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Introduction of Textile Industry
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Introduction of Textile Industry

1.1 Introduction

India has been in the midst of a great social, political and economic change ever since reforms were introduced in various spheres of activity. The country has greater confidence to take on the competition from developed countries and has attracted global investors in ever increasing measure. The Textile industry is one of the oldest industries in India. The sector has made significant contributions in terms of forex earnings and employment and is one of the mainstays of the economy. Indian Textile Industry occupies a very important place in the economic life of India. The Indian textile industry is one of the largest in the world with a massive raw material and textiles manufacturing base. Our economy is largely dependent on the textile manufacturing and trade in addition to other major industries. About 27% of the foreign exchange earnings are on account of export of textiles and clothing alone. The textiles and clothing sector contributes about 14% to the industrial production and 3% to the gross domestic product of the country. Around 8% of the total excise revenue collection is contributed by the textile industry. So much so, the textile industry accounts for as large as 21% of the total employment generated in the economy. Around 35 million people are directly employed in the textile manufacturing activities. Indirect employment including the manpower engaged in agricultural based raw-material production like cotton and related trade and handling could be stated to be around another 60 million.

A textile is the largest single industry in India and amongst the biggest in the world, accounting for about 20% of the total industrial production. It provides direct employment to around 20 million people. Textile and clothing exports account for one-third of the total value of exports from the country. There are 1,227 textile mills with a spinning capacity of about 29 million spindles. While yarn is mostly produced in the mills, fabrics are produced in the power loom and handloom sectors as well. The Indian textile industry continues to be predominantly based on cotton, with about 65% of raw
materials consumed being cotton. The yearly output of cotton cloth was about 12.8 billion m about 42 billion ft. The manufacture of jute products 1.1 million metric tons ranks next in importance to cotton weaving. Textile is one of India’s oldest industries and has a formidable presence in the national economy inasmuch as it contributes to about 14 per cent of manufacturing value-addition, accounts for around one-third of our gross export earnings and provides gainful employment to millions of people. They include cotton and jute growers, artisans and weavers who are engaged in the organized as well as decentralized and household sectors spread across the entire country.

1.2 History of Textile Industry

The history of textile is almost as old as that of human civilization and as time moves on the history of textile has further enriched itself. In the 6th and 7th century BC, the oldest recorded indication of using fiber comes with the invention of flax and wool fabric at the excavation of Swiss lake inhabitants. In India the culture of silk was introduced in 400AD, while spinning of cotton traces back to 3000BC. In China, the discovery and consequent development of sericulture and spin silk methods got initiated at 2640 BC while in Egypt the art of spinning linen and weaving developed in 3400 BC. The discovery of machines and their widespread application in processing natural fibers was a direct outcome of the industrial revolution of the 18th and 19th centuries. The discoveries of various synthetic fibers like nylon created a wider market for textile products and gradually led to the invention of new and improved sources of natural fiber. The development of transportation and communication facilities facilitated the path of transaction of localized skills and textile art among various countries.¹

A. Ancient and Prehistoric

→ Prehistory – spindle used to create yarn from fibres.
→ c. 28000 BC – Sewing needles in use at Kostenki in Russia.
→ c. 27000 BC – Impressions of textiles and basketry and nets left on little pieces of hard clay.
→ c. 25000 BC – Venus figurines depicted with clothing.
→ c. 6500 BC – Approximate date of Naalebinding examples found in Nehal Hemar cave, Israel. This technique, which uses short separate lengths of thread, predated the invention of knitting with its continuous lengths of thread and requires that all of the as-yet unused thread be pulled through the loop in the sewn material. This requires much greater skill than knitting in order to create a fine product.
→ c. 6000 BC – Evidence of woven textiles used to wrap the dead at Catalhoyuk in Anatolia.
→ c. 5000 BC – Production of linen cloth in Ancient Egypt, along with other bast fibers including rush, reed, palm, and papyrus.
→ 4200 BC – Date of Mesolithic examples of Naalebinding found in Denmark, marking spread of technology to Northern Europe.
→ c. 3000 BC – Breeding of domesticated sheep with a wooly fleece rather than hair in the Near East.
→ 200 BC to 200 AD – Approximate date of earliest evidence of "Needle Knitting" in Peru, a form of Naalebinding that preceded local contact with the Spanish.
→ c. 200 AD – Earliest woodblock printing from China. Flowers in three colors on silk.
→ 247 AD – Dura-Europos, a Roman outpost, is destroyed. Excavations of the city discovered early examples of naalebinding fabric.
→ 298 AD – earliest attestation of a foot-powered loom with a hint the invention arose at Tarsus
→ 500 to 1000 AD – spinning wheel in use in India.
→ 500 AD - jia xie method for resist dyeing usually silk using wood blocks invented in China. An upper and a lower block are made, with carved out compartments opening to the back, fitted with plugs. The cloth, usually folded a number of times, is inserted and clamped between the two blocks. By unplugging the different compartments and filling them with dyes of different colors, a multi-colored pattern can be printed over quite a large area of folded cloth.
→ 600 AD – Oldest samples of cloth printed by Woodblock printing from Egypt.
B. Medieval History

→ 1000's AD – Finely decorated examples of cotton socks made by true knitting using continuous thread appear in Egypt.
→ 1275 – Approximate date of a silk burial cushion knit in two colors found in the tomb of Spanish royalty.
→ 1562 – Date of first example of use of the purl stitch, from a tomb in Toledo, Spain, which allows knitting of panels of material. Previously material had to be knitted in the round in a tubular form and cut it open.
→ 1589 – William Lee invents stocking frame, the first but hand-operated weft knitting machine.

C. Modern History

→ c. 1600 – The modern spinning wheel comes together with the addition of the treadle to the flyer wheel.
→ 1733 – John Kay patents the flying shuttle.
→ 1738 – Lewis Paul patents the draw roller.
→ 1758 – Jedediah Strutt adds a second set of needles to Lee's stocking frame thus creating the rib frame.
→ 1764 – James Hargreaves or Thomas Highs invents the spinning jenny (patented 1770).
→ 1767 – John Kay invents the spinning frame.
→ 1768 – Josiah Crane invents the hand-operated warp knitting machine.
→ 1769 – Richard Arkwright's water frame.
→ 1769 – Samuel Wise solves the mechanization of W. Lee's stocking frame.
→ 1779 – Samuel Crompton invents the spinning mule.
→ 1784 – Edmund Cartwright invents the power loom.
→ 1791 – The Englishman Dawson solves the mechanization of the warp knitting machine.
→ 1793 – Samuel Slater of Belper establishes the first successful cotton spinning mill in the United States, at Pawtucket; beginnings of the "Rhode Island System"
→ 1794 – Eli Whitney patents the cotton gin.
→ 1798 – The Frenchman Decroix or Decroise patents the circular bearded needle knitting machine.
→ 1799 - Charles Tennant discovers and patents bleaching powder.

**Cottage Stage**

There are some indications that weaving was already known in the Paleolithic. An indistinct textile impression has been found at Pavlov, Moravia. Neolithic textiles are well known from finds in pile dwellings in Switzerland. One extant fragment from the Neolithic was found in Fayum at a site which dates to about 5000 BC.

The key British industry at the beginning of the 18th century was the production of textiles made with wool from the large sheep-farming areas in the Midlands and across the country. This was a labor-intensive activity providing employment throughout Britain, with major centres being the West Country; Norwich and environs; and the West Riding of Yorkshire. The export trade in woolen goods accounted for more than a quarter of British exports during most of the 18th century, doubling between 1701 and 1770. Exports of the cotton industry centered in Lancashire had grown tenfold during this time, but still accounted for only a tenth of the value of the woolen trade. Before the 17th century, the manufacture of goods was performed on a limited scale by individual workers. This was usually on their own premises and goods were transported around the country. Clothiers visited the village with their trains of pack-horses. Some of the cloth was made into clothes for people living in the same area, and a large amount of cloth was exported. Rivers navigations were constructed, and some contour-following canals. In the early 18th century, artisans were inventing ways to become more productive. Silk, wool, fustian, and linen were being eclipsed by cotton, which was becoming the most important textile. In Roman times, wool, linen and leather clothed the European population, and silk, imported along the Silk Road from China, was an extravagant luxury. The use of flax fibre in the manufacturing of cloth in Northern Europe dates back to Neolithic times.
During the late medieval period, cotton began to be imported into northern Europe. Without any knowledge of what it came from, other than that it was a plant, noting its similarities to wool, people in the region could only imagine that cotton must be produced by plant-borne sheep. John Mandeville, writing in 1350, stated as fact the now-preposterous belief: "There grew in India a wonderful tree which bore tiny lambs on the ends of its branches. These branches were so pliable that they bent down to allow the lambs to feed when they are hungry." This aspect is retained in the name for cotton in many European languages, such as German Baumwolle, which translates as "tree wool". By the end of the 16th century, cotton was cultivated throughout the warmer regions of Asia and the Americas.

Spinning evolved from twisting the fibres by hand, to using a drop spindle, to using a spinning wheel. Spindles or parts of them have been found in archaeological sites and may represent one of the first pieces of technology available. They were invented in India between 500 and 1000 AD.

**Industrial Revolution**

The textile industry grew out of the industrial revolution in the 18th Century as mass production of yarn and cloth became a mainstream industry. In 1734 in Bury, Lancashire, John Kay invented the flying shuttle one of the first of a series of inventions associated with the cotton industry. The flying shuttle increased the width of cotton cloth and speed of production of a single weaver at a loom. Resistance by workers to the perceived threat to jobs delayed the widespread introduction of this technology, even though the higher rate of production generated an increased demand for spun cotton.
Shuttles

In 1761, the Duke of Bridgewater's canal connected Manchester to the coal fields of Worsley and in 1762, Matthew Boulton opened the Soho Foundry engineering works in Hands worth, Birmingham. His partnership with Scottish engineer James Watt resulted, in 1775, in the commercial production of the more efficient Watt steam engine which used a separate condenser.

In 1764, James Hargreaves is credited as inventor of the spinning jenny which multiplied the spun thread production capacity of a single worker — initially eightfold and subsequently much further. Others credit the original invention to Thomas Highs. Industrial unrest and a failure to patent the invention until 1770 forced Hargreaves from Blackburn, but his lack of protection of the idea allowed the concept to be exploited by others. As a result, there were over 20,000 Spinning Jennies in use by the time of his death. Again in 1764, Thorp Mill, the first water-powered cotton mill in the world was constructed at Royton, Lancashire, England. It was used for carding cotton. With the spinning and weaving process now mechanized, cotton mills cropped up all over the North West of England.²
D. 19th Century Developments

→ 1801 – Joseph Marie Jacquard invents the Jacquard punched card loom.

→ 1806 – Pierre Jeandeau patents the first latch needle for using on knitting machine.

→ 1813 – William Horrocks improves the power loom.

→ 1814 – Paul Moody of the Boston Manufacturing Company builds the first power loom in the United States; beginnings of the "Waltham System"

→ 1823 - Associates of the late Francis Cabot Lowell of the Boston Manufacturing Company begin operations at the Merrimack Manufacturing Company at East Chelmsford, Massachusetts. In 1826, East Chelmsford becomes incorporated as the town of Lowell, Massachusetts, the first factory city in the United States.

→ 1828 – Paul Moody develops the leather belt and pulley power transmission system, which would become the standard for U.S. mills.

→ 1830 – Barthelemy Thimonnier develops the first functional sewing machine

→ 1833 – Walter Hunt invents the lockstitch sewing machine but, dissatisfied with its function, does not patent it.

→ 1842 – Lancashire Loom developed by Bullough and Kenworthy, a semi automatic Power loom.

→ 1842 – John Greenbush patents the first sewing machine in the United States.

→ 1847 – William Mason Patents his "Mason self-acting" Mule.

→ 1849 – Matthew Townsend patents the variant of latch needle which has been the most widely used needle in weft knitting machines.

→ 1856 – William Henry Perkin invents the first synthetic dye.

→ 1856 – Thomas Jeacock of Leicester patented the tubular pipe compound needle.

→ 1857 – Arthur Paget patents a multi-head knitting machine called "Paget-
machine".
→ 1859 – Redgate invents a warp knitting machine working with vertical
position latch needles, called later as "Raschel machine" named after the
French actress Elisabeth Felice Rachel.
→ 1864 – William Cotton patents the straight bar knitting machine named after
him "Cotton machine".
→ 1865 – The American Isaac Wixom Lamb patents the flat knitting machine
using latch needles.
→ 1865 – Clay invents the double-headed latch needle which has enabled to
create purl stitch knitting.
→ 1866 – The American Mac Nary patents the circular knitting machine with
vertical needles for fabrication of socks and stockings with heel and toe
pouches.
→ 1878 – Henry Griswold adds a second set of needles horizontal needles to the
circular knitting machine enabling knitting of rib fabrics as cuff for socks.
→ 1881 – Pierre Durand invents the tubular pipe compound needle.
→ 1892 – Cross, Bevan & Beadle invent Viscose
→ 1889 – Northrop Loom: Draper Corporation, First automatic bobbin changing
weaving loom placed in production. Over 700,000 would be sold worldwide.

The Cartwright Loom, the Spinning Mule and the Boulton & Watt steam engine, the
pieces were in place to build a mechanized textile industry. Developments in the transport
infrastructure that is the canals and after 1831 the railways facilitated the import of raw
materials and export of finished cloth.

Firstly, the use of water power to drive mills was supplemented by steam driven water
pumps, and then superseded completely by the steam engines. Samuel Greg joined his
uncle's firm of textile merchants, and, on taking over the company in 1782, he sought out
a site to establish a mill. Quarry Bank Mill was built on the River Bollin at Styal in
Cheshire. It was initially powered by a water wheel, but installed steam engines in
1810. Quarry Bank Mill in Cheshire still exists as a well preserved museum, having been in use from its construction in 1784 until 1959. It also illustrates how the mill owners exploited child labor, taking orphans from nearby Manchester to work the cotton. It shows that these children were housed, clothed, fed and provided with some education. In 1830, the average power of a mill engine was 48 hp, but Quarry Bank mill installed a new 100 hp water wheel. William Fairbairn addressed the problem of line-shafting and was responsible for improving the efficiency of the mill. In 1815 he replaced the wooden turning shafts that drove the machines at 50rpm, to wrought iron shafting working at 250 rpm, these were a third of the weight of the previous ones and absorbed less power.

A Roberts’s loom in a weaving shed in 1835. Note the wrought iron shafting, fixed to the cast iron columns. Secondly, in 1830, using an 1822 patent, Richard Roberts manufactured the first loom with a cast iron frame, the Roberts Loom. In 1842 James Bullough and William Kenworthy, made the Lancashire Loom. It is a semi automatic power loom. Although it is self-acting, it has to be stopped to recharge empty shuttles. It was the mainstay of the Lancashire cotton industry for a century, when the. Originally, power looms were shuttle-operated but in the early part of the 20th century the faster and more efficient shuttle less loom came into use. Today, advances in technology have produced a variety of looms designed to maximize production for specific types of material. The most common of these are air-jet looms and water-jet looms. Industrial looms can weave at speeds of six rows per second and faster.
Roberts’s self-acting mule with quadrant gearing thirdly, also in 1830, Richard Roberts patented the first self-acting mule. Stalybridge mule spinners strike was in 1824, this stimulated research into the problem of applying power to the winding stroke of the mule. The draw while spinning had been assisted by power, but the push of the wind had been done manually by the spinner, the mule could be operated by semiskilled labor. Before 1830, the spinner would operate a partially powered mule with a maximum of 400 spindles after, self-acting mules with up to 1300 spindles could be built.

Table no 1.1 Looms in UK

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<th>Year</th>
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<th>1820</th>
<th>1829</th>
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The industrial revolution changed the nature of work and society. The three key drivers in these changes were textile manufacturing, iron founding and steam power. The geographical focus of textile manufacture in Britain was Manchester, England and the small towns of the Pennines and southern Lancashire.

Textile production in England peaked in 1926, and as mills were decommissioned, many of the scrapped mules and looms were bought up and reinstated in India. The demographic change made by World War I, had made the labor-intensive industry unprofitable in England, but in India and later China it was an aid to development.3
E. 20th Century

→ 1900 – Heinrich Stoll creates the flat bed purl knitting machine.
→ 1910 – Spiers invents the circular bed purl knitting machine.
→ c. 1920 – Hattersley looms developed by George Hattersley and Sons.
→ 1949 – Heinrich Mauersberger invents the sewing-knitting technique and his "Malimo" machine.
→ 1953 – First commercial polyester fiber production by DuPont.
→ 1954 – Fiber reactive dye invented.
→ 1963 – Open-end spinning developed in Czechoslovakia.

Major changes came to the textile industry during the 20th century, with continuing technological innovations in machinery, synthetic fibre, logistics, and globalization of the business. The business model that had dominated the industry for centuries was to change radically. Cotton and wool producers were not the only source for fibres, as chemical companies created new synthetic fibres that had superior qualities for many uses, such as rayon, invented in 1910, and DuPont's nylon, invented in 1935 as an inexpensive silk substitute, and used for products ranging from women's stockings to tooth brushes and military parachutes.

The variety of synthetic fibres used in manufacturing fibre grew steadily throughout the 20th century. In the 1920s, acetate was invented; in the 1940s, acetate, modacrylic, metal fibres, and saran were developed; acrylic, polyester, and spandex were introduced in the 1950s. Polyester became hugely popular in the apparel market, and by the late 1970s, more polyester was sold in the United States than cotton.

By the early 20th century, the industry in the developed world often involved immigrants in "sweat shops", which were usually legal but were sometimes illegally operated. They employed people in crowded conditions, working manual sewing machines, and being paid less than a living wage. This trend worsened due to attempts to protect existing industries which were being challenged by developing countries in South East Asia, the Indian subcontinent and Central America. Although globalization saw the manufacturing
largely outsourced to overseas labor markets, there has been a trend for the areas historically associated with the trade to shift focus to the more white collar associated industries of fashion design, fashion modeling and retail. Areas historically involved heavily in the "rag trade" include London and Milan in Europe, and the Soho district in New York City.

By the late 1980s, the apparel segment was no longer the largest market for fibre products, with industrial and home furnishings together representing a larger proportion of the fibre market. Industry integration and global manufacturing led to many small firms closing for good during the 1970s and 1980s in the United States; during those decades, 95 percent of the looms in North Carolina, South Carolina and Georgia shut down, and Alabama and Virginia also saw many factories close.4

F. 21st Century

In 2002, textiles and apparel manufacturing accounted for $400 billion in global exports, representing 6% of world trade and 8% of world trade in manufactured goods. In the early years of the 21st century, the largest importing and exporting countries were developed countries, including the European Union, the United States, Canada and Japan. The countries with the largest share of their exports being textiles and apparel were as follows (2002):

- Bangladesh: 85.9%
- Macau: 84.4%
- Cambodia: 72.5%
- Pakistan: 72.1%
- El Salvador: 60.2%
- Mauritius: 56.6%
- Sri Lanka: 54.3%
- Dominican Republic: 50.9%
- Nepal: 48.7%
- Tunisia: 42.4%
1.3 Milestone Years in Indian Textile Industry

Shri Jamshedji Tata: Started his first venture by acquiring a bankrupt oil mill in Chinchpopkli converted it into a cotton mill and renamed it to Alexandra Mill

Exceptional entrepreneurs who put India on the global textile map

Chart no.1.1 Indian Textile Industry

1869

Shri Jamshedji Tata: Started his first venture by acquiring a bankrupt oil mill in Chinchpopkli converted it into a cotton mill and renamed it to Alexandra Mill

1900-1960

Shri GD Birla, Lala Shriram (DCM), Shri Mafatlal Gaganbhai (Mafatlal), Shri Piramal Chaturbhuj (Morarjee), Singhanias (JK/Raymond), Wadia – Bombay Dyeing, others

1970

Shri Dhirubhai Ambani (Reliance Industries)

1980

Shri S.P Oswal (Vardhman), others

1990

Shri Sanjay Lalbhai (Arvind), others

2000

Jiwarajka family, others e.g. SKNL, BRFL, Welspun, Abhishek – each already or poised to soon become a billion US$ integrated textile

1.4 Segments of Indian Textile Industry

Indian Textile Industry can essentially be categorized into two segments:

1. Organized Textile Industry
2. Unorganized Textile Industry
1. Organized Textile Industry

Organized Textile Industry is a highly organized one with immense importance on capital intensive production process. This sector is characterized by sophisticated mills where technologically advanced machineries are utilized for mass production of textile products.

2. Unorganized Textile Industry

Unorganized Textile Industry sector is the dominant part in this industry which mainly utilizes the traditional practices woven or spun in cloth production and hence is labour intensive in nature. This industry is characterized by the production of clothes either through weaving or spinning with the help of hands. The decentralized nature is considered as another important feature of the unorganized textile industry in India.

1.5 Leading Textile Mills in India

1. Raymond Ltd., Mumbai
2. Grasim Industries Ltd., Nagda
3. DCM Textiles, New Delhi
4. S. Kumars, Kolkata
5. Reliance Industries, Ahmedabad
6. Mafatlal Industries, Mumbai
7. Aravind Mills Limited, Ahmedabad
8. Ashima Syntex, Ahmedabad
9. Nahar Spining, Ludhiana
10. Hisar Spinning Mills Ltd.
11. Anand Silk Mills, Valsad
12. Titex Silk Mills, Valsad
13. Shree Sainath Silk Mills, Valsad
14. Shreeji Trading Company, Surat
15. Garden Silk Mills Ltd., Surat
16. Raj Rayon Ltd., Mumbai
18. Shiyaji Silk Mills Ltd, Thane
19. Nirmala Fabrics, Thane

1.6 Uses of Textiles

Textiles have an assortment of uses, the most common of which are for clothing and for containers such as bags and baskets. In the household they are used in carpeting, upholstered furnishings, window shades, towels, coverings for tables, beds, and other flat surfaces, and in art. In the workplace they are used in industrial and scientific processes such as filtering. Miscellaneous uses include flags, backpacks, tents, nets, handkerchiefs, cleaning rags, transportation devices such as balloons, kites, sails, and parachutes textiles are also used to provide strengthening in composite materials such as fiberglass and industrial geotextiles. Using textiles, children can learn to sew and quilt and to make collages and toys.

Textiles used for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as technical textiles. Technical textiles include textile structures for automotive applications, medical textiles e.g. implants, geotextiles reinforcement of embankments, agro textiles for crop protection, protective clothing e.g. against heat and radiation for fire fighter clothing, against molten metal’s for welders, stab protection, and bullet proof vests. In all these applications stringent performance requirements must be met. Woven of threads coated with zinc oxide nanowires, laboratory fabric has been shown capable of "self-powering nanosystems" using vibrations created by everyday actions like wind or body movements.
1.7 Sources and Types of Textiles

Textiles can be made from many materials. These materials come from four main sources: animal wool, silk, plant cotton, flax, jute, mineral asbestos, glass fibre, and synthetic nylon, polyester, acrylic. In the past, all textiles were made from natural fibres, including plant, animal, and mineral sources. In the 20th century, these were supplemented by artificial fibres made from petroleum. Textiles are made in various strengths and degrees of durability, from the finest gossamer to the sturdiest canvas. The relative thickness of fibres in cloth is measured in deniers. Microfibre refers to fibres made of strands thinner than one denier.

1. Animal Textiles

Animal textiles are commonly made from hair, fur, skin or silk. Wool refers to the hair of the domestic goat or sheep, which is distinguished from other types of animal hair in that the individual strands are coated with scales and tightly crimped, and the wool as a whole is coated with a wax mixture known as lanolin, which is waterproof and dirtproof. Woollen refers to a bulkier yarn produced from carded, non-parallel fibre, while worsted refers to a finer yarn spun from longer fibres which have been combed to be parallel. Wool is commonly used for warm clothing. Cashmere, the hair of the Indian Cashmere goat, and mohair, the hair of the North African Angora goat, are types of wool known for their softness.

Wadmal is a coarse cloth made of wool, produced in Scandinavia, mostly 1000~1500CE. Silk is an animal textile made from the fibres of the cocoon of the Chinese silkworm which is spun into a smooth fabric prized for its softness. There are two main types of the silk: 'mulberry silk' produced by the Bombyx Mori, and 'wild silk' such as Tussah silk. Silkworm larvae produce the first type if cultivated in habitats with fresh mulberry leaves for consumption, while Tussah silk is produced by silkworms feeding purely on oak leaves. Around four-fifths of the world's silk production consists of cultivated silk.
2. **Plant Textiles**

Grass, rush, hemp, and sisal are all used in making rope. In the first two, the entire plant is used for this purpose, while in the last two, only fibres from the plant are utilized. Coir coconut fibre is used in making twine, and also in floormats, doormats, brushes, mattresses, floor tiles, and sacking.

![Traditional textile making tools from 14th century Persia](image)

Straw and bamboo are both used to make hats. Straw, a dried form of grass, is also used for stuffing, as is kapok. Fibres from pulpwood trees, cotton, rice, hemp, and nettle are used in making paper. Cotton, flax, jute, hemp, modal and even bamboo fibre are all used in clothing. Pina pineapple fibre and ramie are also fibres used in clothing, generally with a blend of other fibres such as cotton. Nettles have also been used to make a fibre and fabric very similar to hemp or flax. The use of milkweed stalk fibre has also been reported, but it tends to be somewhat weaker than other fibres like hemp or flax. Acetate is used to increase the shininess of certain fabrics such as silks, velvets, and taffetas.

Seaweed is used in the production of textiles, a water-soluble fibre known as alginate is produced and is used as a holding fibre, when the cloth is finished, the alginate is dissolved, leaving an open area. Lyocell is a man-made fabric derived from wood pulp. It
is often described as a man-made silk equivalent, it is a tough fabric that is often blended with other fabrics like cotton, for example. Fibres from the stalks of plants, such as hemp, flax, and nettles, are also known as ‘bast’ fibres.

3. **Mineral Textiles**

Asbestos and basalt fibre are used for vinyl tiles, sheeting, and adhesives, "transite" panels and siding, acoustical ceilings, stage curtains, and fire blankets. Glass fibre is used in the production of spacesuits, ironing board and mattress covers, ropes and cables, reinforcement fibre for composite materials, insect netting, flame-retardant and protective fabric, soundproof, fireproof, and insulating fibres.

Metal fibre, metal foil, and metal wire have a variety of uses, including the production of cloth-of-gold and jewellery. Hardware cloth US term only is a coarse weave of steel wire, used in construction. It is much like standard window screening, but heavier and with a more open weave. It is sometimes used together with screening on the lower part of screen doors, to resist scratching by dogs.

4. **Synthetic Textiles**

A variety of contemporary fabrics From the left: even weave cotton, velvet, printed cotton, calico, felt, satin, silk, hessian, polycotton.
Embroidered skirts by the Alfaro-Nunez family of Cochas, Peru, using traditional Peruvian embroidery methods. All synthetic textiles are used primarily in the production of clothing. Polyester fibre is used in all types of clothing, either alone or blended with fibres such as cotton. Aramid fibre e.g. Twaron is used for flame-retardant clothing, cut-protection, and armor. Acrylic is a fibre used to imitate wools, including cashmere, and is often used in replacement of them. Nylon is a fibre used to imitate silk; it is used in the production of pantyhose. Thicker nylon fibres are used in rope and outdoor clothing. Spandex trade name Lycra is a polyurethane product that can be made tight-fitting without impeding movement. It is used to make activewear, bras, and swimsuits.

Olefin fibre is a fibre used in activewear, linings, and warm clothing. Olefins are hydrophobic, allowing them to dry quickly. A sintered felt of olefin fibres is sold under the trade name Tyvek. Ingeo is a polylactide fibre blended with other fibres such as cotton and used in clothing. It is more hydrophilic than most other synthetics, allowing it to wick away perspiration. Lurex is a metallic fibre used in clothing embellishment. Milk proteins have also been used to create synthetic fabric. Milk or casein fibre cloth was developed during World War I in Germany, and further developed in Italy and America during the 1930s. Milk fibre fabric is not very durable and wrinkles easily, but has a pH similar to human skin and possesses anti-bacterial properties. It is marketed as a biodegradable, renewable synthetic fibre. Carbon fibre is mostly used in composite materials, together with resin, such as carbon fibre reinforced plastic. The fibres are made from polymer fibres through carbonization.
1.8 Units of Textile Measurement

Textile yarns are measured in various units, such as: the denier and tex linear mass density of fibres, super S fineness of wool fiber, worsted count, woolen count, cotton count or Number English Ne, Number metric (Nm) and yield the inverse of denier and tex. Yarn is spun thread used for knitting, weaving, or sewing. Thread is a long, thin strand of cotton, nylon, or other fibers used in sewing or weaving. Both yarn and thread are measured in terms of cotton count and yarn density. Fabric is cloth, typically produced by weaving or knitting textile fibers, and is measured in units such as mommes. Momme is a number that equals the weight in pounds of a piece of silk if it were sized 45 inches by 100 yards, thread count a measure of the coarseness or fineness of fabric, ends per inch (e.p.i), and picks per inch (p.p.i).

1. Fiber/Fibre

a. Denier

Denier or den is a unit of measure for the linear mass density of fibers. It is defined as the mass in grams per 9000 meters. The denier is based on a natural standard i.e., a single strand of silk is approximately one denier. A 9000-meter strand of silk weighs about one gram. The term denier comes from the French denier, a coin of small value worth $\frac{1}{12}$ of a sou. Applied to yarn, a denier was held to be equal in weight to $\frac{1}{24}$ of an ounce. The term micro denier is used to describe filaments that weigh less than one gram per 9000 meters. The International System of Units uses the unit "tex" instead. One can distinguish between filament and total measurements in deniers. Both are defined as above but the first only relates to a single filament of fiber commonly known as denier per filament (DPF) whereas the second relates to a yarn, an agglomeration of filaments. The following relationship applies to straight, uniform filaments:

\[
DPF = \frac{\text{total denier}}{\text{quantity of uniform filaments}}
\]

The denier system of measurement is used on two- and single-filament fibers. Some common calculations are as follows:
1 denier  = 1 gram per 9 000 meters

= 0.05 grams per 450 meters (\(\frac{1}{20}\) of above)

= 0.111 milligrams per meter

In practice, measuring 9000 meters is both time-consuming and unrealistic; generally a sample of 900 meters is weighed and the result multiplied by 10 to obtain the denier weight.

♦ A fiber is generally considered a microfiber if it is one denier or less.
♦ A one-denier polyester fiber has a diameter of about ten micrometers.
♦ Denier is used as the measure of density of weave in tights and pantyhose, which defines their opacity. Opacity is then categorized into five broad categories by manufacturers in the industry. Ultra sheer 1 to 10 denier, sheer 10 to 30 denier, semi opaque 30 to 40 denier, opaque 40 to 70 denier and thick opaque 70 denier or higher.

One can calculate the diameter of a filament given its weight in denier with the following formula:

\[
\varphi = \sqrt{\frac{4.444 \times 10^{-6} \cdot \text{denier}}{\pi \rho}}
\]

Where \(\rho\) represents the material's density in grams per cubic centimeter and the diameter is in cm.
b. Tex

Thread made from two threads

Tex is a unit of measure for the linear mass density of fibers and is defined as the mass in grams per 1000 meters. Tex is more likely to be used in Canada and Continental Europe, while denier remains more common in the United States and United Kingdom. The unit code is "tex". The most commonly used unit is actually the deciTex, abbreviated dtex, which is the mass in grams per 10,000 meters. When measuring objects that consist of multiple fibers the term "filament Tex" is sometimes used, referring to the mass in grams per 1000 meters of a single filament. Tex is used for measuring fiber size in many products, including cigarette filters, optical cable, yarn, and fabric. One can calculate the diameter of a filament given its weight in dtex with the following formula:

\[ \varphi = \sqrt{\frac{4 \times 10^{-6} \cdot \text{dtex}}{\pi \rho}} \]

Where \( \rho \) represents the material's density in grams per cubic centimeter and the diameter is in cm.
Table no 1.2 Diameter

<table>
<thead>
<tr>
<th>Tex (g/km)</th>
<th>Yield (yards/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>550</td>
<td>900</td>
</tr>
<tr>
<td>735</td>
<td>675</td>
</tr>
<tr>
<td>1100</td>
<td>450</td>
</tr>
<tr>
<td>1200</td>
<td>413</td>
</tr>
<tr>
<td>2000</td>
<td>250</td>
</tr>
<tr>
<td>2200</td>
<td>225</td>
</tr>
<tr>
<td>2400</td>
<td>207</td>
</tr>
<tr>
<td>4400</td>
<td>113</td>
</tr>
</tbody>
</table>

c. S or super S number

S or super S number is an indirect measure of the fineness of the wool fiber. It is most commonly seen as a label on wool suits and other tailored wool apparel to indicate the fineness of the wool fiber used in the making of the apparel. The numbers may also be found on wool fabric and yarn.

d. Worsted count

Yarn spinning factory
Worsted count or spinning count is an indirect measure of the fineness of the fiber in a worsted wool yarn expressed as the number of 560-yard 1 yard = 0.9144 meters lengths (hanks) of worsted yarn that a pound 0.45359237 kilograms of wool yields. The finer the wool, the more yarn and the higher the count. It has been largely replaced by direct measures.

e. Yield

Similar to Tex and denier, yield is a term that helps describe the linear density of a roving of fibers. However, unlike Tex and denier, yield is the inverse of linear density and is usually expressed in yards/lb.

2. Yarn and thread

a. Cotton count

Cotton count is another measure of linear density. It is the number of hanks 840 yd or 770 m of skein material that weigh 1 pound 0.45 kg. Under this system, the higher the number, the finer the yarn. In the United States cotton counts between 1 and 20 are referred to as coarse counts. A regular single-knit T-shirt can be between 20 and 40 count; fine bed sheets are usually in the range of 40 to 80 count. The number is now widely used in the staple fiber industry.

Hank: a length of 7 leas or 840 yards (770 m)
   One lea – 120 yards (110 m)

b. Yarn length

\[ l/m = 1693 \times l_m/Nec \times m/kg, \]

where \( l/m \) is the yarn length in meters, \( l_m/Nec \) is the English cotton count and \( m/kg \) is the yarn weight in kilograms. English cotton count (NEC) is an indirect counting system, that is, the higher the number the finer the yarn.

- Thread: a length of 54 inches (1.4 m) (the circumference of a warp beam)
- Bundle: usually 10 pounds (4.5 kg)
- Lea: a length of 80 threads or 120 yards (110 m)
Denier: this is an alternative method. It is defined as a number that is equivalent to the weight in grams of 9000 m of a single yarn. 15 denier is finer than 30 denier.

Tex: is the weight in grams of 1 km of yarn.

To convert denier to cotton count: \( \frac{l_m}{N_{ec}} = \frac{5315}{\rho/den} \), where \( \frac{l_m}{N_{ec}} \) is the cotton count and \( \rho/den \) is the density in denier.

To convert Tex to cotton count: \( \frac{l_m}{N_{ec}} = \frac{590.5}{\rho/tex} \), where \( \frac{l_m}{N_{ec}} \) is the cotton count and \( \rho/tex \) is the density in Tex.

1 Tex = \( \sqrt[9]{\rho} \) den

c. Thread

Thread is a cotton yarn measure, equal to 54 inches (1.4 m).

**Table 1.3 Yarn density conversion**

<table>
<thead>
<tr>
<th>Denier</th>
<th>m/g</th>
<th>Tex</th>
<th>Worsted</th>
<th>Cotton</th>
<th>Woolen (run)</th>
<th>Linen (lea)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>180</td>
<td>5.6</td>
<td>160</td>
<td>106</td>
<td>56</td>
<td>298</td>
</tr>
<tr>
<td>75</td>
<td>120</td>
<td>8.3</td>
<td>106</td>
<td>72</td>
<td>37</td>
<td>198</td>
</tr>
<tr>
<td>100</td>
<td>90</td>
<td>11.1</td>
<td>80</td>
<td>53</td>
<td>28</td>
<td>149</td>
</tr>
<tr>
<td>150</td>
<td>60</td>
<td>16.6</td>
<td>53</td>
<td>35</td>
<td>19</td>
<td>99</td>
</tr>
<tr>
<td>200</td>
<td>45</td>
<td>22.2</td>
<td>40</td>
<td>27</td>
<td>14</td>
<td>74</td>
</tr>
<tr>
<td>300</td>
<td>30</td>
<td>33.4</td>
<td>27</td>
<td>18</td>
<td>9.3</td>
<td>50</td>
</tr>
<tr>
<td>400</td>
<td>22.5</td>
<td>44.4</td>
<td>20</td>
<td>13</td>
<td>7.0</td>
<td>37</td>
</tr>
<tr>
<td>500</td>
<td>18</td>
<td>55.5</td>
<td>16</td>
<td>11</td>
<td>5.6</td>
<td>30</td>
</tr>
<tr>
<td>700</td>
<td>12.9</td>
<td>77.7</td>
<td>11.4</td>
<td>7.6</td>
<td>4.0</td>
<td>2</td>
</tr>
<tr>
<td>1000</td>
<td>9</td>
<td>111</td>
<td>8.0</td>
<td>5.3</td>
<td>2.8</td>
<td>15</td>
</tr>
<tr>
<td>1500</td>
<td>6</td>
<td>166</td>
<td>5.3</td>
<td>3.5</td>
<td>1.9</td>
<td>10</td>
</tr>
<tr>
<td>2000</td>
<td>4.5</td>
<td>222</td>
<td>4.0</td>
<td>2.7</td>
<td>1.4</td>
<td>7</td>
</tr>
</tbody>
</table>

Approximate yarn measurement comparison
3. **Fabric**

a. **Mommes**

Mommes (mm) are units of weight traditionally used to measure the surface density of silk. It is akin to the use of thread count to measure the quality of cotton fabrics, but is calculated in a very different manner. Instead of counting threads, the weight in mommes is a number that equals the weight in pounds of a piece of silk if it were sized 45 inches by 100 yards. This is because the standard width of silk is 45 inches wide, though silk is regularly produced in 55-inch widths, and, uncommonly, in even larger widths. Silk can also be measured by weight in grams. 1 momme = 4.340 grams per square meter; 8 mommes is close to 1 ounce per square yard or 35 grams per square meter. The usual range of momme weight for different weaves of silk are:

- Habutai – 5 to 16 mm
- Chiffon – 6 to 8 mm (can be made in double thickness, i.e. 12 to 16 mm)
- Crepe de Chine – 12 to 16 mm
- Gauze – 3 to 5 mm
- Raw silk – 35 to 40 mm (heavier silks appear more ‘wooly’)
- Organza – 4 to 6 mm
- Charmeuse – 12 to 30 mm

The higher the weight in mommes, the more durable the weave and the more suitable it is for heavy-duty use. And, the heavier the silk, the more opaque it becomes. This can vary even between the same kinds of silk. For example, lightweight charmeuse is translucent when used in clothing, but 30-momme charmeuse is opaque.

b. **Thread count**

How to determine the number of twists per inch in a piece of yarn?
Thread count or threads per inch (TPI) is a measure of the coarseness or fineness of fabric. It is measured by counting the number of threads contained in one square inch of fabric or one square centimeter, including both the length (warp) and width (weft) threads. The thread count is the number of threads counted along two sides up and across of the square inch, added together. It is used especially in regard to cotton linens such as bed sheets, and has been known to be used in the classification of towels.

Thread count is often used as a measure of fabric quality, so that "standard" cotton thread counts are around 150 while good-quality sheets start at 180 and a count of 200 or higher is considered percale. Some, but not all, of the extremely high thread counts tend to be misleading as they usually count the individual threads in "plied" yarns. For marketing purposes, a fabric with 250 two-ply yarns in both the vertical and horizontal direction could have the component threads counted to a 1000 thread count although "according to the National Textile Association (NTA), which cites the international standards group ASTM, accepted industry practice is to count each thread as one, even threads spun as two- or three-ply yarn. The Federal Trade Commission in an August 2005 letter to NTA agreed that consumers 'could be deceived or misled' by inflated thread counts. In 2002, ASTM proposed a definition for "thread count" that has been called "the industry's first formal definition for thread count". A minority on the ASTM committee argued for the higher yarn count number obtained by counting each single yarn in a plied yarn and cited as authority the provision relating to woven fabric in the Harmonized Tariff Schedule of the United States, which states each ply should be counted as one using the "average yarn number."

**c. Ends per inch**

Ends per inch are the number of warp threads per inch of woven fabric. In general, the higher the ends per inch, the finer the fabric is. The current fashion is to wear t-shirts with a higher thread count, such as soft and comfortable "30 single" tee shirt that has 30 threads per inch as contrasted to the standard t-shirt with an 18 thread count per inch. Ends per inch are very commonly used by weavers who must use the number of ends per
inch in order to pick the right reed to weave with. The number of ends per inch varies on the pattern to be woven and the thickness of the thread. Plain weaves generally use half the number of wraps per inch for the number of ends per inch, whereas denser weaves like a twill weave will use a higher ratio like two thirds of the number of wraps per inch. Finer threads require more threads per inch than thick ones, and thus result in a higher number of ends per inch.

The number of ends per inch in a piece of woven cloth varies depending on what stage the cloth is at. Before the cloth is woven the warp has a certain number of ends per inch, which is directly related to what size reed is being used. After weaving the number of ends per inch will increase, and it will increase again after being washed. This increase in the number of ends per inch and shrinkage in the size of the fabric is known as the take-up. The take-up is dependent on many factors, including the material and how tightly the cloth is woven. Tightly woven fabric shrinks more than loosely woven fabric, as do more elastic yarns and fibers.\(^7\)

### 1.9 List of Textile Fibers

Textile fibres can be created from many natural sources such as animal hair or fur, insect cocoons such as silk worm cocoons, as well as semi synthetic methods that use naturally-occurring polymers, and synthetic methods that use polymer-based materials, and even minerals such as metals to make foils and wires. The textile industry requires that fibre content be provided on content labels. These labels are used to test textiles under different conditions to meet safety standards and to determine whether or not a textile is machine washable or must be dry-cleaned. Common textile fibres used in global fashion today include:\(^8\)
<table>
<thead>
<tr>
<th>Fibre</th>
<th>Source</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byssus</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chiengora</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Qiviut</td>
<td>Muskoxen</td>
<td>Softness, warmth</td>
</tr>
<tr>
<td>Yak</td>
<td>Yak</td>
<td>-</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Rabbits</td>
<td>Softness</td>
</tr>
<tr>
<td>Wool</td>
<td>Sheep</td>
<td>Warmth</td>
</tr>
<tr>
<td>Lambswool</td>
<td>Lambs</td>
<td>Softness, elasticity, warmth</td>
</tr>
<tr>
<td>Cashmere wool</td>
<td>Indian cashmere goat</td>
<td>Softness</td>
</tr>
<tr>
<td>Mohair wool</td>
<td>North African angora goat</td>
<td>Warmth, holds dyes well, lightweight</td>
</tr>
<tr>
<td>Camel hair</td>
<td>Arabian Dromedary and Northeast Asian Bactrian camels</td>
<td>Warmth, lightweight</td>
</tr>
<tr>
<td>Alpaca / Vicuna / Guanaco / Llama wool</td>
<td>South America camelid varieties</td>
<td>Softness, warmth</td>
</tr>
<tr>
<td>Angora wool</td>
<td>Angora rabbit</td>
<td>Softness, blends well with other fibres</td>
</tr>
<tr>
<td>Silk</td>
<td>Chinese mulberry silkworm</td>
<td>Smooth fabric finish with high shine</td>
</tr>
</tbody>
</table>
Table No. 1.5 Plant-based fibers (cellulosic fibers)

<table>
<thead>
<tr>
<th>Fibre</th>
<th>Source</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abaca</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Coir</td>
<td>Coconut</td>
<td>Strength, durability</td>
</tr>
<tr>
<td>Cotton</td>
<td>Shrub</td>
<td>Lightweight, absorbent</td>
</tr>
<tr>
<td>Flax</td>
<td>Herbaceous plant</td>
<td>Lightweight, absorbent, used to make linen</td>
</tr>
<tr>
<td>Jute</td>
<td>Vegetable plant in linden family</td>
<td>Strength, durability</td>
</tr>
<tr>
<td>Kapok</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kenaf</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Raffia</td>
<td>Raffia palm</td>
<td>-</td>
</tr>
<tr>
<td>Bamboo</td>
<td>Grass pulp</td>
<td>Lightweight, pliable fibre</td>
</tr>
<tr>
<td>Hemp</td>
<td>Cannabis</td>
<td>Strength, durability</td>
</tr>
<tr>
<td>Modal</td>
<td>Beech tree</td>
<td>Softness, lightweight</td>
</tr>
<tr>
<td>Piña</td>
<td>Pineapple leaf</td>
<td>-</td>
</tr>
<tr>
<td>Ramie</td>
<td>Flowering plant in nettle family</td>
<td>-</td>
</tr>
<tr>
<td>Sisal</td>
<td>-</td>
<td>Strength, durability</td>
</tr>
<tr>
<td>Soy protein</td>
<td>Tofu-manufacturing waste</td>
<td>-</td>
</tr>
</tbody>
</table>
### Table No.1.6 Mineral-based fibers

<table>
<thead>
<tr>
<th>Fibre</th>
<th>Source</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos Cloth</td>
<td>asbestos</td>
<td>Fire-resistance, light weight</td>
</tr>
<tr>
<td>Glass, Fibreglass</td>
<td>Mixed silicates</td>
<td>Fire-resistance, futuristic appearance in some products</td>
</tr>
<tr>
<td>Metals</td>
<td>Gold, silver, and many other minerals</td>
<td>Foil, fibres, wire</td>
</tr>
</tbody>
</table>

### Table No. 1.7 Synthetic fibers

<table>
<thead>
<tr>
<th>Fibre</th>
<th>Source</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rayon (Viscose)</td>
<td>Regenerated cellulose, semi synthetic</td>
<td>Lustrous appearance, absorbent</td>
</tr>
<tr>
<td>Acetate</td>
<td>Cellulose, semi synthetic</td>
<td>Lustrous appearance, pliable fabric</td>
</tr>
<tr>
<td>Tencel</td>
<td>Wood pulp, semisynthetic</td>
<td>Lightweight</td>
</tr>
<tr>
<td>Polyester</td>
<td>Polymer, polyethylene terephthalate</td>
<td>Wrinkle-resistant, easy care</td>
</tr>
<tr>
<td>Aramid</td>
<td>Aromatic polyamide</td>
<td>Heat- and tear-resistant</td>
</tr>
<tr>
<td>Acrylic</td>
<td>Acrylonitrile</td>
<td>Imitates wools and cashmeres due to softness</td>
</tr>
<tr>
<td>Ingeo</td>
<td>Polylactide</td>
<td>Wicks away persperation (hydrophilic)</td>
</tr>
<tr>
<td>Luminex</td>
<td>Fibre optics</td>
<td>Light-emitting</td>
</tr>
<tr>
<td>Lurex</td>
<td>Polyamide, polyester</td>
<td>Metallic appearance, sheen</td>
</tr>
<tr>
<td>Lyocell</td>
<td>Cellulose</td>
<td>Strong, soft, absorbent, biodegradeable</td>
</tr>
<tr>
<td>Material</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Nylon</td>
<td>Polyamide</td>
<td></td>
</tr>
<tr>
<td>Spandex (Lycra)</td>
<td>Polyurethane</td>
<td></td>
</tr>
<tr>
<td>Olefin</td>
<td>Polyethylene, polypropylene</td>
<td></td>
</tr>
<tr>
<td>PLA fibre, Polylactide</td>
<td>Polymers, lactic acid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silk-like appearance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stretches easily</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wicks away perspiration (hydrophilic), lightweight (olefin fibres have the lowest specific gravity of all fibres)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lightweight, wicks away perspiration (hydrophilic), UV light-resistant</td>
<td></td>
</tr>
</tbody>
</table>

1.10 Growth and Structure of Indian Textile Industry

I. Growth of Indian Textile Industry

1. The textile and apparel industry is one of the leading segments of the Indian economy and the largest source of foreign exchange earnings for India. This industry accounts for 4 percent of the gross domestic product (GDP), 20 percent of industrial output, and slightly more than 30 percent of export earnings. The textile and apparel industry employs about 38 million people, making it the largest source of industrial employment in India.

2. India has the second-largest yarn-spinning capacity in the world after China, accounting for roughly 20 percent of the world’s spindle capacity. India’s spinning segment is fairly modernized, approximately 35 to 40 percent of India’s spindles are less than 10 years old. During 1989-98, India was the leading buyer of spinning machinery, accounting for 28 percent of world shipments. India’s production of spun yarn is accounted for almost entirely by the “organized mill sector,” which includes 285 large vertically-integrated “composite mills” and nearly 2,500 spinning mills.

3. India has the largest number of looms in place to weave fabrics, accounting for 64 percent of the world’s installed looms. However, 98 percent of the looms are accounted for by India’s power loom and handloom sectors, which use mostly
outdated equipment and produce mostly low-value unfinished fabrics. Composite mills account for 2 percent of India’s installed looms and 4 percent of India’s fabric output.

4. The handloom and power loom sectors were established with government support, mainly to provide rural employment. These sectors benefit from various tax exemptions and other favorable government policies, which ensure that fabrics produced in these sectors, are price competitive against those of composite mills.

5. The fabric processing dyeing and finishing sector, the weakest link in India’s textile supply chain, consists of a large number of small units located in and around the powerloom and handloom centers. The proliferation of small processing units is due to India’s fiscal policies, which favor small independent hand- and power-processing units over composite mills with modern processing facilities.

6. The production of apparel in India was, until recently, reserved for the small-scale industry (SSI) sector, which was defined as a unit having an investment in plant and machinery equivalent to less than $230,000. Apparel units with larger investments were allowed to operate only as export-oriented units (EOUs). As a result, India’s apparel sector is highly fragmented and is characterized by low levels of technology use.

7. It is quite clear to us that the market size of India is growing at a very high pace. That is why the foreign investors are flocking to India for investment purposes in order to get hold of a chunk of this expanding pie. With increasing demand for the products of Indian Textile Industry, new players are jumping in the league to get a slice of the profitable pie and the already existing textile mills are raising their capacity for increasing their supply. Hence, the expansion process of the domestic industry is also not far behind. Thus, it can be said that the whole Indian economy is on a growing trend which has its obvious impact on every possible sector including the Indian Industry.
8. In contrast to other major textile-producing countries, India’s textile sector is characterized by mostly small-scale, nonintegrated spinning, weaving, cloth finishing, and apparel enterprises, many of which use outdated technology. Some, mostly larger, firms operate in the “organized” sector where firms must comply with numerous government labor and tax regulations. Most firms, however, operate in the small-scale “unorganized” sector where regulations are less stringent and more easily evaded. The unique structure of the Indian textile industry is due to the legacy of tax, labor, and other regulatory policies that have favored small-scale, labor-intensive.

9. Enterprises, while discriminating against larger scale, more capital-intensive operations. The structure is also due to the historical orientation towards meeting the needs of India’s predominately low-income domestic consumers, rather than the world market. Policy reforms, which began in the 1980s and continued into the 1990s, have led to significant gains in technical efficiency and international competitiveness, particularly in the spinning sector. However, broad scope remains for additional reforms that could enhance the efficiency and competitiveness of India’s weaving, fabric finishing, and apparel sectors.

II. Factors Responsible Behind The Growth of Textile Mills in India

Some of the major factors responsible behind the growth of textile Mills sector are:

1. An immense demand of Indian apparels and textiles in the international market

2. Low custom duties on imported textile machinery

3. Less tight government restrictions on imported goods Major trading partners regarding import of textile machineries include U.S., Germany, Switzerland and U.K. India ranks second in the global textile industry and accounts a major portion to the overall Indian exports. For the sustenance of this growth and to maintain the competence in the international market, the textile mills in India need to be modernized.
III. Structure of India’s Textile Industry

The textile sector in India is one of the world’s largest. The textile industry today is divided into three segments:

1. Cotton Textiles
2. Synthetic Textiles
3. Other like Wool, Jute, Silk etc.

All segments have their own place but even today cotton textiles continue to dominate with 73% share. The structure of cotton textile industry is very complex with co-existence of oldest technologies of hand spinning and hand weaving with the most sophisticated automatic spindles and loom. The structure of the textile industry is extremely complex with the modern, sophisticated and highly mechanized mill sector on the one hand and hand spinning and hand weaving (handloom sector) on the other in between falls the decentralized small scale powerloom sector. Unlike other major textile-producing countries, India’s textile industry is comprised mostly of small-scale, non-integrated spinning, weaving, finishing, and apparel-making enterprises. This unique industry structure is primarily a legacy of government policies that have promoted labor-intensive, small-scale operations and discriminated against larger scale firms. Unlike other major textile-producing countries, India’s textile industry is comprised mostly of small-scale, non-integrated spinning, weaving, finishing, and apparel-making enterprises. This unique industry structure is primarily a legacy of government policies that have promoted labor-intensive, small-scale operations and discriminated against larger scale firms.¹⁰

1.11 India’s major Competitors in The World

To understand India’s position among other textile producing the industry contributes 9% of GDP and 35% of foreign exchange earnings, India’s share in global exports is only 3% compared to China’s 13.75% percent. In addition to China, other developing countries are emerging as serious competitive threats to India. Looking at export shares, Korea 6% and Taiwan 5.5% are ahead of India, while Turkey 2.9% has already caught up and others like Thailand 2.3% and Indonesia 2% are not much further behind. The reason for this
development is the fact that India lags behind these countries in investment levels, technology, quality and logistics. If India were competitive in some key segments it could serve as a basis for building a modern industry, but there is no evidence of such signs, except to some extent in the spinning industry.

**Table No. 1.8 India’s Competitive Position in Stages of Textile Manufacture**

<table>
<thead>
<tr>
<th>Process</th>
<th>Determinants of Competitive Advantage</th>
<th>India's Competitive Position</th>
<th>Emerging Competition</th>
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<tbody>
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<td>Spinning</td>
<td>Quality, cotton price</td>
<td>Medium</td>
<td>Indonesia, Turkey</td>
</tr>
<tr>
<td>Weaving</td>
<td>Technology, automation, Power, finance</td>
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<td>Vietnam, Philippines</td>
</tr>
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<td>Processing,</td>
<td>Scale economy, Technology, environment, Issues, finance</td>
<td>Low</td>
<td>China, Vietnam, Philippines</td>
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<tr>
<td>Garmenting</td>
<td>Labour cost, Productivity, Brand fashion design</td>
<td>Medium</td>
<td>Bangladesh, Sri Lanka, Morocco, east Europe, Mexico</td>
</tr>
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</table>

1.12 Government Policies, Schemes and Corporations for Promoting Textile Industry in India

1. The Multi-Fibre Agreement (MFA)

The Multi-Fibre Agreement (MFA), that had governed the extent of textile trade between nations since 1962, expired on 1 January 2005. It is expected that, post-MFA, most tariff distortions would gradually disappear and firms with robust capabilities will gain in the global trade of textile and apparel. The prize is the $360 bn market which is expected to grow to about $600 bn by the year 2010 barely five years after the expiry of MFA.
2. National Textile Policy 2000

Faced with new challenges and opportunities in a changing global trade environment, the GOI unveiled its National Textile Policy 2000 (NTP 2000) on November 2, 2000. The NTP 2000 aims to improve the competitiveness of the Indian textile industry in order to attain $50 billion per year in textile and apparel exports by 2010.86 The NTP 2000 opens the country’s apparel sector to large firms and allows up to 100 percent FDI in the sector without any export obligation. Export Promotion Capital Goods (EPCG) scheme To promote modernization of Indian industry, the GOI set up the Export Promotion Capital Goods (EPCG) scheme, which permits a firm importing new or Secondhand capital goods for production of articles for export to enter the capital goods at preferential tariffs, provided that the firm exports at least six times the c.i.f. value of the imported capital goods within 6 years. Any textile firm planning to modernize its operations had to import at least $4.6 million worth of equipment to qualify for duty-free treatment under the EPCG scheme.

3. Export-Import Policy

The GOI’s EXIM policy provides for a variety of largely export-related assistance to firms engaged in the manufacture and trade of textile products. This policy includes fiscal and other trade and investment incentives contained in various programs.

4. Duty Entitlement Passbook Scheme (DEPS)

DEPS is available to Indian export companies and traders on a pre- and post-export basis. The pre-export credit requires that the beneficiary firm has exported during the preceding 3-year period. The post-export credit is a transferable credit that exporters of finished goods can use to pay or offset customs duties on subsequent imports of any unrestricted products.
5. **The Agreement on Textiles and Clothing (ATC)**

The Agreement on Textiles and Clothing (ATC) promises abolition of all quota restrictions in international trade in textiles and clothing by the year 2005. This provides tremendous scope for export expansion from developing countries. Guidelines of the revised Textile Centres Infrastructure Development Scheme (TCUDS) TCIDS Scheme is a part of the drive to improve infrastructure facilities at potential Textile growth centres and therefore, aims at removing bottlenecks in exports so as to achieve the target of US$ 50 billion by 2010 as envisaged in the National Textile Policy, 2000. Under the Scheme funds can be given to Central and State Government Departments and Public Sector Undertakings Other Central and State Government’s agencies and recognized industrial association or entrepreneur bodies for development of infrastructure directly benefiting the textile units. The fund would not be available for individual production units.

6. **Technology Upgradation Fund Scheme (TUFS)**

At present, the only scheme through which Government can assist the industry is the Technology Upgradation Fund Scheme (TUFS) which provides for reimbursing 5% interest on the loans finance raised from designated financial institutions for benchmarked projects of modernization. IDBI, SIDBI, IFCI have been designed as nodal agencies for large and medium small scale industry and jute industry respectively. They have co-opted 148 leading commercial banks/cooperative banks and financial institutions like State Finance Corporations and State Industrial Development Corporation etc.

7. **Scheme for Integrated Textile Parks (SITP)**

To provide the industry with world-class infrastructure facilities for setting up their textile units, Government has launched the “Scheme for Integrated Textile Parks (SITP)” by merging the ‘Scheme for Apparel Parks for Exports (APE)’ and ‘Textile Centre Infrastructure Development Scheme (TCIDS)’. This scheme is based on Public-Private Partnership (PPP) and envisages engaging of a professional agency for project execution. The Ministry of Textiles (MOT) would implement the Scheme through Special Purpose Vehicles (SPVs).
8. National Textile Corporation Ltd. (NTC)

National Textile Corporation Ltd. (NTC) is the single largest Textile Central Public Sector Enterprise under Ministry of Textiles managing 52 Textile Mills through its 9 Subsidiary Companies spread all over India. The headquarters of the Holding Company is at New Delhi. The strength of the group is around 22000 employees. The annual turnover of the Company in the year 2004-05 was approximately Rs.638 crores having capacity of 11 lakhs Spindles, 1500 Looms producing 450 lakh Kgs of Yarn and 185 lakh Mtrs of cloth annually. Cotton Corporation of India Ltd. (CCI) The Cotton Corporation of India Ltd (CCI), Mumbai, is a profit-making Public Sector Undertaking under the Ministry of Textiles engaged in commercial trading of cotton. The CCI also undertakes Minimum Support Price Operation (MSP) on behalf of the Government of India.

9. The Ministry of Textiles

The Ministry of Textiles is responsible for policy formulation, planning, and development export promotion and trade regulation in respect of the textile sector. This included all natural and manmade cellulosic fibres that go into the making of textiles, clothing and handicrafts.

10. Power loom Development and Export Promotion Council(PLDEPC)

Powerloom development and export promotion council, set up by the ministry of textiles government of India. PDEXCIL provide some export assistance as follows

1. Exploration of overseas market.
2. Identification of items with export potential.
3. Market survey and up-to-date market intelligence. Contact with protective buyers to interest them in your products.
4. Providing your company's profile to overseas buyers and vice-versa.
5. Advice on international marketing.
6. Display of selected product groups.
11. Cotton Textile Export Promotion Council (TEXPROCIL)

The Council looks after the export promotion of cotton fabrics, cotton yarn and cotton made-ups. Its activities include market studies for individual products, circulation of trade enquiries, participation in exhibitions, fairs and seminars at home and abroad, in order to boost exports.

1.13 Government Policies Affecting The Industry

As India steps into an increasingly liberalized global trade regime, the GOI has implemented several programs to help the textile and apparel industry adjust to the new trade environment. On November 2, 2000, the GOI unveiled its National Textile Policy (NTP) 2000, aimed at enhancing the competitiveness of the textile and apparel industry and expanding India’s share of world textile and apparel exports to 10 percent by 2010 from the current 3-percent level. The study identifies the following measures taken by the GOI to achieve these objectives:

1. Under the NTP 2000, the GOI removed ready-made apparel articles from the list of products reserved for the SSI sector. As a result, foreign firms may now invest up to 100 percent in the apparel sector without any export obligation.

2. The GOI grants automatic approval within 2 weeks of all proposals involving foreign equity up to 51 percent in the manufacture of textile products in the composite mills and in the manufacture of waterproof textile products.

3. On April 1, 1999, the GOI implemented the Technology Upgradation Fund (TUF) to spur investment in new textile and apparel technologies. Under the 5-year $6 billion program, eligible firms can receive loans for upgrading their technology at interest rates that are 5 percentage points lower than the normal lending rates of specified financial institutions in India. According to GOI officials, this interest rate incentive is intended to bring the cost of capital in India closer to international costs.
4. The GOI created a $16 million “cotton technology mission” to increase research on improving cotton productivity and quality.

5. EOU's and composite mills that produce yarn for captive consumption are exempt from the GOI’s hank yarn obligation, which requires each spinning mill to produce 50 percent of its yarn for the domestic market in hank form 80 percent of which must be in counts of 40s and lower for use in the handloom sector. The GOI plans to reduce the hank yarn obligation from 50 percent to 30 percent for all other spinning units.

6. To boost exports and encourage new industry investment, the GOI under the quota entitlement policy increased the share of quotas earmarked for units investing in new machinery and plants.

7. To promote modernization of Indian industry, the GOI set up the Export Promotion Capital Goods (EPCG) scheme, which permits a firm importing new or secondhand capital goods for production of articles for export to enter the capital goods at preferential tariffs, provided that the firm exports at least six times the c.i.f. value of the imported capital goods within 6 years. Any textile firm planning to modernize its operations had to import at least $4.6millionworth of equipment to qualify for duty-free treatment under the EPCG scheme.

8. In an effort to spur investment in the textile industry, on April 1, 1999, the GOI reduced the amount to $230,000 and eliminated preferential treatment for imports of secondhand equipment under the EPCG scheme.

1.14 Policy Recommendations

India is a land of great potential since it is perhaps the only country in the world that is self-sufficient and complete in the cotton value chain. This strong advantage, however, has been frittered away due to fragmented and myopic vision of the government that resulted in policies that ran counter to market signals. The current industry structure is in a significant sense- a tribute to the Indian textile and clothing sectors who have managed
to perform despite the throttling policy constraints. In view of the global developments in retail sector, driven by emancipated consumer, and keeping in mind that the protection that quota afforded to Indian textile market would soon disappear, it is imperative for the Indian textile and clothing sectors to reform, and do that quickly. As is evident by now, most of the impediments to India’s export competitiveness lies at home. Market access conditions arise only after India develops the competence to survive in the market.

Also, it is clear that most of the problems are structural in nature, and emerge from a lack of holistic view about the entire value chain- from fibre to retail, which in itself is engendered by the fragmented government policies. Needless to write, most of the reform in this industry pertains to changes in government policies. However, before delineating the policy changes required to make the Indian textile and clothing sectors globally competitive, it would be useful to mention a few of the guiding principles which lay the foundation of recommendations.

1. While the role of the government in creating and sustaining national advantage is significant, it is inevitably partial because in the absence of underlying national circumstances that support competitive advantage in a particular industry, the best policy intentions would fail. India is endowed with these ‘underlying national circumstances’ in textile and clothing sectors in full measure.

2. Governments do not control national competitive advantage, they only influence it. The central role of the government policy therefore, is to deploy a nation’s resources labour and capital with high and rising levels of productivity, since productivity is the root cause of a nation’s standard of living.

3. Governments cannot create competitive industries. Firms must do so. Governments shape or influence the context and institutional structure surrounding firms, as well as the inputs that firms draw from. Based on these premises, following policy recommendations are made.
[A] Textile Specific

I. Home demand creation

Allow Foreign Direct Investment (FDI) in garment retailing to enable large, modern retail showrooms to set up shops in India. Owing to comparative advantages in clothing manufacture that would be available indigenously, the government need not worry if these large retailers would begin to outsource their clothing requirements. Presence of large retailers would create domestic demand for ready-to-wear garments, and also push for higher productivity in garment manufacturing through bulk orders. This would also help promote large-scale manufacturing facilities for garmenting, and help Indian exports diversify into standardized, mass-clothing items.

II. Promote fair competition

Rationalize excise duty structure across the entire value chain from fibre to garment retailing.\textsuperscript{12} Levying of moderate, uniform VAT should be the long-term objective.

1. Do away with exemptions on ginned cotton, hank yarn, grey fabric, hand processors and a few specified processes, knitwear and hosiery and SSI units in garments’

2. Rationalize excise duty incidence at spinning stage. Spinning bears almost 55\% of total excise revenue collections from this industry, but contributes only 39\% to value addition.

3. Abolish Additional Excise Duty (Textile and Textile Articles)- AED (T&TA) on mmf/yarn and cotton yarn.

III. Remove policy-bias against synthetic fibre/yarn.

- Rationalize excise duties on synthetic fibre to bring it in line with cotton fibre
- Lower customs duty on raw materials used in manufacture of synthetic fibre/yarn
IV. Regulations and Controls

There exists a plethora of regulations like Cotton Control Order, Essential Commodities Act, which need to be critically reviewed in view of their limited usefulness.\textsuperscript{13} they are products of an era of shortages, and a drag in the era of surpluses that characterizes the Indian textile and clothing sectors currently.

[B] Textile Non-Specific

I. Infrastructure

This relates to the building of world class infrastructure- port, inland transportation, power, and communication etc- facilities within the country. Owing to resource constraints, and gestation lag, it may not be possible to develop such structure for the entire country at once. As a first step, such infrastructure must be made available to units in Special Economic Zones, and extended to rest of the country. Specific recommendation on each of these economy-wide factors is beyond the scope of this study. Nevertheless, this must not belittle the very high degree of adverse impact that the poor quality of Indian infrastructure has had on Indian exports of textile and Clothing. For instance, China enjoys an overall 37% advantage of which 13% is cost advantage over India in shipping garments due to delays and inefficiencies at the Indian ports. 25% of production cycle time in Indian exports of apparel is owing to delays at customs. Quick response and just-in-time delivery is virtually impossible.

II. Modify Labour related Provisions

Modify the labour related provisions in Industrial Disputes Act 1948 (Ch V-B), Contract Labour Regulation and Abolition Act 1970 Section 10 and Trade Union Act 1926, to bring them in line with current realities and market requirements. That fabricators are today the ‘backbone’ of the garment industry is chiefly due to the outdated labour laws in India. That has created fragmentation specially in the garment industry since it is more labour intensive. Outmoded laws related to retrenchment, transfers, dismissals and job rotations have adversely affected organized mills too. This has given rise to an industry
structure that is completely incapable of becoming globally competitive. It has prevented modernization, scale economies in bulk purchases, production and marketing, and product-diversification into assembly-line produced items.

III. Clusters for Competitiveness- Supply Chain Perspective

For higher value added exports, conglomeration approach is one technique for acquiring sustainable and global competitiveness. Right from availability of primary raw material, to spinning, weaving, processing and garment-converting units, along with the testing labs, etc. should be developed in a compact geographical area, for which a demarcation of some form and substance already exists. Govt. policies must be industry-friendly, and infrastructure in such areas should be world class. In developing such conglomerations, locational factors, particularly pertaining to raw material availability, should also be considered. These ‘clusters’ could also be much focused on products that India has revealed a competitive advantage in. This develops the supply chain approach and optimizes the synergy between textile and clothing sectors. Such restructuring of the industry could be facilitated greatly through the nodal finance agencies IDBI and SIDBI under the TUFS. Project appraisal techniques by bankers should participate in the responsibility of creating globally competitive textile and clothing industry in India.

IV. Collaborating to Compete- Policies on Investing Abroad

Strategic alliances have become crucial in the textile and clothing sectors in view of the growing number and scope of PTAs. Government needs to design its policies for Indian companies investing abroad in consonance with this reality. Access to markets like EU and US might increasingly be mostly via those developing countries that have a PTA with world’s big markets. Indian textile and clothing industry has a great potential, which has not been cultivated for global performance. The above set of recommendations would provide the right kind of institutional context and investment climate for the Indian firms engaged in these sectors to rise to the occasion. As for making the Indian textile and clothing industry globally competitive, the government can trust the ingenuity of the Indian entrepreneurs.
1.15 Role of Indian Textile Industry in the Economy

Textile industry plays a significant role in the economy. The Indian textile industry is one of the largest and most important sectors in the economy in terms of output, foreign exchange earnings and employment in India. It contributes 20 percent of industrial production, 9 percent of excise collections, 18 percent of employment in industrial sector, nearly 20 percent to the country’s total export earnings and 4 percent to the GDP. The sector employs nearly 35 million people and is the second highest employer in the country. The textile sector also has a direct link with the rural economy and performance of major fibre crops and crafts such as cotton, wool, silk, handicrafts and handlooms, which employ millions of farmers and crafts persons in rural and semi-urban areas. It has been estimated that one out of every six households in the country depends directly or indirectly on this sector.

India has several advantages in the textile sector, including abundant availability of raw material and labour. It is the second largest player in the world cotton trade. It has the largest cotton acreage, of about nine million hectares and is the third largest producer of cotton fibre in the world. It ranks fourth in terms of staple fibre production and fourth in polyester yarn production. The textile industry is also labour intensive, thus India has an advantage.

The key advantages of the Indian industry are:

1. India is the third largest producer of cotton with the largest area under cotton cultivation in the world. It has an edge in low cost cotton sourcing compared to other countries.

2. Average wage rates in India are 50-60 percent lower than that in developed countries, thus enabling India to benefit from global outsourcing trends in labour intensive businesses such as garments and home textiles.

3. Design and fashion capabilities are key strengths that will enable Indian players to strengthen their relationships with global retailers and score over their Chinese competitors.
4. Production facilities are available across the textile value chain, from spinning to garments manufacturing. The industry is investing in technology and increasing its capacities which should prove a major asset in the years to come.

5. Large Indian players such as Arvind Mills, Welspun India, Alok Industries and Raymond’s have established themselves as 'quality producers' in the global market. This recognition would further enable India to leverage its position among global retailers.

6. India has gathered experience in terms of working with global brands and this should benefit Indian vendors.

**1.16 Importance of Textile Industry to Indian economy India**

1. Second largest producer of textiles and garments after China
2. Second largest producer of cotton in the world
3. Second largest employer in India after agriculture–Direct Employment to 35mn. people
4. Constitutes about 12% of India’s exports
5. Contributes about 14% to Industrial production
6. Contributes about 4% to GDP
7. Investment made in Textile sector since launch of TUFs scheme is Rs. 208000 crores till June 2010

**1.17 Impact of Current Global Economic Scenario**

1. The Indian textile industry is largely small and fragmented and organized players constitute only 5% of the industry.
2. The smaller players(SME’s) have been badly impacted in the current scenario on account of the following
3. Sudden drop in prices of cotton, for example Shankar 6 variety of cotton came down from about Rs. 57,000 per candy to Rs. 33,000 per candy
4. Sudden depreciation of Indian Rupee is a vis US$ from about Rs.44.62 levels in April 2011 to Rs.53.62 levels in December 2011, there by representing a fall of 20.17%
5. Slow down in India’s major export market viz. USA & Europe, resulting in to consolidation of sourcing; there by affecting the smaller players in terms of loss of business
6. In Coimbatore Tirupur and other southern belt, the power supply from the grid is erratic and most of the time the units have to run on DG sets resulting in power cost of Rs.8–Rs.9 per unit making them unviable
7. Higher interest cost regime, there by smaller units already impacted by the other factors are not able to sustain such increase.

1.18 Position of the Indian Textile Industry in the World Textile Economy

India contributes 20% to world spindle age capacity, the second highest spindle age in the world after China. It contributes 6% to the world rotorage and 62% to the world loomage. However in High-tech Shuttless Looms this industry’s contribution is only 4.1% to the world Shuttless loomage. 12% to the world production of textile fibers and yarns is from India and is the largest producer of Jute, second largest producer of silk and cellulose fiber and yarn, third largest producer of cotton and fifth largest producer of synthetic fibers and yarns. India’s key assets include a large and low-cost labour force, sizable supply of fabric, sufficiency in raw material and spinning capacities. On the basis of these strengths, India will become a major outsourcing hub for foreign manufacturers and retailers, with composite mills and large integrated firms being their preferred partners. It will thus be essential for SMEs to align with these firms that can ensure a market for their products and new orders.

1. It should be admitted that adoption of world class technology, economies of scale and global manufacturing practices are very vital.
2. It is time the industry takes a pragmatic outlook of its capabilities.
3. Though rated as a major player next only to China and has packets of excellence, the Indian industry still carries unwanted baggage of the past.

4. This legacy stems from the fact that the industry was subject to whimsical adhoc policy regimes since independence.

5. It is in this context, one should see whether India is a cost effective textile producer and the policy makers will allow laggards to make the way for the fittest. The immediate challenge facing Indian textiles is the integration of various sectors.

6. Though the importance of improving the power infrastructure cannot be ignored the mute question is whether the textile industry should deploy its scarce resources in creating infrastructure or in beefing up the manufacturing base so as to meet the future challenges. Given the obsolete technology in the industry and the sub-scale of economies, it is imperative that all efforts and resources are directed at sprucing up the manufacturing base.

7. The industry has, over the years, contributed significantly to national output, employment and exports. At present, industry accounts for about 14% of our total industrial production and contributes to nearly 17% of total exports. It provides direct employment to about 35 million people and another 56 million are engaged in allied activities. The textile export has registered a growth.

8. India has most liberal and transparent policies in Foreign Direct Investment (FDI) amongst emerging countries. India is a promising destination for FDI in the textile sector. FDI is allowed 100% in the textile sector under the automatic route. FDI in sectors to the extent permitted under automatic route does not require any prior approval either by the Government of India or Reserve Bank of India (RBI).

9. The investors are only required to notify the Regional Office concerned of RBI within 30 days of receipt of in word remittance. Ministry of Textiles has set up FDI Cell to attract FDI in the textile sector in the country.

1.19 Challenges of Textiles Industry
Textile supply chains compete on low cost, high quality, accurate delivery and flexibility in variety and volume. Several challenges stand in the way of Indian firms before they can own a larger share of the global market:

1. **Scale:**

Except for spinning, all other sectors suffer from the problem of scale. Indian firms are typically smaller than their Chinese or Thai counterparts and there are fewer large firms in India. Some of the Chinese large firms have 1.5 times higher spinning capacity, 1.25 times denim and 2 times gray fabric capacity and about 6 times more revenue in garment than their counterparts in India thereby affecting the cost structure as well as ability to attract customers with large orders. The central tendency is to add capacity once the order has been won rather than ahead of the demand. Customers go where they see both capacity and capabilities. Large capacity typically goes with standardized products. These firms need to develop the managerial capabilities required to manage large work force and design an appropriate supply chain. For the size of the Indian economy, it will have to have bigger firms producing standard products in large volumes as well as small and mid size firms producing large variety in small to mid size. Then there is the need for emergence of specialist firms that will consolidate orders, book capacities, manage warehouses and logistics of order delivery.

2. **Skills**

Three issues must be mentioned here:

- There is a paucity of technical manpower there exist barely 30 programmes at graduate engineering levels graduating about 1000 students this is insufficient for bringing about technological change in the sector.
- Indian firms invest very little in training its existing workforce and the skills are limited to existing processes.
- There is an acute shortage of trained operators and supervisors in India. It is expected that Indian firms will have to invest close to Rs. 1400 bn by year 2010 to increase its global trade to $ 50 bn. This kind of investment would require, by our
calculations, about 70,000 supervisors and 1.05mn operators in the textile sector and at least112, 000 supervisors and 2.8mn operators in the apparel sector assuming a 80:20 ratio of investment between textiles and apparel. The real bottleneck to growth is going to be availability of skilled manpower.

3. Cycle Time

Cycle time is the key to competitiveness of a firm as it affects both price and delivery schedule. Cycle time reduction is strongly correlated with high first pass yield, high throughput times, and low variability in process times, low WIP and consequently cost. Indian firms have to dramatically reduce cycle times across the entire supply chains which are currently quite high. Customs must provide a turnaround time of ½ day for an order before Indian firms can they expect to become part of larger global supply chains. Indian firms need a strong deployment of industrial engineering with particular emphasis on cellular manufacturing, JIT and statistical process control to reduce lead times on shop floors. Penetration of IT for improving productivity is particularly low in this sector.

4. Innovation & Technology

A review of the products imported from China to USA during January–April 2005 reveals that the top three products in terms of percentage increase in imports were Tire Cords & Tire Fabrics 843.4% increase over the previous year, Non-woven fabrics 284.1% increase and Textile Fabric Finishing Mill Products 197.2% increase FICCI, 2005. None of these items, however, figure in the list of imports from India that have gained in these early days of post-MFA. Entry into newer application domains of industrial textiles, nanotextiles, home furnishings etc. becomes imperative if we are to grow beyond 5–6% of global market share as these are areas that are projected to grow significantly. Synthetic textiles comprise about 50 per cent of the global textile market. Indian synthetic industry, however, is not well entrenched. The Technology Upgradation Fund of the government is being used to stimulate investment in new processes.
5. Domestic Market

The Indian domestic market for all textile and apparel products is estimated at $26 bn and growing. While the market is very competitive at the low end of the value chain, the mid or higher ranges are overpriced i.e., ‘dollar pricing’. Firms are not taking advantage of the large domestic market in generating economies of scale to deliver cost advantage in export markets. The Free Trade Agreement with Singapore and Thailand will allow overseas producers to meet the aspirations of domestic buyers with quality and prices that are competitive in the domestic market. Ignoring the domestic market, in the long run, will peril the export markets for domestic producers. In addition, high retail property prices and high channel margins in India will restrict growth of this market. Firms need to make their supply chain leaner in order to overcome these disadvantages.

6. Institutional Support

Textile policy has come long ways in reducing impediments for the industry sometimes driven by global competition and, at other times, by international trade regulations. However, few areas of policy weakness stand out labour reforms, power availability and its quality, customs clearance and shipment operations from ports, credit for large scale investments that are needed for upgradation of technology, and development of manpower for the industry. These are problems facing several sectors of industry in India and not by this sector alone.

1.20 Problem Faced by The Textile Industry in India

The cotton textile industry is reeling under manifold problems. The major problems are the following:

1. Sickness

Sickness is widespread in the cotton textile industry. After the engineering industry, the cotton textile industry has the highest incidence of sickness. As many as 125 sick units have been taken over by the Central Government. Sickness is caused by various reasons like the problems mentioned below.
2. Obsolescence

The plant and machinery and technology employed by a number of units are obsolete. The need today is to make the industry technologically up-to-date rather than expand capacity as such. This need was foreseen quite some time back and schemes for modernization of textile industry had been introduced. The soft loan scheme was introduced a few years back and some units were able to take advantage of the scheme and modernize their equipment. However, the problem has not been fully tackled and it is of utmost importance that the whole industry is technologically updated. Not many companies would be able to find resources internally and will have to depend on financial institutions and other sources.

3. Government Regulations

Government regulations like the obligation to produced controlled cloth are against the interest of the industry. “During the last two decades the excessive regulations exercised by the government on the mill sector has promoted inefficiency in both production and management.

4. Low Yield and Fluctuation of Cotton Output

The cotton yield per hectare of land is very low in India. This results in high cost and price. Further, being largely dependent on the climatic factors, the total raw cotton production is subject to wide fluctuation causing serious problems for the mills in respect of the supply of this vital raw material.

5. Competition from Man-made Fibres

One of the serious challenges facing the cotton textile industry is the competition from the manmade fibers and synthetics. These textures are gradually replacing cotton textiles. This substitution has in fact been supported by a number of people on the ground that it is
not possible to increase substantially the raw cotton production without affecting other crops particularly food crops.

6. Competition from other Countries

In the international market, India has been facing severe competition from other countries like Taiwan, South Korea, China and Japan. The high cost of production of the Indian industry is a serious adverse factor.

7. Labour Problems

The cotton textile industry is frequently plagued by labour problems. The very long strike of the textile workers of Bombay caused losses amounting to millions of rupees not only to the workers and industry but also to the nation in terms of excise and other taxes and exports.

8. Accumulation of Stock

At times the industry faces the problems of very low off-take of stocks resulting in accumulation of huge stocks. The situation leads to price cuts and the like leading to loss or low profits.

9. Miscellaneous

The industry faces a number of other problems like power cuts, infrastructural problems, lack of finance, exorbitant rise in raw material prices and production costs etc.
Reference:


11. Misra, (1993), World import of clothing and textiles has grown at over 6% p.a. annual average all along the 1990s. Even during the MFA era, the decline in India’s global market share was due to reasons at home, and not due to demand factors.

12. N. K. Singh,(2002), This recommendation has just been made by the GOI Expert Group on Textile Policy set up under the chairmanship of N. K. Singh (November 2002).


14. Anthony Reid, “Southeast Asian Consumption of Indian and British Cotton Cloth,” 1600-1850


17. Huw Bowen, British Exports of Raw Cotton and Cotton Textiles from India to China during the Late Eighteenth and Early Nineteenth Centuries.


