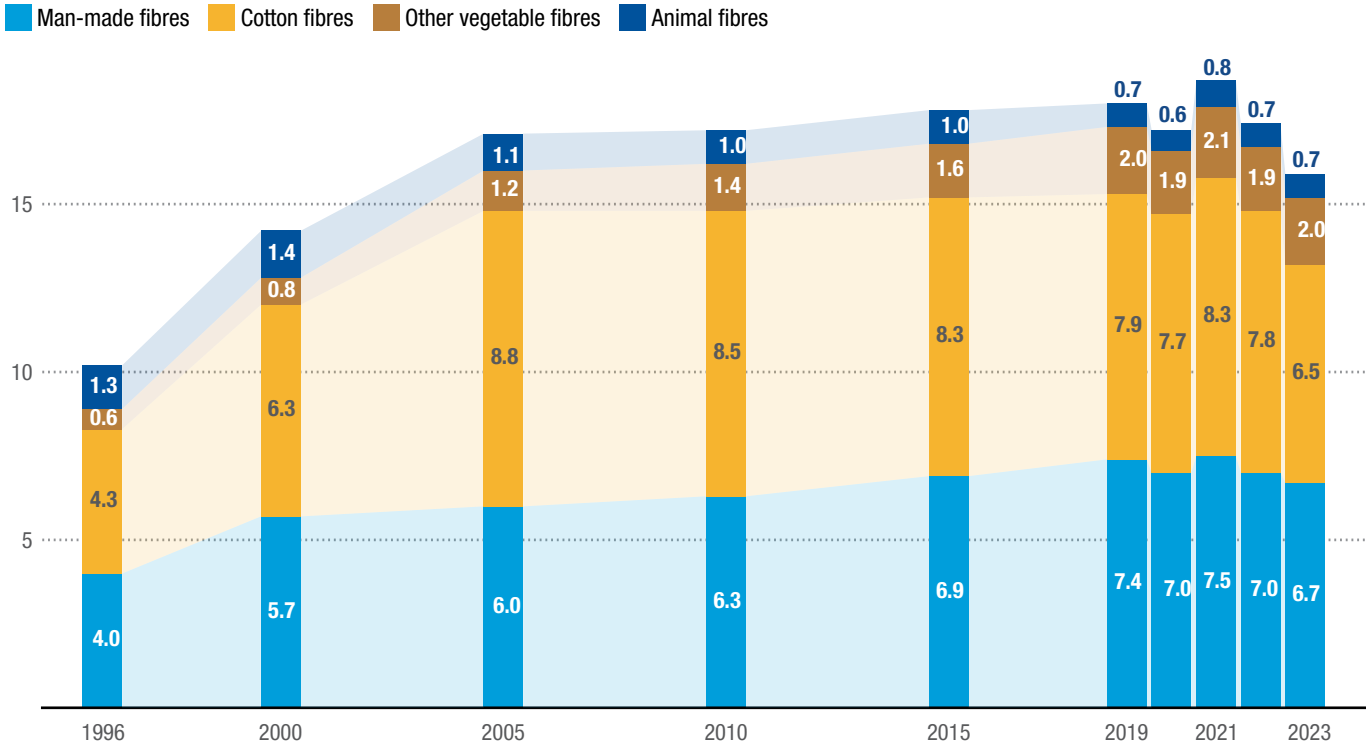
Production and trade data reveal a stronger inclination for natural fibres to be traded internationally compared to man-made fibres. The trade shares of fibres reflect the extent to which domestic production is shifted abroad for further processing. Changes in these shares over time highlight shifts in the organization of production. In 2023, the trade-to-production ratio for cotton, other vegetable fibres, and animal fibres stood at 0.26, 0.32, and 0.26, respectively. In contrast, the ratio for man-made fibres was notably lower at 0.075. Back in 1996, these ratios were 0.22, 0.17, 0.48, and 0.18, respectively. This indicates that the propensity to trade was lower for both cotton and other vegetable fibres but higher for animal fibres and man-made fibres at that time. These evolutions suggest that while vegetable fibres have increasingly been traded and processed across multiple countries and regions, the processing of animal fibres—and particularly man-made fibres—has become more concentrated in countries that produce the raw materials as illustrated and discussed in section 5.

The number of countries exporting raw fibres is shrinking, particularly for traditional materials like cotton and wool. However, eco-friendly fibres like hemp and flax are expanding.

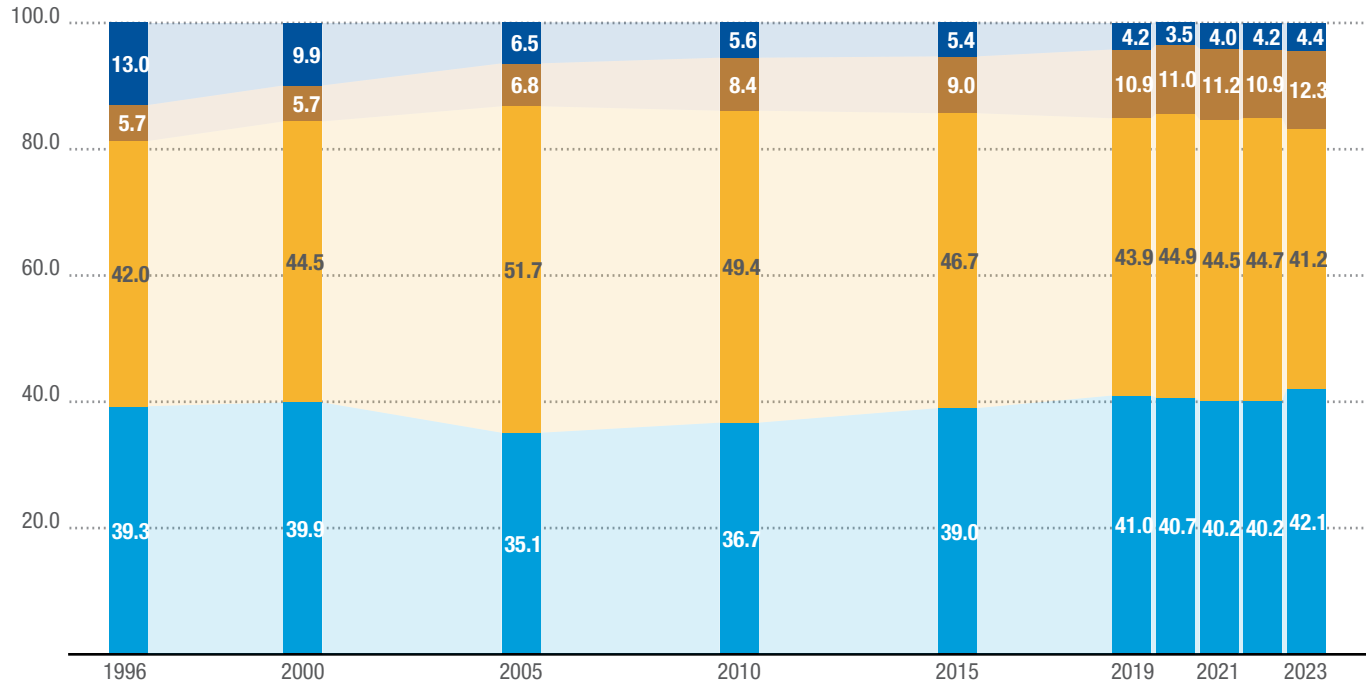
[19] Data source: https://www.imf.org/en/Research/commodity-prices .

Figure 3
Wavering Cotton leadership in total trade volume in fibres

a) Volume, selected years (1996-2023), millions of tons



b) Volume share, selected years (1996-2023), percentage



Source: UNCTAD secretariat's calculations based on UN-COMTRADE.

Yarn

Yarn is the secondary product derived from fibres, accounting for higher trade values. Total yarn trade increased from approximately US$ 25 billion in 1996 to US$ 41 billion in 2023, peaking at about US$ 47 billion in 2022 (Figure 4a). Man-made fibre yarn consistently dominated, growing from US$ 16.9 billion to US$ 26.5 billion and maintaining a 64-65 per cent market share throughout the period (Figure 4b).

Cotton yarn trade increased from 6.2 to US$ 10.9 billion between 1996 and 2023, representing about 25-30 per cent of total yarn trade. Its share peaked at 31.6 per cent in 2015.

Other vegetable fibres and animal fibres maintained minor shares, collectively accounting for about 8.5 per cent of yarn trade value by 2023. Animal fibre yarn notably decreased from 9.8 per cent in 1996 to 5.9 per cent in 2023 echoing figures revealed for fibres.

A significant shift occurred in 2022 when yarn trade peaked at US$ 47 billion, followed by a sharp decline in 2023, affecting all fibre types but maintaining their relative proportions. This sharp decline can be attributed to diminished demand for garments, which adversely impacted the global apparel industry, affecting yarn and fabric demand in numerous countries.[20]

Man-made yarn also dominated trade in volume throughout the period, growing from 4.4 to 8.5 million tons (Figure 5a), maintaining a steady share around 65-70 per cent (Figure 5b). Cotton yarn volumes doubled from 1.7 to 3.4 million tons between 1996 and 2023. Its share in total traded volumes increased slightly from 25.8 per cent in 1996 to 27.0 per cent in 2023 with peaks at above 30 per cent between 2010 and 2020. A notable peak occurred in 2021 at 13.5 million tons, followed by a slight decline.

Other vegetable fibres and animal fibres remained minor components, collectively accounting for less than 8 per cent of total trade volume by 2023, with animal fibres showing the most significant relative decline from 3.6 per cent in 1996 to about 1 per cent since 2019.

> Natural fibre yarn markets are concentrating among fewer exporting countries while man-made yarn maintains broader participation.

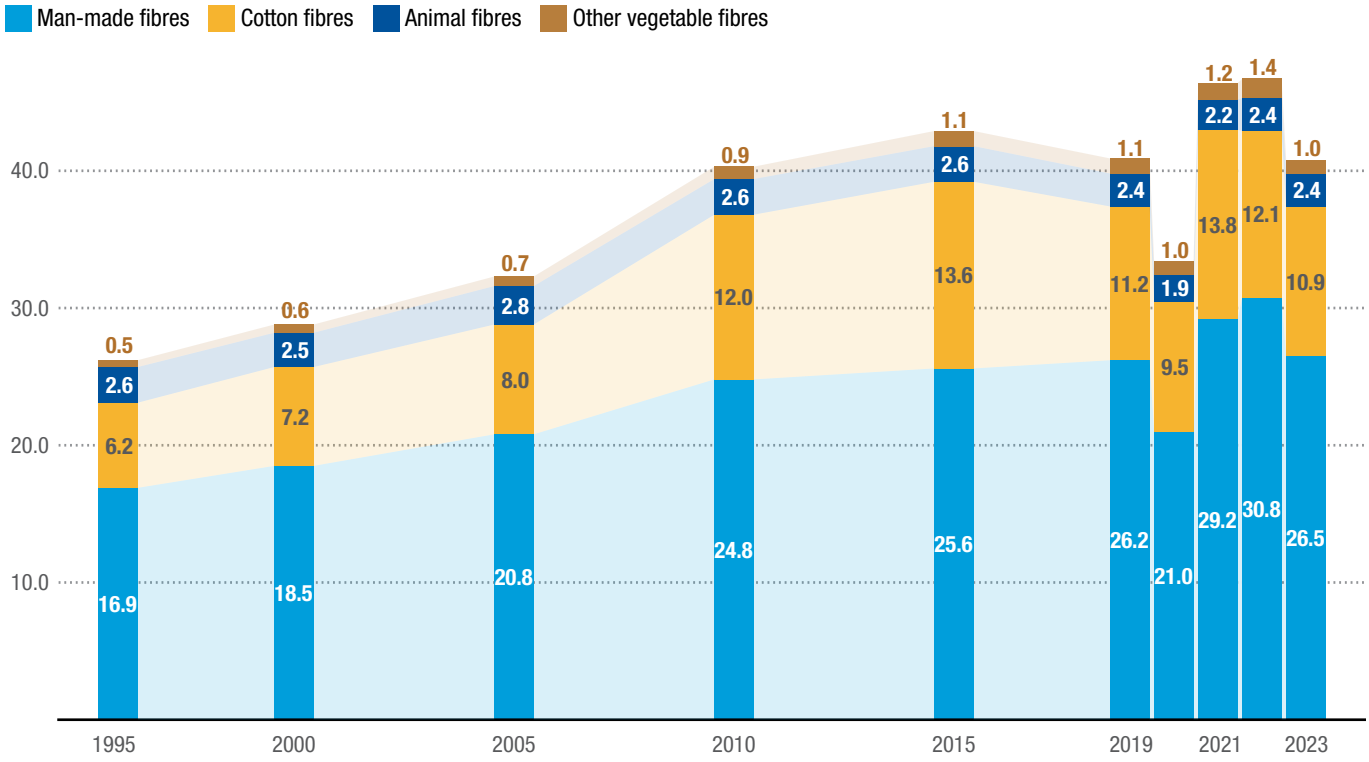
[20] As reported by https://www.fibre2fashion.com/news/yarn-news/india-s-yarn-exports-suffer-15-89-drop-in-average-prices-in-2023--290091-newsdetails.htm?type=p

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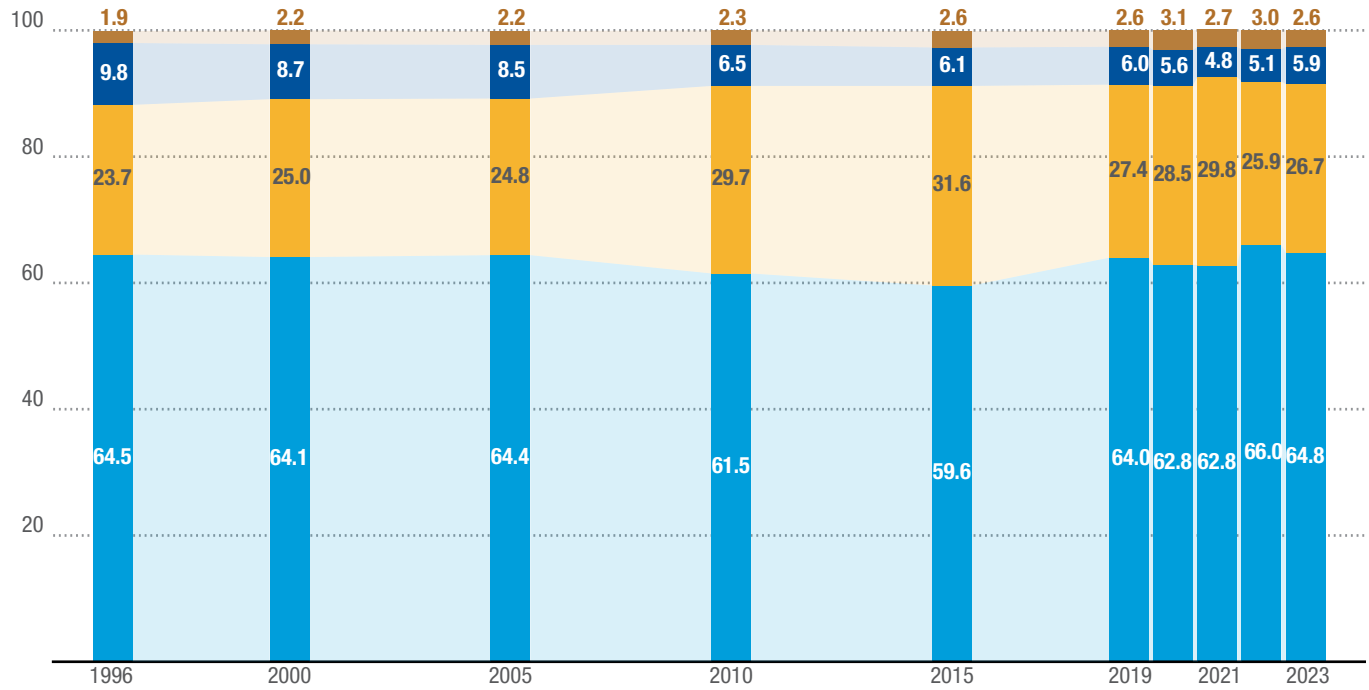
Figure 4

Man-made fibres dominate total trade value in yarn

a) Value, selected years (1996-2023), billions of US$



b) Value share, selected years (1996-2023), percentage

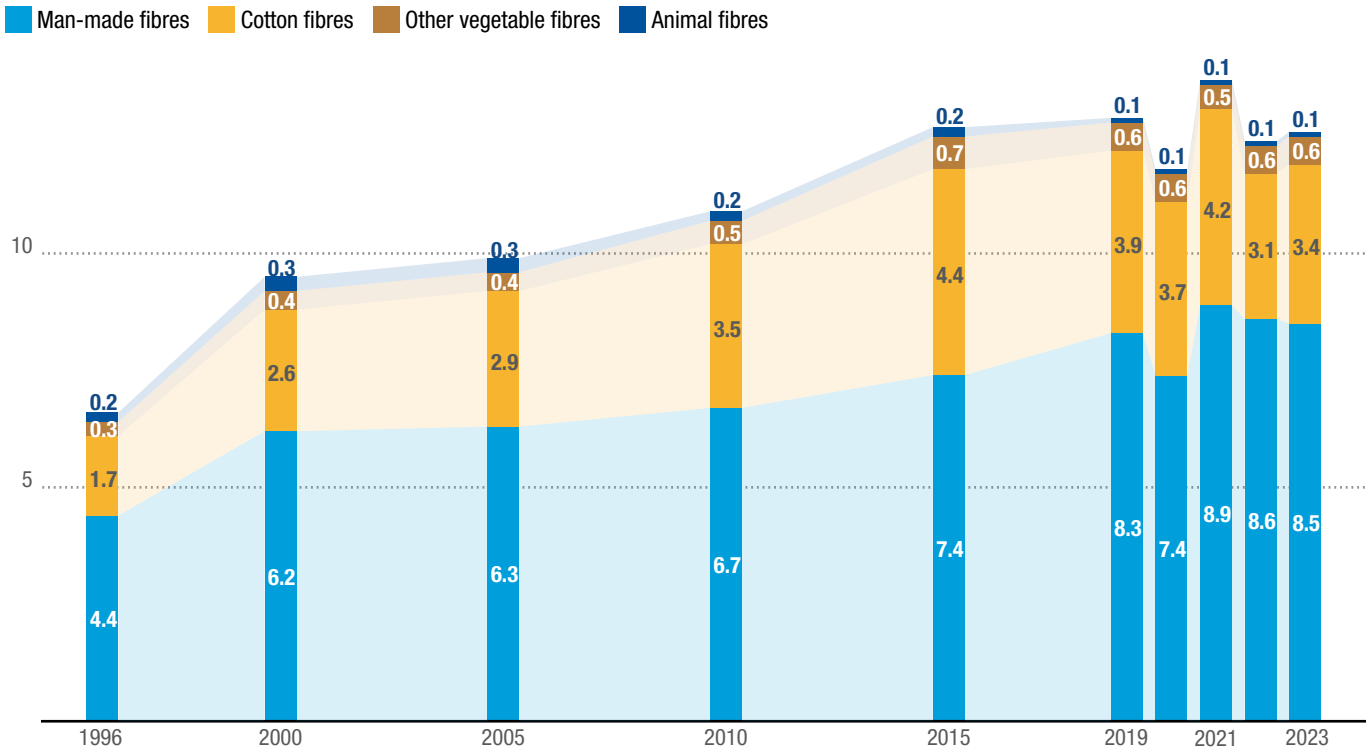


Source: UNCTAD secretariat's calculations based on UN-COMTRADE.

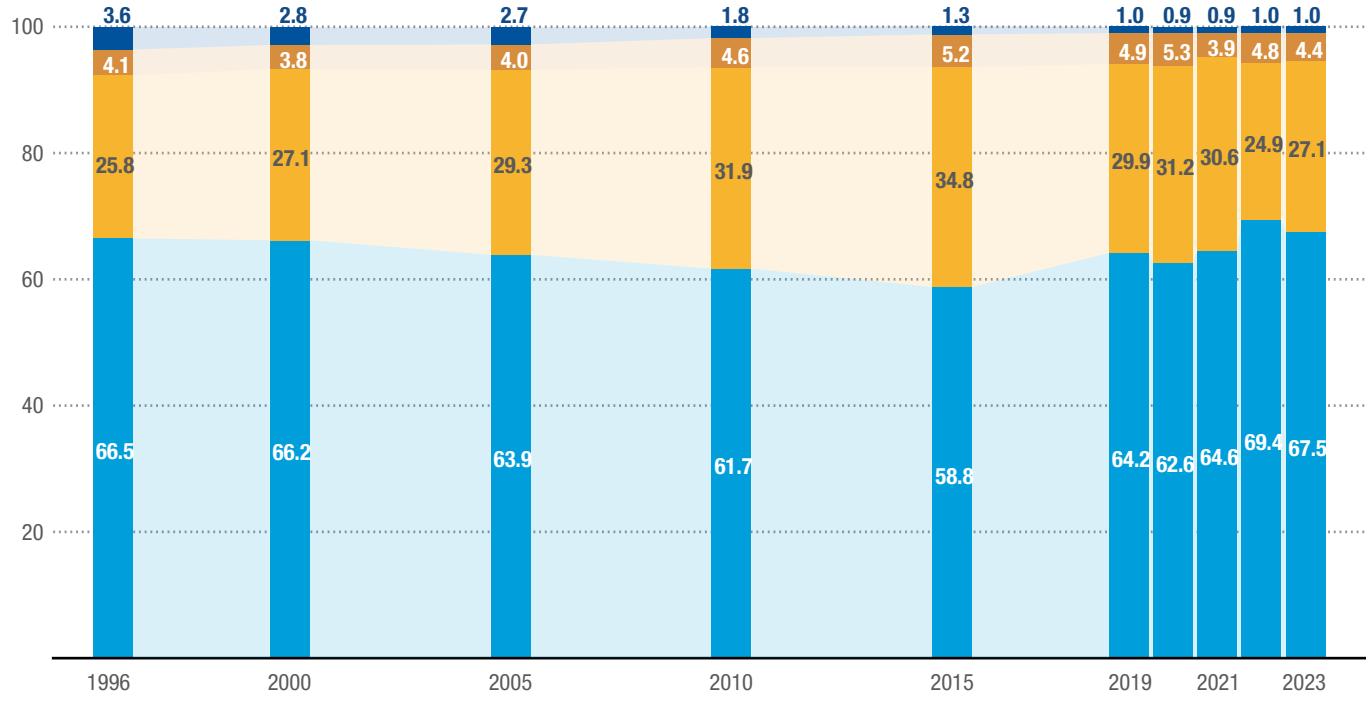
Figure 5

Man-made fibres dominate total trade volume in yarn

a) Volume, selected years (1996-2023), millions of tons



b) Volume, selected years (1996-2023), percentage

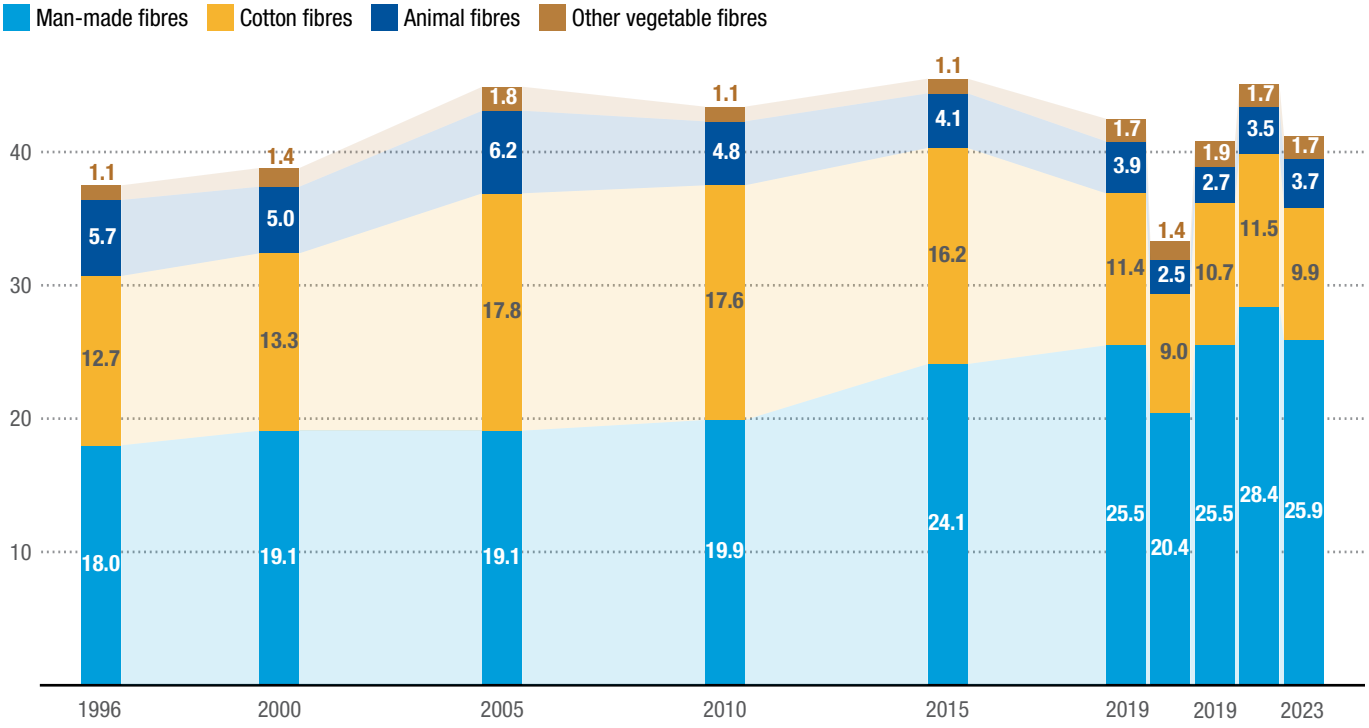


Source: UNCTAD secretariat's calculations based on UN-COMTRADE.

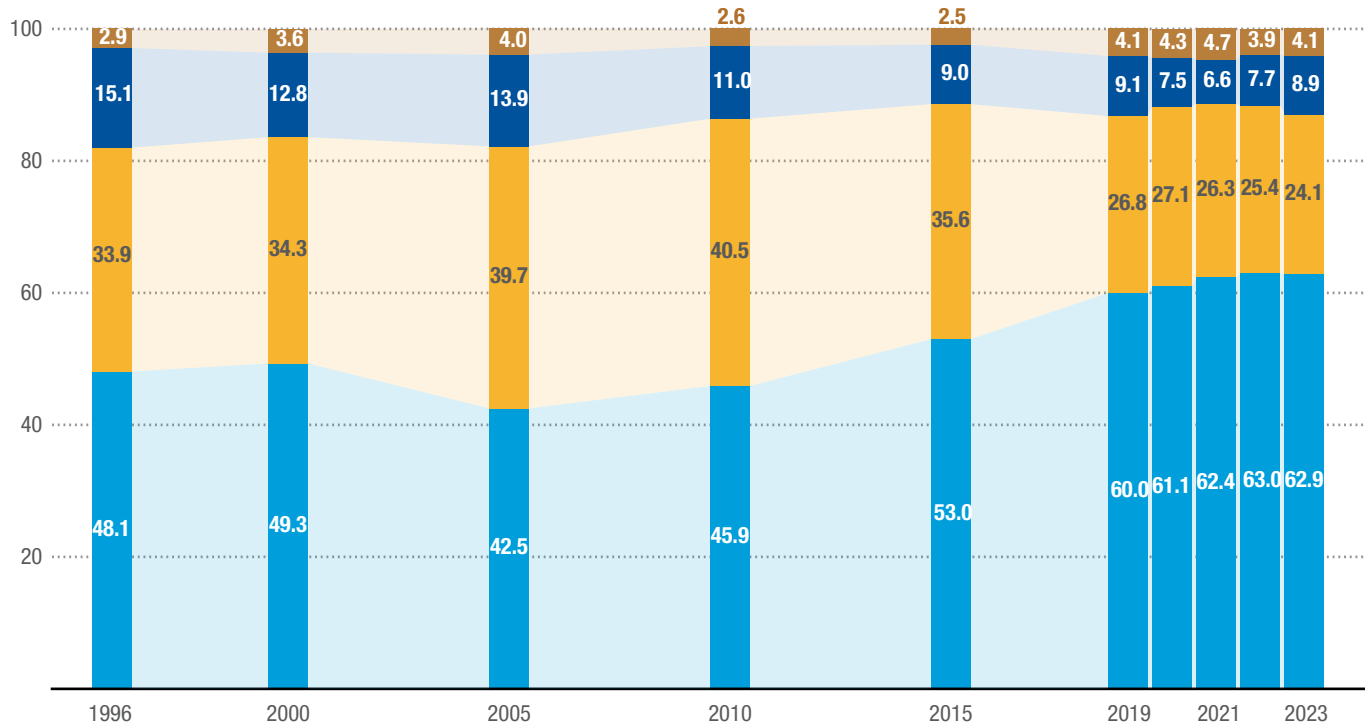
Figure 6

Uncertain growth trends in value of trade in fabrics accompanied by diminishing shares of cotton

a) Value, selected years (1996-2023), billions of US$



b) Value share, selected years (1996-2023), percentage



Source: UNCTAD secretariat's calculations based on UN-COMTRADE.

Fabrics

Total fabrics trade saw a relatively small growth in the period considered, when compared with the other processing stages. It increased from about US$ 37 billion in 1996 to US$ 40 billion in 2023, with a peak of US$ 44 billion in 2022 (Figure 6a). This is consistent with Yao and Whalley (2015) findings for the 2005-2013 period who found relatively small increase in textiles as compared to textile products. This suggests that processing has intensified within large and cost-efficient fabric producers, such as China or India. The end of the ATC allowed large producers to repatriate production processing originally relocated through quota hopping investment[21] and reduced the need for transhipment to circumvent quotas application.

Man-made fabrics dominated throughout the period, rising from US$ 18.0 billion to US$ 25.9 billion and maintaining a 65-70 per cent market share (Figure 6b). Cotton fabrics trade declined from US$ 12.7 billion to US$ 9.9 billion between 1996 and 2023. Its share reached 40 per cent in 2010 and dropped by about 16 percentage points in the following decade to reach 24.1 per cent in 2023. Both fibres groups show a relatively important drop in their traded values in 2023.

Other vegetable fibres and animal fibres maintained minimal shares, collectively representing less than 7 per cent of total trade value since the end of the 2000s'. Animal fibre fabrics notably decreased from US$ 5.7 billion (15.1 per cent) in 1996 to US$ 3.7 billion (8.9 per cent) in 2023.

The data on trade volumes demonstrates a clear shift toward man-made fabrics in global trade, with synthetic materials becoming increasingly dominant.

Total volume increased from 2.7 to 5.8 million tons during this period (Figure 7a). A notable peak occurred in 2022 at 6.4 million tons before declining in 2023.

Man-made fabrics grew substantially from 1.1 to 4.2 million tons, with their share rising dramatically from 39.7 per cent to 72.9 per cent (Figure 7b). Cotton fabric volumes increased substantially between 1996 and 2005, moving from 1.3 to 2.7 million tons, but declined significantly during the following two decades, moving back in 20023 to its 1996 level. The share of cotton fabrics also decreased dramatically between 2005 and 2023, moving from 44.9 per cent to 22.2 per cent.

Other vegetable fibres and animal fibres maintained minimal shares with a diminishing relative importance due to stable absolute volumes. While they jointly represented about 11 per cent of total trade volumes in 1996, this share fell to 5 per cent in 2023.

More countries are now exporting fabrics across multiple fibre categories, with particularly strong growth seen in flax and jute fabrics.

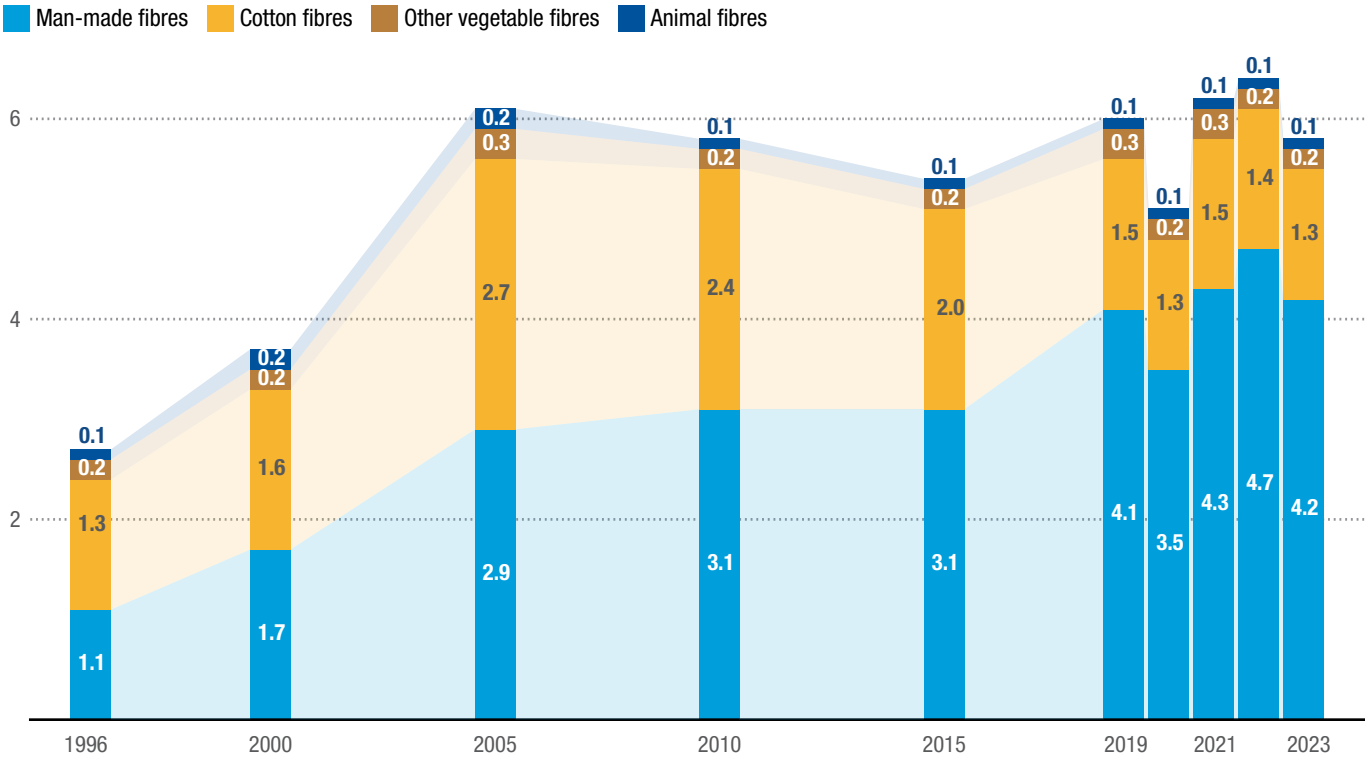
[21] See Dayaratna-Banda and Whalley (2007) for empirical evidence.

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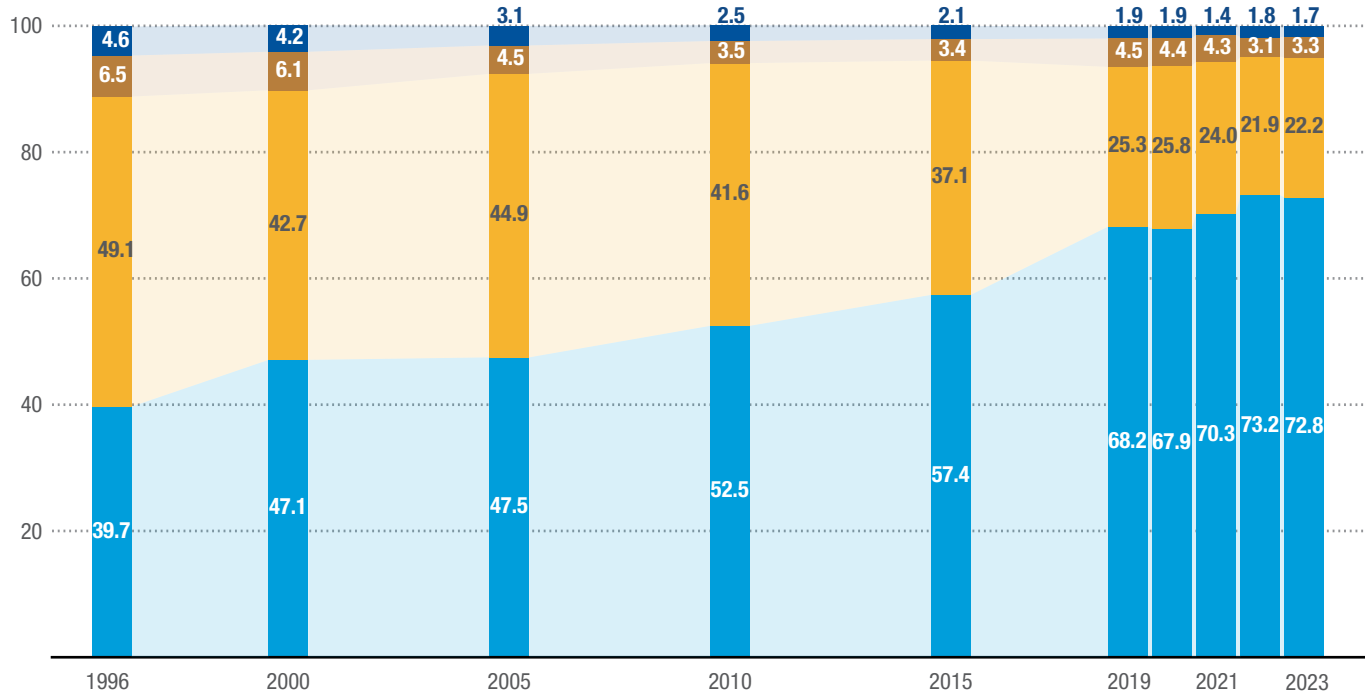
Figure 7

Volume of trade in fabrics shows a consistent shift from cotton to man-made fabrics

a) Volume, selected years (1996-2023), millions of tons



b) Volume shares, selected years (1996-2023), percentage



Source: UNCTAD secretariat's calculations based on UN-COMTRADE.

Chapter IV

Trade policy



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Trade patterns closely relate to access conditions prevailing internationally, with Tariffs and Non-Tariff Measures being major components of market access.[22]

Tariffs

In the past decades, tariffs in the sector have seen a general decline, reflecting a global shift toward trade liberalization. Additionally, the narrowing of tariff ranges suggests some convergence in tariff policies across countries. However, despite this overall reduction, fabrics and yarn continue to face higher tariffs than raw materials, highlighting a pattern of tariff escalation.[23]

Effectively applied tariffs[24] for all man-made product categories (i.e., raw, yarn, and fabrics) have declined steadily between 1996 and 2023 (Figure 8). Fabrics consistently face the highest tariffs among the three categories. The gap between the tariffs on raw materials and finished products like fabrics has remained notable, indicating higher trade protection for goods requiring a higher level of processing. Similar to man-made fibres, tariffs on cotton products have also declined gradually over time.

Fabrics have the highest tariff rates, followed by yarn, and then raw materials. The decline in tariffs for cotton fabrics is slightly less steep compared to yarn and ginned cotton, suggesting slower liberalization for these finished products.

Tariffs for vegetable fibre products other than cotton also show a downward trend, reflecting a general reduction in trade barriers. Fabrics have the steepest decline among all product categories but still maintain the highest tariff levels.

Tariffs for animal fibres follow a similar trend to other fibre types, with steady reductions over time. Fabrics again face the highest tariffs, with yarn and raw materials being progressively lower. The gap between tariffs on raw materials and finished products remains significant, indicating persistent protection for domestic textile manufacturing industries.

Figure 8 highlights a general gradual shift toward lower tariffs. The decline in tariffs from 1996 to 2023 suggests ongoing trade liberalization, though the pace varies by product category and fibre type. We observe that across all fibre groups, fabrics consistently have the highest tariffs, followed by yarn and raw materials. This pattern, known as tariff escalation, reflects a global trend where more processed products face higher trade tariffs compared to less processed ones. The differences in tariff levels between raw materials, yarn, and fabrics may reflect the strategies of many countries to encourage local processing and manufacturing.

Fabrics and yarn consistently face higher tariffs than raw materials, demonstrating clear tariff escalation in global trade.

[22] In this section, all tariffs are expressed in ad-valorem terms. While full-time series are available for tariffs, information about NTMS is essentially cross sectional for most countries.

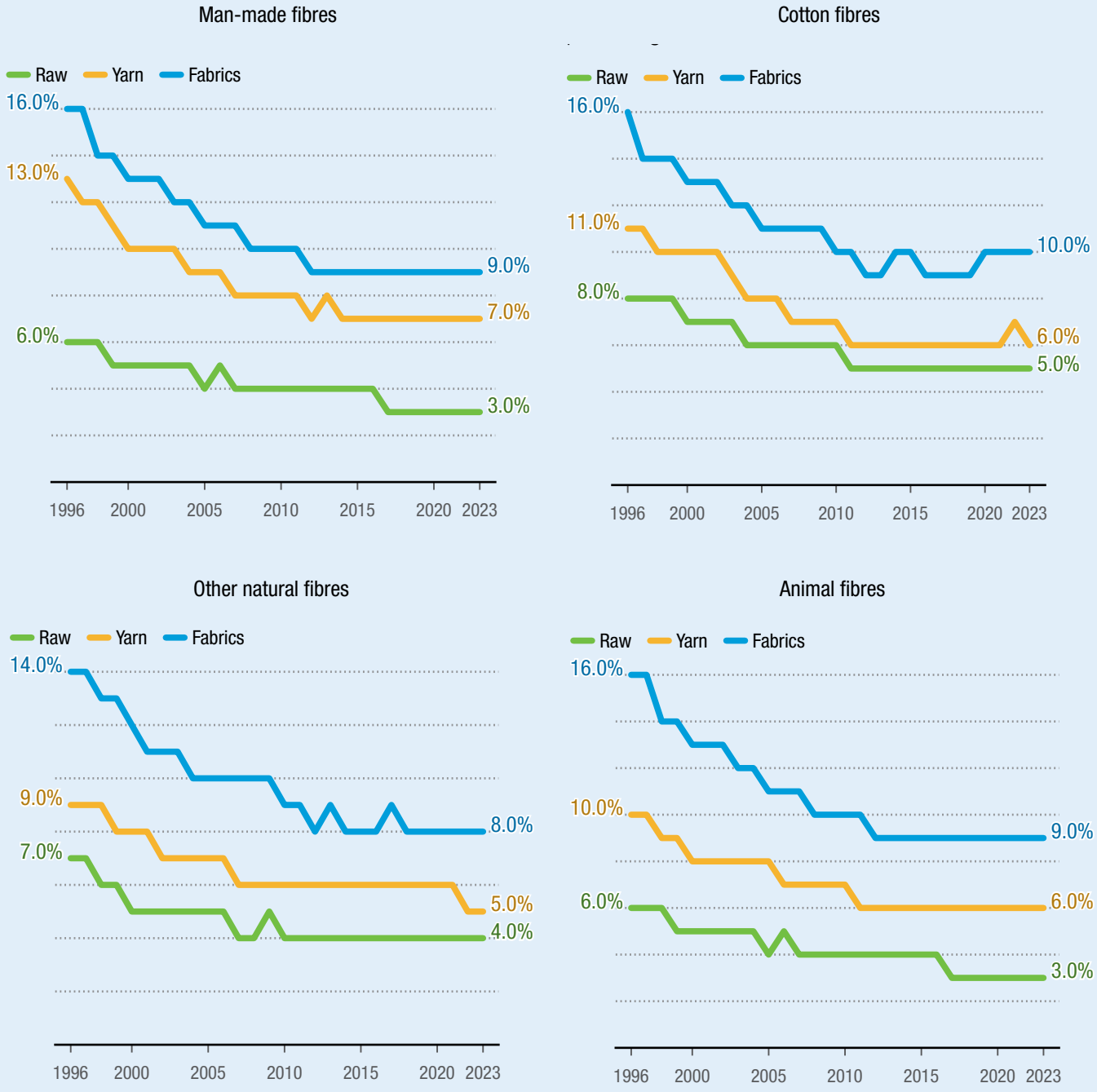
[23] See UNCTAD (2012) for a comprehensive discussion about escalation patterns.

[24] The effectively applied tariff is defined as the lowest available tariff. If a preferential tariff exists, it will be used as the effectively applied tariff. Otherwise, the MFN applied tariff will be used. See the World Integrated Trade Solution explanatory notes for a more detailed discussion about the various tariffs that can be applied to a trade record. https://wits.worldbank.org/wits/wits/witshelp/content/data_retrieval/p/intro/c2.types_of_tariffs.htm

Figure 8

Tariff escalation persists despite lower effectively applied tariffs

Tariffs on man-made, cotton, other natural and animal fibres, selected years (1996-2023), percentage



Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information.
Note: Reported average levels are computed by taking the simple cross-country average of the simple average of all fibre products included in a specific fibre type and product category obtained at the country level.

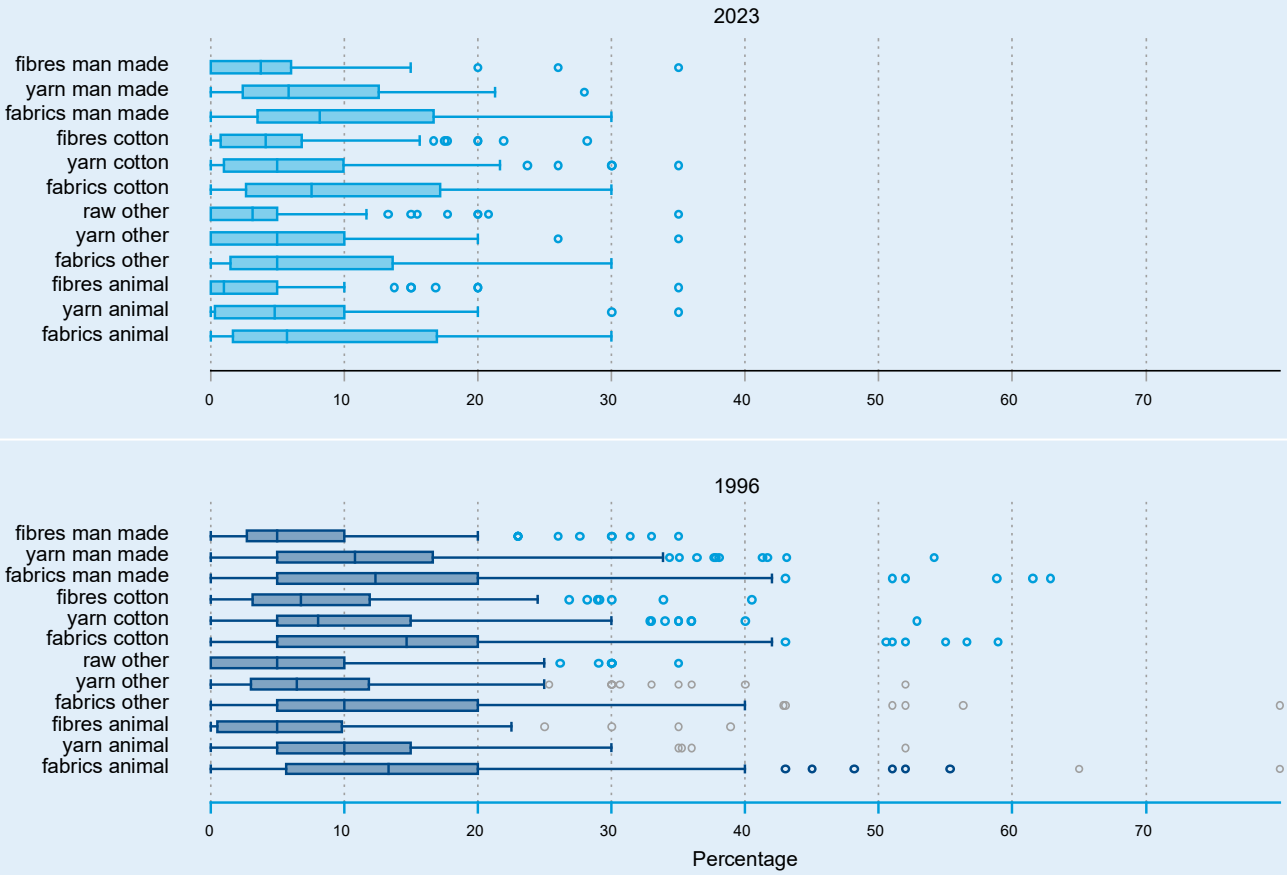
In addition to the general decrease in tariff rates from 1996 to 2023, the range of tariffs (shown in Figure 9 by the width of the boxes and whiskers in the box plots) has narrowed, indicating less variation in tariff rates among countries. In 1996, there were numerous high outliers across all fibre types and product categories, some reaching up to 70-80 per cent. By 2023, the number and extent of high outliers had significantly reduced, though some still exist. The 1996 data show wider boxes and longer whiskers, indicating greater dispersion in tariff rates.

The 2023 data show more compact boxes and shorter whiskers, suggesting more harmonized tariff policies across countries. All fibre types and product categories show a downward shift in median tariffs from 1996 to 2022. The most pronounced median decreases are seen in cotton and man-made fabrics.

Figure 9

Lower and more harmonized effectively applied tariffs across countries

Selected years (1996-2023)



Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information.
Note: The horizontal box plot displays: the median (shown as a vertical line inside the box); the interquartile range (IQR) - represented by the box itself (the left edge is the 25th percentile and the right edge is the 75th percentile); the "whiskers" extending from the box, showing the range up to 1.5 times the IQR; and outliers (shown as individual points) beyond the whiskers.

Non-Tariff Measures

Natural fibres face significantly more NTMs than man-made fibres.

NTMs include technical measures such as Sanitary and Phyto-sanitary (SPS) measures,[25] technical barriers to trade (TBTs) and pre-shipment requirements, and non-technical measures like quotas, price control and contingent trade protective measures.[26] Due to limited availability of intertemporal information, the analysis in this section focuses on the prevailing non-tariff measures (NTMs) applied by importing countries to fibre products (Table 1). The prevalence of non-tariff measures (NTMs) is reflected by the number of measures applied by importing countries, categorized by fibre type and product group. While the count of measures serves as a simple indicator of prevalence, it appears to be an effective measure of stringency, with minimal computational requirements.[27]

For raw materials, all types of natural fibres face a higher number of NTMs compared to man-made fibres. The mean number of NTMs applied to natural fibres is around 9, with median values ranging between 7 and 8. In contrast, man-made fibres face a lower mean and median number of NTMs of 6 and 4, respectively, reflecting the fact that synthetic raw materials face fewer phyto-sanitary measures.

The NTMs applied to yarn products follow a pattern similar to those for raw materials. Man-made fibre yarns have the lowest mean NTM at 6 and a median of 5. In contrast, natural fibre yarns, particularly those made from other vegetable and animal fibres, face higher NTMs, with means and medians ranging between 8 and 9. The maximum NTMs for yarn products are slightly lower than those for raw materials, ranging between 29 and 32.

For fabrics, NTMs appear to increase slightly for certain fibre types. Animal fibre fabrics have the highest NTMs, with a mean of 9, a median of 7, and a maximum of 35, which is the highest value recorded in the dataset. Other vegetable fibre fabrics have a mean NTM of 8 and a median of 6, which is similar to yarn products. Man-made fibre fabrics continue to show the lowest NTMs, with a mean of 6, a median of 5, and a maximum of 29.

The standard deviation of NTMs across all fibre types and product categories is consistently around 6 to 7, indicating a moderate level of variability in the measures applied by importing countries.

[25] Sanitary and phytosanitary (SPS) measures are typically associated with agricultural products and natural fibres to ensure they are free from pests, diseases, and contaminants. However, man-made fibres, such as polyester and nylon, are produced using chemicals. Regulations may require compliance with safety standards to ensure that harmful chemicals (e.g., formaldehyde or heavy metals) are not present in the fibres or finished products. Measures like the European Union's REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) regulate the use of hazardous substances in synthetic fibres and textiles to protect human health and the environment.

[26] This section focuses on a limited selection of non-tariff measures (NTMs) that are included in established international classifications. A notable exclusion is subsidies for which information is characterized by limited country, time, and instrument coverage. The analysis is based on the International Classification of NTMs available at https://unctad.org/topic/trade-analysis/non-tariff-measures/NTMs-classification.

[27] To accurately assess their stringency, a detailed analysis of the specific requirements within each regulation would be necessary, along with their conversion into an ad valorem equivalent. However, such a comprehensive examination falls outside the scope of this study. See UNCTAD (2018) for an extensive theoretical discussion and practical implications.

Table 1

Natural fibres are subject to a greater number of Non-Tariff Measures (NTMs) compared to man-made fibres

Number of measures: selected statistics

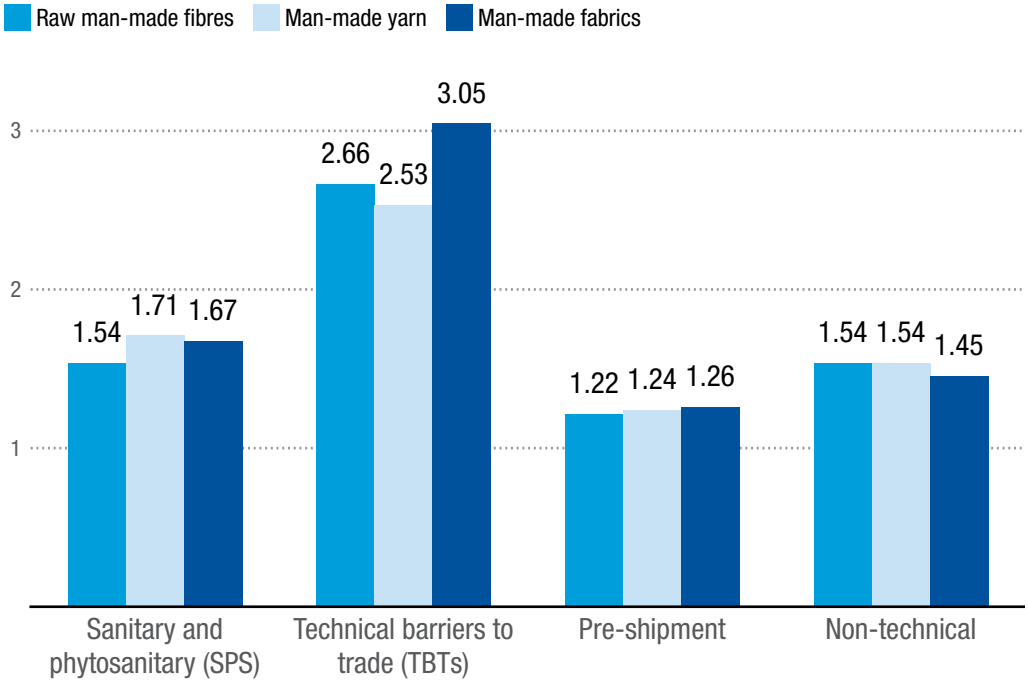
		Mean	Median	Standard-deviation	Maximum
Fibres	Man-made	6	4	6	29
	Cotton	9	7	6	29
	Other vegetable	9	8	7	32
	Animal	9	7	7	34
Yarn	Man-made	6	4	6	29
	Cotton	8	7	6	29
	Other vegetable	9	8	7	32
	Animal	8	6	6	31
Fabrics	Man-made	6	5	6	29
	Cotton	7	6	6	29
	Other vegetable	8	6	7	29
	Animal	9	7	7	35

Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information

Figure 10

NTMs prevalence for man-made fibres: Consistent application of measures across all stages of processing

Number of measures

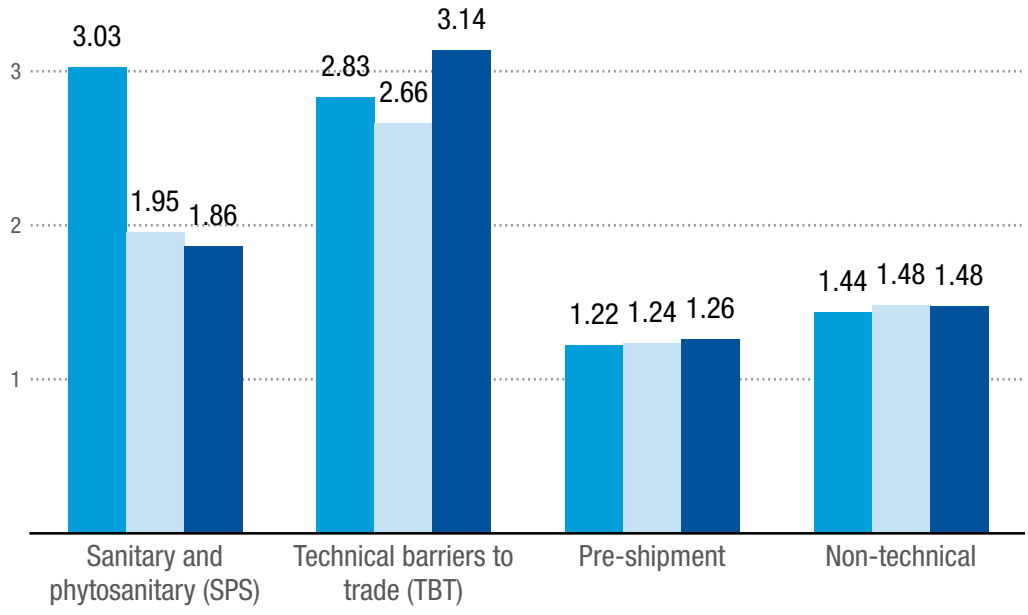


Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information

Figure 11

NTMs prevalence for cotton: Fibres face the highest number of SPS measures

Number of measures



Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information

When considering the number of NTMs applied to the different product categories of man-made fibres, it is notable the uniform application of non-tariff measures indicating consistent trade policies affecting all stages of the production chain (Figure 10). For example, the incidence of SPS measures is consistent across all product categories (raw, yarn, and fabrics), with each facing 1 to 2 measures. This uniform application suggests low differentiation in SPS requirements for man-made fibres, due to their minimal association with biological risks. TBT measures are the most prevalent type of NTMs for all product groups, particularly for fabrics, which face the highest number of measures (around 3.5). Yarn and raw materials also face significant TBT measures, though fewer than fabrics. This trend reflects the importance of technical regulations and standards in ensuring compliance with product quality and safety requirements, particularly for finished goods like fabrics.

The number of pre-shipment inspection measures is low and consistent across raw materials, yarn, and fabrics, with all product categories facing about 1–2 measures. This suggests that pre-shipment requirements, such as quality checks and certifications, are evenly applied across the supply chain. Non-technical measures, such as quotas or trade restrictions, are applied similarly across all product categories, with each product category facing around 2 measures.

Figure 11 illustrates the number of NTMs applied to cotton products. The uniform application suggests consistent trade policies, except for ginned cotton and the application of SPS, with approximately 3 measures applied, as compared with 2 measures for yarn and fabrics. The prominence of SPS measures for ginned cotton highlights the need to address potential agricultural risks, such as pests or diseases, during international trade.

TBTs are the most prevalent type of NTMs for cotton products, particularly for fabrics, which face around 3.5 measures. Yarn and ginned cotton also face significant TBT measures, though slightly fewer than fabrics. This trend reflects the importance of technical regulations for ensuring product quality and compliance, especially for value-added goods like fabrics. The number of pre-shipment inspection measures is low and consistent across raw materials, yarn, and fabrics, with all product categories encountering around 1–2 measures. This indicates that pre-shipment requirements are applied evenly across the cotton supply chain. Non-technical measures, such as quotas or trade restrictions, are applied similarly across all product categories, with each facing approximately 2 measures.

Man-made fibres show uniform NTM application across all stages, whereas natural fibres exhibit large numbers of SPS/TBT measures for raw materials, reflecting stricter agricultural and safety controls.

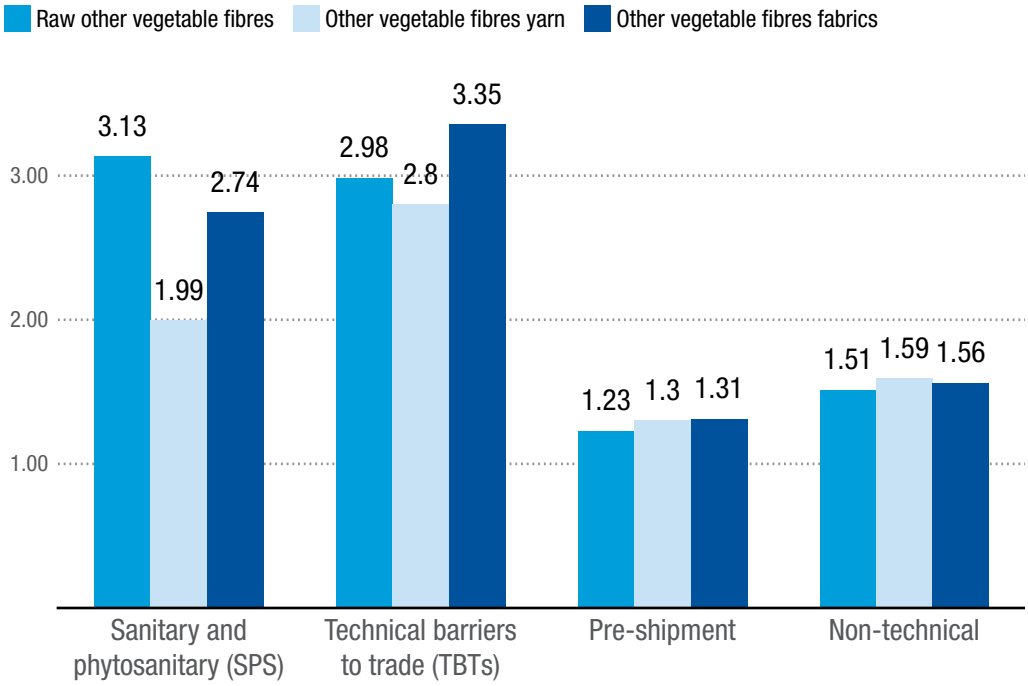


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Figure 12

NTMs prevalence for other vegetable fibres: Fibres and fabrics face higher numbers of SPS measures and TBTs

Number of measures

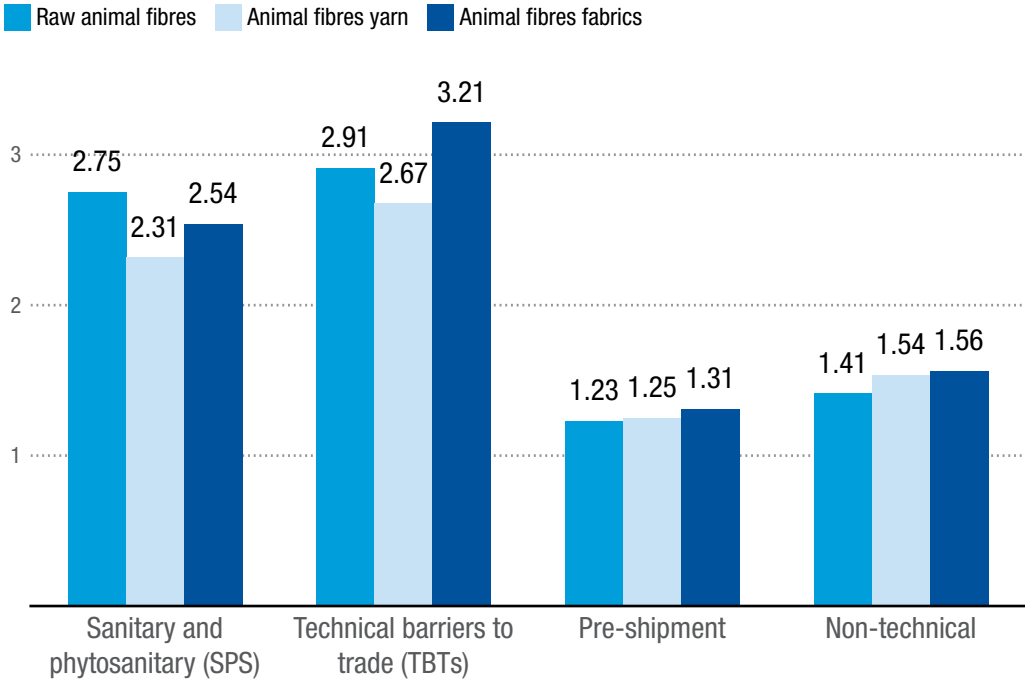


Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information

Figure 13

NTMs prevalence for animal fibres: Fibres and fabrics face higher numbers of SPS measures and TBTs

Number of measures



Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information

Like cotton, other raw vegetable fibres also face higher SPS measures (3 measures on average), indicating a stronger focus on regulating raw materials to ensure safety (Figure 12). Fabrics have slightly fewer SPS measures applied than fibres, and yarn has the least among the three product categories. Fabrics face the highest number of TBT measures (just above 3), due to their processed nature, necessitating stricter technical standards. Yarn and fibres have almost equal TBT measures, slightly below fabrics.

All three product categories (raw, yarn, and fabrics) face similar levels of pre-shipment measures, averaging around 1.5 measures. This suggests uniformity in pre-shipment inspections or certifications across these products. Non-technical measures, such as administrative or procedural barriers, are also imposed uniformly across raw, yarn, and fabrics at around 1.5 measures on average.

Selected NTMs applied to products from animal fibres follow the same pattern of those applied to vegetable fibres (other than cotton), as illustrated by Figure 13.



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Chapter V

Production and trade integration patterns



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Production and trade flows can reveal unique characteristics of global supply chains within the fibre subsectors. Data from 2019 to 2023 on the production, export, and import shares of the top five producers for each fibre type, along with the tariffs they impose on imports,[28] provide valuable insights into the patterns and dynamics of global fibre industry supply chains.

For man-made fibres, China plays a core role across the entire supply chain, accounting for a significant 73 per cent of global production by volume in raw materials. This leadership extends through all three segments of the supply chain, with China holding substantial shares in yarn exports (32 per cent) and fabric exports (44 per cent). The United States is a key importer, particularly of raw materials (8 per cent share), while Viet Nam consistently appears as an important importer across the value chain. China exhibits moderate tariff escalation, with rates increasing from 4.9 per cent for raw materials to 7.8 per cent for fabrics. In contrast, India, the second-largest producer, maintains high tariffs across all stages, ranging from 20 to 24.6 per cent. Notably, developed economies such as the United States impose lower tariffs on raw materials but higher tariffs on fabrics.

For cotton, the production landscape shows a clear concentration among a few major players. India leads with 23 per cent of production, closely followed by China at 22 per cent, while the United States, Brazil, and Pakistan round out the top five producers. There is an interesting pattern in the trading dynamics—the United States dominates the export market for ginned cotton (39 per cent share in value terms), while China is the primary importer (26 per cent share in value terms). A notable observation in the yarn segment shows a shift in dominance. Viet Nam emerges as a major player in yarn exports (26 per cent share), while China becomes the largest importer (40 per cent share). This suggests a significant role for Viet Nam in the intermediate processing stage of the cotton supply chain. In the fabrics sector, China maintains its strong position with a 31 per cent share in exports, while Pakistan and Italy also emerge as significant exporters. The import market for fabrics appears more diversified, with Viet Nam, Tunisia, and Indonesia among the key importing nations. The data reveals an intricate global supply chain where countries often specialize in various stages of production and processing. There is a clear pattern of some countries being strong in raw material production (like India in cotton), while others excel in processing and manufacturing (like Viet Nam in yarn production) without precluding, however, strong positions in more downstream sectors. This can reflect both natural resource endowments and industrial development strategies of different countries. India and China, the top producers, maintain high tariffs across raw (19.9 per cent and 22 per cent), yarn (20.3 per cent and 4.8 per cent), and fabrics (24.5 per cent and 7.6 per cent). The United States, a major producer, has maintained lower tariffs throughout the chain (3 per cent for raw) until 2023 while Brazil and Pakistan show escalating tariff structures, particularly high for fabrics.

China leads global production and trade across most fibre types while other nations specialize in specific segments.

For industrial hmp, the production landscape is dominated by France with a 46 per cent share of global production, followed by China (22 per cent).[29] This European leadership continues in the trade arena, with the Netherlands being the largest exporter by value (27 per cent) and Italy the largest importer (18 per cent). France maintains its strong position in export weight (56 per cent), demonstrating its pivotal role in the

[28] See Tables A.2 and A.3 of the appendix.
[29] See UNCTAD (2022) for a comprehensive review of the sector.

Countries exhibit distinct roles along value chains:Viet Nam dominates cotton yarn exports while importing raw materials, Italy excels in high-end wool fabrics, and China processes European flax and hemp into yarns and fabrics

global hemp industry. In the yarn segment, China becomes the leading exporter (72 per cent), with Romania (11 per cent) as a distant second. The United States emerges as a significant importer (15 per cent) along with the Republic of Korea (13 per cent). The import-export patterns suggest a complex processing chain where raw materials from Europe are processed in Asia before being traded globally. Interesting pattern of low tariffs in developed markets (France, Netherlands) versus higher in developing markets are observed. France, despite being a major producer, has extremely low tariffs, while China maintains moderate tariffs (6 per cent for raw).

European countries play a significant role in the flax industry,[30] particularly in production and raw material trade. France dominates production with a remarkable 76 per cent share, followed by Belgium (9 per cent) and Belarus (5 per cent). The export market for raw flax mirrors this production pattern, with France (64 per cent) and Belgium (21 per cent) maintaining their core role . In the yarn segment, China emerges as a major player with 55 per cent of exports, while Italy accounts for a significant share of imports (24 per cent). This suggests that while Europe dominates raw material production, processing increasingly occurs in Asia, particularly China. The fabrics sector shows China's continued dominance in exports (42 per cent), followed by Italy (14 per cent). The import market is more diversified, with the United States (12 per cent) and Viet Nam (9 per cent) being significant importers. Belarus shows significant tariff escalation from raw (15 per cent) to fabrics (10 per cent). France and Belgium, despite being major producers, maintain extremely low tariffs. China has moderate but consistent tariffs across the supply chain.

For Jute, the production landscape is heavily concentrated in South Asia, with India leading at 48 per cent of global production, followed closely by Bangladesh at 46 per cent. This regional dominance is reflected in the export patterns, where Bangladesh holds a commanding 69 per cent share of raw jute exports by value, while India accounts for 11 per cent. The yarn segment shows Bangladesh's continued dominance with an impressive 93 per cent share of exports, while Türkiye emerges as the largest importer (38 per cent) followed by China (17 per cent). This suggests that while South Asia plays a leading role in production and initial processing, the manufacturing of final products is more geographically dispersed. In the fabrics sector, India and Bangladesh maintain their strong positions with 38 per cent and 33 per cent of exports, respectively. The United States appears as a significant importer with a 20 per cent share, indicating its role as a major end-market for jute products. India and Bangladesh, the dominant producers, maintain high tariffs throughout (20-23 per cent). Interesting contrast with Cambodia, which has lower tariffs despite being a producer.

China dominates the silk industry with 57 per cent of global production, followed by India at 38 per cent. This central role extends to the export market, where China accounts for 49 per cent of raw silk exports by value. Viet Nam has emerged as a significant player with 17 per cent of raw silk exports. The yarn segment shows an interesting pattern with China leading exports at 44 per cent, while Japan emerges as a major importer with 19 per cent share. Romania appears as an unexpected significant player in yarn exports with 18 per cent share, suggesting specialized processing capabilities. In the fabrics sector, China maintains its leading position with 42 per cent of exports, followed by Italy at 25 per cent. This indicates Italy's significant role in high-end silk fabric production. The import market shows interesting diversity with Italy, France, and the United States being significant importers, suggesting their role in luxury garment manufacturing. China and India, the major producers, maintain significant

[30] Camilleri (2023) provides an in-depth discussion of the historical and botanical factors that explain this fact.

tariffs. Thailand has a notably high fabric tariff (13.6 per cent) despite low production.

For raw wool, China leads global production with 20 per cent share, followed closely by Australia at 18 per cent and New Zealand at 8 per cent. Interestingly, while China is the largest producer, Australia dominates the export market with 46 per cent of value exports, reflecting its focus on high-quality wool production. China appears as the largest importer of raw wool with 48 per cent share, followed by Italy (11 per cent), suggesting their significant wool processing industries. In the Yarn segment Italy emerges as a key player in exports (22 per cent), followed by China (17 per cent) and Romania (7 per cent). The import market shows a diverse pattern with Italy leading at 13 per cent, followed by Germany (10 per cent) and the United Kingdom (8 per cent). This suggests that Italy not only imports raw wool but also processes and exports significant quantities of wool yarn, serving high-end textile markets. For fabrics, Italy maintains its strong position with 50 per cent of fabric exports, demonstrating its dominance in high-value wool fabric production. China follows with 11 per cent share, while the United Kingdom accounts for 8 per cent. The import market shows China leading with 13 per cent share, followed by Morocco and Cambodia, indicating the global spread of wool fabric manufacturing.

The wool supply chain reveals specific production and trade patterns, where Oceania (Australia and New Zealand) specializes in raw wool production and exports, China plays a dual role as both a major producer and the largest importer of raw wool and Italy emerges as a crucial player in processing and value addition, particularly in yarn and fabric production. Moreover, the presence of countries like Romania in yarn production and Morocco in fabric imports suggests a complex global manufacturing network.

This pattern reflects the historical development of the wool industry and the current global textile manufacturing landscape, where raw material production, processing, and manufacturing often occur in different geographical locations based on comparative advantages and industrial capabilities. China, the largest producer, shows an interesting pattern with extremely high raw tariffs (26.3 per cent) but lower processed goods tariffs. Australia, another major producer, maintains low tariffs across the board.

This information enables the identification of diverse approaches to production and trade integration in the global fibre industry, reflecting differences in resource endowments, industrial capabilities, and trade policy strategies (Table A.4 of the appendix).

A handful of countries in East and South Asia act as global textiles and textile products processing hubs, consuming most of the global raw material production (natural and man-made fibres), to then process and export most end use textile products. Global textiles and textile products processing hubs include Bangladesh, India and Viet Nam, although China was the first mover and remains the dominant example.

A complete integration approach with significant scale economies, supplemented by imports is adopted by China. After its accession to the WTO in 2001, China grew to become the predominant textile and textile products actor at each stage of the value chain[31]. It is important to note China's large share of consumption (i.e., processing) of cotton, silk and several other natural fibres, alongside the country's predominance in the production and consumption of man-made fibres.

Major producers employ contrasting tariff strategies reflecting varied industrial and trade priorities: India maintains uniformly high rates, China escalates tariffs moderately, while EU producers like France impose minimal tariffs despite production dominance

[31] See for a detailed analysis CICC Global Institute. (2024). Textiles and Apparel—Expanding Production Bases Overseas While Moving Up the Industry Chain. In: The Reshaping of China's Industry Chains. Springer, Singapore. https://doi.org/10.1007/978-981-97-1647-0_17

Since the 1990s, China has capitalized on the fast fashion boom, securing over 50 per cent of fast fashion sales in the United States and Japanese markets by 2022.[32] In the European Union, the largest import market for textiles and textile products,[33] Chinese brands trail behind European leaders but a significant portion of these brands' production, as in other industries, is outsourced to China.[34]

Since the early 2010s, countries such as Viet Nam, Türkiye and India have succeeded in capturing important shares of the textiles and textile products markets. Each has followed different strategies, based on their endowments and advantages.[35] India also follows a complete integration approach but with a narrower focus on cotton and jute, high tariffs, and balanced domestic-export orientation. India is the world's major producer of cotton fibre – alongside China – and the second-largest producer of polyester fibre, albeit at a much smaller scale then China.[36]

Bangladesh has adopted a similar approach in the context of jute production and processing. An approach emphasizing processing stages, relying on imported raw materials, and applying low to moderate tariffs is adopted by Viet Nam and Türkiye. The textiles and textile product industry in both Türkiye and Viet Nam import most of the polyester and cotton fibres they consume.[37] Italy's approach relies on a specialization in high-value segments, leveraging design and quality, with low tariffs and NTMs under European Union policy.

[32] https://secondmeasure.com/datapoints/fast-fashion-market-share-us-consumer-spending-data-shein-hm-zara/

[33] https://www.cbi.eu/market-information/apparel/what-demand

[34] https://www.scmglobe.com/zara-clothing-company-supply-chain/

[35] Das S, Hasan M R and Das D (2024). Who is the next China? Comparative advantage analysis from top ten apparel exporting nations. Competitiveness Review. 34(6). 1127-1154. https://doi.org/10.1108/CR-06-2023-0143

[36] Presentation by Lorena Ruiz at the 82nd plenary meeting of the ICAC in Tashkent Sept 29-Oct 3, 2024. https://icac.org/Content/EventDocuments/PdfFilesf97500c9_ebbf_46b0_81f2_bdbcc3f824cd/Lorena_ICAC%20PM%20UZBEKISTAN%202024%20-%20LORENA%20RUIZ.pdf

[37] https://www.textiletoday.com.bd/an-overview-on-global-fiber-and-yarn-market

Chapter VI

Concluding remarks



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This study analyzed global fibre production and trade between 1996 and 2023 revealing profound transformations in the textile global supply chain trade patterns. Much of this evolution aligns with the expected effects of the end of the quota system in place until 2005. However, one significant and less-anticipated development has been the rapid and sustained rise of man-made fibres. Not only have these fibres grown in volume, but they have also reshaped the composition of the textile industry—driven in large part by the expansion of the fast fashion model.

Domestic input availability has been a key determinant of global leadership in the industry. Both India and China have benefited from domestic supply chains: India in natural fibres, and China in man-made fibres industry Local availability of raw materials, combined with comprehensive processing capacities -from spinning weaving and knitting has enhanced export competitiveness. These capabilities have also enabled firms to move up the value chain into design, branding and marketing.

Exporting nations including China, India, Viet Nam, and Türkiye have prioritized product innovation to meet evolving consumer preferences in global markets.[38] The study reveals increasing trade volumes across all processing stages, alongside greater specialization and regional clustering. The rise of distinct textile regional hubs highlights opportunities for small producers to integrate into these hubs but also the industry's exposure to risks from excessive geographic export concentration.

Trade policy trends offer a mixed picture. While tariffs have declined across all product categories, suggesting increased trade liberalization, tariff escalation remains prevalent -protecting downstream industries in many countries. Furthermore, the prevalence of non-tariff measures, particularly technical barriers to trade, suggests that market access challenges have intensified rather than disappeared.

The analysis highlights divergent national strategies in fibre and textile integration. China's vertically integrated model, maintaining strong positions across all supply chain stages, contrasts sharply with the specialized focus of countries like Viet Nam and Türkiye on processing activities. Meanwhile, India's focused integration approach in specific sectors and Italy's emphasis on high-value segments demonstrate how countries can successfully leverage their particular advantages within the global market.

The increasing concentration of textile and apparel processing in these East and South Asian countries, along with the large scale, multi-fibre nature of these industries, has important implications for the market and industrial development prospects for developing countries producing natural fibres. Strategic responses are needed to avoid marginalization and to harness opportunities for industrial development

Looking forward, these findings suggest several important considerations for industry stakeholders and policymakers. First, the increasing dominance of man-made fibres seems likely to continue, though environmental concerns and sustainability requirements may influence future development patterns.[39] Second, the concentration of processing activities in specific regions, while efficient, may require careful management of

[38] See Alam et al. (2019) for empirical evidence and detailed discussion.

[39] See Avrhami (2022) for a comprehensive discussion on the growing environmental concerns associated with the dominance of synthetic fibres and the related fast-fashion industry model.

supply chain risks. Third, the diverse integration patterns observed suggest that successful participation in global fibre markets can take multiple forms, depending on local capabilities, strategic choices, and a variety of other factors.

The following key implications emerge for developing countries seeking to establish or enhance their role in this industry:

Strategic positioning in the supply chain: Developing countries must assess their competitive advantages to determine the optimal entry points into the supply chain. Countries with raw material production capabilities (e.g., cotton, jute, or hemp producers) can benefit from policies that promote domestic processing to capture more value before export. Those with established industrial bases may find opportunities in yarn or fabric production, while others can explore high-value niche markets, such as organic or sustainable fibres. Countries with industrial foundations may target yarn or fabric production, while others may pursue high-value niches such as organic or sustainable textiles.

Productive development policies to support local processing: Given the persistent tariff escalation and market access barriers for processed goods, developing countries need productive development policies to support domestic fibre processing. These include targeted investment incentives for textile manufacturing, infrastructure development (such as energy and logistics improvements), and skills development programs to enhance local expertise in fibre processing and fabric production. and skills development initiatives to build domestic capabilities in fibre transformation and textile manufacturing.

Sustainability as a competitive advantage: Growing environmental concerns presents an opportunity for countries to lead in sustainable textile production. This includes supporting the development of biodegradable fibres, improving sustainability in cotton and jute production, and attracting investment in circular economy models that encourage textile recycling and reduced waste. Achieving sustainability certifications can also improve market access to high-value consumer markets in Europe.

Leveraging regional and global trade agreements: As fibre and textile processing become concentrated in certain regions, developing countries must enhance their participation in regional supply chains. Regional trade agreements (such as the African Continental Free Trade Area -AfCFTA- in Africa or the Association of Southeast Asian Nations Free Trade Area -AFTA- in Southeast Asia) can provide market access advantages and facilitate intra-regional supply chains.

Investment in technology and innovation: Competing in a supply chain increasingly dominated by synthetic fibres requires investment in technological upgrading. Countries should prioritize technology transfer initiatives, support research in fibre innovation (e.g., bio-based synthetic fibres), and encourage partnerships between local firms and global textile producers to modernize production capabilities.

Supply chain risk mitigation: The concentration of processing activities in a few countries creates vulnerabilities in global supply chains. Developing countries can present themselves as alternative production hubs by improving their trade infrastructure, ensuring regulatory stability, and providing a reliable environment for textile investments. Strategic diversification strategies—such as promoting new products within and outside the fibre supply chain or establishing multiple trade routes—can also enhance resilience. The geographic concentration of processing introduces vulnerabilities. Developing countries can position themselves as alternative hubs by enhancing trade infrastructure, ensuring regulatory predictability, and creating investment-friendly environments. Diversifying trade routes and product offerings can further strengthen supply chain resilience.

Upgrading from commodity exporters to textile hubs: Many developing countries continue to export unprocessed fibres with limited value addition. Advancing along the value chain, requires coordinated strategies across agriculture (fibre production), manufacturing (yarn and fabric processing), and fashion/apparel industries. Governments must foster linkages between these sectors and create enabling conditions for the development of integrated textile clusters that connect SMEs to global markets.

Whether through leveraging raw material production, advancing processing capabilities, or capitalizing on sustainability trends, developing countries have significant opportunities to increase their role in global textile markets. However, success will depend on strategic value addition and diversification, targeted policy choices, investment attraction, and integration into both regional and global trade networks.

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Annex

Table A.1

Fibre types and categories in the HS classification (4-digit headings)

Fibres types	Categories		
	Raw	Yarn	Fabrics
Cotton	5201, 5202, 5203, 5204, 5202, 5203, 5204	5205, 5206, 5207	5208, 5209
Other vegetable	5301, 5302, 5303, 5304, 5305	5306, 5307, 5308	5309, 5310, 5311
Animal	5001, 5002, 5003, 5101, 5103, 5104, 5105	5001, 5002, 5003, 5106, 5107, 5109	5007, 5111, 5112
Man-made	5401, 5501, 5502, 503, 5504, 505, 5506 5507, 5508	5509, 5510, 5511, 5402, 5403, 5404, 5405, 5406	5407, 5408, 5512, 5516

Source: World Customs Organization HS nomenclature https://www.wcoomd.org/en/topics/nomenclature.aspx

Table A.2

Fibres production and trade: top five producing 2019-2023, exporting and importing economies (share in total value and volume, in percentage)

Man-made	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Raw	China (73)	China (17)	China (9)	China (20)	United States (9)
	India (7)	Republic of Korea (9)	United States (8)	Republic of Korea (11)	Türkiye (9)
	United States (3)	Japan (8)	Türkiye (8)	Indonesia (8)	China (8)
	Taiwan Province of China (2)	Germany (7)	Germany (6)	Thailand (8)	Viet Nam (6)
	Republic of Korea (2)	United States (7)	Viet Nam (5)	Austria (6)	Germany (6)
Yarn		China (32)	Türkiye (8)	China (43)	Türkiye (11)
		India (7)	United States (6)	India (10)	Brazil (8)
		Indonesia (5)	China (6)	Indonesia (7)	Viet Nam (7)
		Türkiye (5)	India (5)	Viet Nam(5)	India (6)
		Viet Nam (5)	Brazil (5)	Türkiye (4)	Republic of Korea (6)
Fabrics		China (44)	Viet Nam (13)	China (58)	Viet Nam (6)
		Republic of Korea (6)	China (5)	India (5)	United States (5)
		Taiwan Province of China (6)	Indonesia (5)	Republic of Korea (4)	Indonesia (5)
		Italy (5)	United States (4)	Taiwan Province of China (4)	Brazil (5)
		Japan (4)	Morocco (3)	Türkiye (3)	United Arab Emirates (5)

Cotton	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Ginned	India (23)	United States (39)	China (26)	United States (38)	China (25)
	China (22)	Brazil (20)	Viet Nam (18)	Brazil (20)	Viet Nam (18)
	United States (15)	Australia (8)	Türkiye (14)	Australia (7)	Türkiye (14)
	Brazil (10)	India (6)	Pakistan (9)	India (7)	Pakistan (9)
	Pakistan (6)	Greece (4)	Indonesia (7)	Greece (4)	Indonesia (7)
Yarn		Viet Nam (26)	China (40)	Viet Nam (29)	China (48)
		India (20)	Türkiye (6)	India (19)	Türkiye (6)
		Uzbekistan (9)	Republic of Korea (3)	Uzbekistan (11)	Russian Federation (5)
		Pakistan (8)	Portugal (4)	Pakistan (8)	Republic of Korea (4)
		China (7)	Viet Nam (3)	China (5)	Portugal (3)
Fabrics		China (31)	Viet Nam (8)	China (36)	Viet Nam (6)
		Pakistan (11)	United States (6)	Pakistan (15)	Türkiye (5)
		India (7)	Italy (5)	India (10)	Italy (5)
		Italy (7)	Tunisia (4)	Türkiye (6)	United States (4)
		Türkiye (6)	Indonesia (4)	Italy (3)	Republic of Korea (4)

Industrial hemp	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Raw	France (46)	Netherlands (27)	Italy (18)	France (56)	Spain (24)
	China (22)	France (24)	Germany (10)	Netherlands (24)	Germany (17)
	Republic of Korea (6)	Spain (9)	Spain (9)	Germany (7)	Czechia (16)
	Netherlands (6)	Germany (7)	Czechia (8)	Romania (2)	Netherlands (6)
	Australia (5)	China (7)	Switzerland (4)	Belgium (2)	United States (6)
Yarn		China (72)	India (21)	China (70)	India (18)
		Romania (11)	United States (15)	Romania (12)	United States (17)
		Italy (4)	Republic of Korea (13)	Germany (3)	Republic of Korea (16)
		Tunisia (4)	Italy (11)	Tunisia (3)	Italy (10)
		Germany (2)	Portugal (9)	Italy (3)	Portugal (7)

Flax	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Raw	France (76)	France (64)	China (58)	France (57)	China (39)
	Belgium (9)	Belgium (21)	Belgium (14)	Belgium (27)	Belgium (26)
	Belarus (5)	Egypt (4)	India (9)	Belarus (5)	Netherlands (11)
	Russian Federation (3)	Belarus (3)	France (4)	Egypt (4)	France (6)
	China (3)	Italy (2)	Lithuania (3)	Lithuania (1)	India (5)
Yarn		China (56)	Italy (24)	China (54)	Italy (21)
		Italy (11)	India (11)	Italy (7)	Portugal (10)
		Poland (7)	Portugal (11)	Poland (7)	India (9)
		Tunisia (6)	Türkiye (10)	Tunisia (6)	Türkiye (9)
		France (5)	Belgium (8)	France (5)	Belgium (9)
Fabrics		China (42)	United States (12)	China (54)	Italy (8)
		Italy (14)	Viet Nam (9)	Italy (7)	United States (6)
		Belgium (6)	Italy (8)	Belarus (6)	Indonesia (6)
		India (5)	Indonesia (5)	Belgium (4)	Spain (6)
		Türkiye (4)	Spain (5)	Türkiye (3)	Viet Nam (5)

Jute	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Raw	India (48)	Bangladesh (69)	India (23)	Bangladesh (74)	India (26)
	Bangladesh (46)	India (11)	Pakistan (20)	India (12)	Pakistan (23)
	Cambodia (4)	China (8)	Nepal (14)	China (5)	Nepal (15)
	Uzbekistan (1<)	Kenya (2)	Nigeria (12)	Kenya (2)	China (9)
	China (1<)	Belgium (2)	China (8)	Belgium (2)	Nigeria (8)
Yarn		Bangladesh (93)	Türkiye (38)	Bangladesh (94)	Türkiye (36)
		India (3)	China (17)	India (2)	China (22)
		China (1)	India (8)	Türkiye (1)	India (10)
		Türkiye (1)	Iran (Islamic Republic of) (5)	Nepal (1)	Iran (Islamic Republic of) (5)
		Nepal (1)	Uzbekistan (3)	China (1)	Uzbekistan (5)
Fabrics		India (38)	India (31)	India (37)	India (29)
		Bangladesh (33)	United States (20)	Bangladesh (37)	United States (19)
		Nepal (15)	Netherlands (5)	Nepal (15)	Netherlands (5)
		China (5)	Germany (5)	China (3)	Iran (Islamic Republic of) (5)
		Pakistan (2)	United Kingdom (3)	Pakistan (3)	Germany (5)

Silk	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Raw	China (57)	China (49)	India (33)	China (28)	China (36)
	India (38)	Viet Nam (17)	Romania (14)	India (16)	India (17)
	Uzbekistan (2)	Uzbekistan (6)	Italy (12)	Viet Nam (13)	Angola (11)
	Viet Nam (1)	Italy (6)	China (11)	Uzbekistan (11)	Italy (6)
	Thailand (<1)	India (5)	Viet Nam (6)	Belgium (8)	Romania (6)
Yarn		China (44)	Italy (35)	China (55)	Italy (24)
		Romania (18)	Japan (19)	Romania (11)	Japan (15)
		Italy (13)	India (6)	Italy (9)	Pakistan (9)
		Viet Nam (10)	Romania (4)	Viet Nam (9)	India (7)
		Thailand (2)	United States (4)	India (3)	Nigeria (6)
Fabrics		China (42)	Italy (17)	China (59)	Nigeria (47)
		Italy (25)	France (9)	Türkiye (17)	Kyrgyzstan (16)
		France (6)	United States (8)	Italy (4)	Italy (4)
		India (6)	Tunisia (5)	India (3)	United Arab Emirates (3)
		Republic of Korea (4)	Japan (5)	Republic of Korea (3)	Myanmar (3)

Wool	Production	Exports	Imports	Exports	Imports
	Volume	Value	Value	Volume	Volume
Raw	China (20)	Australia (46)	China (48)	Australia (30)	China (40)
	Australia (18)	China (10)	Italy (11)	New Zealand (13)	India (12)
	New Zealand (8)	New Zealand (7)	Czechia (5)	China (7)	Italy (7)
	Türkiye (5)	South Africa (6)	India (5)	South Africa (5)	Czechia (5)
	United Kingdom (4)	Argentina (4)	Germany (4)	United Kingdom (4)	United Kingdom (5)
Yarn		Italy (22)	Italy (13)	China (18)	United Kingdom (13)
		China (17)	Germany (10)	Italy (17)	Italy (11)
		Romania (7)	United Kingdom (8)	India (6)	Germany (8)
		Germany (6)	China, Hong Kong SAR (7)	Romania (5)	United States (5)
		India (5)	United States (6)	Germany (5)	China, Hong Kong SAR (5)
Fabrics		Italy (50)	China (13)	Italy (39)	China (11)
		China (11)	France (5)	China (19)	Morocco (7)
		United Kingdom (8)	Japan (5)	United Kingdom (6)	Cambodia (4)
		Japan (5)	Germany (5)	Japan (4)	Türkiye (4)
		Germany (3)	Italy (5)	Republic of Korea (3)	Italy (4)

Source: UNCTAD secretariat's calculations based on FAOSTAT and UN-COMTRADE information.

Table A.3
Effectively applied tariffs (percentage) in top five producing economies

Fibre type	Production (share in total production)	Raw	World average	Yarn	World average	Fabrics	World average
Man-made	China (73)	4.9		6.3		7.8	
	India (7)	20		21		24.6	
	United States (3.3)	1.5	4.2	8.1	7.4	10.2	9.6
	Taiwan Province of China (2)	1.5		5.7		9.9	
	Republic of Korea (2)	6.8		7.7		9.8	
Cotton	India (24)	19.9		20.3		24.5	
	China (23)	22		4.8		7.6	
	United states (14)	3	5.1	5.6	6.5	6.8	9.8
	Brazil (10)	8.4		18		26	
	Pakistan (5)	3.3		11		11.5	
Industrial hemp	France (50)	0		1.4			
	China (19)	6		5			
	Republic of Korea (6)	2	3.3	8	4.6	N/A	
	Netherlands (5)	0		1.4			
	Australia (5)	0		0			
Flax	France (76)	0		1.9		2.3	
	Belgium (9)	0		1.9		2.3	
	Belarus (5)	15	4	5	5.3	10	8.8
	Russian Federation (3)	6.3		4.2		8.7	
	China (3)	5.7		5		7.9	
Jute	India (48)	21		20		23	
	Bangladesh (47)	23		25		22	
	Cambodia (4)	0	3.3	0	5.3	7	7.4
	Uzbekistan (1<)	N/A		N/A		N/A	
	China (1<)	2		3.6		7.4	
Silk	China (57)	7.3		6		7.8	
	India (38)	15		15		20	
	Uzbekistan (2)	2	3.1	5	6	10	9
	Viet Nam (1)	2.3		1.9		3.3	
	Thailand (<1)	0		2.3		13.6	
Wool	China (20)	26.3		5		8.3	
	Australia (18)	0		2.5		2.7	
	New Zealand (8)	0	3.3	3	6.1	2	9.5
	Türkiye (5)	0.2		1.6		5.5	
	United Kingdom (4)	0		2		8	

Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information.

Table A.4
Approaches to production and trade integration and use of trade policy instruments

Fibre type	Key players	Integration approach	Tariff structure	Non-Tariff Measures (NTMs)
Man-made fibres	China: 73% raw material production, 32% yarn exports, 44% fabric exports.	Complete Integration: Dominates all supply chain stages, uses imports to supplement production.	Moderate escalation: 4.9% (raw) to 7.8% (fabrics). High on cotton.	Slightly more stringent NTMs at all stages.
	India: Second-largest producer, high tariffs.	Complete Integration (Narrower Scope): Focuses on cotton and jute, balanced domestic and export markets.	High tariffs: 20-24.6% across all stages.	High incidence, aligned with tariff policy.
	Viet Nam: Key importer across the value chain.	Processing-Focused Integration: Relies on imported raw materials, export-oriented manufacturing.	Low tariffs on raw materials and yarn, moderate on fabrics.	Relatively more NTMs on raw materials, possibly for quality control.
	United States: Major importer of raw materials (8%).	Specialty Integration: Low tariffs on raw materials, higher on fabrics.	Low tariffs on raw materials (3%), higher on fabrics.	Aligned with developed economies trade policies.
Cotton	India: 23% production, high tariffs.	Complete Integration: Strong in raw material production, high tariffs for protection.	High tariffs: 19.9% (raw), 20.3% (yarn), 24.5% (fabrics).	High incidence, reflecting protectionist policies.
	China: 22% production, 31% fabric exports.	Complete Integration: Dominates fabric exports, moderate tariffs.	Moderate tariffs: 22% (raw), 4.8% (yarn), 7.6% (fabrics).	Slightly more stringent NTMs at all stages.
	Viet Nam: 26% yarn exports, key importer.	Processing-Focused Integration: Strong in yarn production, relies on imports.	Low to moderate tariffs.	Relatively more NTMs on raw materials.
	United States: 39% ginned cotton exports.	Specialty Integration: Low tariffs on raw materials, higher on fabrics.	Low tariffs on raw materials (3%), higher on fabrics.	Aligned with developed economies trade policies.
Industrial hemp	France: 46% production, 56% export weight.	Complete Integration: Dominates raw material production and exports.	Very low tariffs.	Low NTM incidence.
	China: 22% production, 72% yarn exports.	Processing-Focused Integration: Strong in yarn exports, relies on imports.	Moderate tariffs: 6% (raw).	Moderate NTM incidence.
	Netherlands: 27% export value.	Specialty Integration: Focus on high-value exports.	Low tariffs.	Low NTM incidence.
Flax	France: 76% production, 64% raw exports.	Complete Integration: Dominates raw material production and exports.	Very low tariffs.	Low NTM incidence.
	China: 55% yarn exports, 42% fabric exports.	Processing-Focused Integration: Strong in yarn and fabric exports, relies on imports.	Moderate tariffs across the chain.	Moderate NTM incidence.
	Belarus: Significant tariff escalation.	Processing-Focused Integration: Focus on processing stages.	Escalating tariffs: 15% (raw) to 10% (fabrics).	Moderate NTM incidence.

Table A.4 *(cont.)*

Approaches to production and trade integration and use of trade policy instruments

Fibre type	Key players	Integration approach	Tariff structure	Non-Tariff Measures (NTMs)
Jute	India: 48% production, 38% fabric exports.	Complete Integration: Strong in raw material production and fabric exports.	High tariffs: 20-23% across all stages.	High NTM incidence.
	Bangladesh: 46% production, 69% raw exports, 93% yarn exports.	Complete Integration: Dominates raw and yarn exports.	High tariffs: 20-23% across all stages.	High NTM incidence.
	Cambodia: Lower tariffs despite being a producer.	Processing-Focused Integration: Focus on processing stages.	Lower tariffs compared to India and Bangladesh.	Moderate NTM incidence.
Silk	China: 57% production, 49% raw exports, 42% fabric exports.	Complete Integration: Dominates all supply chain stages.	Significant tariffs across the chain.	Moderate NTM incidence.
	India: 38% production, significant tariffs.	Complete Integration: Strong in raw material production.	High tariffs.	High NTM incidence.
	Italy: 25% fabric exports, significant importer.	Specialty Integration: Focus on high-end fabric production.	Low tariffs (European Union policy).	Low NTM incidence.
Wool	China: 20% production, 48% raw imports.	Dual Role: Major producer and importer, high raw tariffs.	High raw tariffs (26.3%), lower on processed goods.	Moderate NTM incidence.
	Australia: 18% production, 46% raw exports.	Specialty Integration: Focus on high-quality raw wool production.	Low tariffs across the board.	Low NTM incidence.
	Italy: 22% yarn exports, 50% fabric exports.	Specialty Integration: Dominates high-value wool fabric production.	Low tariffs (European Union policy).	Low NTM incidence.

Source: UNCTAD secretariat's calculations based on UNCTAD-TRAINS information.

Box 1

Transitioning to a quota-free trade system for textiles and textile products

Textile and textile products from developing countries have faced restrictive blocks (i.e., quotas) to their exports for half a century. The Multi-Fibre Arrangement (MFA) grew out of a series of voluntary export restraints imposed, initially, by the United States on Japanese textile exports in 1955. By the end of the 1950s, the United Kingdom also started to limit imports from Hong Kong, India, and Pakistan. Quotas on cotton textiles and apparel products were first institutionalized with the Short-Term Arrangement in 1961, which was extended to two subsequent Long-Term Arrangements throughout the 1960s and early 1970s. As the Asian economies' textile and textiles products production continued to grow, developed countries instated the MFA in 1974 to deal with "market disruptions" in other fibre markets. As a result, textile and textile products were kept out of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO).

The Agreement on Textile and Clothing (ATC) was part of the Uruguay Round, which was concluded in 1994.[40] The ATC ended the MFA and began the process of integrating textile and textile products into GATT/WTO rules by removing their quotas. Integration occurred over four phases that gradually ended quotas applied to all four major textile and clothing segments, that is, yarn, fabrics, clothing and made-up textile products such as table linen, carpets, curtains. On January 1, 2005, Phase IV abolished the remaining quotas, which still covered 49 per cent of export volumes at that time. In addition to gradually removing quotas, the ATC improved developing countries' access to developed- country markets by accelerating quota growth over the four phases of quota removal.

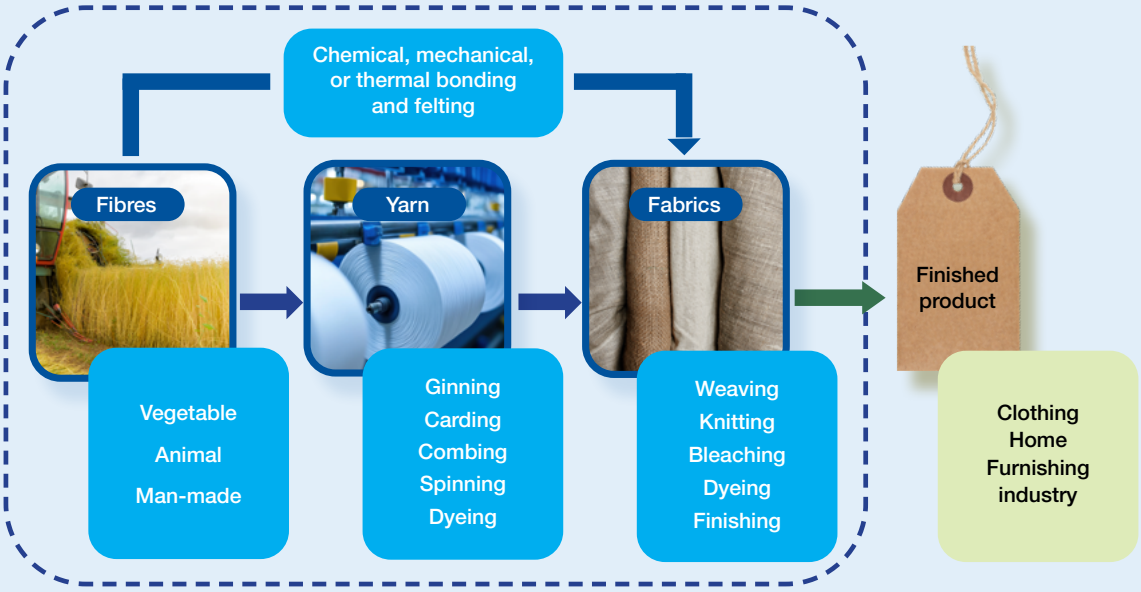
Yao and Whalley (2015) examined the transition to a quota-free regime in global textiles and clothing trade ten years after the ATC ended. Their key findings include: 1) Clothing and textiles trade grew faster than global trade from 2005 to 2013, with clothing trade expanding more than textiles. China remained the largest global exporter in both textiles and clothing. In 2001, China accounted for 11.1 per cent and 18.4 per cent of global textiles and clothing exports, respectively, rising to 35.9 per cent and 40.3 per cent by 2013. Despite pre-2013 containment agreements, China has strengthened its dominance in global textiles and clothing exports, with a particularly pronounced advantage in clothing; 2) Average prices for both sectors declined after quotas ended; 3) Clothing export quality decreased, reversing earlier quality upgrades under the MFA; 4) Export concentration by country rose, reflecting reduced MFA-driven quota-hopping investments; 5) Import concentration changed little, as quotas primarily impacted exports; 6) Clothing concentration indices rose significantly, while textiles remained stable; and 7) Regional trade among RTA members decreased due to freer global trade.

[40] The text of Wthe ATC is available at https://www.wto.org/english/docs_e/legal_e/16-tex_e.htm#top. An explanation of the ATC is available at https://www.wto.org/english/res_e/publications_e/ai17_e/textiles_all.pdf

Box 2

From fibres to fabrics

The figure provides a synthetic representation of the key transformation stages in the textile and garment manufacturing value chain. The dashed boundary delineates the three primary product categories examined in this study: fibre, yarn, and fabric. A fibre is defined as a continuous filament of material with a high length-to-diameter ratio. Through mechanical processing (drafting and twisting), fibres are consolidated into yarn, a continuous strand composed of interlocked fibres possessing sufficient cohesion for subsequent textile operations. Fabric formation predominantly occurs via weaving or knitting processes. In weaving, orthogonal yarn systems (warp and weft) are interlaced, while knitting involves forming intermeshed loops from a single yarn. Alternative fabric production methods bypass yarn formation entirely, employing non-woven technologies such as bonding and felting. Bonding is a fibre consolidation through chemical adhesives, thermal fusion (for thermoplastic fibres), or mechanical entanglement (e.g., needle punching, hydroentanglement). Felting primarily applicable to animal fibres exploits scale-induced fibre entanglement through controlled moisture, heat, and mechanical agitation.



Source: UNCTAD secretariat's elaboration based on Rajkishore (2023)

Box 3

Fibres classification

The table presents a comprehensive classification of fibres showcasing their diverse origins and applications in textiles and other industries. It distinguishes between fibres derived from natural sources and those created through chemical processes. The classification highlights the significant variety of synthetic fibres, particularly those derived from petrochemicals, underscoring their importance in modern textile production. Natural fibres are categorized based on their biological origin and chemical composition. Plant fibres are primarily composed of cellulose, while animal fibres consist of proteins. Most natural fibres come from plant sources, including oil palm, sugarcane, kenaf, jute, pineapple, roselle, rice husk, sugar palm, and coconut husk (Balaji et al., 2015; Girisha et al., 2012; Ishak et al., 2013; Nadlene et al., 2016). Natural fibres can be categorized into six types which are bast fibres (e.g. jute, flax, industrial hemp, ramie and kenaf), leaf fibres (e.g. abaca, sisal and pineapple), seed fibres (e.g. cotton, coir and kapok), core fibre (e.g. kenaf, hemp and jute), grass and reed fibres (e.g. wheat, corn and rice) and other types (e.g. woods and roots).

Natural				
Proteins Animal-keratin polymer	**Cellulosics** Vegetable-glucose polymer			**Mineral**
	Bast	**Seed**	**Leaf**	
Wool Silk Leather Skins Alpaca Mohair Angora Camel Vicuna	Flax/Linen Ramie Jute Industrial hemp Grasses Banana	Cotton Coir Kapok	Sisal Bamboo Abaca (Manila hemp) Pineapple	Abestos Metals (e.g. copper, silver and gold)

Man-made									
Natural Polymer			**Synthetic**						**In-organic**
Regenerated Cellulosics	**Cellulose Ester**	**Latex**	**Petrochemicals**						
			Polyamide	Poly-vinyl	Chlorofibre	Fluorofibre	Polyolefin	Aramid	
Viscose Modal Wood (Lyocell/ Tencel) Bamboo Alginate Peat	Acetate Triacetate	Rubber	Nylon Tactel Cordura Polyester Acrylic Elastane Microfibres derivatives of polyester, polyamide and acrylic	Acrylic Modacrylic	PVC (Polyvinylchloride)	PTFE (Polyetra-luoroethylene)	Polyethylene Polypropylene	Kevlar Nomex	Carbon Glass Metal Ceramics Rock wool

Source: UNCTAD secretariat's elaboration based on Rajkishore (2023), Faruk et al. (2012) and Luo et al. (2012).



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