

Organic Standards in Textiles Processing and Product Certification

Kanwar Usman

International Cotton Advisory Committee,
1629 K Street, NW. Washington DC. USA.



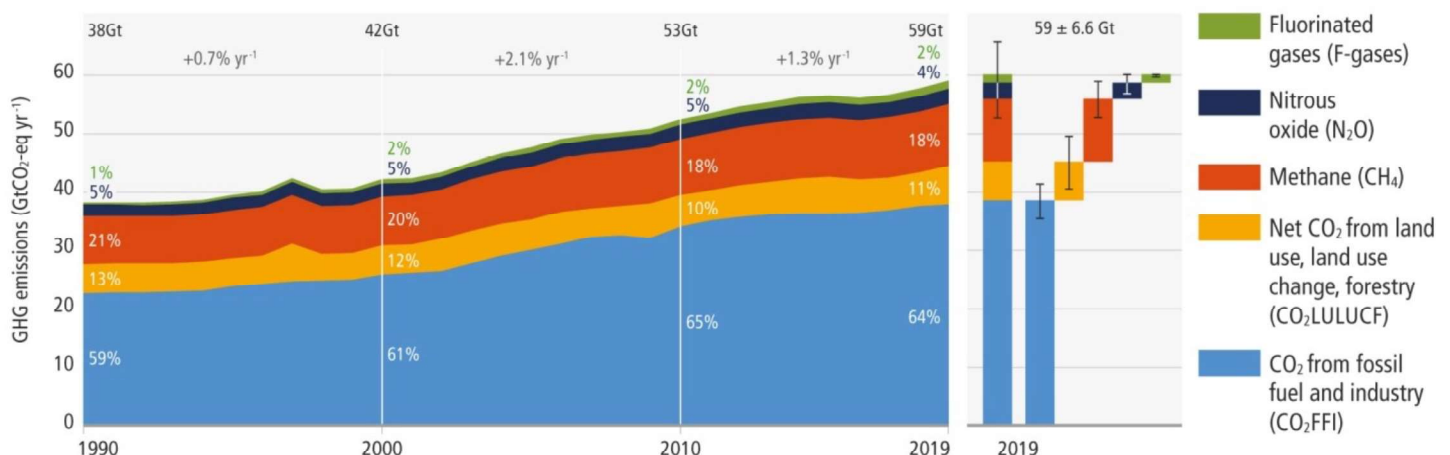
Kanwar Usman, a 1999 graduate of the National Textile University in Pakistan, has been appointed as the first-ever Head of Textiles at the International Cotton Advisory Committee (ICAC). With 23 years of experience in the textiles value chain, Usman has worked in various roles including production, teaching, retail brands, and in government for policy formulation and implementation. During his early years of practical experience, Usman worked with Nishat Mills where he was responsible for the installation of a spinning unit. He also worked as a lecturer at the National Textile University and completed his MBA program at the University of East London.

Usman worked for the Ministry of Commerce and Textile for 15 years and headed Research, Development and Advisory Cell and Textile Wing for 12 years. He played a pivotal role in formulating three textiles policies in Pakistan and designed and operated several support schemes to promote trade and improve competitiveness in the textiles value chain. In his current role at ICAC, Usman is responsible for providing advice to member countries on the development of their textiles value chain. He also provides a platform for sharing best practices, innovation, and sustainability measures for the textiles and allied industries.

Introduction

Global net anthropogenic greenhouse gas (GHG) emissions increased from 38 GtCO₂-eq in 1990 to 59±6.6 GtCO₂-eq in 2019, representing a 154% increase compared to 1990 (IPCC, 2022). CO₂ emissions from fossil fuel and industry (CO₂FFI) remained the highest, increasing from 23 GtCO₂-eq in 1990 to 38±3 GtCO₂-eq in 2019, a 167% increase. CO₂ emissions from land use, land-use change, and forestry (CO₂LULUCF) increased by 133%, reaching 6.6±4.6 GtCO₂-eq in 2019 compared to 5 GtCO₂-eq in 1990. Between 1990 and 2019, methane (CH₄) emissions increased from 8.6 GtCO₂-eq to 11±4 GtCO₂-eq, fluorinated gases (F-gases) from 0.43 GtCO₂-eq to 1.4±0.41 GtCO₂-eq, and nitrous oxide (N₂O) from 2.05 GtCO₂-eq to 2.7±1.6 GtCO₂-eq.

Figure 1: Global Net Anthropogenic GHG Emissions 1990-2019
(Source: IPCC 2022)



In 2019, approximately 34% (20 GtCO₂-eq) of total net anthropogenic GHG emissions came from the energy supply sector, and 24% (14 GtCO₂-eq) from industry. When emissions from electricity and heat production are attributed to the sectors using the final energy, 90% of these indirect emissions are allocated to the industry, increasing its relative GHG emissions share from 24% to 34%. CO₂FFI accounts for the largest share of global net emissions.

Textiles

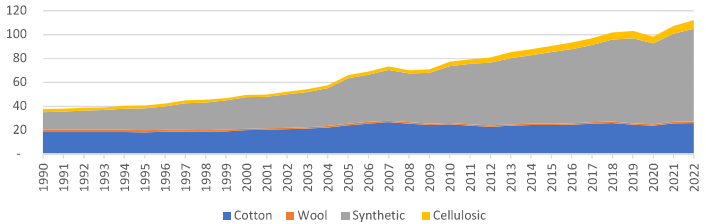
Textiles encompass a lengthy value chain, beginning with fibres that can be natural, synthetic, or artificial. Over time, global fibre consumption has experienced significant growth, with projections indicating continued expansion. As reported by the

International Cotton Advisory Committee (ICAC, 2021) in their annual World Textiles Demand publication, global fibre production rose to 107 million tonnes in 2021, a substantial increase from the 37 million tonnes produced in 1990.

Table 1: Global Net Anthropogenic GHG Emissions 1990-2019

	2019 Emissions GtCO ₂ -eq	1990 to 2019 Increase GtCO ₂ -eq	Emissions in 2019 - Relative to 1990 %
CO ₂ FFI	38±3	15	167
CO ₂ LULUCF	6.6±4.6	1.6	133
CH ₄	11±4	2.4	129
N ₂ O	2.7±1.6	0.65	133
F-gases	1.4±0.41	0.97	354
Total	59±6.6	21	154

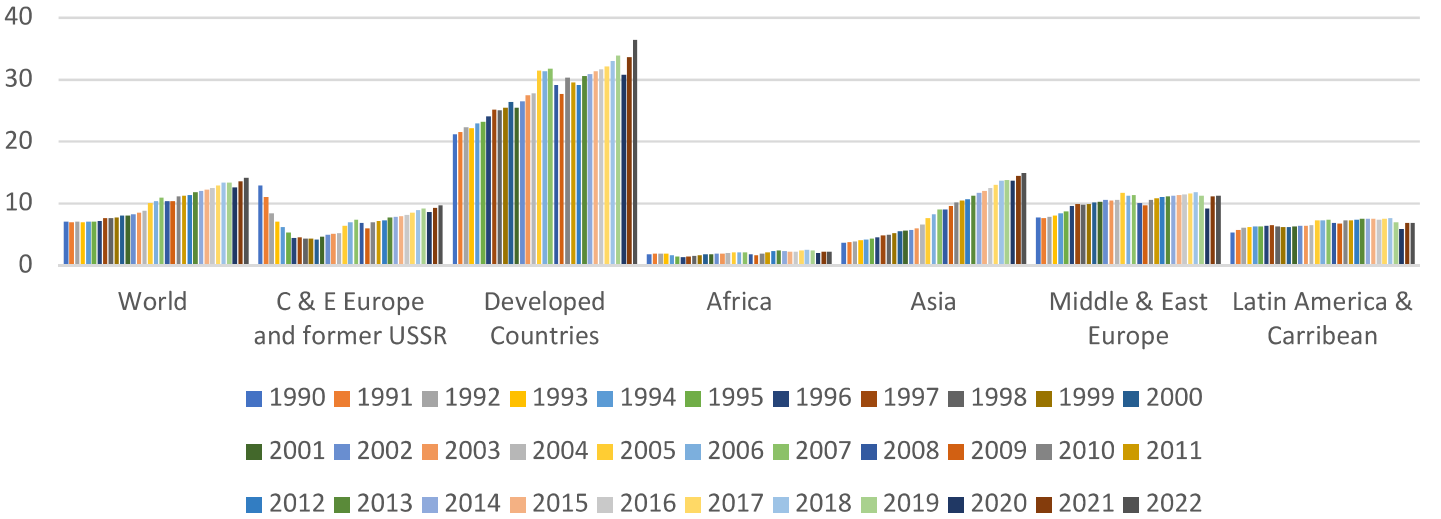
Figure 2: Fiber Consumption in Million Metric Tonnes 1990-2021



Source: World Textiles Demand, International Cotton Advisory Committee, 2022

The rise in textile consumption can be attributed not only to population growth but also to the increased per capita consumption. According to ICAC, per capita textile fibre consumption grew from 7.11 kg/capita in 1990 to 14.14 kg/capita in 2022. In developed countries, per capita consumption increased from 21.19 kg/capita in 1990 to 36.46 kg/capita in 2022. Asia experienced a remarkable surge in per capita consumption, rising from 3.73 kg/capita in 1990 to 14.91 kg/capita in 2022.

Figure 3: Textiles Fiber Consumption, Kg / Capita (Source: World Textiles Demand, International Cotton Advisory Committee, 2022)

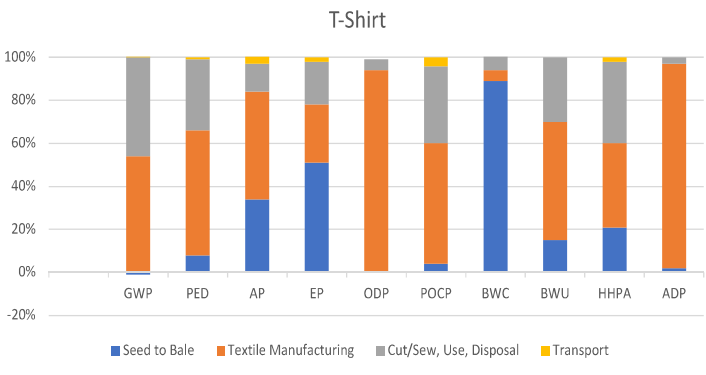


It is anticipated that per capita consumption in Asia will continue to grow as more individuals enter the middle and high middle-income brackets.

Life Cycle Assessment

Life Cycle Assessment (LCA) provides a comprehensive evaluation of the environmental impacts and resource usage of a product, from the raw materials utilized in its production to its disposal at the end of its life. A crucial element of LCA is the Life Cycle Inventory (LCI), which quantifies relevant energy, material input, and environmental release data associated with manufacturing and other processes. When examining the entire life cycle of cotton, the textile manufacturing and consumer use phases account for the majority of impacts across various categories (Cotton Inc., 2016). The assessment takes into consideration Global Warming Potential (GWP), Primary Energy Demand (PED), Acidification Potential (AP), Eutrophication Potential (EP), Ozone Depletion Potential (ODP), Photochemical Ozone Creation Potential (POCP), Blue Water Consumption (BWC), Blue Water Use (BWU), Human Health Particulate Air (HHPA), and Abiotic Resource Depletion Potential (ADP).

Figure 4: Relative Contribution to Each Impact Category of Knit T-shirt (Source: LCA, Cotton Incorporated)



In considering the entire cotton life cycle, the textile manufacturing and consumer use phases dominate most of the impact categories. This is primarily due to garment laundering, high electricity usage in fibre processing, and energy expenditures related to conditioning, processing, heating, and drying of water during preparation, dyeing, and finishing processes. While agricultural production's contribution to the total impact is lower than consumer use and textile manufacturing phases in most categories, water consumption, eutrophication, acidification, and field emissions associated with nitrogen fertilizer, irrigation, and ginning are identified as significant contributors to overall impact.

Hot-Spots In Textile Value Chain

Key hotspots in the textiles value chain are summarized in the “Sustainability and Circularity in the Textile Value Chain” report (UNEP, 2020) and the “Catalysing Science Based” report (UNEP, 2021), as follows:

Fibre Production:

- Extensive use of fossil fuels in synthetic fibre production, leading to impacts on climate, health, and ecosystems.
- Significant use of agrichemicals, land, and water for natural fibre production, particularly cotton, affecting biodiversity and ecosystems.
- Unsafe working conditions and fragile legal systems, resulting in health and social risks.

Textile Production:

- Heavy reliance on fossil fuels for heat and electricity generation in energy-intensive textile processes, causing impacts on climate, health, and ecosystems.
- Utilization of hazardous chemicals, which affect health and ecosystems, particularly through water pollution.
- Release of microfibres, impacting ecosystems and potentially human health.
- Unsafe working conditions and fragile legal systems, leading to health and social risks.

Use Phase:

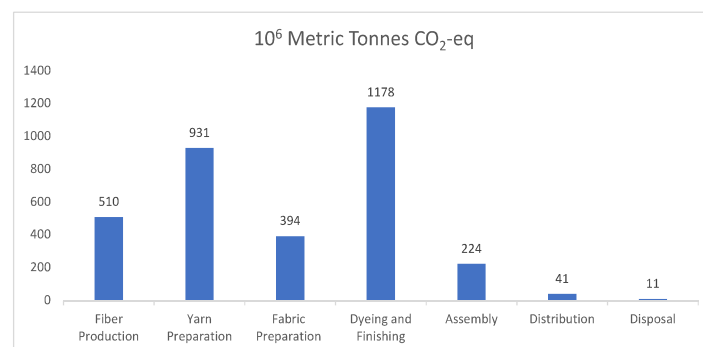
- High electricity consumption during textile care throughout their lifetime, with fossil fuels used for energy production, leading to impacts on climate, health, and ecosystems.
- Extensive water usage and release of microfibres during textile washing, contributing to water scarcity and impacts on ecosystem health.

End-of-Life:

- Low recovery rates of textiles at the end of their life, resulting in substantial material value loss and depletion of non-renewable resources.

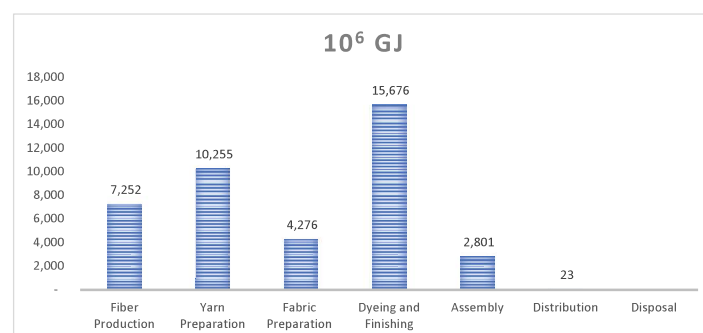
Furthermore, reports like “Carbon Emissions in the Garment Sector in Asia (ILO, 2021)” and “Measuring Fashion (Quantis, 2018)” have also evaluated the environmental impact of the global apparel sector.

Figure 5: Climate Change Impacts by Life Cycle Stage based on multiple fibers (Source: Measuring Fashion, Quantis 2018)



The study highlighted that these impacts stem from the apparel industry's dependence on hard coal and natural gas for electricity and heat generation. Dyeing processes demand high energy due to the wet processes employed, which involve heating large quantities of water. Fabric preparation (knitting and weaving) and yarn preparation (spinning) primarily require electricity and little to no additional heat, leading to a reduced impact on climate change. Hard coal and natural gas contribute to 60% to 70% of the climate change impacts during the dyeing and finishing stage.

Figure 6: Resources (Source: Measuring Fashion, Quantis 2018)



The dyeing and finishing, yarn preparation, and fibre production stages exhibit the most significant impacts on resource depletion. This is primarily due to the energy-intensive processes reliant on fossil fuel energy. Notably, the study estimates that if the business-as-usual scenario persists, GHG emissions could increase to 4.01 GtCO₂-eq.

In 2018, stakeholders from the garment sector collaborated to commit to climate action through the United Nations Framework Convention on Climate Change (UNFCCC) Fashion Industry Charter for Climate Action (UNFCC, 2021). Signatories of the charter pledged to reduce greenhouse gas (GHG) emissions by 30% by 2030, based on a 2015 baseline, and to achieve net-zero

ro emissions by 2050. This commitment poses a significant challenge, as achieving this reduction would require over half a billion tonnes of carbon dioxide to be reduced across the sector per year by 2030. Meeting this challenge will require system-level changes in the production and consumption of textiles and garments, which will likely have significant impacts on how and where garments are produced, and the employment associated with this production (ILO, 2021).

Figure 7: Textiles Climate Change in 2030 in Business-as-Usual Scenario (Source: Measuring Fashion, Quantis 2018)

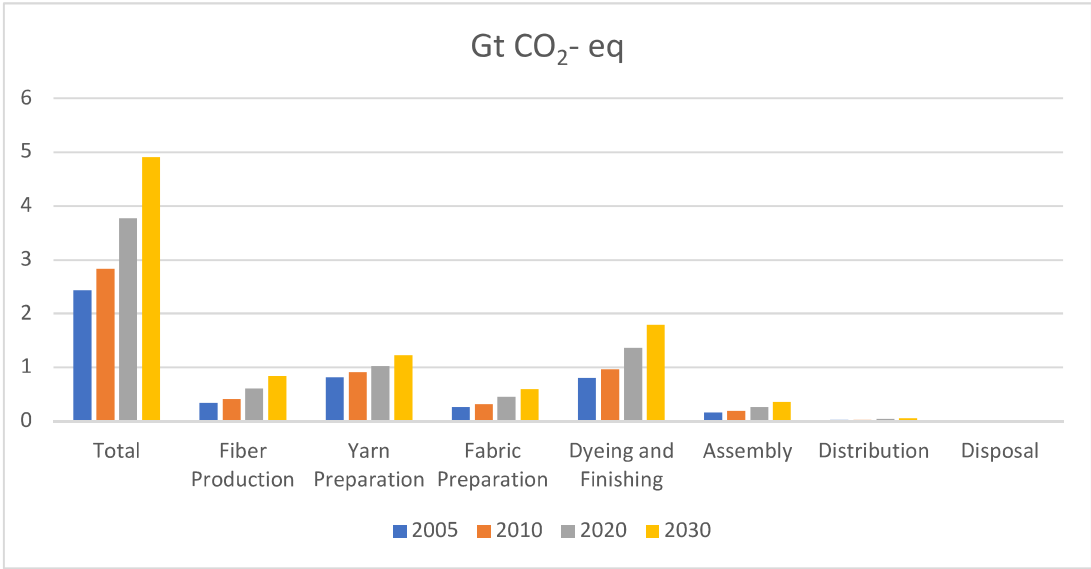
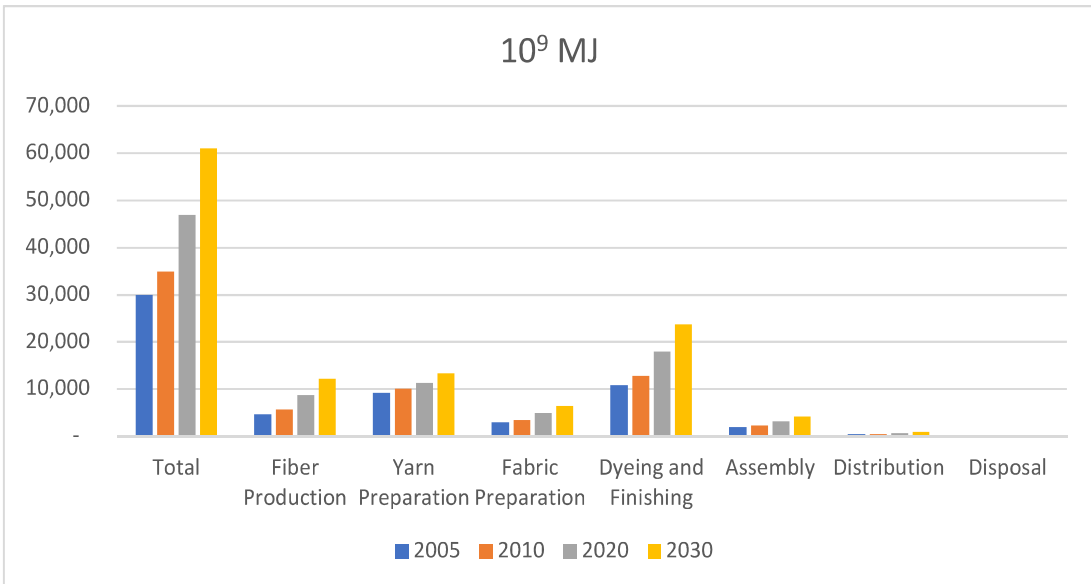


Figure 8: Textiles Resources in Business-as-Usual Scenario (Source: Measuring Fashion, Quantis 2018)



Taking into consideration the impact of fibres and textiles on the climate, key players around the world have become increas-

ingly aware of their responsibility towards sustainability and the environment for over a decade. The sustainability of the value chain can be evaluated based on three dimensions: economic, environmental, and social impact. Environmental impact includes greenhouse gas emissions (also known as the cotton footprint or climate change impact), as well as other emissions to air, water, and land, depletion of resources, non-renewable energy use, land use, water use, and diminished ecosystem quality.

The use of organic textiles can contribute to controlling pollution and making products free from negative environmental impacts. Organic textiles can consist of natural, cellulosic, or synthetic fibres. Cotton and polyester are two major raw materials used in the textile value chain. Conventional cotton is one of the most chemically intensive crops, with serious consequences for the climate. On the other hand, organic cotton is grown with methods that focus on building ecosystem health. Farmers cannot use toxic persistent pesticides, synthetic fertilizers, or genetically modified organisms. Organic farmers also must use methods that build

soil health and support on-farm biodiversity (Shade and Delate, 2021). The importance of organic cotton is evident from the fact that the Global Warming Potential (GWP) for organic cotton for 1,000 kg of fibre is 978 KgCO₂-eq, while for conventional cotton, it is 2,446 KgCO₂-eq (Angela, 2019). Therefore, using organic cotton can significantly reduce greenhouse gas emissions and contribute to a more sustainable textile industry (La Rosa and Grammaticos, 2019).

Polyester is the widely used fibre in textiles. Production of conventional polyester apparel starts with the extraction of crude oil. This non-renewable fossil fuel recourse consists of thousands of different organic compounds, including pure hydrocarbons, and molecules with functional groups containing, oxygen, nitrogen, and certain minerals (Speight, 2011). Crude oil is such a complex mix, it must be refined and

processed to obtain the building blocks of PET, namely ethylene glycol and purified terephthalic acid (PTA). This is achieved by heating, distillation and other processes that release harmful toxins (Greene, 2014) such as BTEX compounds (benzene, toluene, ethylbenzene, and xylene), particulate matter, nitrogen oxides (NO_x), SO₂ and CO. Ethylene glycol and PTA react by condensation to form ethylene terephthalate units, which are then linked via ester bonds (CO–O) to form the long chains of PET. In theory, ester bonds can be hydrolysed, which means PET can be de-polymerized, but the large aromatic ring gives PET notable stiffness and strength, especially when the polymer chains are arranged in an orderly manner as in the case of textile fibres, making PET highly resistant to biodegradation at its end-of-life phase (Mandal, 2019). The PET is then used to produce fibre and then spun into yarn and then fabric. Fabric is then processed and there are more than 15,000 chemicals that can be used during the fabric processing (Roos et al., 2019). The entire process may require significant amount of energy approximately 125 MJ/Kg polyester fibre which results in emission of 27.2 KgCO₂-eq/kg of polyester woven fabric. In general, synthetic fibres show a higher impact on climate change than natural fibres (Beton, 2014).

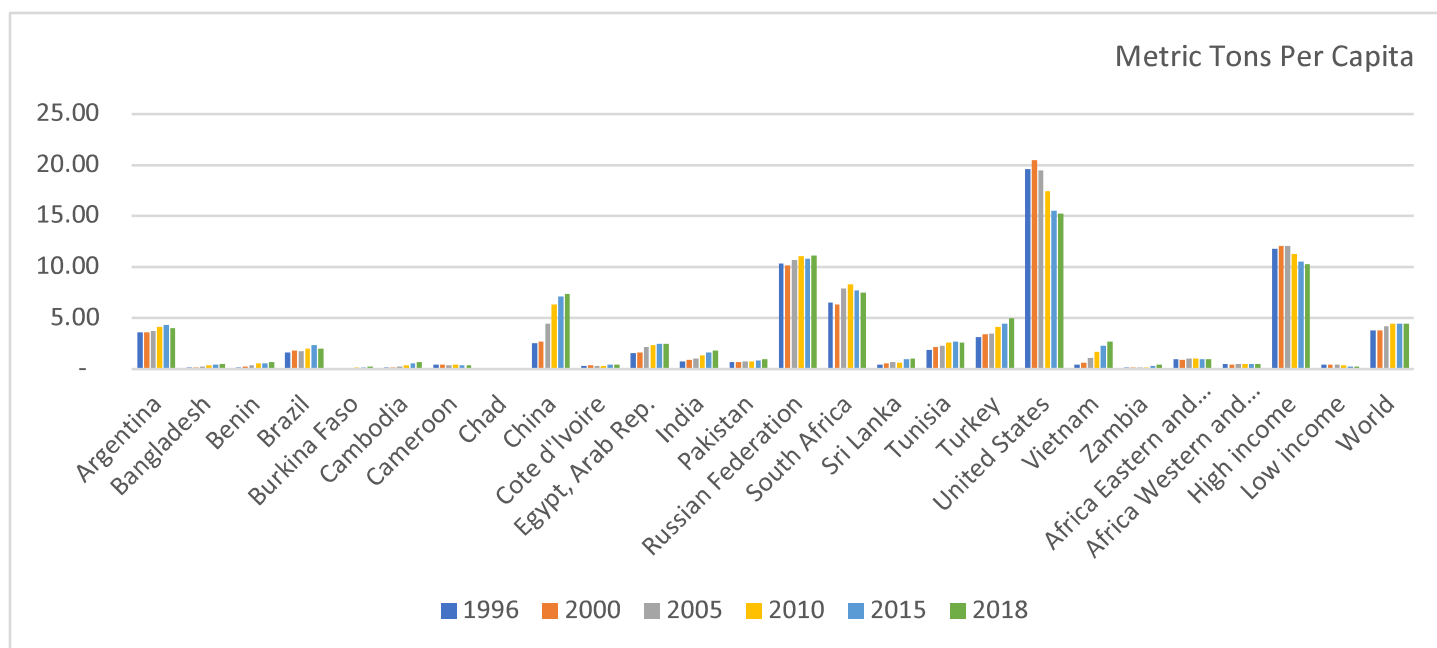
The term ‘organic’ extends beyond the fields and is not limited to cotton alone. According to the Global Organic Textile Standards (GOTS), when organic fibre is processed and certified through GOTS, it must follow strict regulations to protect the health of the planet and people from the farm to the consumer. GOTS requires fibres to be certified according to relevant International Federation of Organic Agriculture Movement (IFOAM, 2020) Family of Standards, which includes regulations from around the world, such as Regulation (EC) 834/2007, USDA National Organic Program (NOP), APEDA National Program for Organic Production (NPOP), and China Organic Standard GB/T19630.

Certification bodies must have a valid and recognized accreditation for the standard, such as ISO 17065 accreditation, NOP Accreditation, or IFOAM Accreditation. The GOTS Standard covers the processing, manufacturing, packaging, labelling, trading, and distribution of all textiles made from at least 70% certified organic natural fibres. To be labelled “made with organic,” a fabric must be made of at least 70% organic fibre, while a fabric labelled “organic” must be made of at least 95% organic fibre. The remaining 5% or 30% of the fabric can consist of regenerated fibres from certified organic raw materials, sustainably managed forestry (FSC/PEFC), or recycled or certified recycled synthetic fibres (recycled polyester, polyamide, polypropylene, or polyurethane). The standard focuses on compulsory criteria only, except where an exception is expressly stated. Some of the criteria are compliance requirements for the entire facility where GOTS products are processed, including environmental management, wastewater treatment, minimum social criteria, auditing of processing, manufacturing, and trading stages, and ethical business behaviour.

While it is nearly impossible to produce textiles in an industrial manner without the use of chemical inputs, the approach taken by GOTS is to define criteria for low-impact and low-residual natural and synthetic chemical inputs. Therefore, in addition to basic requirements on toxicity and biodegradability, GOTS prohibits entire classes of chemicals, such as all heavy metals. This ensures that only chemicals with low environmental and health impact are used in the production process.

GOTS, however, does not directly address the carbon footprint of an organization or its production practices, but GOTS made it mandatory that companies shall assure compliance with the applicable national and local legal environmental requirements applicable to their processing/manufacturing stages including those referring to emissions to air, wastewater discharge as well as disposal of waste and sludge. It is required that Company shall have a written environmental policy and procedures in

Figure 9. Emissions (Source: World Bank Data)



place to allow monitoring and improving relevant environmental performances in their facilities. The environmental policy shall be shared with all employees. The available data and procedures for energy and water resource consumption per kg of textile output and target goals and procedures to reduce energy and water consumption per kg of textile output should be included, depending on the processing and manufacturing stages. Companies are also required to maintain complete records of chemical use, energy and water consumption, wastewater treatment, and sludge disposal. While GOTS does not specify wastewater standards beyond a maximum limit for COD, it does place significant emphasis on quality parameters and limit values for residues in GOTS goods, including additional fiber materials and accessories. This ensures that the products meet strict environmental standards and limit the negative impact of textiles on the environment and human health.

The GOTS sets requirements on social conditions that are equivalent to leading social sustainability standards. The labor practices are interpreted in accordance with the International Labor Organization (ILO) standards, which include prohibiting forced, bonded, or slave labor; ensuring workers have the right to join or form trade unions and to bargain collectively, maintaining safe and hygienic working conditions, prohibiting child labor, discrimination, and harassment. The GOTS also requires that companies have occupational health and safety, social compliance policies, and quality assurance systems in place.

The number of certified facilities in GOTS increased to 12,388 in 2021, compared to 10,338 in 2020. GOTS certification bodies also increased from 15 in 2020 to 18 in 2021. The world is recognizing organic textiles, with other organic certification organizations like the Organic Content Standard (OCS) also gaining traction. However, OCS is limited to certifying that a product contains 100% organically grown content (Textile Exchange, 2021).

Table 2: 2022 Environmental Performance Index (EPI) Ranking for 180 Countries (Source: World Bank Data, 2022)

Rank	Country	Score	RegionalRank
1	Denmark	77.9	1
2	United Kingdom	77.7	2
160	China	28.4	21
172	Turkey	26.3	19
176	Pakistan	24.6	6
177	Bangladesh	23.1	7
178	Vietnam	20.1	24
180	India	18.9	8

Most textiles are manufactured in developing and least developed countries, while a significant proportion is consumed in developed countries (UNEP, 2020). The Environmental Performance Index (EPI) offers a data-driven summary of the state of environmental sustainability worldwide (Wolf et al., 2022). The EPI ranks 180 countries on their environmental performance, using 40 performance indicators across 11 categories covering

climate change, environmental health, and ecosystem vitality (Source: <https://epi.yale.edu>). Interestingly, the major hubs for cotton, polyester, and textile manufacturing are ranked at the bottom of the ranking, indicating poor environmental performance (Wolf et al., 2022).

Countries may view the situation differently, as about 60% of GHG emissions come from just 10 countries, while the 100 least-emitting contribute less than 3% (Source: World Bank Data).

There is much work to be done to improve sustainability in textile manufacturing countries, and organic textiles are an important way to achieve sustainability and implement the United Nations Sustainable Development Goals.

Roadmap

To promote sustainable and specifically organic textiles, a roadmap should be developed with stakeholders for:

- GHG emission reductions
- Energy/Processing (Manufacturing)/Chemicals
- Raw materials
- Logistics
- Policy formulation
- Collaboration in existing initiatives

It is crucial to engage stakeholders in textile-producing countries, including governments, to:

- Design an action plan with specific targets and timelines
- Map existing initiatives promoting sustainability, including organic textiles
- Identify measures to improve energy efficiency, renewable energy, effluent water treatment, and social compliance
- Design new schemes to incentivize textile manufacturers, set targets for manufacturers, and link government facilitation
- Explore practical ways for brands/retailers to collaborate and support manufacturers in achieving sustainability, since these activities involve costs and long-term buying commitments encourage faster implementation
- Create consumer awareness to share costs
- Share knowledge and success stories, especially for Small Medium Enterprises (SMEs)
- Consider out-of-the-box approaches, such as assigning carbon credits to consuming countries rather than producing countries, which may encourage brands/retailers to invest in manufacturing
- Establish a unified compliance audit system to reduce audit fatigue and costs, initially unifying common points of each compliance certificate
- Implement digital traceability techniques with open access policies
- Connect the supply chain from fibre to textile manufacturing

and ultimately to retailers/brands

- Address hazardous substances and improve transparency on product chemical content, production history, and use properties, devising effective communication strategies after consulting stakeholders
- Promote innovative raw materials, processes, machinery, and renewable energy
- Develop circular and climate-smart textile supply chains
- Coordinate efforts for agreed legislation across member countries, considering the entire value chain and using science-based targets and effective dissemination campaigns.

Figure 10. A spinning mill



ICAC Private Sector Advisory Council (PSAC)

Lastly, the ICAC's vision for textiles acknowledges the importance of textiles for cotton. The ICAC has recently revamped the Private Sector Advisory Panel into the Private Sector Advisory Council (PSAC) and shifted from individual members to national cotton and textile associations. The PSAC Executive Committee includes governments, cotton producers, merchants, the textile sector, and brands. The ICAC is also in the process of creating the International Textile Research Council to collaborate with the private sector, academia, and governments, intending to establish a uniform set of sustainability criteria, especially for organic cotton, accepted by member governments.

References:

La Rosa, Angela, D. and Grammaticos, S.A. 2019. Comparative Life Cycle Assessment of Cotton and Other Natural Fibers for Textiles Applications. *Fibers* 2019, 7(12), 101; <https://doi.org/10.3390/fib7120101>

Beton, A. 2014. Environmental Improvement Potential of Textiles 2014, European Commission, (p-78) <https://publications.jrc.ec.europa.eu/repository/handle/JRC85895>

Cotton Inc. 2016. Cotton Incorporated, LCA Update of Cotton Fiber and Fabric Life Cycle Inventory 2016, <https://resource.cotton-inc.com/LCA/2016-LCA-Full-Report-Update.pdf>

Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al. 2022. 2022 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy. epi.yale.edu

Global Organic Textiles Standards (GOTS), <https://global-standard.org/downloads>.

IFOAM. 2020. https://www.ifoam.bio/sites/default/files/2022-06/FamilyFrame_2020_June%202022.pdf

Greene, J.P. 2014. Chapter 3 - Life Cycle Information.

Textile Exchange. 2021. <https://textileexchange.org/app/uploads/2021/02/OCS-403-V3.0-Quick-Guide-to-the-OCS.pdf>

IPCC. 2022. Intergovernmental Panel on Climate Change (IPCC) 2022, Mitigation of Climate Change, IPCC_AR6_WGIII_FinalDraft_FullReport.pdf p 7/2913

ILO. 2021. International Labor Organization (ILO), Reducing the Footprint, How to Assess Carbon Emissions in the Garment Sector in Asia, 2021, https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_781938.pdf

Shade, J and Delate, K. 2021. Organic Cotton: one of the most important choices you can make for the environment, https://www.organic-center.org/sites/default/files/publication_files/organiccottonreport.pdf

ICAC. 2021 & 2022. Reports by Lorena Ruiz. International Cotton Advisory Committee, World Textiles Demand, <https://icac.org/Publications?MenuId=41>

Mandal, S and Dey, A. 2021. 1-PET Chemistry. In *Recycling of Polyethylene Terephthalate Bottles*; Thomas, S., Rane, A., Kanny, K., VK, A., Thomas, M.G., Eds.; William Andrew Publishing: Norwich, NY, USA, 2019; pp. 1–22. ISBN 978-0-12-811361-5

Quantis 2018. Measuring Fashion, Environmental Impact of the Global Apparel and Footwear Industries Study, https://quantis-intl.com/wp-content/uploads/2018/03/measuringfashion_globalimpactstudy_full-report_quantis_cwf_2018a.pdf

Roos, S., Jonsson, C., Posner, S., Arvidsson, R., Svanstrom, M. 2019. An inventory framework for inclusion of textile chemicals in life cycle assessment

Speight, J.G. 2011. Chapter 12–Petrochemicals. In: Speight JG (ed) *Handbook of Industrial Hydrocarbon Processes*. Gulf Professional Publishing, Boston, pp 429–466

UNEP. 2020. United Nations Environmental Programme (UNEP); Sustainability and Circularity in the Textile Value Chain: Global Stocktaking 2020, <https://wedocs.unep.org/handle/20.500.11822/34184>

UNEP. 2021. United Nations Environmental Program (UNEP); Catalyzing Science-based Policy Action on Sustainable Production and Consumption, 2021 <https://www.unep.org/resources/publication/catalysing-science-based-policy-action-sustainable-consumption-and-production>

UNFCCC. 2021. United Nations Climate Change, Global Climate Action, Fashion Industry Charter for Climate Action, 2021 <https://unfccc.int/climate-action/sectoral-engagement/global-climate-action-in-fashion/about-the-fashion-industry-charter-for-climate-action>

World Bank Data. 2022. <https://data.worldbank.org/>