

Global Silk Industry

A Complete Source Book

Rajat K. Datta & Mahesh Nanavaty

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Global Silk Industry: A Complete Source Book

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SILK IN ELEVEN LANGUAGES

Chinese -- SI

English -- SILK

French -- SOIE

German -- SEIDE

Indian -- RESHAM

Italian -- SETA

Japanese -- KINO

Korean -- SOI

Latin -- SERICUM

Russian – SOLK

Spanish -- SEDA

Foreword

Xavier Gavyn Lavergne, Secretary General of the International Silk Association (I.S.A), Lyon, France.

This is a complete silk book that gives us the opportunity to understand the work of the whole world silk sector. As International Silk Association, we back up Indian work and acknowledge all researches that are put to develop more efficient communication on silk.

We thank the authors for giving us the opportunity to introduce the International Silk Association (ISA), which has been well known for its commitment to the exchange in the post-cocoon silk business all around the globe. With a little more than 190 members in about 40 countries, it helps silk professionals to understand the scope of business that is related to silk, and, every second year; it is an opportunity for the ISA to present a view of the current situation at the ISC Congress.

There are three big sectors, viz., Apparel, Accessories, which is more or less a sub-sector of apparel and Furnishing. According to these market sectors, people in countries where the standard of living is high may buy silk because to them it represents something that is needed for their social, personal or sensual needs. It is also important to note that we'll focus here on silk with a touch of class and high range products. Silk, Indeed is scarce, the last available report showed that it represents some 0.18% of all the world fibers. Such a quantity is quite a strong argument for selling silk. However, it must always be made quite clear that silk demands a level of excellence at every stage of production.

The brisk markets for silk are to be found in the USA for apparel, accessories and furnishing; in Japan mostly for accessories but also garments; in Europe for accessories, furnishing and apparel; but also in China and in India where both countries have a part of their population that enjoys a standard of living as high as some Europeans or North Americans. On the whole the market for silk is having some difficult time as far as the exchange of raw materials is concerned. Silk fabric weavers, printers and finishers in Western countries have to face fierce competition from Asian countries where the level of quality is improving very quickly and where creative fabrics are more and more to be found. For made ups, the sector of accessories is the head of the sector pulling all markets upwards. The U.S.A, Japan, Europe, but also China and India are consuming very high value products from fashionable designers. They put a lot of money in spending on branded goods.

QUALITY IS THE ISSUE: Silk must be a quality item, it is a natural fiber and appeals to a lot of people for its smoothness, shine, softness and insulating properties. Silk, however, is being widely attacked by chemical fibers that sometimes are called in misleading ways to remind, yet in a wrong way to the customer of silk. Most of the time products are not silk-made, the customer is either deceived or does not really care and the silk market is endangered.

On the whole if we look at the market, the movement in depth is that silk is still used by fashion and trend designers in leading fashion countries; but the offer in shops that follows is not always to the same level owing to slashed price-policy and silk like garments and accessories. In Paris, Milan, London, New York, Tokyo, Shanghai and Delhi, present silk in the collections and the themes of comfort,

legendary aspects, glamorous looks, which make thriving forever.

HIGH VALUE IS THE SECRET OF SUCCESS: Creativity is besides quality an important factor. Above all, in order to be seen, silk must be in the right trends for colors. This gives value to the base fabric that otherwise will be used as a fabric among others. Designers do not like polyester or acetate or polyamide better. They like the added value, the image content value that is based on communication for the products.

If silk is struggling to find a market or if you continue to see appalling apparel with poor fashion oriented designs or if you give it the 'granny' award for creativity with losing colors and trims, and last but not least if you dump the prices in a fierce blind competition; then, no doubt silk will be killed. On the other hand, show it on computer presentation, train your public to admire the qualities of silk, explain, educate, teach, play, make silk a real show business with real qualities behind that you can trust, talk of the strength of silk as to back the speech with relevant information and then the audience will feel the magic of a luxury mix.

With the amount of research that is put into the development of new technologies for hybrids production, trans-genetics and breeding in labs, and sericulture farms around the world, silk has got a very bright and shining future. Just as smooth as silk.

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Preface

The global demand for natural textiles fibers has been rising despite growth of manmade fibers with their diversified properties and cheaper prices; and the world consumption of silk is also increasing despite its limited, stagnant production and high prices. Its popularity is no more confined to super-rich or haute couture; silk is now an affordable luxury for the middle class in Europe and USA, and continues to hold its way in Asia as traditional ceremonial wear.

Here are gathered, indeed, the main information and analysis regarding the history of production and trade of this exceptional textile fiber, from the origins of silk to the 21st century, covering the important changes in the silk scenario, notably in the course of the 20th century, which explain today's situation and enlighten the future.

Japan, the top silk producer until 1970s has receded to much lower place. Though Japan has made significant advance in sericulture and silk technology, China has leaped forward both in silkworm rearing and post-cocoon silk processing and is enjoying a singular hold over the world market. India has doubled its silk production and has emerged as the second biggest source to the world clothiers. India's recent advances in evolving better bivoltine silkworm strains and upgrading rural processing technology have encouraged many tropical countries to adopt sericulture for uplifting their rural population.

The technical sections are also particularly interesting, since they cover sericultural technologies (mulberry culture, silkworms rearing, seed production) as well as modern

industrial technologies regarding cocoon processing, reeling, weaving and dyeing-printing. The chapter dedicated to the current results and orientations of research is of a particular interest and it is quite original in a book dedicated elsewhere to economical aspects and marketing.

The present source book traces recent global status of silk and describes in depth the sericulture practices country-wise, both in temperate and tropic regions of the world, as also silk processing, and marketing of raw silk, finished silk and ready-to-wear including high fashion couture creations of Italy, France and Switzerland.

The book attempts to fill in a void in the current information available in English on the world status of sericulture and silk. We presume it would definitely interest scientists, technologists and students connected with the textile industry as also the textile designers, converters, importers and exporters the world over. It would also help the boutiques, buying-selling organizations, and chain of department stores to understand why silk sells and why it is superior to other textiles. This source book covers the entire global scenario of silk as it has entered very successfully in the 21st Century.

We must mention here our sense of obligation to Secretary Generals, International Silk Association (ISA) and International Sericulture Commission for sharing the silk information and for the forewords. We are indebted to Senior Officers of Central Silk Board (CSB), India and its institutions as well as Chinese National Institute of Sericulture, and several scientists who helped us immensely to complete the book. Silk is Silk.

Rajat K Datta & Mahesh Nanavaty. Authors

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1 Global Textile Scenario

The 20th century ushered in revolutionary inventions in science and technology and the global textile scenario too underwent spectacular changes with advent of manmade fibers during middle of the century. The world of textile fibers, which had remained passive for three thousand years, has been changing almost every year since middle of the century. The change over from hard labor to mighty machine during the 'Industrial Revolution', development of cotton gin during the close of the 19th century, emergence of rayon and astonishing development of manmade have completely upset the traditional formulae which hitherto operated the natural fiber industries.

1.1 Macro view of Fiber Scene

Natural textile fibers – cotton, wool and silk – dominated the world textile market until mid-century. The beginning of cellulose and synthetic fibers and their sudden spurt changed the textile fiber consumption pattern overnight. The post-war years' review by Food and Agriculture Organization (FAO) points out 52 per cent jump in the world consumption of fibers during 1948-58 due to rise in population and better living standards. During this post-war decade though the usage of natural fibers rose substantially; cotton by 53 per cent, wool by 70 per cent and silk over 100 per cent, the newly emerged manmade over took all targets and its consumption shot up by 2,000 per cent. Even the beginning years of the 21st Century has not changed the rising trend of manmade.

Though natural fibers have lost their share in global textile fiber consumption, these fibers have successfully withstood severe competition from manmade and by the beginning of

the 21st century; their production and consumption are slowly rising. The ecology conscious people in Europe and USA are seeking natural textiles; cotton, wool and silk. Manmade blended with cotton, wool or silk have gained wide acceptance in the world market. The blends provide comfort of natural fibers with properties of wash and wear and durability of manmade. This trend has given boost to production of cotton, silk and cellulose fibers dominated by versatile modified rayon.

1.2 Natural Textiles – Cotton

Cotton has been hailed as ‘King’ of textile fibers and despite manmade fibers rising over cotton production through engineered chemical process, cotton continues to command royal respect and is much sought after among consumers of textiles the world over. Cotton has a long history dating to 3,000 B.C. with India claiming credit for origin of cotton. The Greek historical Herodotus (484 B.C.) made the first historical mention of cotton. He wrote after his trip to India, “There are trees in which fleece grew... and natives made cloth”. The ancient globetrotters, Marco Polo, Vasco-de-Gama and Columbus too mentioned about weaving and spinning of cotton and sheer silk in China and India. In the following centuries cotton spread to east and west. It seems Chinese developed spinning wheel and despite their efforts of keeping it secret, cotton spinning spread to Japan and elsewhere. Arabs took cotton craft to Spain and from there cotton cultivation and spinning became popular all over Europe. In America, Virginia claims credit for first cultivation of cotton in USA in 1607.

Cotton, one of the world’s leading agricultural crops, provides textile fibers for a wide range of uses from clothing through home furnishings to fabrics for industrial uses.

Cotton is most comfortable to wear, quite durable, resistant to abrasion, washable and relatively inexpensive. Non-woven cotton made by bonding of fibers together is extensively used for disposable products like towels, tea bags, tablecloths, bandages and disposable hospital sheets. Modern textile finishes have made cotton crease resistant, stain resistant and shrink resistant. Cotton is also ideal for blending with manmade and other natural textile fibers.

World cotton production almost doubled within three decades from 1930 to 1960s but since then the growth rate staggered with manmade' production making strides since 1970s. According to International Cotton Advisory Committee (ICAC) the present production of cotton is 19,800,000 m. MT (2001), with China bagging lion's share of 4, 000, 000 m. MT, USA 3, 750, 000 MT, India 2, 280, 000 m. MT followed by Pakistan, Uzbekistan, Turkey and others. The main consumers are China – 4, 700, 000 m. MT, India – 2, 850, 000 m. MT and USA 2, 460, 000 m. MT. The total global consumption which exceed production is estimated around 19, 700, 000 m. MT during end of 1990s.

Table - 1.1: Worldwide demand for Textile Fibers - 1992 to 2001 (Thousand Metric tons)

Type of fiber	1992	1993	1994	1995	1996	2001
Cellulose fibers Yarn+Monofilament	695	699	667	684	667	-----
Staple+TOW	1,631	11,634	1,670	1,789	1,614	
Total Cellulose	2,327	2,334	2,337	2,473	2,282	2692
Synthetic fibers Yarn+Monofilament	7,973	8,395	9,164	9,862	10,319	9769
Staple+TOW	8,188	8,190	8,795	8,619	9,348	9,475
Total Synthetic	16,161	16,585	17,958	18,482	19,667	19244
Total Manufactured	18,488	18,919	20,295	20,954	21,949	31,601
% of World Total	47%	48%	50%	51%	52%	53%
Natural Fibers Raw Cotton	18,732	18,521	18,328	18,509	19,040	19,814
Raw Wool	1,702	1,657	1,555	1,472	1,442	1,180
Raw Silk	67	68	69	92	71	82
Total Natural	20,501	20,246	19,952	20,073	20,553	24908
% of World Total	53%	52%	50%	49%	48%	42%
World Total	38,989	39,165	40,247	41,027	42,502	59,201
World Total %	100	100	100	100	100	100

Source: Fiber Organon (June 2002)

1.3 Wool and Worsted Fibers

Man discovered wool even earlier than cotton. Man hunted the sheep both for food and clothing in the Stone Age, some 1, 75,000 years ago. Both sheep and wool seem to have been introduced by Central Asia to Europe. The finest, breed, the Phoenicians took Marino into Spain long before the Christian era. The finer qualities of wool from Marino are at present found in warm and dry regions of Australia, South Africa and Argentina. The other breed of sheep wool, mostly found in Asia is long wool type suitable for carpets and mixed wool fabrics. Wool yarns are classified as woolen or worsted types according to spinning method employed. Woolen yarns are from short fibers loosely spun with little twist; worsted yarns are smooth with higher twist and make closely woven fabrics.

Like cotton, wool production rose mostly during the 20th century reaching record production of 1,590,000MT raw wool by 1970. But during 1970-90 wool production was stagnant till 1993. The production declined over 3 per cent from 1,657,000 m. MT in 1993 to 1,429,000 m. MT in 1997. (Fiber Organon, June 1998) (Table 1.1). Wool and worsted yarn are extensively used for clothing, blankets, carpets and durries. The main fine quality wool producing countries are Australia, Russia, New Zealand, Argentina and South Africa. India, Pakistan, China, Middle East and North Africa are suppliers of wool suitable for carpets and furnishings. Leading consuming countries are European Union, United States, Japan and Russia, though the woolen clothes are also in demand in other countries in temperate regions.

1.4 Era of Manmade Fibers

Manmade fibers are the result of man's urge to probe deep into secrets of nature and make a small wonder by him. The first man to visualize the possibility of manmade fiber by imitating the silkworm's spinning process was an English scientist, Robert Hooke, who in 1664 put his imagination in a book called 'Micrographia'. The next man to carry forward Hooker's dream was a French scientist who in 1734 predicted that manmade fibers would be made from gums and resins. A century elapsed, nothing happened. Again in 1845 an weaver named Louis Schwabe and the Swiss chemist, C.F.Schonbein made news with the former fitting a machine with a nozzle which forced out artificial fibers from a liquid and the latter discovering nitrocellulose, a preparatory step towards rayon manufacture.

It was however, let to the genius of Count Hilarire de Chardonnet who produced first rayon from pulp made of mulberry barks during middle of the nineteenth century. He is known as 'Father of Rayon'. The successful launching of rayon in Europe and America gave necessary impetus to the chemists and fiber technologists the world over and began a feverish research activity to discover new manmade fibers. A major triumph of man's efforts came during the 1930s when 'nylon', a true synthetic fiber was developed by a sheer accident in the laboratory of a well-known American firm, E.I. Due Pont de Nemours. The firm had started studies on polymerization: "how and why certain small molecules unite to form giant molecules such as those found in rubber, cotton or silk". One of the chemists after experimentation was trying to remove polymer from a vessel and he found to his surprise that a fiber could be drawn from that sticky tissue. Some more research undertaken to form nylon, first called 'Polymer 66', and was placed in the market

in 1938 as bristles in tooth brushes. Year later nylon hosiery hit the textile fashion and within a year edged off silk from the hosiery market and gradually nylon became a household word the world over. The post-war period brought out a host of several other true synthetic fibers, which can broadly be put under three groups – polyester, acrylic and polyvinyl groups.

The basic method of manufacture of manmade fibers in its crude form is the imitation of the silkworm's spinning system. There are three basic techniques of producing manmade fibers, though all of them in a simple way forced a chemical solution known as polymer through a spinneret, a nozzle with tiny holes. A polymer is the union of simple molecules or monomers into a giant molecule (macro-molecule). The process is called polymerization. Thus all fibers including natural ones are composed of molecules, held together within a macro-molecule by the manmade fibers, and represent man's attempt to arrange molecules in the same way as nature arranges them and later converting them into fibers by taking a clue from the silkworm, the master spinner.

The manmade fibers are broadly classified into four groups: (1) cellulose fibers, (2) synthetic fibers, (3) protein-base fibers, and (4) inorganic fibers. The cellulose fibers include: (a) viscose rayon, (b) cuprammonium rayon, and (c) acetate. The synthetic fibers cover polyamide, polyester and other true synthetic fibers. A host of new manmade fibers have burst upon the world textile scene in recent years. Fiber manufacturers and textile laboratories are emerging with newer fiber concepts to meet wide range of specific end-uses. Modern research and development work on manmade fibers is the key to rising success and growing versatility of manmade. In fact, the manmade fibers have

given rise to almost a new textile technology by revolutionising almost every phase of textile production from fiber-spinning through weaving and wet-processing to marketing and after-sales service. There are several new manmade fibers, which have come out of experimentation recently claiming a measure of commercial success. New concepts have emerged both among rayon and synthetic fiber ranges.

The international trade in manmade fibers is divided into three phases: the first phase covers the period from 1890 when rayon was first introduced to the world to early 1920s; the second phase spreads through 1920s through end of 1930s – the period marked with active commercialization of rayon and the birth of true synthetic nylon in 1939. There was a complete dislocation for about a decade from 1940 to 1949 with the Second World War destroying heavily the fiber-producing capacity of Japan and Germany. The third phase covers the post-war period from 1950 to the beginning of 21st century – the period of phoenix-like resurgence of manmade fibers and their phenomenal rise to the present world status.

Until 1920s the traditional practices of international textile trade were based on cotton, wool and silk with cotton playing the premier role seconded by wool. The cotton production accounted over 85 per cent and wool 15 per cent of the total global output. During the second phase this conventional ratio changed. The process began in 1922 when rayon (92m.kg.) accounted for one per cent of the total output; rayon's share rose to two per cent by 1927, seven by 1935 and 12 per cent by 1940 – a year when nylon was added to rayon. During the Second World War the combined output of rayon and nylon ranged between 12 and 15 per cent of the world production of textile fibers. Its output was

less than 1,200 m Kg a year. It was during the third phase – the post-war years – which the manmade fibers blossomed into versatile fibers. While rayon remained somewhat stagnant, synthetic fibers diversified. Nylon introduced in 1939-40, shot to world popularity; and a host of other synthetic fibers, including polyester and acrylic hit the market.

1.5 Multifibers, Microfibers and Blends

The manmade fibers have opened up an era of multifibers and ushered in a new textile philosophy of co-existence among fibers. The tremendous rise of manmade, particularly of non-cellulose fibers during the past fifty years has completely revolutionized the traditional formulae, which hitherto governed the world trade in fibers and fabrics. The manmade fibers account for over 52 per cent of the total world output of major textile fibers and surpass the natural ones in both performance and economic values. But no more manmade make a bid to compete with natural fibers; on the contrary, through a new concept of blends the manmade seek a harmonious development of all fibers to meet the rising demand of fibers for clothing and industrial uses. In fact, the time has arrived when manmade fibers are no more grouped separately from the natural ones. All are just fibers – each playing its own role in meeting the world demand.

The modern manmade fibers are blends – two or more different fibers blended before they are spun. There is a difference between the intimate blending of two or more fibers before they are spun into yarn and mixed yarn, in which yarns spun from distinct fibers are combined by weaving into a single fabric. The most popular manmade are cotton-rayon, nylon-wool, nylon-cotton, polyester-cotton,

polyester-wool and acrylic-wool. Then there are solution-dyed or spun-dyed fibers, which are dyed before spinning. Such colored fibers show remarkable resistance to fading when exposed to sunlight or constant wear and washing. A host of new manmade fibers with versatile properties are entering into the global textile market each year. In recent years microfibers with polyester blends have entered the commercial fibers with 'silk look', but despite all efforts to endow silk like look and silky touch, manmade have yet to go a long way to meet the environment friendly and healthy characteristics of natural fibers.

1.6 Silk Survives, Succeeds

Silk enters the 21st century as strong, smooth, much-sought-after environment friendly, healthy (next to human skin) textile fiber. Despite shrinking of sericulture in Japan and Korea due to high cost industrialization and severe competition from manmade, silk has not only survived but has succeeded globally in raising its production and demand. The world silk demand shot up from 68,000 MT in 1993 to over 86,000 MT in 1998 registering 21 per cent rise within a span of five years (Courtesy International Silk Association, Lyon). Though this a miniscule percentage of world textile fiber production, silk continues to rule as 'Queen' of textile fibers, just as cotton is considered 'king' of fibers.

Though historical development and international trade in silk is discussed in depth in the book, it is necessary to highlight the salient features of silk development during close of the century. There are three emerging trends, which have completely changed the production and consumption pattern of silk industry. First, Japan and Korea are gradually abandoning sericulture due to high labor cost and pressure

from high-tech industries, but China, India, Thailand and Brazil seem successful in raising silk productivity and production. The second important development is availability of medium priced silk garments; crease-resistant silk apparels, which are in big demand among middle class professionals particularly women workers. The demand for both high-priced and medium-priced silk garments continue to rise due to growing concern for protecting environment, particularly among industrial countries which are even prohibiting use of certain chemicals, dyes and prefer natural to chemical fibers. Thus natural textiles – cotton and silk are witnessing a new era of global demand, which may sharply rise in the next millennium.

The Secretary General of the International Silk Association (ISA) forecasts rising global demand for silk and points out factors behind the rise: (i) New Concept: Until 1980s silk was worn only for special occasions but silk is no more a luxury or ceremonial dress; it is now a casual wear, and even sportswear; (ii) New products: This includes thermal wear, sportswear, undergarments, shirting and crease-resistant fabrics. The sand-washed garments which were popular during mid 1990s have lost their share in the market; (iii) New Prices: Silk was hitherto confined to a small affluent minority but thanks to new industrial production methods and economy of scale, combined with low wages in many developing countries, prices of silk have come down during 1990s; (iv) New Channels of Distributions; silk, no more an exclusive product for high-priced boutiques, has now become more visible and touchable on the shelves of the super markets and departmental stores; (v) New Consumers: Silk was confined mostly to women's wear and men could expect at the most a silk tie. Now men can find shirts, jerkins, socks, T-shirts, shorts and few other items, which are exclusively made from natural silk.

According to ISA Secretary General a large scale import of silk garments “have not captured the market share once held by traditional products but have created a new market in which silk was never present in any appreciable quantities’. Though there are no in-depth market studies on this aspect, he feels “it seems unlikely that there has been a transfer of consumers from traditional up-market, luxury products to inexpensive everyday products”. Thus France, Italy and Switzerland continue to process raw silk to turn out most expensive scarves, ties and women wear for high fashion aristocratic clients. Even in Asia, though Japanese ‘kimono’ has lost its appeal among young ones, the silk consumption has shot up with Japanese going for western clothing. In India, traditional silk ‘sari’ continues to hold its sway over women, both young and old for ceremonial wear, the young generation loves silk as dress material.

The wave of sand-washed silk garments seems to have ebbed in Europe and USA and several silk lovers did call this development as ‘vulgarization’ and condemned the flood of cheap silk garments as damaging the queenly status of silk. Even some purists also condemn the growing concept of silk blends. But such fears are not likely to lower the prestigious position of silk. “It is the quality of the product which will make people continue to buy silk”, according to ISA, which feels quality can be guaranteed with adoption of ISO 9000 standards, which are designed to offer the consumer guaranteed performance and quality.

The future of silk through the 21st century seems quite bright. Though consumption is likely to rise despite its high prices, the question mark is whether the silk production will keep pace with the shooting demand. Japan is foremost in silk consumption; Chinese enjoying high standard of living are also boosting demand for silk within the country and

almost 85 per cent of rising silk production in India is consumed within the country and has to import up to 5,000 MT every year to meet shortfall in demand. The ecology factor is pushing demand for silk in Europe and USA. And the Middle East Arabs adore silk for the flowing robes, prayer mats and carpets. The global production during the twenty-first century may not rise and with the spread of industrialization and shortage of farm labor, the availability of natural fibers may shrink substantially. In fact, during 1998, the global production of cotton is reported to have declined 6 per cent and wool production seems to have dropped by two per cent. The fiber trend also covers silk. The worldwide natural fiber survey by Fiber Organon (December 1998) reports that the future global growth impacts appear to be dependent on technical breakthroughs, perhaps from genetic engineering leading to high yield per acre and a more competitive cost position versus synthetic fibers. China, the world's leading silk producer continues to lose its mulberry acreage, cocoon production and is not able to raise its raw silk output. Brazil is also witnessing stagnant silk production. India and Thailand produce mainly multivoltine silk and raw silk not suitable for automatic reeling. Unless India's recent success in producing bivoltine silk in tropical climate succeed commercially and quickly covers most of silk producing regions in the country, there is no hope of higher silk production during the century.

The purity and sanctity of silk can be best promoted through introduction of 'silk mark' and promotion campaigns. This is also ISA recommendation; it deplores lack of promotion for silk even while advertising high-priced *haute couture* dresses. It is necessary for ISA to evolve a joint strategy for silk promotion with world's top fashion designers and large departmental stores marketing their high priced silk