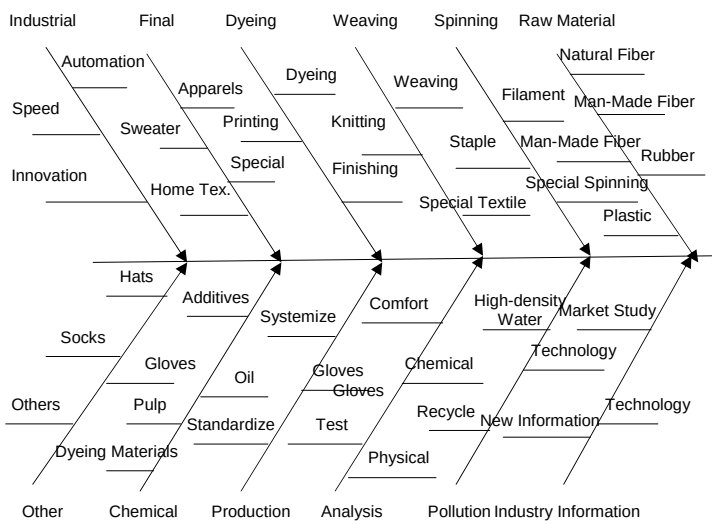
Chapter 12 Textile Industry

Introduction

Scope of Taiwanese Textile Industry

In terms of the production process, the textile industry is viewed from the following perspective: fiber production, spinning, weaving, dyeing, finishing, final product, and packaging. However, manufacturing of textile machines or of dyes and colorants are not included here. This breakdown excludes the manufacture of textile machines of dyes and colorants, which are considered to be part of the machinery and chemistry

According to the Revised Industry Standard Classification (8th Revision) issued in May 2006 by the Directorate General of Budget, Accounting and Statistics (DGBAS), Executive Yuan, Taiwan, the textile industry covers three sub-industries, namely, (1) the man-made fiber industry under Code 1850, which is considered an upstream textile industry, (2) the "textile" industry under Code 11, which is defined as spinning, weaving, dyeing, finishing of fibers, and (3) the "apparel and accessories" industry under Code 12 which covers the cutting and tailoring of apparel and accessories, and is considered a downstream industry. Figure 2-12-1 shows the structure of the textile industry.



Source: " Development Strategies and Model of Taiwan's Textile Industry", edited by S. C. Yao, p. 14 (2006), Taiwan Textile Research Institute

Figure 2-12-1 Structure of Textile Industry

Industry Environment

Since 1998, there has been an oversupply of textile products globally, resulting in massive declines in Taiwan's textile exports. Despite textile exports reaching US$14.5 billion in 1998, they still declined 12.5% from 1997. Textile export declined to US$14.2 billion in 1999, a reduced 1998. Exports rose to US$15.19 billion in 2000, but then declined 17% in 2001 and US$12.6 billion in 2002. It declined of 4% to US$12.14 billion, while 2003's exports were US$11.85 billion or 2% decline. The trend reversed in 2004, with exports increasing to US$12.54 billion. Finally, the export reached US$11.81 billion in 2005, declining 5.8% from the previous year.

According to import and export information by the Customs Department, about half of Taiwan's exports of fibers, spindles, fabrics, and apparel to Hong Kong are transshipped to China. However, in terms of growth rate, textiles exports – with the exception of apparel – including fibers, spindles, fabrics, and accessories all imply decline. In fact, fiber exports to China declined 50%. The main reason was the vast increase in China's production of chemical fibers, raising self-sufficiency, and the reduced amount of polyester products to China. In addition, large scale investments by the textile industry in the past had resulted in Taiwan's lowest production cost among the global textile suppliers, but this also resulted in over-production. Thus suppliers face the unsavory prospects of loosing money as soon as they commence production.

Furthermore, the increasingly difficult investment climate within Taiwan has caused businesses invest overseas. Besides China, many textile producers are also investing in South East Asia and Central America. This has caused changes in the structure of the textile production system.

Overview of the Textile Industry in 2006

Technology

Technical developments in hi-tech textile products include resistance to ultraviolet rays, sprays, dirt, fungus, odor, bacteria, combustion, and fire. A minority of single products provide several applications such as metallic fibers. The following summarizes the technological developments.

Resistance to Ultraviolet Rays

Processing of textiles to improve ultraviolet rays is divided into treatment during spinning the stage, post-production treatment, coating and processing. When technically feasible, ultraviolet ray absorbents and dispersing additives are added during the spinning phase for man-made fibers. The dispersing additives are generally inorganic microscopic grains such as TiO_2, which are extremely hard and are

evenly spread over the fibers. When concentration of additives exceeds 1%, further processing of the fibers will cause wear and tear on the processing equipment, particularly so in the case of fiber yarns with high processing speeds. One way of improving this is to use composite filaments so that those containing micro particles are placed in the core, generally the elements are placed in sheaths to form a protective layer.

Waterproofing

Waterproof processing exploits the difference between the size of water vapors (0.0004μm) and that of rain drops or water elements (100~3,000μm). The textile's surface is designed to have a surface comprising multiple holes with diameters smaller than those of water droplets.

When considering vapor transmission capacity, besides the water transmission ability of the clothing (materials), environmental factors (such as differences in water vapor pressure inside and outside of the clothing), and the quantity of vapor emitted by the human body must also be considered. That is, regardless of the vapor transmission capacity of the materials themselves, when there is little vapor pressure within and outside the clothing, it is difficult for water vapor to pass through. The present technology requirement is for vapor transmission of at least >3,000 g/m^2。

Resistance to Dirt

The method of producing dirt-resistance hydrophobic man-made fibers is called SR processing (soil release processing). SR processing gives hydrophilic qualities to hydrophobic fibers and prevents them from retaining electrostatic dirt particles, thus producing an effect such that oil and dirt will not stick easily. There are two ways to impart hydrophilic qualities: (1) Direct addition of additives during spinning so that hydrophilic units are synthesized on the surface, (2) Chemical treatment so that hydrophilic matter attaches to the fiber surface. The latter is the more popular method, technical indicator is spray resistance >150 degrees.

Resistance to Bacteria and Odors Processing

The main method for producing bacteria-resistant fibers involves a process in which biocides are first added to the polymer solution and then mixed thoroughly before spinning into fibers. Generally, wet spinning is used for organic biocides, while melt-spinning is used for inorganic biocides. It is possible, during subsequent treatment, to allow biocides to be absorbed into deeper parts of the fiber surface, e.g., by developing fibers with rough and miniscule holes, so that during post-production treatment the biocides may be absorbed beneath the fiber surface. The technical indicators are bacteria suppression value >3.0,

bacteria elimination value >1.5, and bacteria reduction rate >50%.

Hundreds of materials have deodorizing properties, including aromatic compounds which change their fragrance when mixed with odorous elements, thus suppressing the odors. This type of deodorizer comprises mainly comprises citral, camphor, cinnameldehyde, and heliotropin. Most odorous elements such as hydrogen sulfide and ammonia can be neutralized through chemical processes such as redox reactions, neutralization reactions, addition/ condensation reactions, ion exchange reactions, and sulfur reaction.

Additionally, deodorizing elements can be extracted from natural substances. For example, the natural elements extracted from camellias contain flavanonols, flavonols, and tannic acid which can also be used as deodorizers. Existing technologies are approaching >80% reducetion of acetic acid, isovalerate, formaldehyde, and hydrogen sulfide, fiber moisture-absorption rate >0.8%, and moisture release rate >0.3%.

Flame- Retardance

Human consumption has grown together with technological development, and there is an increasing demand for fibers and fiber products. However, the fire hazard posed by fiber-based products is one of the major hazards for society, one that can seriously threaten human and property safety. Furthermore, the threat to the human body posed by hazardous gases released during the combustion of flammable textile products is greatly higher than those released by non-flammable textile products.

Flame-retardant additives used in polyester fibers mainly comprise phosphorus and bromine compounds. As a flame-retardant material, phosphorous has better flame-retardant properties than bromine. However, widely available flame-retardant compounds frequently contain more bromine than phosphorous. Ideally flame-retardant materials should contain adequate quantities of both elements. The quantity used in a finished product should be designed to retain flame retardant properties while minimizing any impact on the characteristics of the finished product.

Among halogens, the flame retardant effect of bromine is twice that of chlorine. Thus among combinations of flame-retardant elements, that of phosphorous and bromine has the greatest effect. So as to enhance the flame-retardant effect, consideration must be given to the accompanying interactions between the flame-retardant elements. In terms of technical indicators, the limited oxygen index (LOI) should be as high as possible; it should at least be 30 or greater.

Anti-static Properties

Addition of a little conductive fiber will

prevent electrical interference and hazards. The conductive elements in conductive fibers consist of metals, metallic compounds, and carbon black. The most common element used is carbon black. Its conductivity is caused by the movement of free electrons and not by absorbing humidity and ion transfer. Thus conductive fibers do not rely on the environment's relative humidity; they are able to display excellent conductivity or anti-static properties even in 30%RH or lower. Conductive fibers with resistance of less than $10^8\Omega$.cm can act as a screen against electromagnetic interference. Conductive fibers are more conductive than anti-static fibers. Adding a small quantity of them would achieve an obvious anti-static effect. However, their manufacturing methods are more complex, and they have less-than-ideal mechanical properties and exterior appearance, as well as greater costs.

Conductive fibers and anti-static fibers have their respective strengths. The earliest attempt to use conductive fibers to achieve anti-static effect was the stainless steel fibers produced by Brunswick in the US. Although they posses outstanding heat-resistance, chemical corrosion-resistance, and malleability, they have high relative density, and their elongation and frictional behavior are different from those of organic fibers. In particular they prove to have considerable difficulty in wrapping around other fibers. Moreover they do not have good bending properties or texture. Hence they are rarely used. Despite the excellent conductivity of subsequent carbon-based fibers, their mechanical properties are similar to those of ordinary fibers, and so they are not considered good materials. In 1974 Dupont developed the Nylon BCF yarn Antron III, a type of conductive fiber used in making carpets. The fiber is a type of concentric circle core sheath composite conductive fiber. Its core is carbon black polymers, while its sheath which occupies 96% of the entire fiber body, is made of Nylon 68. This type of conductive fiber has a relative resistance of 10^3~$10^5\Omega$.cm. Furthermore it retains all of the excellent mechanical and physical functions of Nylon 66. An addition of a mere 1~2% of this type of fiber to textiles will achieve excellent anti-static effect. At present the anti-static testing technical requirement is of a surface resistance of less than $5x10^{10}$W. For pure textiles under low humidity and medium humidity level the static protection surface resistance should be $1x10^5$~$1x10^{11}$W.

Production of metallic textiles

Basic materials which undergo metallic treatment are known as base fabrics. Base fabrics can be woven fabrics, knitted fabrics, non-woven fabrics, or composite fabrics. Meanwhile, the types of fibers used can include natural fibers such as cotton and jute

hemp; inorganic fibers such as glass fibers, carbon fibers, asbestos fibers and metallic fibers; recycled fibers such as rayon fibers and cuprammonium rayon; and man-made fibers such as Nylon 6, Nylon 66, aromatic polyamide fibers. These fibers may be either fiber filaments or staples.

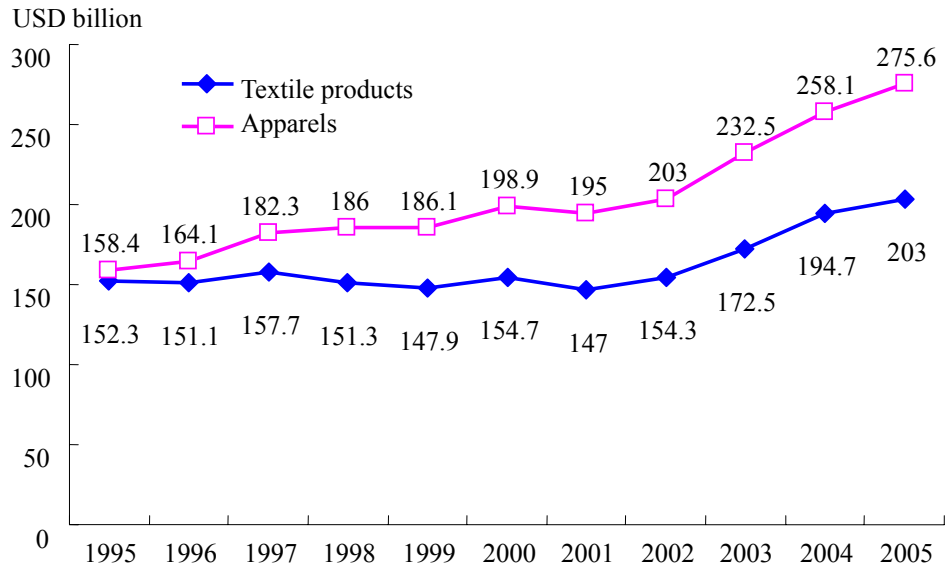
Pasting of the metallic film or metallic fabrics is primarily performed via vapor deposition or spray coating. Since the finished products are identical, it is easy to confuse two methods. Most of the metal used is easily upon exposure to air, thus vapor deposition and spray coating must be performed under a vacuum. Presently the industry is capable of creating apparel using metallic fibers which are thinner then human hair.

Market

Summary of Global Textile Trades

2005 was the first year in which quotas were completely removed from the global textile and garment trade. This change during 2005 represents an important issue for the textile industry and deserves further attention.

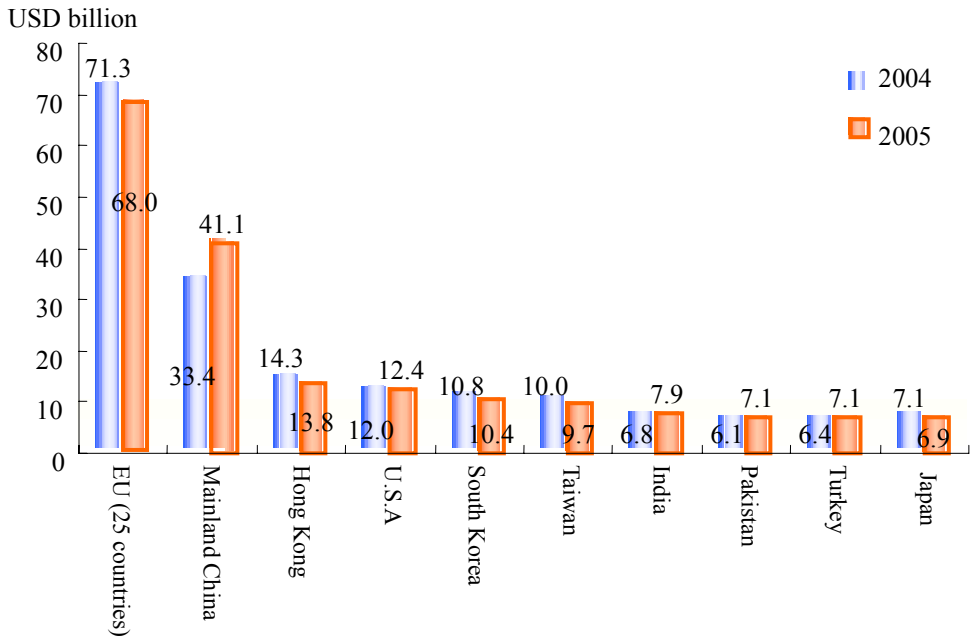
The elimination of quotas implies greater liberalization of textile and garment trades, and has accelerated the trend of low-income nations displacing high income nations in textile and garment production. Nevertheless data published by the World Trade Organization (WTO) for global textiles and garment trades in 2005 indicates growth rates that are roughly the same as in the previous year. During 2005, global exports of textiles and garments totaled US$478.6 billion (see Figure 2-12-2), representing growth of about 6% compared to 2004. Of the two, textiles exports were US$203.0 billion, or a growth of 3.9%, while garment exports were US$275.6 billion, or a growth of 6.4%. Together with increasing global trade volume increases, the increases and decrease in individual nations are also evident. While the overall trend was one of increasing global trade volume, the picture at the individual nation level was more varied, and there were increasing imports of textiles and garments into key markets (such as the U.S.) from some of the lower-income nations, and declining imports from higher-income nations such as those in East Asia. Additionally, new trade restrictions (e.g., special defensive measures adopted by the U.S. against certain textile products from China) contributing to the weak growth in the global textile and garment trades following the elimination of quotas.



Source: WTO; Prepared by ITIS Program, TTRI (2006/11).

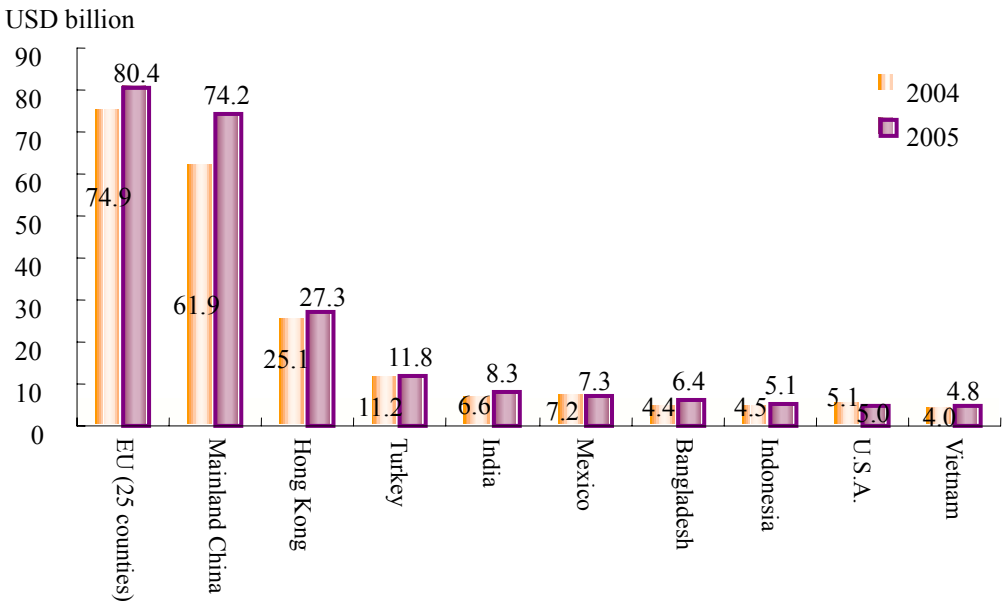
Figure 2-12-1 Global textile and garment volume of trade

Textiles and garment exports in 2004 and 2005 respectively for the world's top ten nations and regions such as China, India, Pakistan, and Turkey are compared to demonstrate the changes between the two years. Growth varied during 2005, but was strongest in China. Textiles exports from China increased from US$33.4 billion in 2005 to US$41.1 billion in 2005, which was a representing growth of a staggering 23%. In contrast, textiles exports in during 2005 for higher-income East Asian countries such as Hong Kong, South Korea, Taiwan, and Japan were lower than in 2004. Further analysis of the exports from the top ten nations and regions including those in Asia such as China, Turkey, India, Mexico, Bangladesh, Indonesia, and Vietnam demonstrates that their 2005 garment exports increased relative to 2004. The above mentioned lower-income nations' exports took up 43% of the global garment exports. From this it can be seen that garment production tended to converge in regions with lower costs.



Source: WTO; Prepared by ITIS Program, TTRI (2006/01).

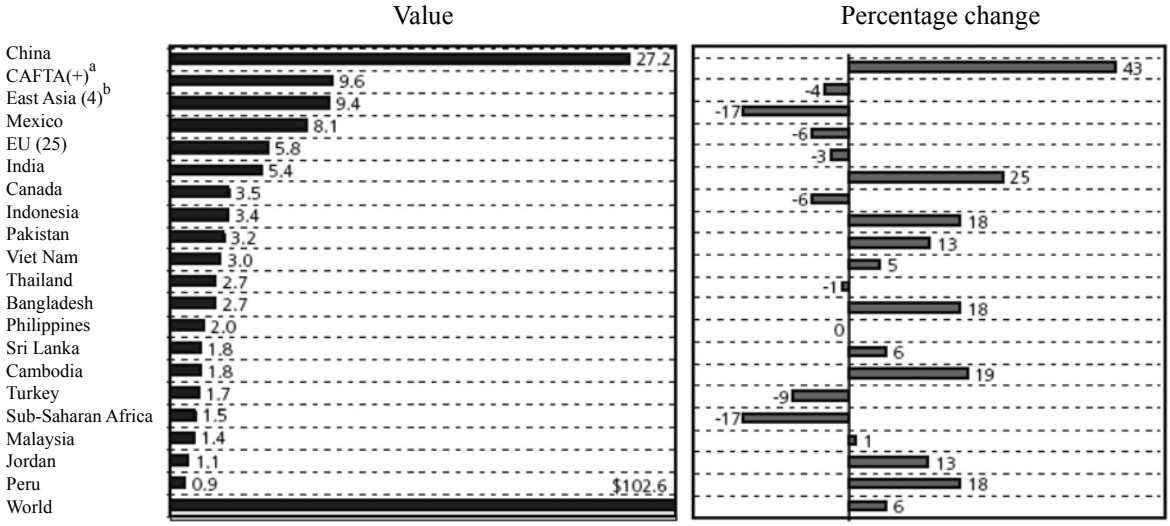
Figure 2-12-3 Changes in Global Textiles Exports for World's Top Ten Nations & Regions (1) in 2004 / 2005



Source: WTO; Prepared by ITIS Program, TTRI (2006/01).

Figure 2-12-4 Changes in Global Garment Exports for World's Top Ten Nations & Regions (1) in 2004 / 2005

Analysis was also performed on the changes during 2005 in the share of the textiles and garment import markets in the U.S. In 2005, U.S. imported textile products and garment were roughly US$102.6 billion (see Figure 2-12-5). China was the major source of imports. Imports from China totaled about US$27.2 billion, representing 26.5% of total textiles and garment imports. This represents a growth for 43% from 2004. Besides China, textile products and garment imports from India, Indonesia, Pakistan, Vietnam, Bangladesh, and Cambodia all displayed significant growth. However, textile and garment imports from CAFTA, East Asia, Mexico and Canada declined. Based on this analysis, there have been changes in the market share for the world's suppliers of textile products and garment into the U.S. As such there have been changes to the market share of textile products and garment production countries/ regions in the American market subsequent to the elimination of quotas. Countries previously benefiting from the Agreement of Textiles and Clothing (ATC) – like the East Asian region, Turkey, and Mexico – have seen their market shares being eroded by low-income countries/ regions. The latecomers, particularly China and India, with their low-cost advantages, demonstrated remarkable growth following the dismantling of trade barriers in the form of quotas. These countries are expected to show enormous potential in terms of textile products and garment exports.



Note 1. CAFTA includes Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras and Nicaragua.
2. East Asian countries include Hong Kong, North Korea, Macau and Taiwan.
Source: US Department of Commerce – International trade statistics –; Prepared by ITIS Program, TTRI (2006/01).

Figure 2-12-5 U.S. Textile Products and Garment Imports from Respective Nations in 2005

Overall, notwithstanding that the global textiles and garment trades have maintained stable growth following the elimination of quotas, it can be seen from the imports from various regions that the labor-rich Asia countries/region will be able to leverage their cost advantages during the non-quota era.

Current Development of Taiwan's Textile Industry

Production

In terms of the number of factories and employees, Table 2-12-1 shows that the scale of Taiwan's textile industry has been shrinking over the years. As of September 2006, there were 5,591 factories employing 172,000 workers. However, the per capita average monthly work-hours and the per capita average monthly wages saw an increase from their respective levels in 2004.

Table 2-12-1 Number of Textile Factories in Taiwan and Employees

Year	Textile & Garment Factories	Employees (1000 persons)	Per Capital Average Monthly Work-hours	Per Capita Average Monthly Wages (NTD)
2000	7,301	238.49	202.7	29,490
2001	7,090	218.03	190.1	29,160
2002	7,101	205.33	190.6	29,708
2003	6,924	198.05	190.7	29,987
2004	6,062	193.4	192.9	30,943
2005	5,810	181.36	190.7	33,141.3
2006(9 months)	5,591	172.53	195.7	33,456

Source: Department of Statistics, Ministry of Economic Affairs, DGBAS, Executive Yuan；Prepared by ITIS Program, TTRI (2006/11).

The production value of man-made fibers has been rising for three years since 2002, peaking at US$153.6 billion in 2005. Other indicators including production revenue and value-added peaked in 2004 (see Table 2-12-2).

On the other hand the production value of the textile industry has been shrinking since 1997. Furthermore production revenue, value-added, and value-added rate reversed their upward trends in 2002 and began to show signs of decline (see Table 2-12-3). The same phenomenon is also seen in the garment and finished apparel industry (see Table 2-12-4).

Table 2-12-2 Annual Production and Value-Added of Man-made fibers

Unit: NTD100 million; %

Year	Production Value	Production Revenue	Intermediate Investments	Value - Added	Value - Added Rate
1997	1,265	1,114	715	399	35.83
1998	1,153	999	649	350	35.03
1999	1,076	1,093	693	400	36.60
2000	1,227	1,443	974	469	32.48
2001	1,135	-	-	-	-
2002	1,228	1,457	891	565	38.81
2003	1,391	2,143	1,461	682	31.83
2004	1,613	2,888	1,944	944	32.70
2005	1,536	3,891*	2,587*	1,304*	33.51*
2006	1,512*	4,670*	3,104*	1,566*	33.53*
2007	1,500*	5,137*	3,414*	1,723*	33.54*

Note 1: the latest statistical Industrial Statistics Survey information by the Department of Statistics, MOEA end on2003; furthermore no survey was conducted in 2001 because of the census.

Note 2: * Denotes Forecast Value

Source: Department of Statistics, MOEA, Monthly Bulletin of Productivity Statistics; other items from Industrial Statistics Survey of Department of Statistics, MOEA.

Table 2-12-3 Annual Production and Value-Added of Textile Industry

Unit: NTD100 million; %

Year	Production Value	Production Revenue	Intermediate Investments	Value - Added	Value-Added Rate
1997	3,842	4,495	2,863	1,632	36.32
1998	3,775	4,511	2,860	1,651	33.37
1999	3,643	4,839	3,077	1,762	36.40
2000	3,659	4,994	3,283	1,711	34.27
2001	3,190	-	-	-	-
2002	3,069	4,527	2,944	1,583	34.96
2003	2,908	4,377	2,956	1,420	32.46
2004	3,069	4,136	2,820	1,316	31.82
2005	2,671	3,908*	2,690*	1218*	31.17*
2006	2,629*	3,751*	2,583*	1,168*	31.13*
2007	2600*	3,675*	2,531*	1145*	31.16*

Note: * Denotes Forecast Value

Source: Department of Statistics, MOEA, Monthly Bulletin of Productivity Statistics; other items from Industrial Statistics Survey of Department of Statistics, MOEA

Table 2-12-4 Annual Production and Value-Added of Garment and Finished Apparel Industry

Unit: NTD 100 million; %

Year	Production Value	Production Revenue	Intermediate Investments	Value - Added	Value - Added Rate
1997	1,047	4,495	2,863	1,632	36.32
1998	1,155	4,511	2,860	1,651	33.37
1999	986	4,839	3,077	1,762	36.40
2000	897	4,994	3,283	1,711	34.27
2001	730	-	-	-	-
2002	681	4,527	2,944	1,583	34.96
2003	647	4,377	2,956	1,420	32.46
2004	587	4,136	2,820	1,316	31.82
2005	473	3,929*	2,707*	1,222*	31.10*
2006	436*	3,811*	2,653*	1,158*	30.39*
2007	430*	3,735*	2,600*	1,135*	30.40*

Note: * Denotes Forecast Value
Source: Department of Statistics, MOEA, Monthly Bulletin of Productivity Statistics; other items from Industrial Statistics Survey of Department of Statistics, MOEA.

Demand

The scale of the domestic market is determined by adding imports to and deducting exports from the domestic market demand. Table 2-12-5 shows the domestic marketdemand peaked during 2004 at NTD 200.2 billion. It subsequently began to show signs of decline. Stimultaneously, exports as a percentage of production were slightly higher in 2006 (January ~September) at 83.7%.

Imports & Exports

Based on observations of imports and exports for January ~ October 2006 (see Table 2-12-6), textile products exports were 5.34% of all products, and imports of textile products were 13.5%. The textiles trade deficit was 47.65% of the total trade deficit, of which exports showed a negative growth of 0.7%, while imports showed a growth of 2.8%.

Table 2-12-5 Market Scale of Taiwan's Textile Industry

Unit: NTD100 million; %

Year	Production Value	Import Value	Export Value	Domestic Market Demand	Exports as Percentage of Production
2000	5,775	903	4,730	1,948	81.9
2001	5,050	796	4,256	1,589	84.3
2002	4,966	855	4,191	1,630	84.4
2003	4,952	1031	4,152	1,831	83.8
2004	5,294	902	4,193	2,002	79.2
2005	4,680	840	3,787	1,733	80.9
2005 (January ~ September)	3,530	619	2,817	1,333	79.8
2006 (January ~ September)	3,433	650	2,875	1,208	83.7

Source: Department of Statistics, MOEA; Statistics Office of Directorate General of Customs, Ministry of Fiancé；Prepared by ITIS Program, TTRI (2006/11).

Table 2-12-6 Trade Statistics for Taiwan's Textile Products for January ~ October 2006

Unit: US$ million; %

Imports & Exports	Exports		Imports		Total Trades	Growth Rate	Surplus/Deficit
	Export Value	Growth Rate	Import Value	Growth Rate			
All products	184,885	13.8	168,941	10.84	353,826	12.38	15,943
Textile products	9,877	-0.7	2,280	2.8	12,157	-0.04	7,596
Textile products as percentage	5.34		13.5		3.43		47.65

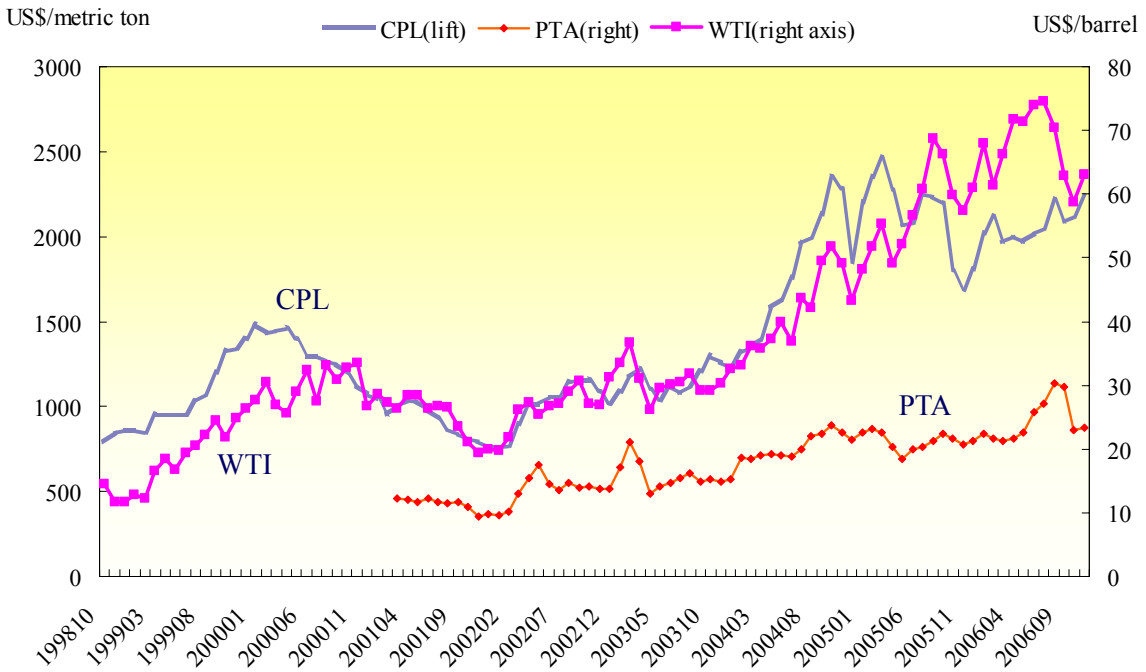
Source: Press release from Department of Statistics, MOEA; Prepared by ITIS Program, TTRI (2006/11).

Important Issues in the Textile Industry

Rising Prices for Raw Materials

Changes in the prices of global supply of man-made fibers have for a long time been rather similar to fluctuations in the price of crude oil. Since 2002, the prices of CPL and PTA have been rising along with the prices of crude oil. By 2006, CPL price was moving within a range of US$2,000~2,100 per metric ton, whole PTA price was maintaining around US$900 per metric ton. It is expected that in 2006, the prices of CPL and PTA will be

maintained around US$2,100 and below US$900 per metric ton respectively, if the price of crude oil were to drop below US$60 per barrel.



Note: Prices of CPL and PTA denoted in US$/ton shown on left axis; West Texas Intermediate prices shown in US$/barrel on right axis.
Source: "Info winner"; Prepared by ITIS Program, TTRI (2006/11).

Figure 2-12-6 Changes in Prices of Crude Oil, PTA, and CPL

Transformation of Industry Structure

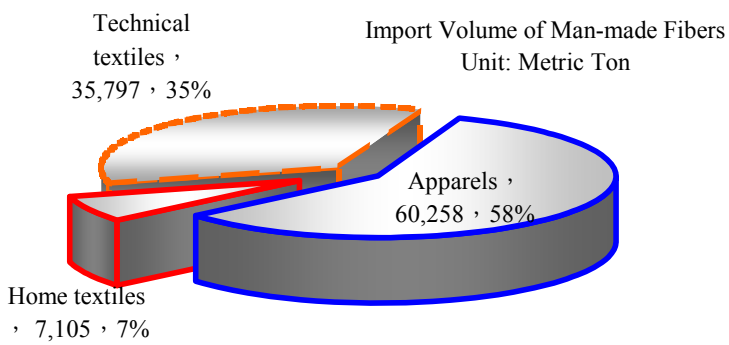
Current Industry Structure

At the moment Taiwan's textile industry is in a phase of industry transformation and upgrade. Besides the sustained research and development of high value-added products for existing textile production facilities and sustained emphasis on design and brand development, there has been considerable investment in developing production capacity for home textiles and technical textiles. Investments in the latter are primarily in technological innovation, product development, and market promotion. The aim is to use advanced technologies to assist the transformation of the textile industry. It is expected that by 2008, the ratio of apparels, home textiles, and technical textiles will be 6:2:2, and that by 2015, it will be 5:2:3.

To further understand the current structure of Taiwan's textile industry, the Production and Economics Center of the Taiwan Textile Research Institute began a survey in 2005, with the survey results renewed every 2 years. Using Taiwan's fiber consumption as the benchmark, the research distinguishes the use of fibers in apparels, home textiles, and technical textiles determine their respective industry structure. Domestic fiber consumption includes imported fibers (about 15% of total domestic fiber demand), and domestically-produced man-made fibers (85% of total domestic fiber demand).

About 75% of Taiwan's fiber imports are natural fibers. Cotton alone makes up nearly 90% of natural fibers. Hence an understanding of the use of cotton will roughly provide an understanding of consumption of natural fibers within Taiwan. Cotton is used primarily in making apparels, such as cotton jackets, t-shirts, shirts, and cotton long and short trousers. The above makes up about 60% of total cotton consumption. Another 30% is used in home textiles, e.g., curtains, seat covers and beddings, while only 10% is used in technical textiles such as medical cotton.

Imports of man-made fibers consisted primarily of special fiber products such as high strength nylon and polyester filament yarns, primarily for industrial use. The import information is then used to estimate the ratio of imported man-made fibers for apparel, home textiles and technical textiles, with the high strength products categorized as technical textiles. According to the estimates, 58% of imported man-made fibers were used in apparel, while only 7% was used in home textiles. With the high volume of high-strength nylon filament yarns, the percentage of man-made fibers in technical textiles jumped to around 35% (see Figure 2-12-7).

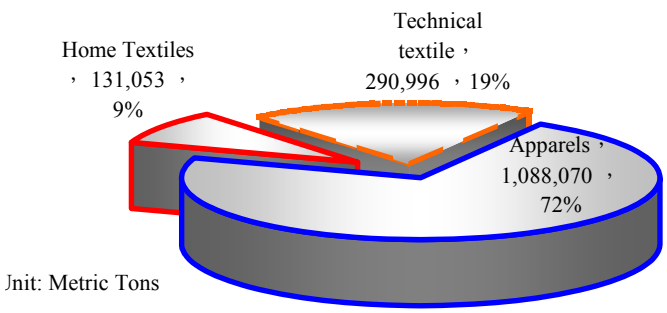


Source: Import & Export Statistics of R.O.C. Customs; Prepared by ITIS Program, TTRI (2005/12).

Figure 2-12-7 Application of Imported Man-made fibers

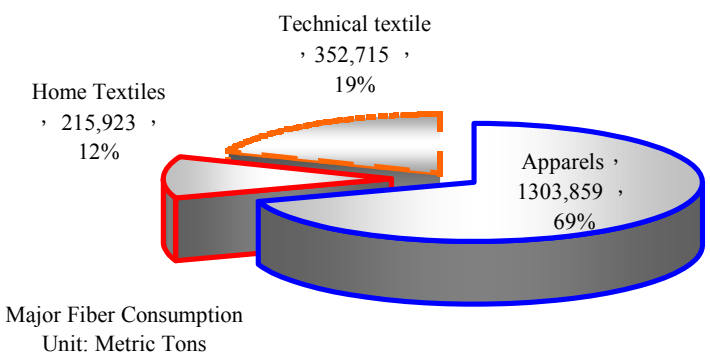
The said research was conducted by way of questionnaires and interviews with Taiwan's major man-made fiber manufacturers regarding the production and distribution of man-made fibers in apparels, home textiles, and technical textiles respectively. Analysis of the survey results reveals that in 2004, 72% of Taiwan's domestically-produced man-made fibers were used in apparels; hence the apparel textiles remained as the main application for man-made fibers. Following apparels were technical textiles, which made up 19%, while home textiles placed last with only 8% (see Figure 2-12-8).

Taking into account the volumes of domestically-produced man-made fibers, cotton imports, and man-made fiber imports, the above mentioned surveys and interviews reveal that the usage ratio for apparel, home textiles, and technical textiles in Taiwan's textile industry is 69%:12%:19% respectively (see Figure 2-12-9).



Source: Survey of Industry Structure (2005/12).

Figure 2-12-8 Application of Domestically-Produced Man-made fibers



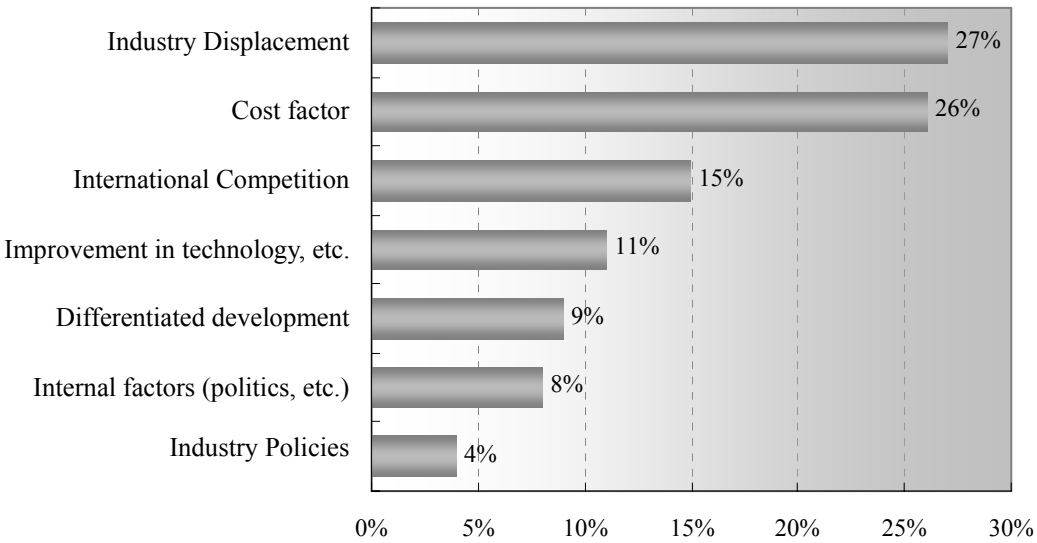
Source: Survey of Industry Structure (2005/12).

Figure 2-12-9 Industry Structure Based on Domestic Fiber Consumption

Factors for Industry Structure

Results of the survey reveal that the three major factors affecting the structure of Taiwan's textile industry are: "Industrial relocation", "costs", and "international competition" (see Figure 2-2-10). Among man-made fiber plants interviewed, 27% thought that "industrial relocation" was the primary reason for changes in the structure of Taiwan's textile industry, and relocated industries consist primarily of the labor-intensive mid to downstream textile industries. Relocation began with the apparels and woolen industries, followed by dyeing and finishing, and weaving and spinning. The relocation of the downstream industries then caused a chain reaction gradually forcing the relocation of mid and upstream industries as well, thus creating changes in the value chain of the entire apparel industry. These changes include a reduction in the demand within Taiwan for fabrics and fibers, and increasing production of apparel differentiated according to functions and brands in response to competition. Potential reasons for relocation relate to of cost and global production and sales distribution in response to international competition and market trends. Indeed, "cost factors" and "impact of international competition" were the second and third most important factors for the changes in the structure of Taiwan's textile industry according to interviewed manufacturers, with roughly 26% and 15% respectively of interviewees citing these reasons.

Another 11% and 9% respectively of the interviewees thought that "technological advances and improved production techniques" and "differentiated development" were factors in the change in industry structure. Considering the direction of the industry's transformation, innovative technologies and product research and development are the key to Taiwan's textile industry becoming a hi-tech industry. In terms of strategies for industrial transformation, the apparel textile sector is focused on increasing value-added and functionalities, while the home textile sector is focused on strengthening designs and applications. Yet another major initiative is the development of new products and new markets for technical textiles. All of the above rely on technological advances and improvements in the manufacturing process to enable the industry to achieve differentiated competitiveness. Finally, other factors that influence the changes in the industry structure include "internal environments" and "industry policies".



Source: Survey of Industry Structure (2005/12).

Figure 2-12-10 Factors Affecting Changes in Industry Structure

Non-tariff Barriers

Generally, any factors that might affect the free trade or additional restrictions on free trade could be considered non-tariff barriers (NTB). Generally, NTB consist of the following: Import Policy Barriers; Standard, Testing, Labeling and Certification Requirements; Anti-dumping & Countervailing Measures; Export Subsidies and Domestic Support; Government Procurement; Service Barriers; lack of adequate protection to Intellectual Property Rights; and other similar barriers.[1]

NTBs are allowed under the former GATT and WTO structures; that is, importing nations are allowed, within reasonable limits, to adopt specific measures to protect the lives and health of their citizens, animals, or plants. NTBs allowed under the WTO include.

Environmental Factors

Importing nations are allowed to formulate their own standards so long as there is no common international agreement on relevant import standards, such as the prohibition for zippers and buttons to contain nickel or the prohibition for fabrics to contain zinc oxide. Nonetheless, product requirements have caused numerous suppliers considerable difficulties, with numerous textile disputes

[1] Source: EU and WTO websites:
http://trade-info.cec.eu.int
http://wto.org/english/trade_e/tbt_e/tbt_e.htm

based on environmental factors. In 2001, an apparel company in China's Jiangsu province was fined US$160,000 for its failure to conform to Germany's numerous environmental protection standards, while a Zhejiang company was informed by its Belgian buyer that it would return 300,000 jackets as their zippers contained chemical substances which are harmful to the human body and the environment.

Social Factors

These are primarily regulations concerning child-labor, non-voluntary labor, working conditions, working hours, and reasonable remuneration. Under the conditions relating to the voluntary nature of work, relevant requirements of international organizations must be complied with (for example, the requirements under SA 8000 of Worldwide Responsible Apparel Production, WRAP). In China – the world's largest textile exporting nation – for example, almost none of the apparel manufacturers in Guangdong province are in compliance with the relevant regulations. Thus if importers were to demand additional documentary proof relating to social factors, most of these manufacturers would be unable to provide them.

Anti-dumping Measures

Dumping occurs when the prices of products in the overseas markets are lower than those in the domestic market, or when the sales prices are lower than the production costs. 3 conditions are required to prove dumping: (1) Dumping test: Proof of importing nation's sale of relevant products below market prices, (2) Damage test: Proof that manufacturers of importing nations have suffered damages because of low-priced imports of certain products, (3) Causation test: Proof of actual losses suffered from dumping. Since 1990, anti-dumping taxes on China grew 10~20% annually. As of 2002, there were 467 anti-dumping cases. With respect to textiles, China has become the leading nation against which anti-dumping claims are being made.

Protective Measures

The greatest difference between protective measures and anti-dumping measures is that anti-dumping is primarily aimed at the products of individual manufacturers, whereas protective measures are primarily erected against specific types of products. When adopting trade protection measures, the country doing so must carry out negotiations with those countries affected by them. As the world's largest textile exporting country, China had agreed that the U.S. and her trading-pact members can adopt protective measures against specific products until the end of 2008; in fact for some the products the defensive protection measures may even be extended to 2013. Generally, the country adopting the

protective measures must convene hearings before doing so, and double protection measures cannot be instituted against similar product types.

Requirements for Proof of Place of Origin

Under the free trade system, proof of place of origin can be seen as an incentive between signatory members of the relevant trade pact to exclude the trading interests of non-members. CAFTA, NAFTA, and EU member nations all enjoy mutual incentive measures.

The adoption of the above NTBs can be both beneficial and detrimental to manufacturers in the exporting nations. They are beneficial in that manufacturers under pressure to improve exports can rapidly raise their product quality so as to meet the requirements of the relevant markets. On the other hand, such an exercise will markedly raise the production costs, thereby increasing the difficulty in entering the relevant market. Additional risks are imposed on both the exporter and the importer.

Table 2-12-7 sets out the NTB of textile importing nations as recognized by Eurotex.

Table 2-12-7 Trade Barriers Adopted By Various Nations against Apparel Imports from the EU

	Argentina	Australia	Brazil	Canada	Chile	Egypt	India	Indonesia	Japan
Registration and documentary requirements	13		9	1	1	4	10	9	
Visa/documents/import permit application	4		4	1		2	4	3	
Compulsory customs duty and requisite procedures	2						2	1	
Customs valuation/minimum import price	2		3		1		2	1	
Delay customs clearance	1		1			1	1	1	
Proof of place of origin	3		1			1		2	
Requirement for goods classification	1						1	1	
Import restrictions/quotas						1		1	
General expenses other than customs duty	1		1			1	4	1	
Restrictions by standards, relevant technological requirements	5	3	4	1	1	7	6	2	4
Labels and explanatory documents	3	1	3	1	1	3	3	1	1
Quality explanation	1	1	1			2	1	1	1
Certification documents						1	1		1
Special health and quarantine requirements	1	1				1	1		1
Subsidies *		1	2		1		2	2	

Table 2-12-7 Trade Barriers Adopted By Various Nations against Apparel Imports from the EU (Continue)

	Argentina	Australia	Brazil	Canada	Chile	Egypt	India	Indonesia	Japan
Intellectual property rights*	1		1		1		1	1	
Export restrictions *							1	1	
Restrictions on payment period			2						
Compensation, distribution							1	1	1
•Average customs tariff	35.0	28.8	34.9	12.4	25.0	30.3	87.8	39.9	6.8

	Malaysia	Mexico	Pakistan	Philippines	China	South Africa	South Korea	Taiwan	Thailand	U.S.
Registration and documentary requirements	3	13	7	4	8	4	5		8	3
Visa/documents/import permit application	1	7	2		2		2		3	
Compulsory customs duty and requisite procedures		2	2	2	4	2			2	1
Customs valuation/minimum import price	1	1	1	1	2	2	1		2	1
Delay customs clearance	1	1	1				1		1	
Proof of place of origin		2								1
Requirement for goods classification			1	1			1			
Import restrictions/quotas			1		1				1	1
General expenses other than customs duty	1	1	1	2	2	2	2		2	1
Restrictions by standards, relevant technological requirements	1	3		1	4		4	3		2
Labels and explanatory documents	1	3			1		1	1		2
Quality explanation					1		1	1		
Certification documents				1	1		1	1		
Special health and quarantine requirements					1		1			
Subsidies *			2		2	1		2	2	
Intellectual property rights*			1	1	2	1	1	1	2	
Export restrictions *					2				1	
Restrictions on payment period			1	1			2			
Compensation, distribution					1		1		1	
*Asterisks indicate that the relevant contravention will be handled under WTO rules, trade commissions primarily focus on intellectual property rights and group negotiations. Where contravention has been established, individual measures must be adopted to avoid the unfair trade practice from spreading.										

Source: Eurotex website - http://www.eurotex.com

The most common trade barrier for textile exports to the EU and U.S. is the environmental requirement. Presently there are more than 10 major environmental labels relating to textiles, most of which originated in Europe. They include: (1) Oeko-tex 100 issued by the International Association for Research and Testing in the Field of Textile Ecology; (2) Harmful substance testing and textile environmental protection standards and MST labels issued Germany's "Consumer and Environmental Protection Association"; (3) Eco-tex environment labels issued by Germany's numerous Scotdic textile dyeing company; (4) Tex Proof label issued by TUV Rhineland; (5) "Green Labels"; (6) "Gruat-Punt" waste recycling labels; Denmark's Milieukuer, and Switzerland's Swan, etc.[2]

Environmental labels can be classified into two types: The first type consists of those standards relating to consumers safety and health, with the labels indicating that the quantity of harmful substances in the final products is lower than the stipulated requirements. That is, textile products cannot pose health hazards to consumers (such as Oeko-tex Standard 100). The other type consists of those requirements relating to the design, production, disposal, and recovery of textile products prohibiting them from causing adverse impact on the environment. For example: (1) The requirement that textile enterprises to establish and implement an appropriate environmental control system conform with the ISO14000 standard, (2) The textile product environmental standards and regulations (2002/371/EC) promulgated by the European Council as an ecological guideline. Textile products which are found to be in compliance during production and disposal are issued the Eco-label. The regulations also stipulate that textile products shall not cause harm to the human body.

Beginning in 2007, the European Union will implement new testing standards for more than 30,000 chemical products. Textile products or plastic products exported to the EU found to contain banned chemical substances will be denied entry into the EU for sale. The new law is known simply as REACH - Registration, Evaluation, and Authorization of Chemicals. In the future all chemical products entering the EU (including textile products) must comply with the standard. Exporters must undergo procedures for registration, evaluation, and authorization, and manufacturers must provide information on the products' properties and toxicity, and production information and information on downstream use. To pass the tests, manufacturers must seek assistance from

[2] Introduction to environmental-friendly textiles, Textile Bulletin No. 166, p.2~13

the issuers of standards and relevant accreditation organizations in the EU. This will significantly increase product costs and operating risks. Therefore Taiwan's textile, apparel, and chemical manufacturers should formulate responses as soon as possible.[3]

Brand Establishment

The brand is at the end of a product's value chain, and possesses high value-added. For Taiwan's major OEM operating model in the past, it was frequently considered of crucial importance in leading Taiwan's textile industry towards one of high value-added. Case studies on Tainan Enterprises and Makalot are summarized below to further explain the branding history.

Tainan Enterprises

OEM Era

Tainan Enterprises was founded in August 1961, and is one of the top ten apparel manufacturers in Taiwan. It is a major OEM/ODM for international apparels. The company noticed very early on the gradual decline of Taiwan's market competitiveness in low-price, simple style textiles. This it began to manufacture mid to high price leisure apparel as its mainstay. The American leisure wear brand GAP which saw growth rates as high as 20% between 1990 and 2000 could be considered representative of leisure wear during this period. Tainan Enterprises became one of GAP's top five suppliers, with the brand accounting for 40~50% of the company's revenues. Hence during this period, the company grew rapidly. The company also handles OEM orders from major international brands such as Ann Taylor, Mast, Tommy, and Express.

Tainan Enterprises' products are primarily exported to the U.S., Europe, and Japan. However, because of increasing labor costs and a severe shortage of labor coupled with difficulties in applying for foreign workers quota, the company began to adjust its production line and outsource its OEM production. It began to establish an international production network by setting up overseas production bases in 1991. At present the company has established plants in Mainland China, Cambodia, Indonesia, and Jordan. The company's main customers are Gap, Eddie Bauer, Takio (Japanese women's fashion), and Gichido (Japanese men's fashion). Within Taiwan the company has 19 hypermarkets or apparel boutiques such as Carrefour, Hongli, and Haima selling its products by way of OEM and ODM.

[3] Introduction to environmental-friendly textiles, Textile Bulletin No. 166, p.14

Entering the Brand Era

■ **Positioning**

In 1993 Tainan Enterprises established the Tony Wear brand. The brand was positioned to be professional and self-confident. It is also aimed at consumer's identification with the brand, such that whenever they see jackets they are reminded of Tony Wear. Tony Jeans was the result of such replication, with the brand representing youthfulness and vitality. In recent years Tony Wear began to promote a lifestyle by moving from mere products to real-life scenarios such as famous racing drivers wearing Tony Wear, in order to achieve the integration of brand and lifestyle.

Another implication for the brand is retail, and its true value is derived from market operations. The company operates through its branch companies in the Mainland to sell products made by the upstream manufacturers through their retail networks. The company establishes core competitiveness for Tony Wear using this operating model, while also seeking strategic partners.

■ **Resources combination**

A successful brand should not be limited only to the Mainland China market. It should also operate in the European and Asian markets. The American market is to be considered differently. Tainan Enteprises's target for the European market was to introduce New Man, not out of consideration for the brand's reputation, but because the completeness of New Man product line and design line would help Tony Wear to directly enter the European market as a European brand.

Tony Town is Tainan Enterprises' retail model, which began in first-tier cities such as Shanghai and Beijing and then spread to second- and third-tier cities like Chengdu and Xi'an. The brand integrates traditional culture with modern urban living designing stores according to the local background. For example, Tony Wear's Chengdu flagship store was a reconstruction of the Hecheng Bank during the early Republic days, and during its opening local senior citizens were invited to speak about the bank's history. On the other hand, the Xi'an shop had mannequins designed as terracotta warriors. Even in Japan or Taiwan there were opportunities for creating scenery along this vein.

International Brand Distribution

Following several years of operation in Mainland China, the Tony Wear team has matured in experience and is ready for accelerating the brand's internationalization. From the 1970s to the present day, Mainland China remains the prime mover of the entire Asia-Pacific region's economy. The company forecasts that by 2010 Mainland China's coastal cities will attain the level of 1990s

Taiwan. The local market can be divided into 3 phases: The first phase involves the replacement of state-owned enterprises by Sino-foreign joint ventures, leisure wear replacing official attire, and combination products replacing single products. The second phase involves composite brands replacing single brands. The third phase involves new commercial circles replacing old commercial circles. With internationalization in mind, enterprises must consider the repositioning of their products. Tainan Enterprises' approach was to begin in Mainland China, before extending to Dubai, Malaysia, Tokyo and finally to brand in Taiwan.

With the profit model changing along with the environment, the question was how to replicate successful profit models to attract consumers in different regions. It is not viable for Tony Wear to bring its Shanghai products wholesale into the Taiwan market.

That is, the brand is an effective profit model. It is expected that Tony Wear's turnover in 2006 will reach US$70 million. Its modest size notwithstanding, the successful establishment of a brand operation team is Tainan Enterprises' biggest source of pride.

Makalot

OEM Era

Since its founding in 1990, Makalot had been sparing no efforts in becoming a large professional apparel supplier. With the American market as its main target, the company aims to capture major brands as its main customers. It has also focused on the development of a diversified range of fashionable products.

Fashionable, diversified mid-price clothing is Makalot's core product. Makalot produces over 2,500 styles of clothing annually in over 15 categories. In the past the majority of Taiwan's apparel makers chose to specialize: companies that specialized in knitted fabrics did not produce plain fabrics, and those that made trousers would not make shirts. The difference between Makalot's products and those of others in the industry was that they include both plain and knitted wear. Furthermore the product range was truly diversified, including shirts, children's wear, infant's clothing (with fire-resistance), pajamas, skirts, suits, long and short trousers, jackets and sports wear. The diversified combination along with specialist production was aimed at providing a one-stop service for customers.

Makalot's products are positioned as mid-price women's fashion. About 75% of its products are women's fashion, 13% consist of children's wear and 12% men's fashion. Makalot has established plants all over the world, including the Philippines, Mainland China, Taiwan, Indonesia, El Salvador,

Vietnam, and Cambodia. Together with the company's New York, Miami, and Paris offices, it is able to operate globally, thereby strengthening its ability to accept orders.

Makalot's history can be classified into three phases: The foundation period was from 1990 to 1996. Between 1997 and 1999 was the expansion phase, revenue jumped from NTD1.5 billion in 1997 to NTD2.3 billion in 1998 and then to NTD2.6 billion in 1999. Then 2000 and 2001 witnessed the company's rapid growth phase. Revenue leaped again from NTD4.1 billion to NTD5.5 billion. The company's 2005 revenue saw a further increase to NTD8 billion.

Entering the Brand Era

On 31 December 2006, the flagship shop for Makalot's homegrown brand "Pica Pica" was officially opened. The company also intends to gradually enter the Chinese market. In terms of products, Makalot will sell Swedish brand Casall and accessories of its own designs under the "pica pica" brand, both of which are positioned as sporty leisure wear. Casall's target customer group consists of urban women of between 35 and 45 years of age and is priced in the mid-range, while "pica pica" is targeted at mid-price leisure wear for women between 28 and 35.

Development Trends of the Textile Industry in 2007

With the elimination of quotas in 2005, the increase in supplying nations has resulted in increased price pressure. There was therefore a re-distribution of market shares for apparel suppliers because of price competition. As the global industry value chain is redrawn, Taiwan's textile industry faces fresh competition as and opportunities. The growth of the world's major fashion retailers and their urgent need to find differentiated products will, so far as the apparel market is concerned, continue to foster the development and market positioning of branded products.

In this environment, the structure of Taiwan's apparel industry must be transformed from one of production and service to one also equipped with design and development capabilities. This will be done by building of the industry's design, research, and development capabilities so as to maintain its OEM abilities and core competitiveness. Simultaneously, Taiwan's up-, mid- and downstream technologies and resources should be consolidated so that businesses can attain full-process technological development and breakthroughs, thereby fostering the entire industry's international market competitiveness. Looking forward to 2007, the development trends for Taiwan's textile industry are as follows.

Strengthening global distribution as a response to globalization and regional economic development trends

In the face of globalization of trade and a market in which supply exceeds demand, the textile industry will by necessity foster its global operating abilities in order to create more opportunities as a solution for intense global competition. Table 2-12-8 shows Taiwan's overseas investments recently. Between 1991 and 2005 investments totaled US$3.4 billion, of which US$2.2 billion (65%) was invested in Mainland China, and US$1.2 billion (35%) was invested in areas other than Mainland China.

Table 2-12-8 External Investments by Textile Industry

Unit: US$1,000

	Textiles		Apparels		Total		Grant Total
	Mainland	Other areas	Mainland	Other areas	Mainland	Other areas	
1991	13,631	52,018	13,191	3,070	26,822	55,088	81,910
1992	18,776	77,964	11,046	4,442	29,822	82,406	112,228
1993	178,546	86,776	104,229	8,560	282,775	95,336	378,111
1994	41,853	46,240	25,085	24,208	66,938	70,448	137,386
1995	60,899	118,313	19,802	22,599	80,701	140,912	221,613
1996	96,881	58,846	9,750	106,631	106,631	165,477	272,108
1997	208,477	66,563	70,918	25,217	279,395	91,780	371,175
1998	129,525	68,497	11,148	20,294	140,673	88,791	229,464
1999	34,333	51,925	6,523	47,378	40,856	99,303	140,159
2000	39,588	12,435	17,604	27,540	57,192	39,975	97,167
2001	22,452	27,191	69,347	24,206	91,799	51,397	143,196
2002	127,504	19,225	78,956	24,785	206,460	44,010	250,470
2003	321,171	65,064	86,622	46,784	407,793	111,848	519,641
2004	147,455	40,697	48,304	9,399	195,759	50,096	245,855
2005	137,179	22,770	56.962	11,302	194,141	34,072	228,213
Grand Total	1,578,270	814,524	629,487	406,415	2,207,757	1,220,939	3,428,696

Source: ITIS Program, TTRI (2006/11).

Vietnam was one of the most promising countries in 2006 for foreign investments, possesses a textile industry which has grown rapidly primarily through the introduction of foreign capital. By the end of 2005, Taiwan had become one of main sources for foreign investments in Vietnam, with an accumulated investment capital of US$1.69 billion, or 52.6% of total foreign investments in Vietnam's textile industry (US$3.22 billion). The investments comprise 156 projects, of which 45 were textile projects and 93 were apparel projects.

Tainan Enterprises was one of the earliest Taiwanese textile companies invested in Vietnam. Its current production capacity has reached 230,000 spinning spindles, and the company has plans to expand its production capacity to 400,000 spinning spindles – making it a world-class spinning factory. Beginning in 2005, Taiwan's major textile companies such as Makalot Industries and Nien Hsing Textiles also terminated their original plans to invest US$200 million to acquire factories and set up apparel factories in Mainland China and instead expanded their production capacities in Vietnam and Cambodia. Lien Ming Textiles also reaped immediate benefits with its transfer in 2002 of its spinning plants from Taiwan to Vietnam. The company even increased the capacity of its 50,000-spinning spindles equipment installed in 2004 to 100,000 spinning spindles. Chung Shing Textiles had also in 2003 already transferred its 50,000-spinning spindle equipment from Taiwan to Vietnam, and is gradually expanding its capacity to the current 90,000 spinning spindle. Furthermore, the acquisition of Vietnamese apparel factories respectively by Eclat textile – which has factories in Mainland China and South East Asia – and Texray Enterprises, have made Vietnam the first choice for Taiwanese investments in textiles and apparel businesses.

Additionally, Vietnam has also become the third major investment destination for Formosa Plastics, following the U.S. and Mainland China. Formosa Plastics' investments in Vietnam comprise primarily petrochemical and textile companies. The company's total accumulated investments of over US$1 billion are close to its investments of US$1.3 billion in petrochemical plants in Mainland China. Formosa Plastics has already built 3 power plants in Vietnam, and is expected to build 6 more in the future, exceeding even Vietnam's state-owned power plant. Formosa Plastics also established Formosa Industries Corporation through joint ventures with its subsidiaries Formosa Chemicals, Nanya, Formosa Taffeta, and Kingcar, to be solely responsible for investments in Vietnam. The joint-venture has plans to set up a textile zone in the Nhon Trach Industrial Area. Of the 300 hectares of land in

the industrial zone, 200 hectares are for foreign investments, 30 hectares are for 3 power plants, 20 hectares are for Formosa Chemicals' textile factory, and 20 hectares are for Formosa Taffeta's weaving factory. The main textile projects include a spinning factory with a capacity of 80000 spindles, and factories for the production of polyester filament yarn, draw textured yarn (DTY), polyester grains for bottles, polyester staple fiber, and polypropylene. The projected total investment of over US$500 million is primarily to develop the chemical fiber industry and to build, in conjunction with Formosa Taffeta, a second fabric factory following the expansion of Vietnam Long An Dyeing & Finishing Factory. Plans are also being made for the development of an apparel factory, to complete the company's integration of Vietnam's textile industry.

More and more Taiwanese textile companies have selected Vietnam as their strategic spot for entering the international market. Moreover, Taiwanese textile enterprises' investments in Vietnam have developed from spinning and apparels in the early days to the present weaving and man-made fiber industries, in a display of upstream and downstream integration. Taiwanese enterprises are even planning the development of textile zones specifically for other Taiwanese investments in preparation for the market's opening up following Vietnam's accession to the WTO. Taiwanese companies are also expecting to take advantage of Vietnam's trading relationship with the integration of China-ASEAN trade, give them a wider market and growth potential.

Strengthened technological development and product design to foster product differentiation

Design consists of two elements: (1) Fashion design and (2) Product design. In terms of fashion design, Taiwan is limited only to the collection and imitation of European and American fashion trends. Therefore there is considerable difficulty in entering the European and American markets in this area. Nevertheless, because of its strong production capacity, Taiwan possesses outstanding product design abilities. Thus the development of homegrown brands through an injection of fashion elements is crucial to the success of Taiwanese businesses, rather than trying to succeed by way of "fashion design".

However, the abovementioned process still requires a strong foundation in raw materials and technologies, otherwise there would be little breakthrough in terms of product innovation, let alone attaining homegrown brands. The experience of TTRI in the development of bamboo charcoal fiber is a good example, covering development of raw materials, patent applications, design, development and production of final products, and creation of the "phyllotex" brand.

Another excellent investigation is Sing Tsai. The company began 17 years ago as an outlet selling fine cotton blankets. Then in October 2006 it opened its Operations Headquarters at Wugu, making it a "leading global manufacturer". The Operations Headquarters comprises a Functions Wear Research & Development Center, an apparels design center, and a sales center for organic fabrics. Leveraging the technologies and resources of the Function Wear Center, the company has garnered numerous key technologies for the enhancement of outdoor performance. These include the establishment of a core certification laboratory which acts as the technological development platform and product certification platform for Function Wear, the development and application of TFE film with high water vapor transmission properties, and the development and application of environmentally-friendly multi-functional PU resin.

Sing Tsai's SINGTEX AIR PASS technology possesses numerous qualities: it is windproof, rainproof, oil proof, oxidization resistant, printable PTFE film, no inner lining is required, thereby reducing costs), and washable, and has excellent air permeability (air permeable value of 0.1cfm) and outstanding water spray qualities. Its qualities exceed even those of international brands like Gore-Tex and Event. At the moment the company is applying for patents in Europe, Hong Kong and Korea, given its needs for an outstanding brand name, Sing Tsai hopes that such top quality products will allow consumers to experience the perfect combination of high technology and modern styling, thereby enhancing Taiwan's industry value-chain and international renown.

Aggressive development of electronic operations management measures enhance rapid response capabilities for production and sales

Global procurement is an irresistible trend. For example, a pair of jeans is tailored in Tunisia, but its zippers are made in Japan and its cotton fabric comes from Benin. The fabric has been dyed and finished in Milan, Italy (the dye comes from Germany), and its copper buttons and threads are also procured in Italy. Following the elimination of quotas, and lower costs and to raise management efficiency, more and more buyers now require their overseas suppliers to be wired so as to possess rapid response abilities. This standard is being used to reduce the number of suppliers.

In order to assist businesses in effectively reducing delivery time and costs and establish rapid response mechanisms, and quicken the pace of globalization, the Technological Department of the Ministry of Economic Affairs has promoted the "Plan for Global Electronic Operations of Textile Industry". The ultimate aim is to make Taiwan the global operations center for the textile industry. Eight

of Taiwan's leading textile enterprises including Lea Lea, Nien Hsing, Everest, Jiahe Hsin LI, Makalot, Ruentex, and Eclat have come together to form the textile industry's "Electronic Alliance", setting the benchmark for global electronic operations and management. Through the alliance, the Taiwan operations headquarters deploys global resources for procurement, production, and distribution, thereby enhancing the enterprises' global competitiveness.

However, underlying the issue of being wired is the issue of being sensitive to customers' demands. Frequently middlemen or traders focus on prices, thus easily creating a distance between manufacturers and consumers. Given that the processing of a piece of cloth from spinning, dyeing, and printing to subsequent treatment is a complex one, one mere error in any of the processes could mean an instant write-off. Indeed this is where manufacturers incur the highest costs. The greatest losses for finished fabrics come from subsequent repairs. As yarns and fabrics have very diverse specifications, if the middlemen were unable to relay the final users' requirements regarding color, texture, and prints then the goods stand a chance of being rejected. Thus a way of improving this situation is for manufacturers and middlemen to communicate with final users.

Furthermore, even if there were no problems with communication, the supply-chain management of the textile industry is still fairly complex. Textile product specifications tend to change often; not only are there numerous combinations for dye temperature and proportion, even the dyeing methods for fiber yarns and fiber filaments are different and difficult to standardize. However the objective of supply-chain management is standardization of actions, prescriptions, and processes. In general, there should be little problem as long as the machines operate normally, but climatic changes and human factors are the chief reasons for discrepancies. Often "human being" poses the greatest problem. Apart from environmental factors, the most important element is often the level of "dedication". In the face of low-price competition from Mainland China, Taiwan's biggest advantages are its supply-chain management and logistics, namely, the know-how which has been extended from production to supply-chain management. This is the best example of the manufacturing industry becoming service oriented.

In-depth research in technologies to create new markets

New materials should be researched and developed to foster differences between products, and then followed by technological development through upstream, mid-stream

and downstream processes, so that the industry can move towards an "innovative differentiation" or "cross-industry upgrade and transformation". Since 2004, the TTRI has partnered with Dow Chemical - the world's leading chemical company in the production of polymers - and in 2006 successfully developed the "new-generation XLA series elastic fiber". It was the world's first POF elastic fiber which overcame the problem of traditional elastic fibers being easily broken during the weaving process.

XLA is different from existing elastic fiber products in that it is resistant to chemicals and is comfortable and soft. Dyeing of XLA is also not likely to cause pollution, and the material also holds is color well. It has soft fine texture and is durable and requires no ironing. The material is now used in golf; imitation deer skin products, double-sided leisure wear, and jeans. Current Taiwanese textile manufacturers involved with the project include Eclat, Nanwei, Ever Shine, and Yi Long Fibers. They will help Dow Chemicals to expand its market share. This successful project has not brought together international research & development resources, but will also allow Taiwan's research results to be promoted on a global scale.

Conclusions

The year 2005 was also the year following the elimination of textile quotas, and the global textiles and apparel trades were growing at the same pace as the preceding year. The growth in 2005 was 6% over that in 2004. Total textiles exports were US$203.0 billion, a growth of 3.9% over the previous year, while apparel exports were US$275.6 billion. At 6.4%, the latter saw a higher growth than that of textile products. With the increase in global trades surpluses and deficits were also fairly obvious. That is, the major markets (such as the U.S.) increased their imports of textiles and apparel from lower-income nations, while reducing their imports from some of the higher-income nations in East Asia.

Although there was no expansion for Taiwan's textile industry during the first year following the elimination of quotas, the industry continued in its efforts towards technological research & development and brand construction. Simultaneously, the industry was fostering its supply-chain management and was developing towards being service-oriented. Looking forward, the global trend for textile products must undergo a convergence of brand merchants and sales merchants. The industry must strengthen its competitiveness in the areas of technologies, costs, quality, and speed. These items will in turn have an impact on global distribution and the ability of enterprises to carry out strategic alliances. Hence enterprises themselves must strengthen their expertise in regulations, taxation, and marketing. Worth

emphasizing is that enterprises – during their partnership with overseas brands – must pay attention to human rights organizations and relevant regulations on environmental protection, the latter was the emerging NTBs under the WTO structure. Therefore, the enterprises must be cautious and meticulous.

Year	2002	2003	2004	2005	2006
NTD/US	34.58	34.42	33.42	32.17	32.53

Note: Exchange rate of US$ to NT$

(TTRI, ITIS)