# Sustainability in Textile and Apparel Industry

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# EXECUTIVE BODY 2021-22



# Content

# Editorial

While COVID has made all of us more resilient, every one of us some way or other contributed to the betterment of the mankind. While we were brave in fighting the pandemic successfully, two of our beloved members lost their fight and TANTU fraternity mourns the untimely death of Mr. Rajkumar Rai and Mr. Kanchan Kanjilal. With industry on the revival track TANTU decided to wait till 2022 to organize the annual seminar and presents the electronic version of this year's TANTU Journal.

Sustainability in the textile and apparel industry is the theme of this year's Tantu Journal. We are happy to present year's Tantu Journal 2021 on the said theme which will put some lights on current state of the sustainability in the textile and apparel industry from various perspectives. Almost everyone will agree on the need of making fashion items in sustainable ways. We care about our mother earth, and we like to keep our environment safe for our next generations. We like to live healthy and safely. For this, we need to show our interest and act in making the fashion more sustainable.

Why it is important? The below facts published on various reports are enough to stir our consciousness.

**Approximately 60% of all materials used by the fashion industry are made from plastic (UNEP, 2019). 500,000 tons of microfibers are released into the ocean each year from washing clothes — the equivalent of 50 billion plastic bottles (Ellen MacArthur Foundation, 2017). The fashion industry is responsible for 8-10% of humanity's carbon emissions – more than all international flights and maritime shipping combined (UNEP, 2018). Some 93 billion cubic metres of water – enough to meet the needs of five million people – is used by the fashion industry annually, contributing significantly to water scarcity in some regions (UNCTAD, 2020)**

Some good news are many top fashion brands joined to the sustainability movement in different ways. Even many Indian clothing brands have come forward in making fabrics and garments in sustainable ways. Promoting new ways of recycling and reusing the apparel items through closed loop, renting garment and thrift stores.

In this journal, our authors have covered sustainability in the fashion industry in various prospective. Dr. R. Chattopadhyay recommends "The textile industry and all those involved with textiles must make efforts to make meaningful contributions to sustainable development by reducing energy and water wastage, developing energy and water efficient and cost effective technologies and using alternative energy."

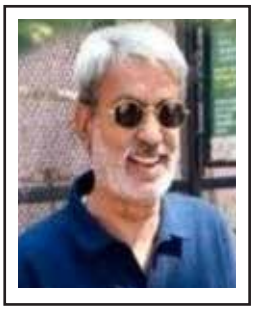
Dr. Arindam Basu advises "Not to throw away or discard textiles which have alternative uses, may be recycled, may become components of any other product. Efforts should be made not to allow discarded textiles to go landfill or to the incinerators. Many times, value added products may be produced out of discarded materials. The purpose is to keep resources in use for a longer duration." We have many things to talk on the sustainability in the textile and fashion business. We from the textile and apparel fraternity concern about the sustainable practices and ethical business. We should not be an observer. We should participate in the sustainable movement. We need to increase awareness among others who don't belong to the textile and apparel supply chain.

Subhadip Dutta has rightly said "sustainability is no longer an option but a necessity."

**Prasanta Sarkar, Editor**
**Aditya Mahapatra, Assistant Editor**

# OBITUARY

## RAJKUMAR RAI (October 25, 1960 — May 14, 2021)



We still remember the best times, the laughter, the discussions, the appreciations, the good life you lived while you were strong. Let your mind be at ease, soul be at rest, remembering how truly you were blessed.

Rajkumar Rai, often lovingly known by "Raju" or "Rajkumar-da" or "Rajkumar-Sir" amongst close friends and acquaintances, has left us for heavenly abode on 14th May 2021, on the very day of Akshya Chaturthi; a celebrated auspicious day of Hindu calendar but marking a great loss for the TANTU fraternity - and a fall of a star from Indian textile community. Mr. Rajkumar was an active member and regular in TANTU events, his three decade long association with us has seen him serving mostly as an executive member and as the treasurer of TANTU for a significance time in the past.

Rajkumar headed several buying agencies and worked for Top German customers of fashion garments and home-textiles like Gerry Weber, Betty Barclay, Miles, Quelle, Sport2000, Eiselmarkt, Migros, Gueldenpfennig, Istrad. He had experience of 28 years mostly in product development, sourcing and production management, quality assurance and his expertise proved critical for conflict management in Buying house for fashion apparels, textiles-woven & knits, leather and home-textiles.

Rajkumar Rai was also closely associated with media, active in social networking sites, earning reputation of critique in industry circle. We will miss those quotes as the social networking accounts will fall silent. TANTU will miss the intense, astute discussions every year in the seminars -be it on technicalities of textile or India's social fabric.

A wonderful human being who nurtured a family with love and worked throughout his life to make this world a better place, Rajkumar Rai will remain immortal in the heart of each and every TANTU member, numerous friends and well-wishers across globe. He is survived by wife, two daughters and a very close knit joint family members. We pray to God to give strength to his family members.

## Kanchan Kanjilal (July 1, 1968— July 9, 2021)

A textile graduate from College of Textile Technology, Serampore (1990 Batch) and Master's from Indian Institute of Technology, Delhi, (1994 Batch) has started his career with Clariant in 1995. He has worked in Jubilant Life Sciences, Arvind, India Glycols, Kusumgar Corporate and Zydex Industries before joining Archroma in 2013. He was with Archroma handling new business development and was active in industry circles.

He was full of life and known for his humble nature yet he lost the battle to COVID 19. All of TANTU family pray for his soul to rest in peace and convey strength to his bereaved family.

# SUSTAINABILITY IN TEXTILE AND APPAREL INDUSTRY – ROLE OF FIBRES AS RAW MATERIAL

**Arindam Basu** | Director General, Northern India Textile Research Association, Ghaziabad 201002

## Introduction

Sustainability is not the buzzword today, in fact it has become the reality and necessity for all industries as people have understood that if they continue to do what they are doing for so long, there will be no natural resources such as pure air, water, minerals etc. available for our next generation. Thinking of the earth with continuous depletion of natural resources makes the businesses think twice. That's the reason why businesses are turning to adopt the concept of circular economy instead of linear economy. Linear economy works with the concept of "take, make, waste" i.e., take natural resources, make the desired product and waste it after use. Whereas, the concept of circular economy believes in circulating the resources with the aim to keep resources, materials, products, equipment and the infrastructure in use for a longer period. It may be done by recycling, remanufacturing, refurbishment, reuse, sharing, repair; ultimately creating a closed-loop system responsible for - minimizing the use of natural resources and creation of waste, pollution, carbon emissions and anything & everything affecting sustainability. In brief, the concept of Circular economy is based around four goals [1].

The main goals include:

(1) Phasing out substances that could cause harm,

(2) Increasing clothing re-use through design and marketing of clothing durability,

(3) Improving recycling and recyclability of mixed fibre items and

(4) To make better uses of resources and switch to renewable wherever possible.

Among the processes involved in textile and apparel industries, wet processing pollutes the environment maximum; hence majority of the efforts are being taken in this area to make this process sustainable. But other processes- starting from selection of fibres, spinning, weaving, knitting, garmenting; also pollute the environment in one way or the other and require efforts and actions to make these sustainable. Fibres as Raw Material play a paramount role in sustainability of textile and apparel industry as these may help in reducing or eliminating environment damaging processes. To reduce carbon footprint and save from the pollution of environment, textile industry has followed various actions such as increased use of renewable biodegradable fibres, producing fibres from renewable sources, more and more use of single fibres for easier recyclability and modification of renewable materials by microbiological treatment etc.

## Renewable material

Raw materials used in the textile industry can be divided into two major categories, (i) renewable materials, which grow, are biodegraded and whose seeds enable them to re-grow and (ii) non-renewable finite materials which do not regrow and the supply of which may soon become exhausted if used intensively. Natural fibres such as cotton, silk, wool, jute, flax are the most popular fibres but their growing processes can be improved keeping a clean environment as main objective. Organic and genetically modified cottons are becoming more acceptable by the major brands in the World. Similarly

organic silk and wool are being tried by several manufacturers.

The Textile Exchange, in its 2017 Preferred Fibers and Materials Market Report [2,3], reported that use of organic and other preferred cotton (like better cotton, Fair trade, Recycled) has increased 47% over the previous year, recycled polyester grew 58%, demand for Lyocell was up by 128% and companies are using 54% more preferred down (certified to the Responsible Down Standard or the Traceable Down Standard).

Generally, it is believed that natural fibres can be considered as sustainable fibres. But depending on their growing processes, fertiliser used, pesticide used, food etc. these natural fibres are classified as per sustainable levels. Textile Exchange defines a preferred fibre or material as one which results in improved environment and/or social sustainability outcomes in comparison to conventional production. Similarly Preferred Cotton (pCotton) is cotton that is ecologically and/ or socially progressive because it has more sustainable properties in comparison to other conventional options. Preferred cottons include Better Cotton Initiative, Cotton made in Africa, Fair trade Cotton, Organic cotton, Organic Fair trade cotton, REEL cotton and recycled cotton. Similarly Preferred animal fibres include Responsible Down, Traceable Down, Downpass Certified, Recycled Down, Organic Wool, Responsible Wool and Recycled wool. In the World, presently the percentage of organic cotton amongst all cotton fibres is only 1% whereas over 22% of World cotton crop now has Preferred Cotton status.

Italy based Orange Fibres, is making a silk like fibre out of orange peels. They are sourcing the orange peels (around 7,00,000 tons) from Sicily which would have ended in landfill. The waste skin, pulp and pips from apple juice farms are transformed into ‘apple skin', a vegan and sustainable leather like fabric that is fully biodegradable.

A relatively recently developed fabric, Coconut Wool, uses sustainably sourced coconut waste to produce a tree free soft rayon [4]. Developed as an alternative to wool by the Australian company ‘Nanollose”, the first viable garment utilising ‘Nullarbor fibre’ was created in December 2018.

Pineapple leather or ‘Pinatex’ has swiftly gained popularity within the footwear industry as a sustainable and vegan alternative to traditional leather. Produced primarily by the UK based “Ananas Anam'' Company, the fabric is made using the fibres from Pineapple leaves, which are natural by products from Pineapple farming industry. The fibres are extracted from the leaves by the pineapple farming communities, by a process called decortications. They are degummed and transformed into a nonwoven mesh, which undergoes a specialised finishing process that gives it leather like texture. Residual leaf biomass from the pineapples is used as biomass.

“Mycelium leather '' is created from the microscopic spores produced by mushrooms. Companies are able to cultivate these cells which naturally self-assemble into a sturdy 3D mesh-like structure that can be compressed to become a viable material. This is then dyed and tanned to create leather like finish. The material is non-toxic and biodegradable and can be produced within days. Companies such as Bolt Threads and MycoWorks are producing this material for use across the fashion and interiors industry.
Food industry by-products are a key area for fabric innovators and alongside apple, pineapple and coconut; waste from the wine industry can be utilised as well. “Grape leather”, developed by the Italian company Vegea, uses waste fibres and oils from wine production to create a sustainable leather alternative. It is created from “grape marc” – a waste material consisting of the grape skins, seeds and stalks that remain after grapes have been pressed for wine.

The fibres produced from Agri waste not only help in reducing carbon footprint it also helps in increasing the income of the farmers. A study at NITRA has found that fibres can be produced from corn husks [5] and those can be used in various textiles and composite products. The scientists at NITRA have successfully extracted fibres from Pine needles using a patented method. The pine needles lie

in the hills causing wildfires and damage of human properties and animal lives. This innovation will help in reducing this risk and fabrics produced using these fibres are biodegradable, renewable and nature friendly [6]. The fibres extracted from pine needles have a unique hollow structure and good moisture absorbency. US based company Bolt threads uses bioengineering to put natural silk genes into yeast cells, which are then cultivated through fermentation yeast, sugar and water. The liquid silk is then extracted and spun into fibres, which are then woven into fabric. The final textile which is called "Microsilk'' has high tensile strength, elasticity, durability and softness.

Recycled cotton and wool fibres and yarns are already available in the market. The recycling is being done from post-consumer sources. Through the FIBERSORT project, Circle Economy has found that upward of 15 percent of all collected PCT is recyclable grade mono material, with more than 80 percent cotton, which is suitable for mechanical recycling into new textiles. With global collected volumes of more than 12 million tonnes per year, this suggests there is plenty of feed stock available. One T-shirt made with Recover yarns containing 52% recycled cotton, saves up to 2700 litres of water. In the Higg Materials Sustainability Index, recycled cotton fibre scores a 1.0, compared to 11.9 for organic cotton and 60.5 for conventional cotton.

## Man-made fibres

Plastic pollution is an increasing focus and various companies are processing plastic waste into textile grade fibres. 'Seaquel" creates recycled polyester using plastic waste salvaged from the Spanish Mediterranean coast. Similarly, "Econyl" uses waste from landfill and oceans to create nylon.
In 2002, Cargil Dow (now Nature Works) won the Greener Reaction Conditions award for their improved polylactic acid (PLA) polymerisation process [7]. Polylactic acid is a polymer derived from lactic acid – a natural product usually derived from corn or sugar beet. It is 100% renewable and 100% compostable. It uses 20-50% less fossil fuel resources than the traditional polymerisation process. Scientists in Japan developed renewable bio based polyester fibre by using bio based paraxylene derived from distilling bio fuel instead of crude oil. The bio based fibre behaves in the same manner as conventional polyester other than being nontoxic.

The average life cycle of textiles, including laundering, accounts for 6.7% of all Global greenhouse emissions, which is equivalent to every person taking a 2500 miles flight every day. It is claimed by Meryl that Meryl Medical's fabrics are based on the Meryl range of polyamide 6.6 yarns produced by Spain's Nylstar [8]. The materials are recyclable, can be washed at low temperature and no shedding of microplastics. The dope dyed fibres are being used to avoid all dyeing and preparatory processes and generation of harmful effluents.

Lululemon has announced a multiyear collaboration with Genomatica to create a lower impact plant based nylon [9]. Genomatica uses biotechnology and fermentation to convert plant based ingredients into widely used chemical building blocks like those used to make nylon. These building blocks are converted into pellets and yarn. These two companies are very close to bring in positive change within the $22 billion global nylon market.
Spinnova have created a process where wood fibres do not need dissolving in harmful chemicals [10]. Instead, it is refined mechanically to create something called microfibrillated cellulose, the feedstock for their process. It is claimed that Spinnova Cellulose fibre can return to nature quickly, taking a few months to biodegrade in natural and marine environment. Hyosung have developed Creora Bio based spandex where petroleum is replaced with corn. Lenzing ECOVERO fibres are tailored to a sustainable lifestyle, and it is derived from sustainable wood and pulp.

Newlight Technologies based in Huntington, California, has announced a partnership with Nike to explore the use of AirCarbon, a carbon negative biomaterial produced by microorganisms from the ocean [11]. It uses

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naturally occurring microorganisms from the ocean that eat air and greenhouse gas and convert it in their cells in Aircarbon – an energy storage material, also known as polyhydroxybutyrate (PHB), that is approximately 40% oxygen from air and 60% carbon from greenhouse gas by weight. AirCarbon is certified carbon negative by SCS GlobalServices, resulting in a net reduction of CO2 in the atmosphere through production and can be melted into range of forms, i.e., fibre, sheets, solid shapes.

Engineers at Washington University in St. Louis have produced amyloid silk hybrid proteins and turned them into fibres that are stronger and tougher than natural spider silk [12]. The artificial silk known as "polymeric amyloid fibres", was produced by the bacteria that was genetically engineered in the laboratory of Fuzhon Zhang, a professor in McKelvey School of Engineering. The research team modified the amino acid sequence of spider silk proteins to introduce new properties, while retaining some of the attractive features of spider silk. The bacteria produced a hybrid polymeric amyloid protein with 128 repeating units. It is claimed that the fibre is stronger than steel and tougher than Kevlar and all previous recombinant silk fibres.

## Technical textiles

Technical textiles are the textile products which are being used mainly for functionality. The usage of these products is increasing day by day and many of the products being used today were never thought of earlier. The natural fibres are being used in large scale in this area to improve the recyclability of the final products such as automotive textiles, building textiles, geo textiles etc. Natural fibre such as coir which is produced from coconut waste are being used extensively in geotextiles due to its biodegradability, high moisture content, medium term life. Many products for riverside protection are presently used along with jute products in which plant seeds are used. The mesh made up of coir or jute fibres acts as a small dam and protects the seedlings from washing away by rainwater and wind. The plants grow on these fabrics and the roots hold on the soil around it. After a certain time, these fabrics degrade into soil. Fibre metal laminates are the contemporary materials used in the aerospace industry due to excellent mechanical behaviour compared to conventional metallic alloys [13]. Attempts have been made to form laminates based on plain weave kenaf fabric, polypropylene and annealed aluminium 6061 through hot press compression method. It was observed by the authors [13] that incorporation of single layer kenaf fabric in untreated FMLs offered the highest tensile properties compared to FMLs with 2 or 3 layers of kenaf fabrics. Similarly use of natural fibres and recycled material nonwovens are increasingly being used as substrate in composite parts in automotive industry [14-18]. The applications include acoustic absorbers, side cowl, headliners, inner and outer dashboard insulator, under engine shield, upholstery backing etc. Flax, sisal and hemp are being explored as replacement for the expensive glass as long fibre reinforcement in polyurethane injection moulding for door panels and other applications [15].

If we consider only the European Union, around 5.8 m tonnes of textiles are discarded by the consumers per year. Only 1.5 m tonnes (around 25%) of these products are recycled by charities and industrial enterprises. The remaining 4.5 m tonnes go to landfill or to the municipal incinerators. The reuse and recycling of discarded textiles has many potential environmental benefits. A new insulating material was made from waste wool and recycled polyester fibres (RPET) for building industry applications [19]. RPET/ waste wool mats showed very good thermal insulation, acoustic absorption, moisture absorption and good fire properties. In another study, potential applicability of acrylic woven fabric waste and woven fabric sub waste as thermal insulation building material was studied. The study indicated that the application of these materials in an external double wall increased its thermal behaviour by 56% and 30% respectively.

So, the conclusion is not to throw away or discard textiles which have

alternative uses, may be recycled, may become components of any other product. Think each used/discarded item may have a customer/consumer. Efforts should be made not to allow discarded textiles to go landfill or to the incinerators. Many times, value added products may be produced out of discarded materials. The purpose is to keep resources in use for a longer duration.

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## About the author

Dr. Arindam Basu, Director General of the Northern India Textile Research Association (NITRA), Ghaziabad is a B. Tech. in Textile Technology from Calcutta University and M.Text. from Bombay University and was placed in First Class in both of them. He completed his Ph. D. from the University of Leeds, England in Textile Engineering during the year 1991. He has more than 32 years' experience in Industry and Research. He is working as Director of various Institutes since 2002. From June 2002 to January 2011 he was the Director of South India Textile Research Association (SITRA), Coimbatore, from January 2011 to March 2014 he was Director of Central Silk Technological Research Institute (CSTRI), Central Silk Board, Bangalore and joined NITRA as Director General during March 2014 and working since then.

# SUSTAINABILITY IN TEXTILE & APPAREL INDUSTRY

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"Development which meets the needs of the present without compromising the ability of future generations to meet their own needs." Practices that fulfil the current needs of the manufacturing of textiles and at the same time do not lower the balance between industry and environment is called sustainable textile manufacturing.

## Introduction

Through the report in 1987, the world was alerted to the need of working towards economic development without exhausting natural resources or harming the environment. Adams (2006) concentrated the idea into three dimensions; social, environmental and economical, dubbed as the three pillars of sustainable development.
Environmental Sustainability refers to ecosystem integrity, carrying capacity and biodiversity whereas Economic Sustainability refers to a system of production that satisfies present consumption without compromising the future needs and the Social Sustainability implies the social duties to achieve fairness in terms of opportunity, adequate provision of social services, political accountability and participation.

## What is the need of sustainability?

Sustainability, as perceived with time, has become a necessity among the producers as well as the consumers. The textile chain is no different with thousands of fibre being wasted at every step of production and with the use of chemicals and other harmful substances (17-20% Global Water Pollution) the toxicity also increases along with the microplastics from clothes that get released during the wash. All this has adverse effects on the environment. Moreover, cruel treatment on animals is very evident in this industry as the workers ruthlessly treat the animals for their skin, wool or feathers. Thus cruelty-free products provide both sustainability and reliability. There is a dire need to adopt newer methods of manufacturing, which do not hamper the environment, and utilize natural resources, to help us not only sustain the textile industries but the eco-system as a whole.

The following measures prescribed by many textile firms can be carried to counter the problem:

(1) Utilization of natural resources, water, and energy in production processes.

(2) Minimising air pollution which is caused at almost all stages of textile manufacturing like dyeing, printing, and finishing by reusing the hot wastewater which creates heat of approximately 120-130 degrees.

(3) Availability of raw materials which are sustainable in the long run.

(4) Handling of chemicals in processes like dyeing and coating which includes heavy-metal-rich dyes and fixing agents, bleaches, solvents and detergents.

(5) Disposal and treatment of waste material.

(6) Adherence to guidelines to eliminate health risks of workers, as well as consumers.

(7) Animal cruelty norms in the procurement of wool, silk, fur, etc.

## What was the take on sustainability during Covid?

The pandemic has caused havoc in every industry possible thus bringing some crucial changes alongside. People are living differently, buying differently, and in many ways, thinking differently. Consumers are aware of what they need vs what they want. Besides feeling redundant the textile chain has come up with real-time solutions while keeping sustainability in check. Both government and private companies are undertaking sustainable measures to thrive in the market.

Government schemes entitled to uphold sustainability during COVID times among others are -

1) Vocal for local- a prominent slogan to empower the home-grown brands is quite in the limelight all over the internet. It has aimed to achieve self-reliance and maintain sustainability in the sector.

(2) Project SURE (Sustainable Resolution) - it is a commitment by India's apparel industry to set a sustainable pathway for the Indian fashion industry. It pledges to develop a sustainable sourcing policy for consistently prioritizing and utilizing certified raw materials that have a positive impact on the environment.

(3) SILK SAMAGRA- it is an Integrated Scheme for Development of Silk Industry that has been able to sustain and strengthen the Sericulture activities in the country. It emphasizes hybrid vigour and genetic-based research and also promotes eco-friendly sericulture.

(4) Project SAMARTH (Scheme for Capacity Building in Textile Sector) - this is an attempt of the Indian Government to increase employment among youth in the textile sector. It is a demand-driven, placement oriented skilling programme to incentivize the efforts of the industry in creating jobs in the organized textile and related sectors.

(5) National Technical Textile Mission- The government has approved the proposal for creation of National Technical Textiles Mission for a period of 4 years (2020-21 to 2023-24) with an outlay of Rs.1480 crores. The focus of the mission is for developing on usage of technical textiles in various flagship missions, programmes of the country including strategic sectors. The use of technical textiles in agriculture, aquaculture, dairy,poultry, etc.

## What are the future aspects of sustainability?

Sustainability is the major concern for the textile and apparel industry. It has evolved with time and is expected to bring new changes in the future. Most of the companies have shifted towards vegan clothing and are incorporating various technologies to improve sustainability.
RFID (Radio Frequency Identification) technology is being used in apparel industries for efficient control and fabricating new clothes from discarded textile materials or old clothes are already in action in few places of the world like Brazil. Textile chemical manufacturers like Archroma is an example of companies which provide sustainable chemicals for textile manufacturing. Inventing newer methods for fiber production like using pineapple leaves as a vegan alternative for leather which is breathable, flexible, and easy to stitch print. Also, designer Roya Aghighi has created a revolutionary concept called biogarmentry where clothes are made of natural fibers that have living

photosynthetic cells resulting in what she called “living clothing” that also purifies the surrounding air, to clean the fabrics, one needs to simply submerge them in water.

Mylo is another sustainable leather fiber developed by bolt threads which have its root structure from the mushroom. It is created by combining mycelium cells with corn, stalks, and nutrient as substrate. Technical or engineered textiles are defined as products that are used for functional purposes rather than for aesthetic characteristics, having applications across various industries have also influenced the sustainability.

## Conclusion

Fast fashion has become a threat to sustainability. It is a term that describes how low-cost clothing brands mimic luxury fashion trends. Cheap clothing items are made available at the cost of the environment. Fast fashion survives when environmental and social resources are neglected, whilst sustainable development leans on all economic, social, and environmental development. People also need to be aware of what is happening behind those fancy clothes they buy. Sustainability should be the prime objective of both producers and customers for a healthy future. After all, it is an individual's choice of what they purchase whilst respecting who made it, all the people involved in the process, and respecting the ecosystem.

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# NEED OF CLIMATE COMMITMENT IN THE APPAREL AND TEXTILE INDUSTRY

**Dipankar Bose** | Global Environmental Manager at Varner

We are in a state of emergency since last 2 years due to the global pandemic and we are doing our best to survive through this. What if we knew in advance about one of the next global challenges that is going to adversely impact our lives and our industry?

Will we do things differently and take preventive measures? Well, we probably should because the challenge here is climate change.

It has been scientifically proven that the adverse effects of climate change are real and main cause is human activity. In 2018 the IPCC stated in their special report "Global Warming Of 1.5°C" that global temperature rises of more than 1.5°C will likely result in severe consequences for people and the planet. [1]

It is a common knowledge that apparel, and textile industries are energy intensive and contributes to significant amount of greenhouse gas emissions. Studies estimate that the apparel industry accounts for approximately 3-7% share of global greenhouse gas emissions. It is high time that our industry acknowledges urgency of this matter and commits to reduce greenhouse gas emissions and limit global warming to 1.5°C

It has been studied that major portion of GHG emissions of apparel and textile products are coming from its upstream value chain, from fibre to finished product manufacturing. Many Brands and retailers as well as manufacturers have started measuring and monitoring GHG emission from their operations as well as upstream supply chain and started taking steps towards reducing their climate footprint. Leading public limited companies have started including climate reporting as an integral part of their annual company report.

Though climate action and reporting are picking up pace in some part of our industry, a significant section of our industry is still just getting started on this journey. Two main reasons of this are lack of awareness and complicated nature of activities.

To understand the critical nature of climate risk to our industry we need to look into recent energy crisis in India, China and many countries in Europe as well imminent natural raw material shortage in textile sector due to global warming, droughts and unpredictable weather patterns. We should also not ignore emerging investor interest and upcoming legislations and regulations in various markets globally which will act as competitive barriers for companies not committing to climate action.

Once we understand and acknowledge the fact that we are indeed facing an emergency when it comes to climate, the next task is to enable the industry to monitor, measure and minimize greenhouse house gas emissions efficiently and effectively. Unlike water or energy use, there is no 'meter' that can directly measure greenhouse gas emission generating from operations and activities of an organisation. GHG accounting can be complicated and intimidating at the beginning to any organisation.

Understanding international standards such as 'GHG Protocol'[2] to align with scope and methodology has been found to be an effective step in GHG accounting of a company. Next steps usually involve mapping each activity that contributes to greenhouse gas emission, collecting the activity data and converting the activity data into greenhouse gas emission. Reducing GHG

emission involves steps such as optimizing energy efficiency and transitioning from fossil fuel-based energy sources.

Leading brands, retailers and manufacturers are setting science-based emission targets[3] and joining forces to fight climate change. Tools such as Higg Index are enabling manufacturers to identify data points as well as collect energy/fuel use data and convert them into GHG emission values. However, standards and tools that help our industry monitor and measure complete scope 1, 2 and 3 emission data of an organisation are yet to find mainstream development and widespread adoption. With a sense of urgency, we need to develop industry wide awareness, scalable solutions for GHG accounting and collaboration within industry to make real progress.

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## About the author

As Global Environmental Manager, Dipankar is currently leading climate action and environmental stewardship for all private brands of Varner, leading retailer in Scandinavia. As a part of the core sustainability team, he focuses on developing climate and environmental goals for Varner and anchoring them within the business strategy as well as the communication strategy. His key strategic engagements are preparing roadmap and implementation framework for the climate and environmental ambition of the organization. On the supply chain side, he works with his team towards environmental performance management, risk management, supplier training and capacity building. He is also the project leader for Sustainability reporting at Varner.

# CULTIVATING NATURALLY COLOURED COTTON: A SUSTAINABLE WAY OF COLOURING COTTON FIBRE

**Montu Basak** | Associate Professor, Fashion Design Department, National Institute of Fashion Technology (NIFT), Kolkata

Keywords: Sustainability, cotton fibres, dyeing, genetic engineering, sustainable fashion, etc.

## Abstract

Cotton fibres, because of its cool properties, has been the centre of attention by all the textile manufacturers since time immemorial. Colouring cotton fibres is regarded as one of the most polluting process among all manufacturing process, thus, scores poorly in its assessment for sustainability impact on the Mother Earth. Colouring cotton fibres naturally through its cultivation could provide a sustainable option for the textile dyeing industries. Genetic engineering of cotton seeds has been miraculous in getting coloured cotton naturally without the need of polluting dyeing process. Coloured cotton fibres cultivated from genetically modified cotton seeds is the way forward for a sustainable future for the 'one of most polluted' tagged textile industries.

## Introduction

Textile Industry has been labelled as one of the most polluting industries among all the industrial processes in the world. Textiles being one of the very basic necessity of human being; its manufacturing can also not be ignored or stopped. Processing of fibres into textile materials requires the usage of extensive water, energy, chemical and other related resources. Dyeing is one such textile processes which contributes a lot in its share of industrial pollution. It nearly estimates 20% of all water pollution originating from industrial effluents. Textile dyeing industry requires a large amount of water, which leads to a significant negative environmental impact on the Mother Earth [1]. It may cause environmental pollution due to its carcinogenic chemical dyestuff and auxiliary usage. There are some new considerable efforts for reducing the ecological hazard and waste generated during textile processing or developing sustainable and green materials [2].

Increasing awareness about sustainability and its benefits in the long run, has a big role to play. Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. Sustainability is the way forward, especially when the issues of global warming and climate change are the Talk of the Town. Therefore, sustainable approach in all process, products and activities has become indispensable for gifting a cleaner, greener, and liveable place for the future generations [3].

One of the sustainable options to mitigate its negative effects on the Mother Earth would be getting naturally coloured cotton through cultivation, same as like 'dope dyed' synthetic fibres; which is dyed during its manufacturing process without the requirement of its afterward dyeing process. Natural cotton fibres come in white colour, is an obvious fact. Compared with white fibre cotton, naturally coloured cotton needs little or no processing and dyeing steps during the textile manufacturing processes, which could eliminate the dyeing costs as well as the disposal of toxic dye waste to the environment. As there are increasing concerns for human health and the world is moving towards for pollution-free organic textiles and products, one of the

promising approaches would be to adopt and promote the usage of naturally coloured cotton fibre for textile clothing.

## Growing Naturally Coloured Cotton Fibres Sustainably

The history of naturally grown coloured cotton dates back to the history of more than 5000 years. It's not a product of any recent genetic engineering or biotechnology. In fact, biotechnology is yet to make a mark on coloured cotton [4]. The species G. barbadense and G. hirsutum were being cultivated in South and Central America as early as 2300 BC **(Figure 1)**

James M Vreeland, who has been researching on coloured cotton, reports in an article in Scientific American (April 1999) that several lint colours have been found in cotton fibres, such as brown, black, mahogany red, red, khaki, pink, blue, green, dirty white and, of course, white are also found in the four species of the genus Gossypium **(Figure 2).**

Naturally coloured cotton fibres that have been grown by the farmers required less amount of pesticides, insecticides as these varieties are insect and disease-resistant and have salt-tolerant qualities as well as they exhibit property for withstanding drought. Organically grown natural coloured cotton have more advantages over conventionally grown naturally grown coloured cotton, as the chemical used for organic coloured cotton are more eco-friendly and environmentally friendly. Biodiversity as well as soil biological activity could be enhanced by organic agriculture. This production is based on the applications of maintaining and improving the ecological harmony. In recent times, brown and green naturally coloured cotton fibres have been successfully grown both conventionally and organically, too.

Figure 1: Harvesting colour in South America

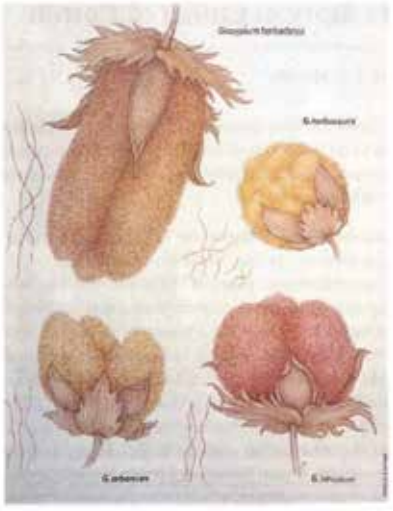

Figure 2: The four species of genus Gossypium cultivated in different colours[5]

## Genetic Engineering behind the Colour of Naturally Coloure Cotton Fibres

The more the society becomes aware about sustainability and eco-friendliness of the products they use, naturally coloured organic cotton fibre (NACOC) has been accepted widely as a conspicuous textile fibre, by the responsible consumers, more than the conventional white cotton fibres **(Figure 3)**. NACOC fibres are being naturally coloured or pigmented during their cultivation with some limited colour shades such as green, brown, mocha and red and their relevant shades **(Figure 4).**

The variety of colour depends on the gene of the fibre as well as on few other conditions like the seasons and geographical locations due to its climate and soil variations [1]. NACOC fibres

Figure 3: Natural white cotton

Figure 4: Naturally coloured cotton

have high resistance to insects and diseases. They have their own limitations too. Further researches are needed for an improvement in the genetic properties of naturally coloured cotton fibres in respect to better yield and better fibre qualities regarding strength, length and micronaire since natural coloured cottons are desired to be more competitive against conventional white cottons [6] 6.

Recent researches have shown improved quality of fibre and yields of naturally coloured cotton by cross-breeding and continuous directional breeding through the application of genetic engineering which requires dissection of the biochemical and molecular mechanisms of pigment composition and formation in coloured fibres [8]. It has been reported, by extraction and composition analysis that the colour in brown fibres may have resulted from flavonoid [6] and gene (GhC4H, GhCHS1, GhF3'H, and GhF3'5'H) expression analysis [7], using expression analyses, indicated that the flavonoid structural genes (GhCHI, GhF3H, GhDFR, GhANS, and GhANR) were involved in the pigmentation, and showed that proanthocyanidins may be the pigments in brown cotton fibres by using dimethylaminocinnaldehyde staining. A comparative proteomic analysis of brown cotton fibres and its near-isogenic line of white cotton fibres have shown that proanthocyanidins (also called condensed tannins) could be the main components of the pigments deposited in brown cotton fibres. They are oligomers of flavan-3-ols, such as procyanidins, prodelphinidins, and propelargonidins, and play protective roles against microbial pathogens, insect attack, and UV irradiation. However, the exact structures and chemical properties of the pigments in brown cotton fibres and the molecular basis of pigment synthesis and deposition remain unknown [8].

## Advantage of Naturally Coloured Organic Cotton (NACOC) Fibres over Normal White Cotton

NACOC has a cost advantage with the elimination of dyeing process in fabric manufacturing. Additionally, instead of colour fading problem which can be encountered in the case of dyed white cotton fibres, the colour of the naturally coloured cotton fibre becomes stronger after laundering. It has also been declared that clothes made from NACOC have been successful for preventing skin diseases as well as protecting skin from ultraviolet radiation. Naturally coloured cotton fibers are one of the more

preferred options for more sustainable, renewable and ecological textile production.

White cotton fiber is one of the most chemically intensive crops cultivated; grown on 3–5% of the world's farmland but it is liable for the usage of 25% of the world's pesticides. For these aforementioned reasons, organically grown naturally coloured cotton fibre has gained lot of advantages over its white counterpart and attracted a massive attention from the sustainability conscious consumers over the last few years.

## Recent Developments

Recently, an important breakthrough was achieved in Australia, and its $2-billion cotton industry is anxiously awaiting new research by the Commonwealth Scientific and Industrial Research Organisation scientists. The plant breeders there have genetically modified cotton to create coloured cotton in black and other rich, dark colours which could become a "game-changer" in the years to come.

Meanwhile, the Government of India was in the process of finalising a pilot-project on coloured cotton involving agricultural universities, cotton research and textile bodies, farmers and the Khadi and Village Industries Commission, Mumbai, National Textile Corporation Ltd. Mumbai and the Federations of Textile Industry and Farmers' Co-operative Societies. This time around, with the government backing coloured cotton, the scenario may be promising for its release and cultivation [9].

## Applications

Naturally coloured cotton has both unique and desirable qualities beneficial to the consumer and the environment. This coloured cotton, being one of the pollution-free, eco-friendly, energy-efficient, cost-effective, nontoxic, novel viable textile material, could be explored in various diversified products. Their application could be translated especially in home textiles, casual wears, upholstery fabrics, where compromised fibre quality is acceptable to some extent [10].


Figure 5: Naturally Coloured Cotton Fibres, Yarn, Fabrics and Garments[11]

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## About the Author


The author is a Textile Engineer by training, an Associate Professor by profession, working currently at NIFT, Kolkata. He holds master's degree in textiles having special interest in textile material innovation in medical textiles and its chemical processing. Air pollution and its effects on human health is an area where the author is actively working on in the recent time. Innovative filter media development is a part of that effort that aims to better human health by providing better personal protection. Alongside, the author enjoys solving real-life problems and designing systems for simplification of processes, especially related to medical textiles.

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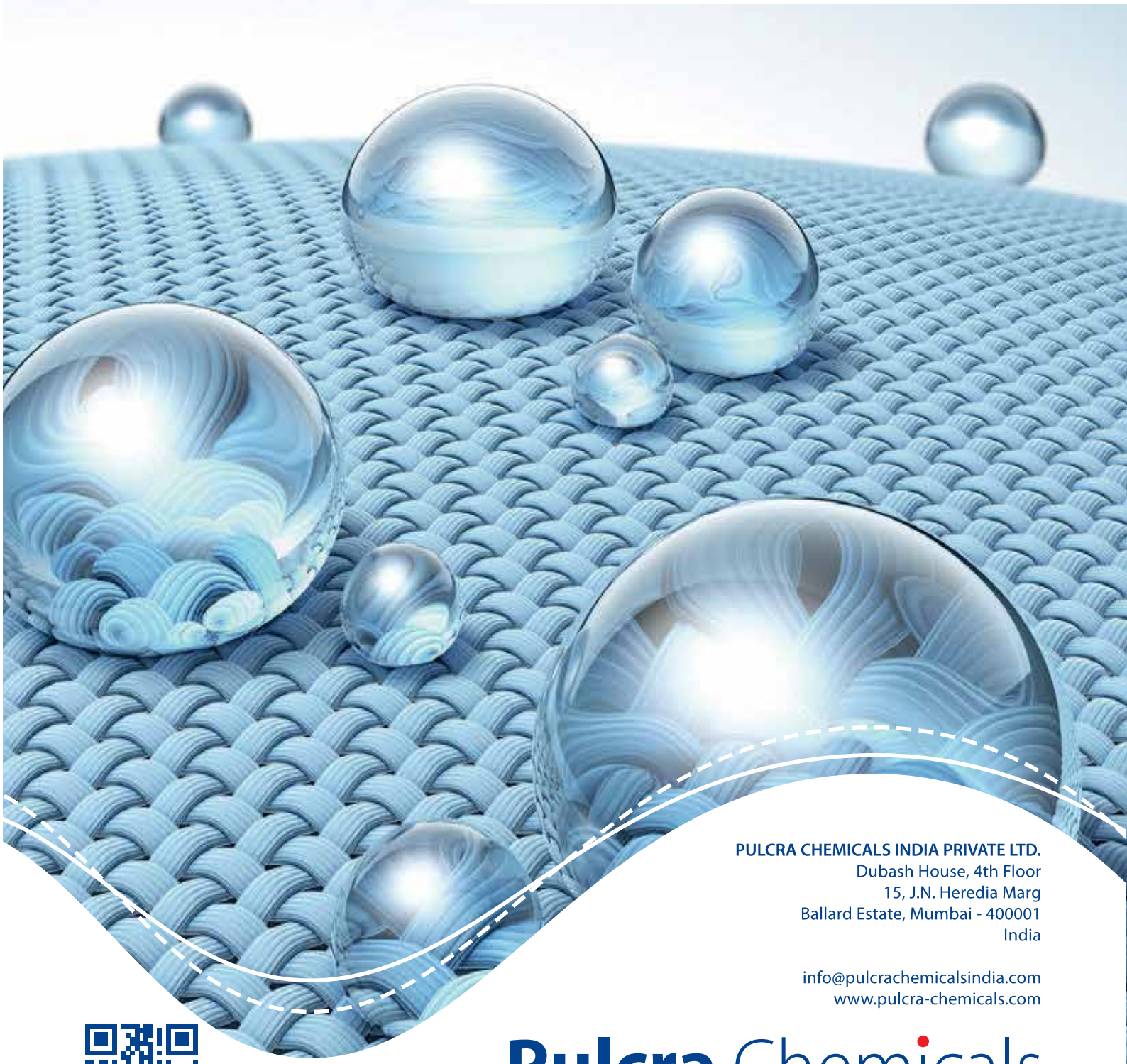

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# A SUSTAINABLE GARMENT – DEFINED IN LAYMAN'S TERMS

**Prasanta Sarkar** | Founder and Content Manager at www.OnlineClothingStudy.com

A few days ago, one person asked me to define 'sustainable garment' in layman's terms. In this article, I will define a sustainable garment in plain terms one can easily understand it.

## Definition of Sustainability

Sustainable means conserving an ecological balance by avoiding depletion of natural resources (Oxford dictionary). Garments are products and apparel items we (human beings) wear to cover our bodies. When a garment manufacturer makes a garment using sustainable materials, makes the garment following the sustainable processes, while taking into consideration of social and economic aspects of employees who were involved in making the garment from fiber to garment, it is called a sustainable garment.

A garment can be labeled as a sustainable garment in many ways. There are many parameters one needs to satisfy before the company gets a certificate for labeling the garment as a sustainable garment. It is true that we cannot make 100% sustainable garments - so instead of trying to make 100% sustainable garments, we can try to improve things to become a sustainable manufacturer and improve our garments' sustainability level.

As a garment manufacturer, you can't control the cotton firming and fibre production, you can't control the weaving and knitting process, you can't control the wet processing and fabric finishing processes to follow sustainable practices. What you can do, you can source sustainable fabrics and sustainable trims (certified materials) for the garments that you will be making in your plant. Follow sustainable practices in your production processes which are possible.

When should one consider a garment is sustainable product (following the definition of sustainable garments)?

**1. A garment made of organic fabrics (organic cotton, bamboo, hemp, jute) is a sustainable garment.** But if the 100% organic cotton garments are made in a sweatshop by underpaid labors and where there is a threat of life (health and safety hazards involved) for workers, the 100% organic cotton made garments are not sustainable garments at all.

**2. A 3D knitted garment is considered a sustainable garment.** When you eliminate some processes from the standard garment making process, it is a step toward making a sustainable garment. The manufacturing process becomes more sustainable – when garments are made with the sustainable process can be called a sustainable garment. For example, 3D knitted garments are considered sustainable - here you make the garment directly from yarn. The 3D knitted garment does not pass through the fabric manufacturing, fabric checking, fabric testing, cutting, fabric processing, stitching. You can map how much energy and resources are used in the fabric to the garment conversion process. When you make a 3D knitted garment using 100% organic cotton yarn, the sustainability level of the item increases.

**3. No wet processing, no dyeing, and no value-added process used can make a garment more sustainable.** If you do not dye the 3D knitted garments or do not print the knitted garments, and if the 3D knitted garment does not go through the wet processing, this garment

becomes more sustainable. Now waterless washing is possible.

Let us consider a garment made of woven fabric, following the cutting of fabrics to the stitching of garments. How these businesses can be defined as a sustainable business.

**4. Are the Khadi items and Khadi garments sustainable garments?**

Khadi fabrics and garments are known as a sustainable product, because of no use or minimum use of natural resources in khadi production – fossil fuel-generated electricity, water, and any form of energy. When the yarn is made by hand (Khadi) and weaving of fabric done by hand (handloom), garments are made by hand or umbrella sewing machines, you cut fabric by hand scissors, you do not use any electricity. Here the garment making process is 100% sustainable.
But if you look at economic sustainability, in most cases khadi may not be a sustainable business. The khadi and handloom industries are not sustainable in the age of fast fashion, where mass production is dominating the manufacturing sector and we prefer to buy low-priced items.
We aim for a better life and for that everyone needs money - so when someone involves in making garments (individuals or companies) they should earn enough money by selling the garment, they should be able to support their family and business growth. If there is no opportunity of earning enough money, nobody will be involved in making such garments. Making hand-made garments don't mean that workers need to work hard than the average workers. In contrast, you cannot meet the market price if you made a garment by hand.

**5. Custom made garments and made-to-order garments are more sustainable compared to mass-produced garments.** In made-to-order, the garment is made when someone needs it. In made to order, you don't hold/block materials for making garments. Less processing of the material. The process is sustainable.

**6. When a garment is made from recycled materials (from the plastic bottles or from disposed of finishing nylon nets, from recycled garments), it is also considered as a sustainable garment.**

Why? Because, you have not used any fresh cotton or other resources for making yarns and fabrics. You recycled the resources (raw material). You have used what is already there as waste, thus it is sustainable. By using waste material and converting it into a garment - you reduced waste in the environment and made the earth clean. Circular fashion is an example of a sustainable garment.

**7. When you make garments using the garment wastes** in the same manufacturing plant, the waste-made-garment is more sustainable compared to the garment made of fresh fabrics. Reason – by using waste materials you stop filling the land by solid waste. Second, you don't use fresh fabrics.

**8. Garment designs** which are made with a least waste generation (no or minimum fabric cutting wastes, no or minimum sewing process. example: Kimono) are sustainable garments.

## Conclusion:

Here, I have explained a sustainable garment from the manufacturer's point of view. When we talk about sustainable fashion or sustainable garment in general, there are many aspects to be considered. You might have seen, these days all brands, manufacturing technology solutions associating their product in making the fashion industry sustainable – from the washing machine, printing machines, CAD system, real-time production tracking systems, dye and chemicals manufacturers, process house, textiles mills all are adopting sustainable manufacturing and sustainable practices.

When you use organic cotton, you need certification from companies/organizations like GOTS. If you use the dyeing process and washing process in the fabric stage and garment washing, there are other certifications like ZDHC.

There are many other factors

that can level up a garment sustainability level.

The definition and requirement change as you apply different sustainable words/terms

- sustainable brand
- sustainable farming
- sustainable product (garment)
- sustainable manufacturing
- sustainable process

I will conclude the topic by asking one question to all readers. Fashion brands are making yarns and apparel products from used plastic bottles. Is this recycling process of plastic bottles sustainable?

## About the Author

Prasanta Sarkar is an author and a fashion industry blogger. He holds a B. Tech degree in Textile Technology from the University of Calcutta (CTTS) and a Postgraduate in Fashion Technology from NIFT, New Delhi.
He worked in a garment export house for two years and in an apparel management consulting firm for two and a half years. At present, he is working at CGS Inc., an IT solution provider for the apparel and fashion industry.
In the year 2011, he started his blog website, www.onlineclothingstudy.com and since then he is writing blogs regularly and sharing his learning on the OCS platform. His blog is helping learners become knowledgeable and informed in the field of apparel manufacturing, apparel manufacturing technology, and apparel supply chain.
As an apparel management consultant and shop floor control system implementation expert, he has visited countries like Sri Lanka, Bangladesh, Turkey, Bulgaria, and Cambodia. He has visited several garment factories in India and in other countries.
He has written and published 6 books including 'Garment Manufacturing: Processes, Practices, and Technology' and 'Industrial Engineer's Digest: A practical guide for engineers in apparel manufacturing.'

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TANTU has created this scholarship to provide financial assistance to the nominated/ selected students to meet the expenditure incurred either partially or fully for to & fro journey either by Rail/Flight in the shortest route, Boarding & Lodging, Logistic support etc. from the institution to the venue for participating the annual seminar. The students will have a hassle-free opportunity to participate in the annual seminar without any registration fee and will also enjoy the facilities & hospitalities made available at the venue during the event. The maximum financial assistance that will be made available Rs.20,000/-(Rupees twenty thousand only) subject to availability of fund with TANTU in the financial year. TANTU has the rights to make any amendment in the proposal whenever it is felt necessary. Four students already availed the scholarship during the year 2018 and 2019. The scholarship wasn't offered during 2019 and 2020 due to COVID and will be available for year 2022 again.

# SUSTAINABILITY IN THE TEXTILE INDUSTRY

**R. Chattopadhyay** | Department of Textile and Fibre Engineering, Indian Institute of Technology Delhi, India

## Introduction

The world is facing many challenges today and these challenges owe its origin to overpopulation, changed lifestyle and greed of the human race. The global challenges that confront us are:

- Global warming
- Water scarcity
- Energy scarcity
- Health & hygiene
- Poverty
- Conflicts
- Terrorism

Various world bodies (UN, WHO, etc.) meet from time to time to discuss the issues stated above. Predictions of deteriorating scenarios are made agreements are signed and action plans are formulated to tackle the issues. However, implementation of the action plan is either not executed properly or carried out slowly. The situation improves marginally, remain almost the same or even deteriorates at times.

Textile industry is one of the biggest industries in the manufacturing sector and contributes significantly to the GDP in developing countries. Without textile human civilization is unsustainable. With increased population, economic development, and leisure activity the consumption of textiles is growing. The pressure to produce more is never ending. In the context of above mentioned challenges, it is important for the textile industry to play its part to mitigate the problems and make meaningful contributions. The industry needs to ponder and look for sustainable solutions which are the need of the hour.

## Sustainability

Sustainable supply chain has emerged as a new field of focus for firms and governments. It encompasses

- economic development,
- environmental performance and
- social betterment

The drivers for going green are

(1) consumer demand driven green initiatives

(2) cost reduction through greening

(3) price premium potential through greening and

(4) government regulation-driven greening.

According to the Brundtland commission [1] of the United Nations, sustainable development is the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.

There are three aspects to sustainability such as:

- environment,
- society and
- economy.

The objective of environmental sustainability is the preservation of nature and the environment for future generations. Economic sustainability means developing business practices which provide a sound basis for income and wealth without over exploiting resources such as raw materials, energy or workforces.

Social sustainability means to create and maintain the well-being of a community as a whole. The integration of all members of the community into this process is a prime concern, therefore.

The relevance of sustainability issues to all those involved in the production and care of textiles are due to the fact

that the textile industry employs a huge labour force that includes women & children and many of them are vulnerable to exploitation and there is a scope to easily pollute the environment.

In some countries, the garment industry has created a situation in which the economy hugely becomes dependent on it, destroying traditional economic & social structures. It can be the source of considerable social unrest in case the manufacturers decide to shift production to locations where cheap labour is abundantly available.

In the future, shortages of resources will create the need for increased sustainability in the textile supply chain [2]. The availability of natural fibres such as cotton, linen wool etc. will decrease to meet the rapidly growing global demand. Countries like China, Brazil and India will be claiming an increasingly large proportion of the cotton harvests for their own use. A ruthless exploitation of nature is to be expected for meeting part of the global demand for textile fibres especially cotton and production will have to be expanded. As a result, there will be depletion of water resources, degradation of soil quality as well as health of farmers in most cotton producing countries.

Stakeholders of the textile and garment industries will be required to implement long-term sustainability concepts considering the complex, interconnected nature of the global economy as well as social and environmental aspects. Whole supply and processing chain will need to be involved.

In the context of supply chain circular economy and supply chain management needs to be integrated. Circular economy is basically an ecological economy with 3R principles i.e. Reduce, Reuse and Recycle.

- Reduce refers to minimizing the amount of substance in the processes of production and consumption.
- Reuse means to extend the time intensity of product and service.
- Recycle means to regenerate renewable resources after use.

Green supply chain management changes the idea of “treatment after pollution” and gives importance to the concept of “reduction of pollution at the source, prevention first, treatment second” mainly at the design of the product and purchase stages.

## Global warming

Global warming is due to accumulation of CO2 generated through burning of fossil fuel which acts as a blanket trapping heat of the earth. An increase in global average temperature by 20C in comparison to what existed pre industrial stage can cause severe problems for mankind. It is stated that over the last century the global average temperature has increased by Temperature 70° C. The consequences of warming are change in rainfall and snow patterns, increased droughts and storms, melting of glaciers and increase in sea levels. Melting of polar ice, abrupt change in weather, torrential rain resulting in flood, tsunami etc. are frequently reported. All these natural phenomena bring a lot of misery to the inhabitants of earth.
Carbon Footprint is a measure of the relative global amount of carbon dioxide (CO2 in Kgs or tonnes) and other greenhouse gases emitted by a human activity or accumulated over the full life cycle of a product or service. As an example, 1 kg of oil when it burns produces up to 3.3 kg of carbon dioxide (CO2).
All industrial activities have some contribution to this global warming. Textile Industry is one of the worst contributors to Global Warming. As an example, the resources requirement for 200 g Cotton T-Shirt:

- 50 Liters Water in industrial processing
  2000 Liters Water in agriculture
  4 $m^2$ of land
  5 kWH energy
  4 kg steam
  0.4 kg chemicals
  CO2 emissions : 10 Kg
  i.e. 50 times its own weight

Up to 60 billion kg of textile goods processed per year worldwide and the consumption is increasing due to increase in population and increased economic

status of people in many developing economies.

## Water

Water continues to be of crucial importance for the sustainability challenges for the textile industry. The textile printing and dyeing process is highly water intensive and generates a lot of wastewater, which contains various pollutants, including toxic chemicals. Water and energy efficiency, waste management including air emissions, waste water and solid waste are identified as the key themes of all interventions. Water required for cotton textile wet processing Processes Water requirements in L/1,000 kg of products [4]

We must reduce, reuse and recycle water in order to reduce the negative impacts to the environment, but also to save the costs of freshwater intake and wastewater treatment. Some of the suggestions are [5]:

- install caustic soda reclamation equipment with more efficient steam-water ratio of 1:4
- Installation of energy efficient steam traps
- Recycle cool water, condensate. Condensate
- generated from the dyeing process and drying cylinder in sizing can be stored in a well-insulated storage tank, for reuse in the washing process.

  Installation of water efficient dyeing machine which work with relatively low liquor ratio of 1:5 Installation of water efficient dyeing machine which work with relatively low liquor ratio of 1:5
- Maintain steam traps.

| | |
|---|---|
| Desizing | 2,500–21,000 litre/100Kg |
| Scouring | 20,000–45,000 litre/100Kg |
| Bleaching | 2,500–25,000 litre/100Kg |
| Dyeing | 10,000–300,000 litre/100Kg |
| Printing | 8,000–16,000 litre/100Kg |

**Figure# 1 plant are**

Further new technologies need to be adopted such as [6]

- Waterless dyeing technology has been under development for several years. Use of recyclable carbon dioxide (supercritical CO2) as the application medium to infuse colour into fabric instead of water.
- Digital textile printing is a very clean process that minimizes waste and substantially reduces water and energy consumption. It is now becoming cost-effective for higher value fabrics. It allows mills to print an almost unlimited array of colours and complex patterns in short runs.
- Perhaps even more promising, is the range of reactive dyes for cotton and cellulosic fibres using technology that assists them in getting absorbed by fibres much faster and uses less salt and less water during dyeing and the washing process.

## Energy

The major area of energy saving in a textile industry are

- Ring spinning
- Humidification plant
- Electrical distribution network
- Compressed air distribution

To produce 1 kg of yarn, on an average 8.45 units of electricity was consumed during the year of 2010. The textile industry uses a vast number of electric motors. Many modern machines utilize multiple motors with a control board for controlling the movement of different parts of the machine. Most electrical motors are designed to run at 50–100% of rated load. Maximum efficiency is usually near 75% of rated load. A motor's efficiency tends to decrease dramatically below about 50% load. Overloaded motors can overheat and lose efficiency. Generally, the motors at the industry are oversized and run below the 50% load. Therefore, it is advisable to change the motors with appropriate size.

According to Harun Kemal

Ozturk [7], about 24- 27% of total electricity is consumed by HVAC systems for the factories. For the energy saving and use of energy efficiently, recommended guidelines should be followed closely so that too much fresh air is not introduced unnecessarily. Also, some conditioned air after filtered can be used with the fresh air to reduce the electricity consumption. Various causes of energy loss in a chemical processing

- through hot water discharge
- through leakages of steam and hot water and improper maintenance
- loss from the pipelines and machines due to lack of insulation.

  For steam transportation over long distances, low pressure and large-diameter piping should be preferred to high pressure and small diameter.

The other means could be to recover heat from hot water, hot air, improve boiler efficiency, maintain steam traps and system, insulate equipment and tanks, fuel savings from reuse of condensate, leak detection, reuse of process and cooling water, preventive maintenance, improved cleaning. Typical Specific Energy Consumption (kWh/kg) for yarns with different yarn counts and final use is shown in Table 1.

According to DEFRA (Department of environment, food and rural affairs, govt. of UK), a comparison between different fibres is stated in Table-2. Synthetic fibres need more energy than textile goods made from natural fibres. They however need less water. It is difficult to say which fibre has minimum environmental impact as textiles made from natural fibres need more water and land.

**Table 1: Typical Specific Energy Consumption (Kwh/Kg) [8]**

| Yarn Count (Tex) | Combed Yarn | | Carded Yarn | |
|---|---|---|---|---|
| | Knitting | Weaving | Knitting | Weaving |
| 37 | 1.38 | 1.63 | 1.34 | 1.62 |
| 33 | 1.58 | 1.88 | 1.54 | 1.86 |
| 30 | 1.79 | 2.12 | 1.73 | 2.09 |
| 25 | 2.19 | 2.60 | 2.11 | 2.55 |
| 20 | 3.06 | 3.64 | 2.96 | 3.57 |
| 17 | 3.89 | 4.62 | 3.74 | 4.53 |
| 15 | 4.42 | 5.25 | 4.23 | 5.12 |
| 12 | 5.52 | 6.81 | 5.52 | 6.72 |

| Table-2: Comparison of environmental impact for different fibres [8] | | | | | |
|---|---|---|---|---|---|
| **Decreasing environ impact** | Energy use | Water use | Greenhouse gases | Waste water | Direct land use |
| | Acrylic | Cotton | Nylon | Wool | Wool |
| | Nylon | Silk | Polyester | Viscose/ modal | Ramie |
| | Polyester | Nylon | Lyocell | Bast fibres | Cotton |
| | Viscose modal | Viscose / modal | PLA | Nylon | Flax |
| | PLA/ cotton/ lyocell | Acrylic | Viscose | Polyester | Hemp |
| | Wool | Hemp | Modal | | Viscose/ modal |
| | Hemp & flax | Wool | Cotton | | Jute |
| | | Flax | Bast fibres | | PLA |
| | | Polyester | Wool | | Lyocell |

## Poverty / conflict and terrorism

One of the reasons for conflicts and extremism is poverty due to non-availability of jobs for the youth. The youth should be made employable to be absorbed and there should be enough job opportunities for them. The country has to use its resources to create jobs that suit the capability and skill of the people. Agriculture, construction of infrastructure and textile and garment industries can provide plenty of jobs and accommodate unskilled, semi-skilled and skilled workers.
Higher the employment generation, higher will be the incentives. 1 billion dollar turnover in textile exports creates over 1 lakh direct jobs in Garmenting and Home Textiles, far higher than all the number of jobs created while assembling/manufacturing electronic/mechanical items or Pharma Chemicals [9]. The manpower requirement in the textile industry by 2022 is estimated to be 26.2 million [10]. According to Indian brand equity foundation [11], the manufacturing sector employs 12.0 per cent of the country's labour force. The sector has a multiplier effect for job creation in the services sector. According to National Manufacturing Policy 2011, every job created in the manufacturing sector creates two-three additional jobs in related activities. Wood, paper products and textile industries tend to be more labor-intensive and require a large workforce, mostly unskilled or nowadays semi-skilled with no special qualifications. It is possible to absorb surplus unskilled workers by investing resources in the Textile & clothing industry.

## Conclusion

To summarize the discussion

- Global warming is a reality and needs to be slowed down if not to be reversed.
- Textile industry and all those involved with textiles must make efforts to make meaningful contributions to sustainable development by reducing energy and water wastage, developing energy and water efficient & cost effective technologies and using alternative energy.

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## About the Author

Dr. R. Chattopadhyay, FIE graduated from the University of Calcutta in Textile Technology and there after obtained his M. Tech and Ph. D degrees from IIT Delhi in1980 & 1984 respectively. He has handled many administrative position in IIT Delhi such as Head, Department of Textile and Fibre Engineering, Professor In-charge Planning, Chairman JEE, Professor In-charge QIP/CEP, Warden Aravali hostel. He is involved in teaching, research, consultancy, organising seminars & tailor made courses for industry and academia. Prof. Chattopadhyay has guided 14 doctoral and 68 master theses and has more than 149 research papers in national, international Journals and conferences.

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# A TALE OF A TEXTILE ENGINEER

**Sanjib Kumar Sinha** | Head-Quality Assurance, Vishal Megamart, A corporate retail group India

*"Traveler change karwake room pe jana!"* Mukherjee da started shouting at me. He just arrived on the spinning floor after having a good breakfast.

I knew it, he has a very good 'U' shaped tummy like a traveler and is always lethargic and negative while he talks. I don't have the option of a good breakfast. I completed my night shift by 6 AM but shift handover *"lafra"* and other formalities are so long that I can only finish my duty by 9 AM. This is the time when all day-staffs like masters, superintendents and others usually roam around in the shed.

I walk down toward my room, constructed in the mill campus only, specified for bachelors. From the room, someone can see the beauty of discarded drums, huge stocks of boiler fuel and feel the continuous melody of spinning machines running. Usually, there is no lock in my room, so I entered the room without unlocking and sat on the bed (sorry! a chair or a stool were fantasy) and take a deep breath "I am a textile engineer."

Spinning, by textile terminology, is a process of drawing out fibres from the bale and twisting them together to form a continuous thread or yarn. Since I studied the textile, I put myself into the whirlpool vortex (this is the unconventional spinning process by which direct fibre sliver can be used for yarns) with lots of dreams, thinking, degrees and expectations, finally twisted all these aspirations to make myself a textile engineer thread.

I knitted my all relationships and dyed myself into a colored engineer boy to market myself for a luminous marriage. The girl's father was very happy to know that the boy is an engineer (stream omitted), surely not very sure about the textile as it was unknown in the 19th century, and was very willing to knot the tie irrespective of the family's economic situation.

However, the irony is I had to surrender myself that my salary is very poor. I do not have normal office duty. I worked at night like a security guard, and I don't know when I can stand on my feet. After realizing this lot of unpredictability, they decided to go for a decent teacher as the bridegroom.

I was spared!

The spinning process starts from blending, followed by carding, combing, slivering, and finally imparting twist to form final yarns. Finally, I understand there are two kinds of twists, S & Z. While I am on duty, I always go in the S direction.

I would like to throw some examples here. Some of them are finding the jobber, mechanics, final spinner, doffers etc. who all will be always out of the shed and these kinds of creatures are generally found in the canteen or roadside from where you have to go in S direction and call them in the shed for their respective jobs.

Being the supervisor, I have all the responsibilities without any power. If anything goes wrong, Bhaduria-ji (Spinning-super boss) will be banging with all kinds of slang on me. If things go well, Mukherjee da will be taking all appreciation and advising to follow his instructions always for achievements. Finally, the irony, the Z-direction was my family, they do not have any idea of sweet S. For them, life is just straight for an engineer, like Z- in all directions is straightfamily, marriage and good life.

The real twist was imparted while I decided to quit my core textile job (spinning, weaving, dyeing and so on) wanted to explore something different. Few seniors started apprising me of my decision as they really failed in this journey. Few were very low, like the "3 Idiots", If you don't want to work for the textile

field then why you did textile study. Who will tell this 4th idiot that I did not have any idea while I ranked in the Joint entrance exam (JEE) some 25+ years ago and that rank decided me where I am today.

My father was not at all happy as I didn't go for civil engineering, which is known as real engineering in my village. "Kaporer abar ki engineering (what is this cloth engineering)" my father chatted with my mother after counseling. I chose this because there was one god, standing in the counseling venue, named "Swadesh Shett", who as stranger, started talking with my father and suggested for textile- there will be always job! And, yes, he was correct, the job market is very good and now I am here in my room, resting on the bed with lots of cotton polyester fiber in hands and on head.

Fortunately, GATE has given me a chance for admission in my college after lots of comforts, speculations and research. I was happy as I don't want to stay outside Bengal. I negotiated with the spinning department for all night shifts for the entire 2 years and did parallel M. Tech. A few days' in the hostel, a few days in spinning, discussion on my future were going good at Z direction.

Suddenly, I took Rs. 300, loaded me in Purva express and landed in New Delhi Railway Station. Real life!!! Started from there. Hide and seek game at IIT hostel, on and off railway station and night shelter at roadways, buses were the honeymoon time at the capital!

This is called Destiny!

I started a job in the hardline division (textile readers, who do not know what hardline is: It is non-textile consumer products like plastic, wood, metal, etc..) as a senior engineer (Testing). Irony, no way, no link with textile jobs! The main job was to test the metal ceramics, wooden, glass and plastics. I shared these activities/jobs with a few other textile engineers as well.

It was published in the media that textile was the second largest employer after agriculture with US$40 billion in 1998 and over 20 million directly employed and contributing 5% GDP!

Being a textile engineer though, I was kicked out of a textile job. The real twist started, when a BA degree holder left the textile testing trainer job for Dubai- organization transferred me to his position. Understood that, I have been included in that 20 million direct employees for textile. After that, the organization went on adding lots of profiles for me, like testing engineer, fabric inspector, garment inspector, multi-skill inspector, compliance auditor, manager, regional manager, and so on.

One thing was very clear, I didn't decide what I wanted to be, the situation pushed me into where I am today. The wah factor of textile is very attractive. It is said (several textile journals) textile Industry in India is one of the largest in the world with a very large base of raw materials. Approximately, 3400 textile mills are having installed capacity of more than 50 million spindles and 8 lacs rotors which is the second largest in the world. Textile is the single largest industry in India amounting to about 20% of the total industrial production. It provides direct employment to around 20 million people.

Textile and clothing exports accounted for one-third of the total value of exports in India. So, I was secured and happy being involved in the textile community at last. This textile journey was not at all smooth. I have been through lots of office politics, language barriers and stress. 4 years out of 25 years of my textile journey was into the apparel and allied part, which have now become the core of my experiences.

I know now how to twist the facts, how to manipulate the game and how to downgrade someone's credibility for survival. Sounds good? No, these are the games. I have been treated by several sources during my job tenure. A few learnings that I would like to share are-

(1) Do not believe your boss that he will try to increase your salary,

(2) Even if you do a good job, make sure this is well recognized and someone should not take away the credibility,

(3) Even though you are honest, you never know who is doing dishonesty in your name - it can be even your immediate

boss or your subordinates,

(4) If you get challenges, speak out,

(5) do not treat office colleague as a family member or friends,

(6) do not think that all the data are very important, and you can take this for your next job, all are useless,

(7) take leaves and do not compromise your family life - at end of the work duty, everybody will forget your dedication,

(8) people will respect your chairs, once you leave, the person you helped, will start poisoning first,

(9) most of the textile friends/senior will not help you for finding a good job for you, and

(10) think about retired life and health.

At the end of my 25 years' textile journey, I was introspecting what I achieved and what I lost. I am not ridiculing my journey but "what I wanted to be" was not dominant on "you can't decide your destiny."

Therefore, if you opt for textile technology (still not clear why few other universities are offering this as textile engineering), you will be automatically thrown into the sea of education and you have to come along with your hard work and dedication to reach an unpredictable destiny. This is very true for most of the textile engineers.

Am I happy?

Finland is the happiest country in the world while India is all the way down at 133. There is no survey whether a textile engineer is happy, and if they are happy, how happy they are, and what's the rank in that happiness index?

This is one of the good research topics that someone can explore.

However, recently with limited conversation and discussion with 20 odd textile professionals, I found 2 are those in the textile service sector who are ready to let their kids explore into textile segments whereas the rest came up denying with a word "No" if possible.

Can I be a good mentor?

Yes, a textile engineer, especially the maku category (maku: real core textile professional), knows everything in the world. They are kick busters, friends, philanthropists and all-rounders. They can have food in a rickshaw stall to a 5-star kitchen. They become the stronger mentors when they find juniors with them. They have the ability to digest all tragic moments in the office, shed, and finally at home!

**Few questions & answers are added here as part of the conclusion.**

---

**Q: What would have been the fate, if I didn't choose textile?**

A: Job-less or having more money

**Q: What is the marriage market value of textile engineers?**

A: For non-textile families, it is unknown and not good. For textile families, it is better to hang till death.

**Q: What relationship do textile engineers believe?**

A: Semi-complicated

**Q: Would you like to be reborn as a textile engineer?**

A: Situational. If born in Bangladesh, yes.

**Q: Why are most textile engineers found with a 'U' shaped tummy?**

A: They eat everything during conferences and with buyers during mill or factory visits. They compete with themselves and make records every time.

**Q: What is the rank of textile engineering among all other engineering?**

A: Not established yet.

**Q: Why recently, a good percentage of textile engineers is found in the IT jungle?**

A: They all were confused and did not read real textile technology.

**Q: Why did I do textile engineering?**

A: By luck.

**Q: When do textile engineers post photos on FB?**

A: While on an official tour or dinner.

**Disclaimer:** This is purely motivational writing based on real-life situations. No way, this can be replicated or will be happening with anyone in any form. So read this very carefully.

## About the Author

Dr. Sanjib Kumar Sinha, having experiences of 26 years in manufacturing and service industries in several international and domestic clients and retailers. He pursued doctoral (Phd) from IIT, Delhi. He published several articles in international journal and delivered seminars on different platform. He completed several training courses, few are ISO 9001-2000 Lead Auditor, ISO 14000/ 14001, SA 8000 Advance etc. His main working area are on strategic planning (Quality Assurance), risk assessment & analysis, resource management, internal audits, supplier management, continuous process improvements, displayed excellence in managing social compliance, product safety, integrity audit and technical audits for key US, EU and domestic retailers /clients and standard like ETI, Sedex, SA 8000. Further exhibited leadership in extending support to premier clients, he fronts led the quality assurance process and customer service, while, identifying improvement areas with focus on profitability & customer satisfaction by ensuring optimal utilization of resources.

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# SUSTAINABILITY ISSUES OF TEXTILE WASTE IN THE UNITED STATES

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## Introduction

It is important to recycle and reuse textiles because Americans alone produce 14 million tons of textile waste a year. This waste piles up in a landfill, and the majority of it is not biodegradable. With fast fashion in full swing, consumers are always shopping the latest trends, wearing them once or twice and tossing them the second when something new & exciting is released. These patterns are toxic for our culture because waste doesn't just disappear, it has lasting impacts on our environment and future population. Recycling and reusing textiles put clothing in a circular economy, which encourages consumers and producers to take what they have and turn it into something new. Companies around the globe are working to find ways to take old textiles and - turn them into something that can be used again or, breaks down into the earth. If we do not act now and educate ourselves on these issues and make active changes in the way we shop, recycle, and produce clothing landfills; there will be lasting impacts on our environment.

## Literature Review

### Environmental Issues in the Textile Industry

It is no secret that we are currently facing many environmental issues that impact the climate, vegetation, and the health of people & animals around the world. Now, more than ever, we are seeing people standing up in protest of unsustainable practices; many people are turning to veganism to stop the killing of animals, there are people buying clothing from sustainable and ethical brands and ditching fast fashion, and there are people that are standing up for human rights. As more and more people become informed about environmental issues, we are seeing more information and statistics are being released to the public in order to criticize companies that go against these new standards. It has become very clear that there are many issues surrounding the textile industry, but the most talked-about issues are the ethics and the environmental issues surrounding the production of textiles.

The textile and clothing industry is one of the most global industries in the world and is worth around one trillion dollars (Desore & Narula, 2017). Every person has had contact with the textile industry in one way or another- everyone has owned a shirt, a pair of pants, a rug, a dishcloth, anything that requires fibers. According to Desore and Narula (2017), the textile industry "is considered as one of the major reasons for pollution worldwide." This industry grows crops that require large quantities of water, uses dyes that can contaminate water, uses finishing processes that can leave a lot of dust in the air and pollute it- among many other dangerous practices. The environmental issues do not start once the fibers or crops get to the factories; the issues actually start when the crops are being grown. Some crops are grown using pesticides or fertilizer, which can be harmful to the environment or to nearby animals. Cotton in particular requires an enormous amount of water to grow, so there is an issue of water waste before the fiber has even entered the factory. For every 1.5 pounds of cotton, approximately 1,500 gallons of water are needed to grow that cotton.

The issue of wastewater is also very important when discussing the textile

industry. There are many chemicals that are used in this industry in order to dye fibers or yarns, to create different designs on fabrics, or to apply certain finishes to the fabrics. Dyes are actually one of the more important and relevant pollutants. "Worldwide environmental problems associated with the textile industry are typically associated with water pollution caused by the discharge of toxic chemicals especially during processing" (Khan & Malik, 2013). One of the larger issues regarding pollution by the textile industry is that of water contamination. Because this industry utilizes as many as 2,000 chemicals and lots of water at every stage in the process, there are huge amounts of water being contaminated and thus polluting surrounding bodies of water. During the dyeing process, in particular, large amounts of "dyestuffs is released due to inefficiencies in the dyeing process and is directly lost to the wastewater, which ultimately finds its way into the environment" (Khan & Malik, 2013). There are some companies that have found ways to reuse the wastewater after it has been filtered and cleaned, but the technology required to do so is extremely expensive and not a luxury that every company can afford.

Textile effluent is, as defined by the United States Environmental Protection Agency, "wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall" ("Effluent," 2020). In a study conducted by Mondal et al. (2017), the researchers noted that there are three major pollutants found in textile effluent- these include color, solids, and toxic metals. The color pollutants include any presence of color in wastewater; most dyes are "stable, not easily degradable and are unaffected by light" (Mondal et al., 2017). Color pollutants and dyes are some of the main issues regarding environmental safety in the textile industry. The solid pollutants include inorganic sodium salts that are used in the various processes of creating textiles. The salts used during the processes increase the level of total dissolved solids (TDS) in the textile effluent. Unfortunately, these dissolved solids are not able to be removed using conventional treatment according to Mondal et al. (2017). The third category refers to toxic metals, which may come from some impurities in chemicals, from a finish used during processing, or may come from dyestuffs.

A lot of issues regarding environmental safety and protection in the textile industry stem from a lack of or, weak policies. For example, India was the first country to discuss the protection and improvement of the environment in its constitution, but the legislation is poorly enforced (Chavan, 2001). Chavan (2001) gave a bold and interesting perspective on environmental policies regarding the textile industry: "Making law only does not help. Environment is a social responsibility. Desirable compliance should come voluntarily from the industry and not by enacting policies." Basically, Chavan is stating that companies in the textile industry should want to be sustainable and environment-friendly, that is not something that you can force on people. If you try and force someone or enact strict policies that they may not want to follow, then they will try and find loopholes or easy-way-out.

In their study, Chavan (2001) classified wastes generated in the textile industry into four different categories: hard to treat, hazardous or toxic, dispersible, and high volume wastes. Hard-to-treat wastes include color, metals, phenol, toxic organic compounds, phosphates, non-biodegradable organic materials, and more. These are classified as hard-to-treat because they "resist biological effluent treatment process, pass through standards activated sludge systems and produce aquatic toxicity" (Chavan, 2001). The next category is hazardous or toxic wastes, which are technically a subgroup of hard-to-treat wastes; this category includes metals, chlorinated solvents, non-biodegradable surfactants, and volatile organic materials. The dispersible category consists of "waste stream from continuous operations, print pastes, wastes from back coating operations, batch dumps of unused process chemicals, etc." (Chavan, 2001). The final category, high volume wastes, is comprised of elements like wash water from prepping, dyes and printing operations, and dye baths.

**Textile Waste and Recycling Procedures in the United States**

The textile industry is the world's second-largest polluter, behind the oil industry, and the number one polluter of water. With the United States being one of the largest importers of garments, they produce a lot of textile waste. The United States is responsible for more than 15 million tons of used textile waste generated each year, "and the amount has doubled over the last 20 years" LeBlanc, R. (2020, November 6). From the year 1960 to 2018 the amount of waste that ended up in a landfill went from 1,710 tons to 11,300 tons Environmental Protection Agency. (2020, October 7). The Environmental Protection Agency estimated "that in 2017, of the 16.9 million tons of textile waste generated in the United States, only 15.2% was recycled, which resulted in 11.2 million tons of textile waste ending up in landfills Environmental Protection Agency. (2020, October 7).

With all of this waste being produced, the textile industry produced almost 8% "of manmade CO2 emissions in 2015" Microlambert. (2019, January 20). Not only do the textiles themselves produce a lot of pollution, the process of making them and producing garments also adds to the pollution. The process takes a lot of energy and pollutes a lot of water. The article by Common Objective states that "the energy used in manufacturing, transporting, packaging and selling a garment all make a contribution to its emissions footprint" Microlambert. (2019, January 20). And "according to the World Resources Institute, it takes 2,700 liters of water to make one cotton shirt" Brown, R. (2021, January 8). Once these textiles are thrown in landfills, they can take a great amount of time to decompose, however, when they do, natural fibers "may release methane and CO2 gas into the atmosphere," and synthetic fibers "may release toxic substances into groundwater and surrounding soil" LeBlanc, R. (2020, December 30). This is not only harmful to our environment and adding to climate change, it is also harmful to humans and their shortage of clean drinking water & good soil to grow agriculture items.

While recycling has become something people are more knowledgeable about, it is still something that needs to be more prioritized. Many people recycle now by taking it to their local textile recycling programs or take it to secondhand shops, but a lot of the time the clothes that are not taken will still end up in landfills. However, to help with the waste, brands can start to incorporate a few more steps to further reduce the effect that textiles have on the pollution of the earth. They can start by switching their virgin fibers to recycled material. They can cut down on the amount of energy and water they use during the process of making the fibers and garments. They can help educate consumers about recycling and reusing their clothing and "invest in systems to re-use rather than throw away clothes" Microlambert. (2019, January 20). And they can help change the trend around the culture of fast fashion. Microlambert. (2019, January 20). Many companies such as Patagonia, H&M, Madewell, The North Face, and Ecoalf are starting to make changes and are "working to fight textile waste" Brown, R. (2021, January 8). We just need more brands and people to join in on this fight and help reduce the amount of pollution that is created each day by the textile industry.

As mentioned earlier in this manuscript, the textile industry has already started to move into a more sustainable process after several environmental concerns have recently arisen. Yet, even with the improvement of methods or the process used when creating textiles the overall industry still has a huge effect on the environment. Globalization and automation are two huge factors of the industry that will most likely stay the same in futuristic years according to many statistics.

On the other hand, society has a big impact on the style of clothing creating mass production which increases leftover textiles. With education on the matter, current and future generations will be aware of these impacts and keep them in mind when they are purchasing textiles.

With this being said, the industry will reflect on their consumers' choices

becoming more efficient and environmentally cautious furthering the safety of citizens.

Alongside the improvement of methods to reduce the amount of textile waste technology is continuing to advance the methods as well. Smarter technology systems are being produced to reduce the amount of electricity used and gases emitted. With such advancement in only a few years, future technology is going to be incomparable. Although there are still many challenges linked to the textile industry based on what has been accomplished in the mere years of sudden concerns, the advancement of the industry as a whole in futuristic years will be unimaginable in the best way.

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## About the author


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# SUSTAINABILITY, NO LONGER AN OPTION BUT A NECESSITY

**Subhadip Dutta** | Country leader of CI, lean management & axis leader of industry 4.0 in Decathlon

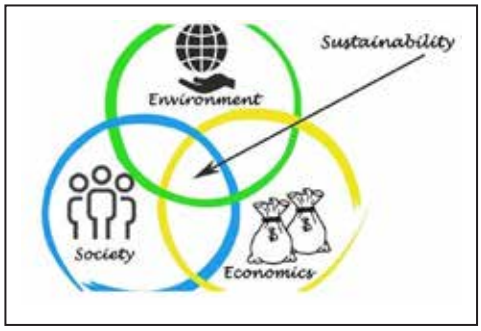
Sustainability is a trending word in today's world. But what is it exactly? What's the holistic meaning of this word which is creating a paradigm shift in world of manufacturing and retail? The textile & apparel industry isn't exempted from this.

In academic sense sustainability means avoidance of the depletion of natural resources in order to maintain an ecological balance. Hence in business perspective it can be said that "sustainability is a business approach to creating long-term value by taking into consideration how a given organization operates in the ecological, social and economic environment. Sustainability is built on the assumption that developing such strategies foster company longevity".

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

What are these 17 SDG it's talking about?

What are the goals where the industry can contribute directly to preserve the only planet that we have so far & create profitability, create value? Please find below the list, where on multiple points In this article, I will focus related to the industry responsibilities.






## Sustainable Development Goals:

- Goal 1. End poverty in all its forms everywhere
- Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 3. Ensure healthy lives and promote well-being for all at all ages
- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- Goal 5. Achieve gender

equality and empower all women and girls

- Goal 6. Ensure availability and sustainable management of water and sanitation for all

- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

- Goal 10. Reduce inequality within and among countries

- Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

- Goal 12. Ensure sustainable consumption and production patterns

- Goal 13. Take urgent action to combat climate change and its impacts*

- Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

- Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

Now let us elaborate on each of the directly relevant goals with actionable points for industry in general & textile/apparel sector in particular as below:

**Promoting gender equality & empowerment of women**

Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in the hierarchical ladder in industry. To benefit from the collective intelligence & empowered participation in solving problems & eliminating/reducing wastages from our value chains, gender equality is a must. It's an essential element to have an equitable, bearable & viable development of our businesses.

**Promoting availability & sustainable water management**

We need to improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse.

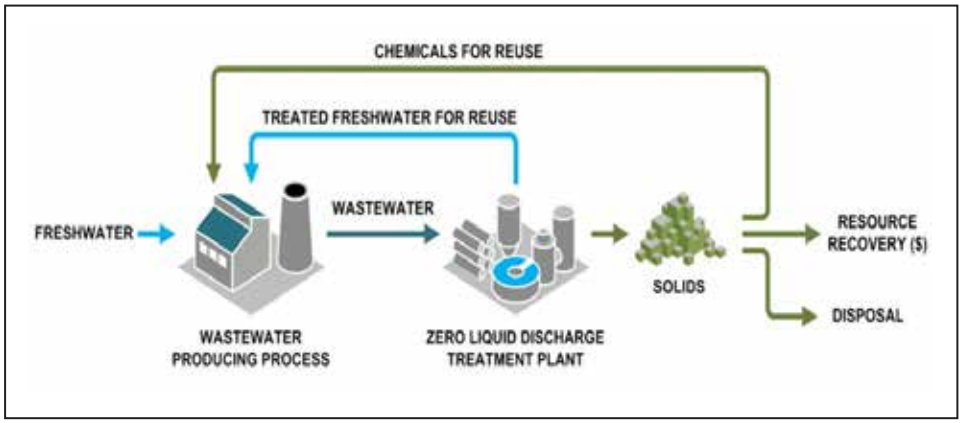
For this ZLD (Zero Liquid Discharge) is one of the most effective concepts currently deployed especially in dyeing & finishing plants in textile & apparel industry and in general also. ZLD is an engineering approach to water treatment where all water is recovered and contaminants are reduced to solid waste. There are some startup companies in India who are proving industry 4.0 ZLD solutions facilitating digitization & automation.

**Promoting sustainable and modern energy impacting climate change**

It's essential now to explore RE (renewable energy) solutions. RE is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale, including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat.

The trend of energy offset or installing solar panels and wind turbines to generate energy is picking up. Offsetting your electricity usage involves reducing the carbon emissions. The cheaper and easier way is to purchase RE credits, or RECs. Using a single, cloud-based platform, Resource Advisor

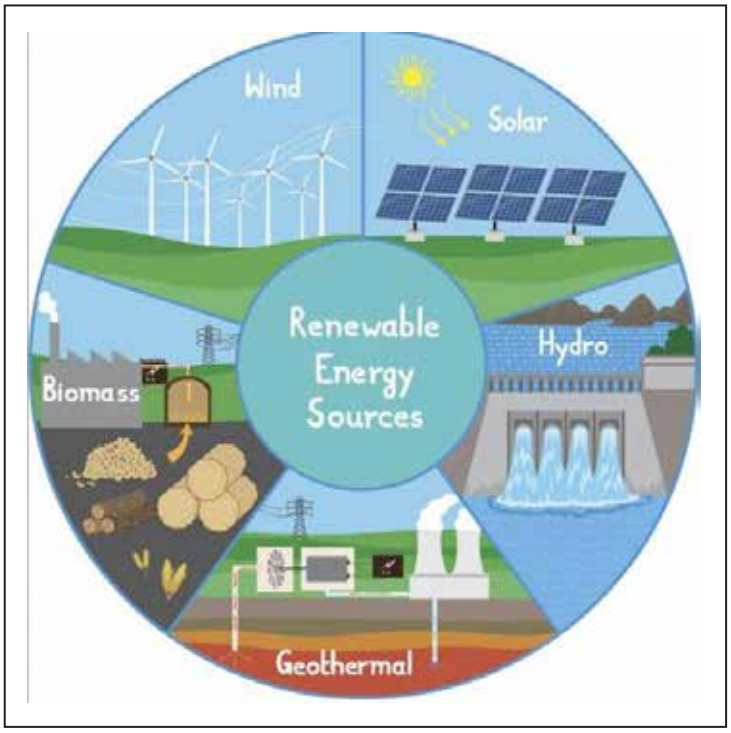
allows you to analyze sustainability metrics in one place. SBTi provides a clearly-defined pathway for companies to reduce greenhouse gas (GHG) emissions.




**Promoting sustained, inclusive and sustainable economic growth, full and productive employment**

Worldwide discussion is picking up on living wages against the minimum wage concept. A living wage is defined as the minimum income necessary for a worker to meet their basic needs. Needs are defined to include food, housing, and other essential needs such as clothing.

Some other priorities are eradication of forced labour or modern slavery, protection of labour rights and promote safe and secure working environments and achieving higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors.




**Promoting zero single use plastic (SUP) in packaging**

Most of our plastic ends up in landfills, our oceans and waterways, and the environment. Plastics do not biodegrade. Instead, they slowly break down into smaller pieces of plastic called microplastics. Plastic items like bags and straws choke wildlife and block animals' stomachs. It destroys are bio-diverse marine life. Hence to preserve the planet the current trend is exploring affordable, functionable & durable eco-friendly packaging solutions. Single-use plastics slowly and gradually break down into smaller pieces of plastic known as microplastics. It can take thousands of years for plastic bags to decompose, thus contaminating our soil and water in the process.


**Promoting protection, restoration and use of ecosystems to sustainably manage forests & combat desertification**

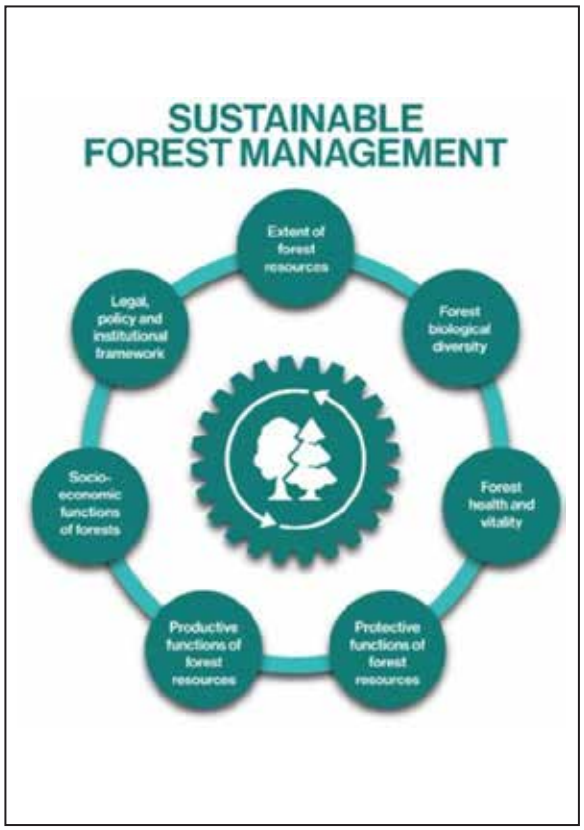
Paper packaging is one of the most important contributing factors to deforestation. Hence, it's imperative to promote SFM. Sustainable forest management (SFM) is the management of forests according to the principles of sustainable development. Sustainable forest management has to keep the balance between three main pillars: ecological, economic and socio-cultural. Successfully achieving this will provide integrated benefits to all, including reducing rural poverty and mitigating some of the effects of climate change.

**Promoting sustainable industrialization, circular economy, lean management, industry 4.0, Eco-design products & foster innovation**

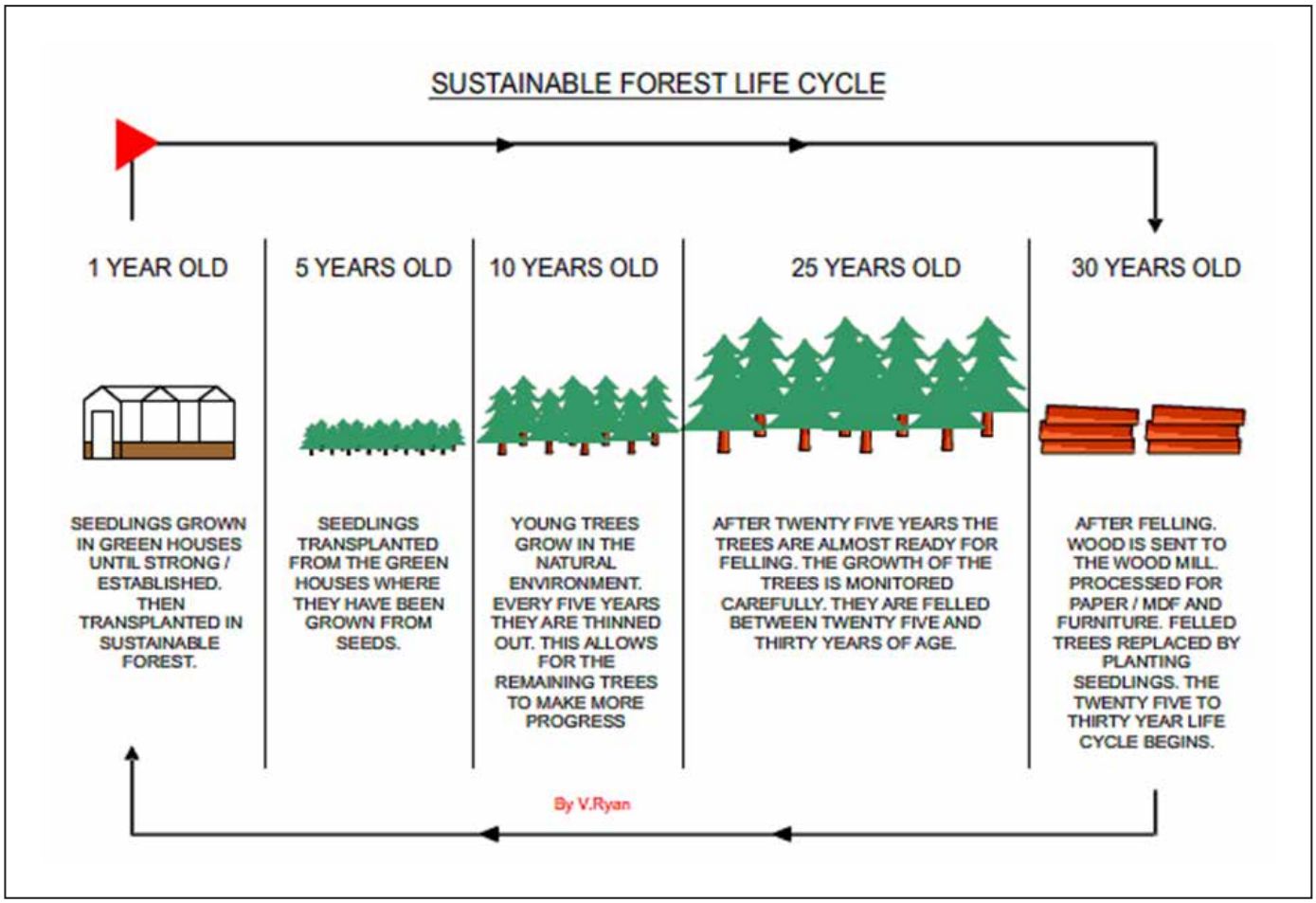
Inclusive and sustainable industrial development (ISID) is the primary source of income generation, allows for rapid and sustained increases in living standards for all people, and provides the technological solutions to environmentally sound industrialization in textile-apparels also.
A circular economy is an economic system that tacklesglobal challenges like climate change, biodiversity loss, waste, and pollution. This regenerative approach is in contrast to the traditional linear economy, which has a "take, make, dispose" model of production. In textile-apparel we can adopt 6Rs = Rethink, Refuse, Reduce, Reuse, Recycle, Repair.

**Lean management or Continuous Improvement** is a management system comprising of routines & tools which collectively & in an empowered way addresses all problems & wastages in a systematic way to better optimize the value chain for better satisfying the customers. This helps to reduce or eliminate wastage in textile-apparel industry making it sustainable.

**Industry 4.0** is the ongoing adoption of automation, digitization, artificial intelligence, augmented reality, virtual reality, IoT, 5G like smart technologies to replace traditional manufacturing. This helps for improved communication and self-monitoring, and production of smart machines that can analyze and diagnose issues without the need for human


SUSTAINABLE FOREST MANAGEMENT
Extent of forest resources
Forest biological diversity
Forest health and vitality
Protective functions of forest resources
Productive functions of forest resources
Socio-economic functions of forests
Legal, policy and institutional framework


Reduce Environmental Footprint
Green products
non-toxic, long-life, recyclable
Cleaner production
using fewer resources
Generate Increased Income
Circular Economy
Recycle waste, reuse resources
Better service
to extend lifespan
Minimize Waste
Collect at end-of-life, remanufacture
Reduce Resource Dependency


SUSTAINABLE FOREST LIFE CYCLE
1 YEAR OLD
5 YEARS OLD
10 YEARS OLD
25 YEARS OLD
30 YEARS OLD
SEEDLINGS GROWN IN GREEN HOUSES UNTIL STRONG / ESTABLISHED. THEN TRANSPLANTED IN SUSTAINABLE FOREST.
SEEDLINGS TRANSPLANTED FROM THE GREEN HOUSES WHERE THEY HAVE BEEN GROWN FROM SEEDS.
YOUNG TREES GROW IN THE NATURAL ENVIRONMENT. EVERY FIVE YEARS THEY ARE THINNED OUT. THIS ALLOWS FOR THE REMAINING TREES TO MAKE MORE PROGRESS
AFTER TWENTY FIVE YEARS THE TREES ARE ALMOST READY FOR FELLING. THE GROWTH OF THE TREES IS MONITORED CAREFULLY. THEY ARE FELLED BETWEEN TWENTY FIVE AND THIRTY YEARS OF AGE.
AFTER FELLING. WOOD IS SENT TO THE WOOD MILL. PROCESSED FOR PAPER / MDF AND FURNITURE. FELLED TREES REPLACED BY PLANTING SEEDLINGS. THE TWENTY FIVE TO THIRTY YEAR LIFE CYCLE BEGINS.
By V.Ryan

intervention. Textile-apparel industries globally have started to incorporate these transformations.

**Eco-design products** are those products that provide environmental, social and economic benefits while protecting public health and environment over their whole life cycle, from the extraction of raw materials until the final disposal. It will have the least CO2 footprint.

**Innovation** as defined as "a new or changed entity realizing or redistributing value". A highlighting element is a focus on newness, improvement, and spread of ideas or technologies. Innovation often takes place through the development of more-effective products, processes, services, technologies. In textile-apparel industry already we see usage or functionality based innovations to better satisfy the customer experience.

## About the author

Subhodeep Dutta holds a B.Tech. degree in Textile Technology from College of Textile Technology, Serampore under Calcutta university (now this institute is known as GCETTS). Total 18 years of experience in diverse textile & apparel sector. He started his professional career in Grasim industries in worsted spinning. Then he joined BVCPS in textile testing & auditing and since last 13 years he is associated with Decathlon. Started as techno-commercial merchandising, then process & project leader of a business unit and currently Country leader for CI or lean management & axis leader on industry 4.0.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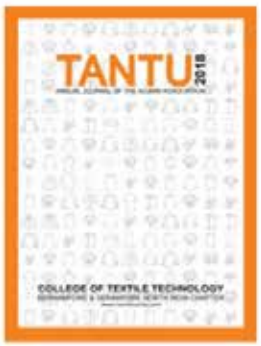


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