2-3. Modernization of Equipment

1) Increased Equipment Due to the Temporary Removal of Equipment Controls

Applications for new equipment were accepted by the BOI between December 1986 and May 1987 and applications were accepted by the MOI during a one-month period in June 1987. Figures for equipment which had been approved up to November 1988 are shown in the following Table.

Table I-2-8. The Number of Equipment Approvals by the BOI and MOI

		BOI		MOI	Total	Equipment in use as of '87	Increase in equipment (%)
		Export 100% 24 mills	Non obligation 17 mills				
Spinning	Application	738,728	320,248	529,948	1,588,924	2,068,100	76.8
(Spindles)	Approved	491,960		529,948	1,021,908		49.4
Weaving Looms	Application	3,558	1,624	5,255	10,437	93,687	11.1
	Approved	2,708		5,255	7,963		8.5
Knitting Machines*	Application	187	35	—	222	50,106	0.4
	Approved	187		—	187		0.4

Source: TID

Note: *Knitting machine is still increasing, so its increase reached 5,000 machines by the end of '88.

The following reasons have been given for this large number of applications to increase equipment: a) a leading company has become even larger and by taking a sizeable piece of the market share is aiming at becoming a price leader; b) though at the present time this company is not involved in spinning or weaving, it has the financial capacity to enter spinning and weaving production. It has received authority for between 10,000 to 20,000 spindles and is offering a joint venture. Though it is not known if it is really serious about this, it has probably been granted authority to do so. Wholesalers in San Pen are probably involved in this; and c) local steadily operated companies are gradually increasing in size.

At any rate, companies are under compulsion to act on their approved applications as they are required to deposit a security with the bank according to the type of machinery involved (spindle-200 Baht, weaving loom- 5,000 Baht), and if they do not carry through with their intentions within two years the money is not returned. By November 1988

orders for roughly 700,000 spindles had already been placed with machinery manufacturers.

The ratio for increased capacity against current equipment levels is extremely high and there are fears that if there is a rush in putting equipment into operation within the next two years the effect on the market will be harmful. A detailed explanation on market demand estimates and on how to maintain a balance is provided in the next report. On the assumption that by 1990 roughly 1 million spindles, 8,000 weaving looms and 5,000 knitting machines will have been put into operation, yarn production will increase by 200,000 tons over the 1987 level of production. At the same time it has been estimated that national fiber consumption will increase by 27,000 tons. As weaving and knitting capacity increase by 35,000 tons, there will be the ability to transform 35,000 tons of yarn into woven and knitted fabrics for domestic consumption and export. However, roughly 160,000 tons of yarn (200,000 minus 35,000 tons) will have to be disposed of. Thus even if an export drive is undertaken to export yarn to countries such as Japan which do not impose quotas, there will still be a surplus of between 120,000 to 130,000 tons, and this will put pressure on both the domestic and the international market. The situation will largely depend on the good sense of the management of spinning factories which plan to increase their equipment. Companies which have received permission from the BOI to expand their equipment are shown in Table I-2-9. The same three categories as in Table I-2-1 are applied.

The original aim of the controls on equipment was to prevent pressure on the market as a result of a surplus in production and a fall in the price, and these controls have been aimed at goods which are easily distributed such as standard products. Accordingly, products based on orders by customers such as is the case with fabric made from dyed yarn were not subject to these controls. Even though weaving looms for making dyed yarn fabric may be defined as multi weft yarn looms, it is possible to make standard products using these looms. Also, even though equipment is renewed on the premise that the old equipment will be thrown away or will be taken out of the country, it is difficult to ascertain whether this does in fact happen. Controls on equipment therefore depend to a large extent on the good sense of companies. Because many of the recent cases for applications involve large companies which combine spinning and weaving, there may be no need for such concern. But as companies in general feel insecure as to the future and there are some which are becoming negative about their businesses, there is a need for the government to announce some sort of policy or to let its view be made known in order to dispel this kind of anxiety. For instance, the period for increasing equipment could be extended from 2 years to 5 in order to avoid a concentration of new equipment over a short period of time, and discussions could be held with industry heads concerning

Table I-2-9. Details of Companies Applying for New or Additional Equipment (BOI Portion)

Name of company	Details of expansion	Capital (MB)	Details of company (as of 1983)
Dr. Manee Laovoravit	40,000 spdl	570.0	
Mr. Suchart Rangnoktai	5,000 spdl	85.29	
Indothai Synthetics Co.	10,295 spdl	205.0	32,832 spdl T/R, R.A. yarn - same group as Thai Rayon & Century textile
Venus Trade Co.	24,600 spdl	419.79	
Bangkok Comtex Co.	40,800 spdl	500.0	
Nanyang Weaving Industry	30,000 spdl	334.4	
Thai Melon Textiles Co.	240,000 spdl	2,889.5	1,358 looms / 132,608 spdl T/C, C yarn and woven fabrics, Sukree Group
Mr. Santhit Phueng Chittisant	32,832 spdl	326.7	
Thai Roong Textile Co.	10,000 spdl	135.0	10,000 spdl Fancy yarn
Sanguanchai Industry Co.	5,000 spdl	70.5	
Mr. Chow Wang Chiu	24,000 spdl	130.0	
Voraphornyarn Spinning Co.	53,480 spdl	828.0	
	100 looms		
	87 knitting machines		
Chiam Rathana Knitting Co.	109,184 spdl	1,219.3	36,000 spdl T/C, C yarn and woven fabrics
	1,000 looms		600 looms
Kangvan Textile Co.	45,144 spdl	403.4	
	500 looms		
Union Textile Industry Co.	19,728 spdl	436.96	117,600 spdl OE 4,000 C, T/C, T/R woven fabbrics, Saha Union Group
	58 looms		2848 looms
Songserm Thai Industry Co.	30,000 spdl	501.0	
	58 looms		
Thai Kriang Spinning-Weaving	20,160 spdl	345.0	
-Bleaching-Dyeing Co.	250 looms		
K Cotton and Ganze Co.	30,240 spdl	730.0	35,000 spdl OE936D C, T/C yarn and woven fabrics
	100 looms		556 looms
Metro Spinning Co.	45,000 spdl	467.0	29,312 spdl C yarn and woven fabrics, previously Thai Yazaki
	400 looms		425 looms
Thai Textile Factory Co.	20,000 spdl	515.0	47,496 spdl T/C, C yarn and woven fabrics, Maj Gen Pramarn/Fujibo
	300 looms		1,250 looms
Mr. Yongyuth Chinatana	30,000 spdl	559.2	
	100 looms		
Century Textile Co.	50 looms	80.0	110 looms, same group as Indo Thai Synthetics
Krungthep Textile Weaving Co.	200 looms	240.0	
Mr. Kiatchai Udomphong-anant	100 looms	58.9	
Thai Tafetta Co.	600 looms	695.0	

Source: News Synopsis, Sep. 19, 1988

dispersing the introduction of equipment over that period. The Thai government has a Textile Industry Development Committee for looking into and discussing such problems and for proposing solutions to them. It is to be hoped that an announcement of new measures relating to this problem will be made in the near future.

At the same time, there is a need to examine how to maintain a balance by increasing weaving and dyeing capacity and also increasing downstream capacity by way of sewing machines etc, to a level which corresponds to spinning capacity. As is mentioned in section 9. "Export Targets", even if exports are distributed among yarn, woven and knitted fabrics, and garments in order to consume the additional 200,000 tons of yarn produced, the number of weaving looms and knitting machines must be increased urgently and current controls imposed on equipment must be removed immediately. Also, the largest bottleneck lies with dyeing capacity. Despite the fact that the dyeing sector is not subject to controls on equipment at the present time, factors such as regulations relating to the environment and suppression caused by the market situation have meant that dyers are not inclined to increase their equipment. There is therefore a need for the government to provide some positive support and to encourage dyers to expand equipment by establishing industrial estates. As this will all take a long time to implement, immediate plans need to be made.

2) Trends In Equipment In the Fiber Manufacturing Industry

(1) Production Capacity and Plans For Increasing Equipment

Table I-2-10 shows the present levels of equipment for fiber producers and their planned increases in equipment. In the case of polyester staple, there are plans to increase the present level of 6,300 t/month to a total of 9,300 t/month. Although the plans of the 2 new companies are not known, Juntex is making moves to establish a company and it is highly likely that this will be realized.

In addition, of particular note is POY's plans to expand its equipment to three times that of the present level.

Table I-2-10.Thai Man-made Fiber Production Capacity & Expansion Plan

(ton/month)

Product	Company Name	1988	Expansion	After Expansion	Remarks
Ployester staple fiber	Teijin Polyester	4,300	('89 April) 2,100 ('89 later)	6,400	Teijin Group
	Thai Melon Polyester	1,800-2,000	1,400-1,500 ('90 later)	3,500	Sukree Group
	Tuntex	--	2,600	2,600	Taiwan Group
	Chiem Pattana	--	1,500	1,500	Spinner
	Charawan Sawat		1,600	1,600	
	Total	6,300	9,300	15,600	
Rayon staple fiber	Thai Rayon	1,500	1,000	2,500	
Polyester filament yarn	Teijin Polyester	1,200	150	1350	10%/each year increase
	Thai Melon Polyester	600			Sukree Group
	Toray Nylon Thai	450			Toray Goup
	Oriental	150			
	Total	2,250			
Pre-oriented yarn (POY)	Toray Nylon Thai	450	100	550	Toray Group
	Oriental	240	360	600	
	Tuntex		350	350	Taiwan Group
	BKK Cable		1,000	1,000	
	Chiem Pattana		870	870	Spinner
	Total	690	2,580	3,270	
Nylon filament yarn	Toray Nylon Thai	600	100	700	Toray Group
	Asia Fiber	600			Virawan Family
	Hantex	300			
	Total				
Acrylo staple fiber					Indian Birla Group

Source: Hearings with Teijin and Toray, materials of Assistant Professor Suehiro, and Chemical Fiber Association (1988 Fiber Handbook)

(2) Attitudes Towards Increasing Equipment (Volume and Quality)

A. Polyester Staple

The situation regarding the production and import of polyester staple is shown in the table I-2-11.

Table I-2-11. Production and Imports of Polyester Staple

		1983	1984	1985	1986	1987
Production	Volume (tons)	114,168	115,527	127,072	133,406	140,504
	Rate of Increase (%)	16.8	11.2	10.0	5.0	5.3
Imports	Volume (tons)	7,112	6,973	7,894	10,109	6,632
	Rate of Increase (%)		2.0	13.2	28.1	64.5

Source: (production) Bangkok Thailand Bank; (imports) Foreign Trade Statistics of Thailand (Department of Customs)

Teijin's plans for increasing equipment involve the following:
i) an anticipated large increase in demand due to the restoration of border business; ii) meeting the increase in spinning equipment; and iii) supplementing the 1,000 tons a month which are presently imported due to a shortfall in supply. It is thought that these three factors will account for the absorption of half of the increase. The increase in spindles is thought to be 900,000, and with 10,000 spindles producing 120 tons/month, if half of the 900,000 spindles are used for pure cotton yarn, then the required amount of polyester works out at 5,400 tons/month.

Although this applies in the longer term, with the installation and operation of increased equipment by two companies in 1989 it is expected that in the shorter term there will be a sudden surge in market supply, an increase in the market shares held by these two companies, and some confusion in regard to price.

At the present time manufacturers are not inclined to diversify into more types of polyester staple in order to produce a full line-up of products. Special types such as cation-dyeable, fiber with special section shape, and fiber with special brightness have been imported and used by spinners, and it would appear that these types of fiber have not been included in plans for increased equipment. Production is difficult if demand is not arranged in economic units, and manufacturers are taking catch-up measures and are keeping a close eye on trends in standard products related to increases in spinning equipment. Yet, although they acknowledge the need for a full range of products manufacturers are not doing anything about this. It would appear that the voices expressing concern over the shortage in special materials and new materials of midstream and downstream will be heard for some time yet.

B. Polyester Filament Yarn

There are a number of reasons why a large market for polyester filament yarn has not developed. These include the decrease in demand for double knit made from polyester

textured yarn which was a worldwide popular fashion at one time; the low level of demand in Thailand for regular filament fabric with the exception of textured yarn fabric; and Thailand's lack of international competitiveness due to the 15-20% cheaper price of Indonesian filament woven fabric and knitted fabric due to the devaluation of the Rupiah and the cheap unit price of electricity and low labor costs. In addition to the fact that textured yarn fabric is comprised mainly of standard products such as tropical, palace, and pongee, some of the remaining double knit production is transferred from South Korea and Taiwan to Thailand. As a result of these factors, production of filament yarn by manufacturers centers mainly on coarser denier yarn for texturizing. Special yarn is imported from Taiwan. A large portion of the production of filament yarn for texturizing is undertaken with POY. Although it has not been confirmed, it has been heard that the 30 texturizing mills which have taken over this production, have been modernized through the replacement of most of their 200 texturizing machines by draw-texturizing machines.

The development of fabrics made from regular filament yarn and also lining fabric for use in garments is something which needs to be worked on. However, there are the problems of the small number of weaving looms for regular filament yarn fabric, delays in modernization, and low international competitiveness.

Nylon filament yarn is confined to a small market like those for fishing nets and tricot. Larger markets such as the garment lining, industrial materials, tire cord, and carpet markets are still small in scale at the present time, and it will take some time before they develop into markets where nylon plays a major role.

3) Trends In the Modernization of Spinning Equipment

When examining the modernization of equipment, the following three points need to be considered by the management of the company: a) policy in the spinning of standard products; b) policy in the spinning of speciality yarns; and c) policy of anticipating the market for the next several years and investment in plant and equipment aimed at linking the processes which follow spinning.

A) Spinning of Standard Products

Standard count of spun yarns of pure cotton (100%), C.V.C. (cotton rich yarns which are, for example, 55% cotton, 45% polyester), T/C (a blend of 65% polyester and 35% cotton), or T/R (65% polyester and 35% rayon) are distributed both domestically and internationally, and there is a market price for these even though there is no market in

Thailand. It is also possible that cheap yarn is imported from abroad and used. (In the second half of 1987 the Thai market price for T/C 45'S was 54-57 Baht/lb compared to a tax inclusive price of 51 Baht/lb for yarn imported from China.) The vast majority of yarn which is distributed domestically and used in woven fabrics and knit, are standard products and there are many spinning plants, including Japanese companies, which produce these standard products (refer to Tables I-2-1, I-2-2). In most of the plants, equipment used for the mass production of 20'S ~ 40'S has not been renewed since the plants were first established due to surplus production by manufacturers of standard products and the pressure which this surplus has put on the market price. Machinery and equipment are expensive due to high tariff rates. While some machines such as Open End machines for which the substantial increase in productivity makes it possible to absorb the higher product cost brought about by their equipment cost, in the case of the common ring spindle, for example, a producer's costs are increased because productivity is only raised by about 10%.

If new machines from Japan were to be used to expand equipment costs would be as follows:

The CIF for 20,000 spindles for spinning T/C 45'S is 240.0 million Baht. The depreciation expense against the CIF price is calculated at a fixed output during ten years of 1,800 tons/year for 20,000 spindles which works out at 13.3 Baht/kg or 6.0 Baht/lb. In addition, with 2.4 Baht/lb, which corresponds to a 40% duty (30% import tariff + 5.0% business tax + 16% standard profit), and 7.2 Baht/lb which corresponds to interest (12%) for the first year, the total cost comes to 15.6 Baht/lb, thus making an added cost of 15.6 Baht/lb over old equipment for which total depreciation has been already completed.

Accordingly, most of the plants buy used machinery when increasing or replacing equipment, which runs counter to the modernization of equipment. Although standard spun yarn using this sort of equipment may be acceptable for the domestic market and for export to the Middle East which is not so stringent, there is the danger of being subject to claims if the yarn is exported to Japan where the requirements regarding quality are stricter. In addition to problems of unevenness and yarn strength variation which often arise in connection with the quality of yarn, there are many other problems. These include the knot number within 1 cone, knot size, regulation of the length of yarn in 1 cone, oil staining of yarn and other problems relating to the precision of spindles and winders and the type of machines used.

B. Special Spinning Yarn

The most typical specialty yarns such as that of Thai Teijin Textile are blended yarns with wool, line, silk, etc, and thick and thin yarn, nep yarn, filament, and spandex covering yarn. These have been developed especially by the company in line with its policy of distinguishing itself from other manufacturers. Teijin also adopts the position that if there is demand it will introduce equipment to produce special yarns of high quality. The speciality products included in Table I-2-1 include the special blended yarns mentioned above, as well as acrylic yarn and various types of fancy yarn.

C. Equipment For the Future

Looking at standard products on an international level, Pakistan is strong in spun yarns with a yarn count under 20'S, and Japan is strong in high count yarn above 60'S. Taiwan and South Korea which had been exporting 30'S-40'S yarn have now shifted over to a higher count yarn in the 40'S to 50'S as a result of having been squeezed out of the export market due to higher wages and an increase in exchange rates. Their export market has been taken over by China and ASEAN countries. Cheap cotton yarn is imported into the Thai domestic market. Also, as commodities with a high count like 60/2S broad are being brought in from overseas, some companies are of the view that in the future they will have to shift over to a higher count. One notable example is the "Thai Shikibou" cotton spinning company which was established in November 1988 by Shikijima Spinning of Japan and the Saha Patana group with the primary purpose of producing high grade cotton yarn. Among these companies considering a shift to a higher count are Japanese companies producing standard products whose higher wage bills brought about by the aging of their employees have caused them to lose their competitive edge over smaller local companies. When changing over to a higher count, it is natural that attention is paid to a balance between fore-spinning and fine spinning and to acquiring combers. But it becomes necessary to acquire doubling and twisting machines also. Companies which produce T/R 30/2S hold an advantage on this point, and these manufacturers are using double twisters in the twisting process in a bid to modernize their equipment.

There are also companies which are modernizing, but in a different direction. These are companies which combine spinning and weaving and produce standard woven fabrics. Producers which introduce air jet looms in order to offset the inefficiency of the shuttle loom and repairing defects with the shuttle will find they are not able to reach their targets due to the number and size of knots of the yarn because they seek a speed four to

five times (500-1,000 r.p.m.) that of shuttle looms. They are starting to introduce winders which are fitted with splicers for producing knotless yarn. Splicers are also beginning to be used in the spinning of yarn for knitting because of the rapid increase in demand for cotton yarn for circular knitting machines as part of high precision and high speed production. Among the 8 spinning companies which were visited, 3 possessed double twisters and 3 had splicers. Among companies with combined spinning and weaving, there are those which view the introduction of air jet looms simply as a means of rationalizing their shuttle looms, and are not aware that the spinning system needs to be rationalized. A considerable amount of time is needed before the spinning process is modernized to meet the trend to a shuttleless weaving system.

As a result of the recent expansion of spinning equipment a large quantity of spun yarn will have to be exported to Japan. But the question remains over the extent to which modernization has taken place as part of this increase in equipment. Furthermore, with the increase in used equipment which is taking place at the present time, there is some concern that it may prove difficult to export yarn.

The purposes of modernization being implemented by advanced countries are mainly labor saving and high productivity in an attempt to get rid of the labor intensive nature of the industry. In the case of Thailand, new equipment must be introduced to raise quality standards in the broad sense of the term. For reference, the implementation of modern equipment in Japan is shown in Table I-2-12.

Although at one time much fuss was made over Open End machines because of their high level of productivity, today their use is restricted to coarser yarns below 20'S. They were used at one time by many Thai spinners, but they are now being used less and less because they contribute to changing the characteristics, upon washing, of fabric used for garments.

Table I-2-12. State of Modernization of Equipment in Japan (1)

Item		End of 1975	End of 1980	End of 1985	End of 1986	End of 1987
Picking and blending process process						
Survey coverage	Set	1,099	948	923	883	862
Bale plucker	%	5.8	7.4	9.5	18.0	20.5
Auto mixer	"	3.5	4.3	7.0	9.6	12.1
Auto lap machine	"	42.2	38.8	38.1	37.9	37.8
Auto lap puller	"	40.7	33.2	32.5	35.3	32.8
Picking and connection	"	17.9	32.4	38.8	40.0	41.5
Air circulator	"	52.8	56.3	56.4	55.2	56.2
Fire extinguishing equipment	"	13.2	24.5	28.7	27.4	28.9
Carding process						
Survey coverage	Units	27,708	21,670	19,301	18,091	17,790
Doffer 15 rpm or more	%	20.8	32.7	40.2	42.1	41.5
Roller doffing	"	8.7	10.3	12.6	13.7	14.2
Automatic can changer	"	--	0.6	0.6	0.7	0.7
Electrical stop motion	"	55.2	70.8	81.2	82.8	85.9
taker-in improvement	"	39.7	55.3	63.9	63.4	65.4
Crush roller	"	4.7	5.7	5.5	5.9	5.8
Sliver unevenness controller	"	6.5	17.3	23.6	23.5	25.4
Auto waste under machine	"	22	29.3	34.4	36.2	37.1
exhauster flat	"	11.1	21.7	26	28.3	29.4
Dust collecting	"	26.1	37.4	45.7	47.9	50.6
Tandem cards	"	0.9	2.3	2.5	3.2	3.5
Can diameter 16 in or more	"	59.1	76.3	87.2	85.6	88.9
20 in or more	"	46.8	66.7	79.4	78.3	80.5
Comping process						
Drawing - lap former	%	35.6	40.4	47	46.6	46.2
Automatic lap machine	"	56.1	81.1	92.3	92.1	92.6
Survey coverage	Units	4,339	3,803	3,659	3,516	3,545
150 nip/min or more	%	41.6	48.6	50.9	50.8	51.1
Garnet cylinder wire	"	57.6	76.2	81.9	83.8	85.6
Can 20 in or more	"	40.9	64.2	80.2	81.2	82.4
Automatic lap transport	"	5.6	6.6	7.5	7.8	7.4
Automatic dust collector	"	42.9	59.1	66.7	69.5	72
Drawing process						
Survey coverage	del	27,739	15,967	12,269	11,381	11,145
Delivery 160 m/min or more	%	29.6	52.5	74.8	77.5	80.6
Pneumatic clearer	"	42.1	73.6	89.7	91.4	92.1
Top arm system	"	51.7	80.5	89.9	91.2	93.6
Automatic clearer	"	12.1	35.1	56.9	60.9	67.3
Sliver unevenness controller	"	0.5	1.1	2.1	2.4	3.1
Can diameter 16 in or more	"	29.8	55.3	76.9	80.3	82.2
20 in or more	"	16.2	38.3	58.8	61.9	64.6
Roving process						
Survey coverage	Spindles	464,679	337,060	292,412	275,902	275,092
Single spinning system	%	93.9	97.3	98.9	98.7	99.2
Spindle 800 rpm or more	"	25.9	44.4	59.8	61.6	62.9
Bearings FTR	"	65.8	86.3	90.9	91.1	92.6
FBR	"	48.4	77.8	90.6	90.9	92.1
Top arm system	"	42.6	77.5	90.5	90.9	92.4
Rotary pneumatic clearer	"	25.5	49.9	78.3	79.6	80.4
Electric stop Spindle + creel	"	42.6	76.3	85.0	87.5	88.0
Spindle	"	45.6	20.6	13.2	10.7	10.6
Lift 14 in or more	"	37.1	64.4	79.2	81.3	82.0
16 in or more	"	19.8	48.4	63.4	65.3	66.9
Easy doffing system	"	14.5	34.0	50.4	53.8	55.1

Source: Japan Spinner's Association

Table I-2-12. State of Modernization of Equipment in Japan (2)

Item			End of 1975	End of 1980	End of 1985	End of 1986	End of 1987
Fine spinning process							
Survey coverage		Spindles	9,237,404	8,037,066	7,452,475	7,126,679	7,068,259
Bearings	FIR	%	79.7	92.6	96.3	96.5	96.7
	FIB	"	67.0	87.0	90.9	92.2	92.9
Top arm system		"	59.3	77.4	86.1	87.7	88.7
Magnet clearer		"	54.1	72.3	79.5	73.9	81.3
Apron	Rubber	"	74.0	90.4	96.0	97.5	97.7
	Rubber skin	"	12.0	1.3	0.2	0.2	0.6
	Synthetic skin	"	1.7	0.5	0.3	0.3	0.2
	Rubber and synthetic skin	"	8.4	3.8	1.7	1.4	1.2
Spindle insert	HA	"	67.7	74.4	76.4	75.3	76.0
	HF	"	19.0	23.6	22.3	23.3	22.9
Full can stop motion		"	74.7	85.8	85.9	86.0	85.5
Automatic speed changer		"	50.2	58.1	58.8	59.3	59.9
Ring diameter	45 mm or more	"	71.0	84.6	89.4	89.6	88.5
	48 mm or more	"	13.4	22.7	24.8	25.4	25.7
Lift 8 in or more		"	22.5	29.9	33.9	34.5	34.8
Chin pulley		"	15.1	23.2	31.8	33.7	34.4
Tangential		"	2.9	3.4	3.9	4.0	4.0
Traveling cleaner		"	67.6	77.7	79.5	79.1	78.8
Auto doffer	Group lifting	"	23.7	35.2	42.3	43.5	44.4
	Single spindle lifting	"	15.0	11.5	10.2	9.4	9.3
	Fixed type	"	3.4	4.4	5.6	5.7	5.9
Mixing, blowing, and picking connection		"	19.6	39.3	47.8	48.7	49.1
Mixing, picking, drawing connection		"	2.2	3.3	4.5	5.3	4.8
Winding process							
Survey coverage		Drum	473,607	359,471	298,840	276,557	262,314
Automatic	Winder	%	51.9	64.7	72.1	73.8	74.7
	Mach	"	--	--	7.2	9.5	12.9
	Abbot	"	24.4	26.1	21.3	18.7	16.3
	Schlaforst	"	7.7	10.6	13.5	14.7	15.2
	Gilboss	"	10.4	18.3	23.0	23.5	23.4
	Camimat	"	1.7	3.7	4.7	4.8	4.5
Electronic yarn cleaner	(photoelectric tube,)	"	12.2	11.1	9.2	8.7	8.0
	(static electric capacity)	"	20.0	35.1	48.0	52.0	56.7
Full can stop motion		"	32.3	69.0	79.3	81.2	82.4
Auto cop feeder		"	29.5	37.9	37.1	38.5	38.4
Auto doffer		"	16.2	19.3	23.8	25.1	28.8
Automatic knotter		"	19.2	34.5	47.3	52.4	58.6
Automatic conveyance (ratio of applicable fine spindles)							
Comber lap		%	2.9	3.4	4.7	5.2	4.9
Cans (carding--drawing)		"	1.9	3.2	4.3	3.1	3.7
Cans (drawing--roving)		"	3.1	7.0	6.3	6.6	7.0
Bobbin of roving (roving--fine spinning)		"	2.2	1.7	3.0	3.0	3.2
Cop (fine spinning--winding)		"	8.7	13.8	17.4	18.6	17.8
Empty wooden bobbin (winding--fine spinning)		"	11.2	18.5	26.3	27.3	28.6
Cheese (winding--packing)		"	2.1	11.4	14.4	15.0	15.4
Waste	Picking and blending	"	10.3	14.3	19.6	21.4	22.3
	Carding	"	15.7	24.6	29.4	32.7	33.4
	Comber	"	23.7	27.2	30.2	31.1	32.3
	Pneumatic filler	"	4.8	5.9	6.6	6.1	6.2
Automatic baling	Cheese, cone	"	2.5	10.9	12.3	12.3	12.4
	Waste	"	2.9	1.8	1.7	1.7	2.9

4) Modernization of Equipment in the Weaving Industry

As shown in Table I-2-13, shuttle looms are the main type of weaving looms used in Thailand. With very few shuttleless looms the industry lags behind in modernization. There are even some manufacturers which operate weaving looms which are 30 years old. Although this is partly due to not having been able to renew equipment freely due to controls placed on equipment, it is also thought that the production surplus in standard products, the cheap cost of female labor, and the high price of weaving looms imported from abroad (on to which roughly 40% is added as a result of import tariffs, business duties, and the duty placed on estimated profits) have made producers less inclined to modernize their equipment. As a result of these factors small companies continue to install more second-hand shuttle looms when expanding their equipment (as shown in the right column of Table I-2-13). Shuttle looms are not simply unproductive, but they also cause a high ratio of fabric defects, and produce undergrade fabric at several times the rate of air jet looms. An increase in shuttle looms is not good in light of hopes to export to Japan in the future. Because improvements in quality are required in the spinning stage for yarn used in air jet loom weaving, air jet looms will start to be widely used only with the integration of both spinning and weaving factories.

Table I-2-13. Trend Towards Shuttleless Cotton Weaving Looms (1987)

	Number Installed			Total for 1978-87	
	Total	Shuttleless	% of Shuttleless	Shuttle	Shuttleless
Thailand	61,433	1,411	2.3	2,076	1,405
China	662,852	12,851	1.9	1,000	13,089
Hong Kong	20,224	7,660	37.9	576	7,543
Japan	247,504	38,368	15.5	23,808	48,613
South Korea	89,996	13,853	15.4	65,735	19,290
Taiwan	81,781	1,411	1.7	10,677	30,506

Source: Japan Textile Monthly, September 1988 edition; Original: ITMF

Shuttleless looms such as the air jet loom and rapier loom cost roughly 1.0 million Baht. This cost is raised to 1.4 million Baht when duties are added. Because a used shuttle loom purchased from Japan costs 50,000 Baht altogether, or roughly 1/30 of the cost of a shuttleless loom, and their productivity ranges from 1/3 to 1/5 of that of shuttleless looms, companies wishing to expand their output are competing with each other to introduce used shuttle looms.

The production of special woven fabrics around dyed patterned fabric, fancy fabric, and fabric which uses special materials. Problems faced in yarn dyed patterned fabrics are open-set marks and pattern deforms which are caused by poor setting when weaving looms shut down. Accordingly, easy setting rapier looms which cause few breakages in the warp are required for producing high quality fabrics. It is said that it takes five years of training before a worker becomes fully competent in using a shuttle loom.

According to a Ministry of Industry ordinance, additional weaving looms to be used for producing dyed yarn fabrics are not required to abide by the ordinance and a distinction is made between them and machines for standard products. However, some manufacturers have voiced the criticism that as long as supervision by authorities remains inadequate, measures for preventing a surplus in standard products are ineffective.

For reference, Table I-2-14 shows equipment used for modernizing weaving machines in Japan and the situation regarding their implementation.

Table I-2-14. Modernization of Equipment in Japanese Weaving Factories

Item		End of 1975	End of 80	End of 85	End of 86	End of 87
(Warp winding process)	Drum	25,872	22,7569	13,518	11,365	8.757
Automatic winder	%	75.0	75.2	60.3	49.3	38.8
spooler	"	64.4	66.2	51.2	40.1	36.0
Schlaforst	"	2.2	2.4	4.0	3.5	—
Gillboss	"	2.3	3.3	3.2	3.9	1.3
(Weft winding process)		28,863	28,384	25,494	24,306	20,935
Hakova	%	7.6	2.2	1.4	1.5	0.8
Abott	"	55.9	54.3	44.9	41.6	37.2
Masscamp	"	4.6	3.2	2.8	3.1	3.3
Kohwa	"	2.1	1.0	0.4	0.4	0.5
Schweiter	"	4.5	4.9	5.2	5.5	5.0
Scheller	"	2.9	4.1	2.4	1.8	1.6
Room winder	"	16.4	24.8	40.0	43.1	48.2
Tip punch attached	"	78.9	79.0	84.6	86.8	89.8
(Warping process)	unit	170	166	165	163	158
Yarn speed						
more than 500 yd/m	%	64.1	69.3	78.8	69.9	71.6
more than 700 yd/m	"	37.7	41.5	50.0	39.9	43.7
V shape	"	54.1	61.4	57.0	50.9	53.8
Stoppage on discovery of unsuitable yarn	"	11.8	50.6	62.4	59.5	55.1
Stop motion	"	83.6	95.2	96.4	94.5	96.3

(sizing process)	unit	147	130	123	123	119
Slasher	%	14.3	10.0	1.6	4.0	4.2
Hot air	"	30.6	23.9	12.2	11.4	12.6
Combined						
Jet	"	33.3	32.3	30.1	32.5	31.9
Other	"	3.4	3.1			
Multi-cylinder						
Normal pressure	"	6.9	5.3	56.1	52.0	51.2
High pressure	"	11.5	25.4			
(Weaving process)	unit	42,019	37,288	31,868	30,539	28,314
(Shuttle/automated)						
Shuttle change	unit	16,266	11,856	7,004	5,257	5,048
	%	38.7	31.8	22.0	17.2	17.8
Cop change	unit	2,395	1,357	966	786	605
	%	5.7	3.6	3.0	2.6	2.1
Box loader						
Low speed	unit	14,034	11,555	8,677	8,212	7,013
	%	33.4	31.0	27.2	26.9	24.8
High speed	unit	541	925	172	172	172
	%	1.3	2.5	0.5	0.6	0.6
Room winder						
Low speed	unit	2,363	5,062	7,379	7,503	7,500
	%	5.6	13.6	23.2	24.6	26.5
High speed	unit	2,375	1,946	2,828	2,982	2,593
	%	5.7	5.2	8.9	9.8	9.2
(Shuttleless)						
Rapier	unit	1,282	1,332	1,436	1,235	1,262
	%	3.0	3.6	4.5	4.0	4.5
Gripper	unit	629	709	798	832	900
	%	1.5	1.9	2.5	2.7	3.2
Other unit	82	350	795	2,224	2,740	
	%	0.2	0.9	2.5	7.3	9.7
Travelling cleaner	%	0.9	1.0	4.0	5.9	8.7
Concentrated oil supply	"	19.5	17.0	21.1	23.4	24.7
Photo-electric broken thread detector						
Weft	"	9.0	21.9	45.1	42.5	44.2
Warp	"	3.4	4.8	11.9	1.1	0.5
Weft & warp	—	—	—	5.3	5.2	

* denotes air jet machines since 1984
Source: Japan Cotton Spinning Association

5) Modernization In the Filament Weaving Industry

At two of the companies which were visited it was possible to take a look at the weaving of polyester filament fabric. One of the two had 414 looms (including 78 rapiers and 4 water jet looms) and produced fabric from standard textured yarn. The other company was engaged in the manufacture of fabrics for curtains and women's suits, and had 120 rapiers and 54 jacquards. It plans to increase its equipment by a further 24 air jet looms and 36 water jet looms. Both of these companies produced cloth of the finest quality, making up for their lack of technology and equipment through effort.

The future increase in garment manufacture will be accompanied by an increase in demand for lining. An announcement made by the Ministry of Industry in December 1987 encouraged the production of taffeta. This of course was aimed at water jet looms. In polyester filament weaving it is necessary to accumulate equipment and technology, thus making it quite difficult to start manufacturing products. A decision on whether to choose the sizing system or the warper system depending on whether filament yarn or no-sizing yarn (due to a lack of demand regular yarn is produced in Thailand at present) has to be made. Also, checks must be made to select the style of warping sizer, using acrylic sizing stuff or other stuff and to confirm the possibility of a fabric-end dyeing check system. In addition to these it must be ascertained whether the dyeing finishing plant has a weight reduction device. A system for providing technical support needs to be established by the Textile Industry Division and others.

6) Modernization in the Dyeing Industry

The equipment and processes used in the dyeing industry differ greatly according to the materials, use, and specifications of the commodity being handled. One feature of the Thai dyeing industry is that it can be divided into three main parts: cotton, T/C and T/R made from polyester fiber, and polyester textured yarn. Because high pressure is required for dyeing products which are made up of polyester fiber, batch dyeing is carried out. Jet circular tubes and high pressure jiggers are used for this. Open jiggers are used for cotton. As a result, padding and continuous dyeing is hardly used at all so that modern devices for ending, such as computer controlled devices and automatic color matching, are not required. This is one of the reasons why the dyeing industry in Thailand is slow to modernize itself.

The second feature of the industry is that many of the dyers do not have apparatus for checking the color fastness of goods, and so use the TID for tests for exports. This situation may be due to the fact that there are no stringent demands for color fastness on

the domestic market. It appeared that, with the growing number of export commodities and being unable to undertake quality control using data obtained after forwarding, the establishment of a system for carrying out inspections in-house has become an urgent task.

The third feature relates to the position of commission dyers. Those which are involved in processing standard products have trouble making ends meet due to stringent processing charges brought about by the high market price for fabric. In addition, dyers which specialize in standard products generally have a considerable amount of surplus capacity. The reason for this is that dyers opted for a high processing capacity for C, T/C, and T/R due to the situation at the time of establishment or a short time later. Subsequently, however, great progress has been made in woven fabric made from textured polyester yarn and circular knitting, and with orders now leaning in this direction, T/C and T/R equipment have been left idle. As a result, many old machines are used and equipment is not renewed. Also, dyers have no inclination whatsoever to increase and modernize their equipment.

The fourth feature is related to water use by dyers. While those situated in Bangkok and its outskirts use underground water, in places where the digging of new wells is prohibited and those where it is necessary to dig to 200 meters below ground level, if industrial water is bought as a substitute for underground water it becomes quite expensive. The cost of 4 baht/m^3 for industrial water is much more expensive than the charge of 75 sattan/m^3 for drawing up well water and makes business less profitable. Such environmental controls pose a problem for the future development of the dyeing industry. Table I-2-15 shows the volume of water used by companies which were visited. Although the large expansion in equipment taking place in the spinning sector requires dyers to increase their capacity, these problems are hindering the development of the dyeing industry, and there is the fear that a large bottleneck will occur in the dyeing process in the future.

The fifth feature is that dyers which process speciality cloth requiring a high degree of processing, such as the dye finishing of polyester filament fabric, fabric made from textured yarn and blended fabrics such as wool, silk and linen, and the finishing of polyester filament to obtain a silk like finish, have the required equipment and technology in place. This is contrary to the criticism that the Thai dyeing industry is weak. With the future increase in demand for high quality materials from the garment manufacturing sector, dyers will be required to add relaxers, and weight reduction apparatus to their equipment.

Table I-2-15. Details of Treatment at Dyeing Factories and Industrial Water and Wastewater Treatment

Company (location)	D-1 Samut Prakarn	D-2 Samut Sakhon	D-3 Bangkok Latphras	D-4 Nakorn Pathom	D-5 Samut Prakarn	D-6 Samut Prakarn
Lines of business	Fabric dyeing and prints	Fabric dyeing	Yarn dyeing	Yarn dyeing and post-dyeing	Post-dyeing and prints	Post-dyeing and prints
Content and amount of treatment	Bleaching 2 mil. yd/mon Fabric dyeing 5 mil. High pressure dyeing 1.2 mil. Roller printing 300,000	Fabric dyeing, jiggers 40 units Yarn dyeing (hank, package) 20 units	Hank dyeing 10 units Loose carriers 2 units Acrylic fiber treatment 110 t/mon	Jet circular 15 tubes Uni Ace 6 sets 1.3 mil. yd/mon	Fabric dyeing Opal processing 5.5 mil. yd/mon	Prints 1.5 mil. yd/mon Bleached 1 mil. Fabric dyeing 2 to 2.5 mil. Yarn dyeing and finish 500,000
Water supplies	Well water High Fe, Ca, and pH	Wells have to be more than 200 m in depth Softening treatment for hard water	Underground water is hard and has no salt content	River water utilized		Underground water 5000 t/mon Pumping costs 75 satan/m^3 Industrial water supplies 4 B/m^3
Wastewater treatment	Wastewater is treated	Wastewater is treated	Neutralization and treatment of wastewater is necessary. 5% cost involved (in prime cost of processing)	BOD treatment, then released back to river.		

Company (location)	D-7 Prathum Thani	D-8 Dommuong Bnagkok	D-9 Samut Prakarn	D-10 Bangkok	D-11 Samut Prakarn	D-12 Rackburi
Lines of business	Post-dyeing and prints	Yarn dyeing, post-dyeing, and finishing	Yarn dyeing	Yarn dyeing and fabric dyeing	Prints	Yarn dyeing
Content and amount of treatment	Ester fil. woven fabric dyeing Ester yarn dyeing Flat screen, 3 units (1.5 mil. yd/mon) Weight reduction processing	Yarn dyeing 120,000 lb/mon Post-dyeing 16,000 bolts/mon Yarn dyeing and finishing 3,500 bolts/mon	Packaging dyeing	Yarn dyeing High pressure continuous dyeing 1500 t/year	Flat screen print, 1 unit Hand work screen	Package dyeing
Water supplies Waste water treatment	Well water 2000 t/d Activated sludge treatment			Well water 130 t/hr		

Due to their high price, expensive equipment for printing such as flat screen printers and rotary screen printers are being introduced by large manufacturers which produce special products and export products.

Although yarn dyeing machines are found in all weaving plants, these are high pressure package dyeing machines for T/C and T/R, many of which are the old type. Also, many old rewinders were seen.

However, as this sort of equipment is used for coarse yarn used in sarongs, etc, their age does not pose any particular problem.

7) Summary of the Situation Regarding the Modernization of Equipment

In summarizing the situation regarding the equipment of the Thai textile industry on the basis of what was observed, the equipment has generally been used from the time of the establishment of the industry for standard products and has not been renewed. This situation has been caused by the continual surplus in production of standard products, the subsequent difficulties faced in maintaining profitability, and the high cost of introducing new equipment due to the approximately 40% for import duties. As a result, it is difficult to introduce new equipment, and it is regarded as acceptable to compensate for this by using cheap labor costs to meet product quality standards. As a consequence, used old style machines are being introduced even today.

In contrast to this, companies involved in the production of speciality products have installed high grade equipment in line with their companies' efforts in developing products, and in order to meet demand. These companies' products possess an internationally acceptable quality level.

If the recent increase in spinning equipment represents a continuation of the existing inclination towards standard products, the modernization of the Thai spinning industry will fall behind the rest of the world. It is also feared that this will cause all sorts of difficulties and chaos in regard to the export drive which should be put into action. Also, a surplus in spun yarn and a pressured market are expected as a result of the disparity between the increase in weaving looms and knitting machines and the increase in spinning equipment. Controls on weaving looms and knitting machines must be removed immediately. The government will have to make known its view on this point to general companies in order to dispel business fears and to allow them to set their own direction for the future. The performance of weaving looms and knitting machines has a direct influence on the quality of products, and as with spun yarn, affects the export competitiveness of woven fabric and knit products.

It is also clear that the types of materials demanded by the garment industry which is rapidly increasing its exports will become more diversified. Just how this demand will be met will depend on the weaving and knitting industry's way of thinking in regard to the selection of machinery. A continuation of the old policy will mean the introduction of old machinery which will frustrate requests from downstream and its export drive. One important factor affecting this policy is the worsening of profitability brought about by the high cost of introducing new machinery. The high prices are due to the level of the exchange rate and the absence of a large machinery manufacturer in Thailand, thus necessitating a dependence on imported machinery. Another major factor is the 40% import duty which has been levied on imported machinery in an attempt to foster domestic industry. Manufacturers of textile machinery have not developed despite many years of policies aimed at that effect. Also, textile machinery manufacturers are internationally in an oligopolic situation. Faced with the present situation in which such manufacturers cannot be expected to emerge in a short time, the high duties serve only to hinder the domestic textile industry. This is a matter which needs to be looked at.

Due to the difficulties facing the dyeing industries such as environmental problems and profitability owing to the type of industry, they are not in a position to accommodate midstream expansion. It is quite possible that this will become a bottleneck which in turn will bring chaos to the market. Consideration should be given to government-level support, such as the establishment of an industrial estate and special incentive measures.

2-4. Technical Levels & Quality

In general, technical and quality levels are based on the level required for each particular product. Levels which are excessive are costly. The main type of products made by the Thai textile industry are standard products for the domestic market, and technical levels and quality standards corresponding to these products are maintained. However, problems will arise if the range of these products is extended so that they become products with stringent quality and delivery requirements and by making them into export items. These problems not only involve quality standards, higher grade equipment, improved technical capacity and differences in commercial practices, but also involve differences in the concept of quality standards and differences in the maximum permissible limit for defects. Accordingly, these problems are not solved just through equipment and technology. Instead, not only is a drastic change in the perceptions of business operators and managers required, but as this involves all workers a drastic change is also required in the consciousness of all workers engaged in production and distribution. This naturally will take a long period of time, and will also require close

supervision. Let us now look at the technical levels and quality standards of the individual industries from this perspective.

1) Spinning Industry

In an attempt to keep costs down spinners use domestically produced cotton which in terms of quality is very uneven, over imported cotton which meets international levels. As a result, all companies, regardless of their size, supply card through an air duct by using a bale mixer to automate the opening and blending process, whereby they implement quality standards aimed at keeping the use of domestic cotton to under 30%. On this point, control and equipment surpasses that of advanced countries.

Spinners' technical levels are shown in Table I-2-17. There are many, even some of those which have already shifted over to OE production, which have doubts over the quality of OE products and oppose introducing OE.

Table I-2-16. OE Production (1987) No. of Spindles

	Ring System	OE System(rotor)	OE Ratio
Thailand	2,061,969	19,696	1.0
China	24,049,360	164,392	0.7
Japan	9,090,064	209,064	2.3
South Korea	3,624,132	41,512	1.1
Taiwan	4,129,504	138,316	3.3

Source: Japan Spinning Monthly, September 1988 edition; Original source: ITMF

Table I-2-17. Features of Technology and Quality in Spinning and Weaving

Company	S-1	S-2	S-3	S-3	S-4	S-4
Scale (standard products)	Spinning 30,000 sp (standard)	Spinning 60,000 sp (special)	Spinning 32,000 (standard)	Weaving 824 looms (standard)	Spinning 21,000 sp (standard/special)	Weaving 318 looms (standard)
Technical and quality features	In planning	Acrylic 3" spinning, 30,000 sp T/C, C 30,000 sp 3" spinning	Splicer Fine spinning breakage 5 to 6 ends/400 sp Fine spinning 1 unit /person 5 persons/bale	824 units copchange, operating well 50 units air jet looms, considerable number idle AJL conversion	Double twisters 6 sets Production 2000 lb /man-mon 5.9 persons/bale	Rapiers 84 units Rapier conversion Opposition of OE
Japanese engineer	1 (JODC)	1 (JODC)	Permanently stationed	Permanently stationed	Permanently stationed	Permanently stationed

Company	S-6	S-6	S-7	S-7	S-8	S-8
Scale (standard products)	Spinning 109,000 sp (standard)	Weaving 2512 looms (standard)	Spinning 45,000 sp (standard)	Weaving 500 looms (standard)	Spinning 40,000 sp (standard)	Weaving 1900 looms (standard)
Technical and quality features	OE 924 drums OE opposed. All workers participate in TQC, ZD, safety, production control targets	Of which 160 AJL Conversion to AJL Many idle machines Winder yarn quality not up to AJL	OE 600 sp (3 sets) in testing Comber owned	Technology for export of grey fabric (Europe and U.S.) AJL do not have selvage and therefore considered problem	All equipment latest Spinning up to 60'S possible Yarn twisters (ring and DT) and splicers owned	Dyed yarn exported to Japan, Middle and Near East
Japanese engineer	Permanently stationed	Permanently stationed	Previously one	Previously one	One	One

Company	S-9	S-9	W-5	W-8	W-9	W-6	W-10	W-11
Scale (standard products)	Spinning 41,000 sp (special)	Weaving 384 looms (special)	Weaving 22 looms (special)	Weaving 300 looms (standard /special)	Weaving 350 looms (standard /special)	Weaving 496 looms (special)	Weaving 452 looms (special)	Weaving 214 looms looms (special)
Technical and quality	Mixed spinning technology for wool, silk, linen (2" spinning) Mix twisted, fancy spinning Double twister Splicer	Rapier 36 units Diverse short run production function	New machinery functions 1,370 units Leno Cutback sucker Fancy yarn Product development and planning being taken up	Used machinery purchased Yarn quality poor Yarn dyed fabrics exported to Middle and Near East and Burma	Rapiers 36 units 4 color rapier and sabi used for high class woven fabrics Stretch denim Small run production control	Rapiers 78 units WJL 4 units Fil. special weave	With Unifil, 60 units 110 units cop-change Also, dobby for all single 4 looms Ability of design and planning CAD-CAM scheduled to be introduced	100 units dobbies 54 units jacquard 36 units WJL 24 units AJL High quality weaves of polyester fil.
Japanese engineer	Permanently stationed and JODC 2		Manager			Technical guidance		One

Source: Based on the results of a survey.conducted by JETRO.

For companies S-3 and S-4 the worker/bale ratio was rather high at 5.0 and 5.9 respectively. In Japan, the 1987 ratio for the average 33.4'S yarn was 2.60 workers per bale. Table I-2-18 shows the average ratio for Thailand based on TTMA data.

Table I-2-18. A Comparison of Productivity (1987)

	Thailand	Japan
Workers/bale	6.97	2.60
Workers/10,000 spindles	181.8	45.7

Source: Japan-Japan Spinning Association data (average 33.4'S); Thailand- calculated on the basis of TTMA data.

It is thought that the difference between these two labor intensive industries lies with the widespread use of auto doffers. Leaving worker productivity aside, judging from the situation observed regarding the yarn break number in the fine spinning process and the unevenness of yarn showing in warping at the weaving plant, the quality of yarn was generally good. This is probably due to the selection of certain quality cotton and the effect of blending. The introduction of the Murata macha splicer shows the high degree of interest in the following process and represents a correct appraisal of what sort of technology is required.

2) Weaving

The fact that shuttle looms are the most commonly used in the Thai weaving factories explains everything in regard to technology and quality. This has occurred due to the acceptance of the market. However, as has been repeated a number of times, fabric defects which are hard to repair can easily occur as a result of shuttle loom weaving. Even after the defects have been fixed, defects which earn demerit marks often remain, thus making it quite difficult for such products to be brought into Japan. Among the companies which were visited there were some which have been successful in exporting grey fabric using the shuttle loom to Europe, the United States and other countries (refer to Table I-2-17). Also, as has already been stated in Table I-2-13, as the ratio for shuttleless looms is 15% in advanced countries, exports using shuttle looms are not always impossible. Nevertheless, with commodities aimed at the domestic market being redirected, efforts will have to be made to set up new technology if exports are started up.

Air jet looms are being introduced in order to make improvements in quality and to raise productivity. As has been said in the section on equipment, breaks in the warp

frequently occur if adequate preparations have not been made in the spinning stage, with the result that the expected rate of productivity cannot be achieved. Although it is relatively easy for manufacturers which engage in both spinning and weaving to develop technology, those specializing in weaving do not have the means to obtain the necessary yarn, and specialist spinners make little progress in development because, even if they were to introduce expensive equipment, they would not be able to sell their yarn at a high price. Much is expected of the educational activities of the TID.

Furthermore, the development of weaving technology related to filament weaving, especially for lining, is complicated. This is because it requires the development of technology at all stages. This includes the development of filament yarn for WJL weaving by fiber producers, the development of a warping system or warp sizing system by weaving plants, the development of special sizing, inspection of uneven dyeability at the beginning of weaving, and the incorporation of the weight reduction process by dyeing plants. Technological development by the TID and guidance by the industry is therefore of extreme importance.

3) Dyeing

Technology relating to T/C, T/R, C, and polyester yarn has been sufficiently developed owing to their long history. Although the equipment of some dyers is older than others, all have developed quality standards which meet the requirements of the products they handle. The level of quality of most of the Japanese companies is high as they either combine spinning, weaving, and dyeing operations, or have these undertaken by members of their group, and have brought quality-related technology from Japan. With the increase in local capital which accompanied the reduction of Japanese capital and withdrawals, this core of Japanese technology has spread locally, with the result that in the case of specific products levels are the same as Japanese products. This can be seen in materials for autumn and winter items made using T/R, and also in the opal treatment of woven fabrics with cotton and filament yarn. Nevertheless, technology has not been accumulated in areas where it has not been required in Thailand, for example, with regard to the requirement for a high degree of color fastness and regulations governing levels of formalin residue. Also, inspection systems have not been put in place. Therefore, it can be said that only some dyeing plants can meet requirements.

There are some people who are concerned about the weak state of printing. However, among the companies visited as part of the survey there was one which had introduced three highly expensive flat screen print machines. It produced high grade women's blouses and dress fabric for the domestic market. Also visited was a trading

company in Tokyo which imports a large quantity of women's dress fabric and products from Thailand. The imported items which were shown to us were cotton prints of medium grade. Also, key equipment is not required for printed T-shirts which are increasing at a rapid rate. No problems were found in relation to printing during the course of the survey. However, it should be added that there is the matter of the level of general color fastness, the financial difficulties faced in importing machinery, and the low level of planning and development in the area of design. But, as in the case of the flat screen print machines just mentioned, supply can be guaranteed if there is real demand.

4) Problems Related to Improving Technology and Quality

One source of real worry for company operators is what method to adopt for raising technical and quality levels and how to obtain knowledge about new materials and new technologies.

(1) Participating in Seminars and Training Held by TID

Due to the antiquated state of equipment, the TID holds lectures in which it passes on information about technology. There are some producers which find these seminars useful, and there are others which say that they want to learn technical know-how and not theory.

(2) Relying on Information From Manufacturers

Overseas dyers use their own laboratories for gathering a huge amount of data, which they pass on to their customers. There is the view that because this is an important means of obtaining information the importation of dyes from overseas will continue. The same can also be said for manufacturers of textile machinery.

(3) Cooperation With Japanese Technical Experts

The cooperation of Japanese technical experts who for many years have made practical contributions to production and who possess practical know-how is the most direct and valuable means of obtaining assistance. Consequently, not only has the JODC provided cooperation, but there are many instances where Japanese technicians who have worked for Japanese companies in Thailand for many years are employed by other local companies on their retirement. It is also common for trading companies to send experts to Thailand. The contributions made by Japanese technicians working for the companies which were visited for the survey are listed in Tables I-2-2, I-2-3, I-2-4 and I-2-5. In six out of the 12 Thai companies where there is no Japanese capital participation whatsoever

there are currently Japanese technical experts who have been sent from Japan, or the companies have received instruction from such experts in the past.

While there is the problem of the Japanese government's budget and also the matter of maintaining a balance with countries other than Thailand, there are plans for providing assistance by sending Japanese technical experts to not only individual companies, but also to assist with TID activities. This would also serve to help solve the problem of what to do with older technicians in Japan.

(4) Improving Quality Through Comprehensive In-house Control Systems

Sixty percent of requests made to the TID for inspections involve inspections for exports. Also, quality inspections are not usually carried out as part of a company's quality control system, something which is required to provide feedback for production. Producers should install machinery and equipment and set up inspection systems for carrying out their own quality and production control. It is from this data that the best technical know-how is created. Although it was not possible to ascertain the situation regarding inspection for all of the companies visited, generally speaking there were many which did not have such systems.

(5) In-house Training System

Among the companies which were visited there was one which informed all of its controllers about the company's business position, set targets which were also broken down, and engaged in target management by making an analysis of the gap between targets and actual performance. There was another company which carried out a campaign to do away with unusual incidents in the course of its operations. It set specific responsibilities for each individual worker, and checked everyday to see whether anything unusual had happened within the limits of each worker's responsibilities. If something had happened the measures taken and the amount of loss (length of stoppage, loss of materials, etc) were written on a huge noticeboard.

2-5. Cost Analysis

1) Labor Wages

The main reason given for the high degree of international competitiveness of Thailand's textile industry is low wage costs. The relative increase in Thailand's international competitiveness is attributed to a rapid loss in competitiveness by South Korea and Taiwan as a result of yearly wage increases and the strengthened position of

their currencies against the US dollar after having freed themselves from their former links with that currency. This situation is shown in Table I-2-19 (1), with a further breakdown provided in Table I-2-19 (2). As against an American labor cost of 100, Thailand's international labor costs range between 6 and 7, which places it in an advantageous position when compared to Japan's 130, Taiwan's 23 and South Korea's 19. However, in listing the top 10 countries in the world for the export value of textiles the source for these figures states that labor cost is not the main factor used in determining export values. It is true that despite their extremely low labor costs, China and Indonesia's total exports are not worth a great deal when compared to other countries. This is probably due to differences in overall strength. However, the influence which these two countries have on Thailand cannot be ignored. Cotton yarn and fabric from China are being imported to the Thai market.

The minimum wage in Thailand was 73 baht/day in 1987 and 1988. However, it has been decided to increase the rate to 78 baht/day from April 1989, and increases are being implemented in gradual stages beginning in January.

There are many textile companies which have been in operation for a long time and in some of these the majority of their employees have long service records. Japanese companies have generally been in business for 20 years and have a high worker retention rate and adopt a wage system based on length of service. Due to the high worker turnover ratio and the adoption of a wage system based on individual productivity in local companies a large gap has appeared in the wage levels of Japanese and local companies. This situation is shown in Table I-2-20.

Table I-2-19. (1) World Ranking of Labor Costs Per Hour

(Unit: US$/Man-Hour)

Ranking	Country	Spring 1988	Comparison with US	Spring 1987	Comparison with US	Winter 1985	Comparison with US	Spring 1984	Comparison with US
1	Switzerland	17.15	182	15.70	170	10.84	125	8.65	101
2	Netherlands	15.62	166	13.75	149	9.76	113	9.80	114
3	Belgium	15.07	160	13.66	148	10.08	116	8.84	103
4	Denmark	15.07	160	13.46	146	10.07	116	7.97	93
5	Japan	14.93	159	11.99	130	8.20	95	6.28	73
6	W.Germany	14.67	156	12.98	141	8.88	103	7.54	88
7	Norway	14.65	155	12.87	139	11.06	128	9.66	112
8	Sweden	14.20	151	13.69	148	9.61	111	7.91	92
9	Austria	14.10	150	12.59	136	8.71	101	6.76	79
10	Italy	13.81	147	12.67	137	8.22	95	6.35	74
11	Finland	12.23	130	10.70	116	8.06	93	6.05	70
12	France	10.88	115	9.99	108	7.44	86	6.07	71
13	Canada	10.78	114	9.85	107	8.50	98	8.50	99
14	U.S.	9.42	100	9.24	100	8.66	100	8.60	100
15	Australia	9.07	96	7.83	85	7.03	81	7.85	91
16	U.K.	8.43	90	7.09	77	5.90	68	5.46	64
17	Ireland	7.39	78	6.70	72	5.31	61	4.20	49
18	Spain	5.69	60	4.78	52	3.54	41	3.87	45
19	Greece	4.47	47	4.00	43	3.14	36	4.30	50
20	Taiwan	2.94	31	2.09	23	1.60	18	1.64	19
21	Tunesia	2.69	29	2.56	28	2.38	27	1.21	14
22	S. Korea	2.29	24	1.77	19	1.57	18	1.89	22
23	Portugal	2.19	23	1.83	20	1.27	15	1.28	15
24	Hong Kong	2.19	23	1.93	21	1.81	21	1.65	19
25	Mexico	1.84	20	0.83	9	1.82	21	2.62	30
26	Uruguay	1.69	18	1.97	21	1.20	14	Unknown	Unknown
27	Columbia	1.69	18	1.66	18	1.65	19	2.81	33
28	Peru	1.64	17	1.40	15	0.74	9	Unknown	Unknown
29	Venezuela	1.27	13	2.35	25	2.51	29	3.27	38
30	Argentine	1.24	13	1.60	17	1.79	21	2.23	26
31	Brazil(SanPaulo)	1.19	13	2.07	22	1.67	19	1.63	19
32	Morocco	1.10	12	0.74	8	0.59	7	Unknown	Unknown
33	Turkey	1.01	11	1.28	14	1.05	12	1.19	14
34	S. Africa	0.86	9	0.82	9	0.91	10	1.64	19
35	Brazil(South)	0.85	9	1.90	21	1.43	16	1.00	12
36	Malaysia	0.81	9	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
37	India	0.77	8	0.65	7	0.61	7	0.71	8
38	Ethiopia	0.68	7	0.29	3	0.27	3	0.27	3
39	Syria	0.67	7	4.29	46	3.41	39	3.12	36
40	Thailand	0.66	7	0.58	6	0.53	6	0.56	7
41	Brazil(North)	0.64	7	0.90	10	1.19	14	0.93	11
42	Philippines	0.64	7	0.57	6	Unknown	Unknown	Unknown	Unknown
43	Kenya	0.60	6	0.62	7	0.58	7	0.53	6
44	Egypt	0.41	4	1.19	13	0.79	9	0.90	10
45	Pakistan	0.40	4	0.37	4	0.31	4	0.49	6
46	Nigeria	0.39	4	0.48	5	1.56	18	2.13	25
47	Sri Lanka	0.30	3	0.31	3	0.29	3	0.28	3
48	China	0.27	3	0.23	2	0.20	2	0.26	3
49	Uganda	0.23	2	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
50	Indonesia	0.22	2	0.20	2	0.23	3	0.23	3

Source: Total labor expenses including various allowances and social expenses.
Exchange rates used, from left to right, those of May 27, 1988, April 8, 1987, January 15, 1986, and March 1, 1984.
Original is from survey of labor costs by Werner International Managing Consultants.

Table I-2-19. (2) Labor Costs Per Hour of Spinning Industries of Main Countries of the World (Spring 1987)

	Africa				South America								Asia											
	Nigeria	South Africa	Tunesia	Uganda	Argentina	Brazil(North)	Brazil	Brazil(South)	Colombia	Peru	Uruguay	Venezuela	Australia	China	Hong Kong	India	Indonesia	Japan	S.Korea	Malaysia	Pakistan	Philipines	Sri Lanka	Taiwan	Thailand
1 Average labor costs per working hour(three shift basis)																									
1)Wages...according to each country's currency	1.16	2.07	1.44	11.50	5.93	55.83	110	86	310	33.35	353	22.99	8.18	0.84	15.19	7.08	238	1,085	1,083	1.33	4.62	9.35	8.24	56.70	14.98
2)Various allowances	0.46	0.27	0.28	0.99	0.76	9.89	28	17	80	11.10	82	2.14	2.21	0.04	1.27	1.62	44	498	395	0.43	1.08	2.09	0.64	11.60	1.21
3)Other expenses	0.11	0.19	0.52	1.25	2.07	37.18	53	33	106	9.78	141	14.65	0.86	0.12	0.64	1.54	68	283	203	0.33	1.35	1.34	0.46	16.20	0.46
4)Total labor costs per hour	1.73	2.53	2.23	13.73	8.75	103	192	137	496	54.23	575	39.78	11.25	1.00	17.10	10.24	372	1,867	1,681	2.08	7.05	12.78	9.34	84.50	16.35
5):Exchange rate(to US$1)	4.45	2.95	0.83	60.57	7.08	161	161	161	293	33.01	340	31.38	1.24	3.75	7.82	13.25	1,682	125	735	2.58	17.46	20.10	30.71	28.70	24.95
6)Total costs per hour (converted to US$)	0.39	0.86	2.69	0.23	1.24	0.64	1.19	0.85	1.69	1.64	1.69	1.27	9.07	0.27	2.19	0.77	0.22	14.93	2.29	0.81	0.40	0.64	0.30	2.94	0.66
7)Cp.[arospm wotj U.S.(%)]	4	9	29	2	13	7	13	9	18	17	18	13	96	3	23	8	2	159	24	9	4	7	3	31	7
2 Working hours																									
1)Standard working hours per day	8	10	8	7	8	8	8	8	8	8	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8
2)Standard working hours per week	39	49	45	40	46	45	42	48	48	47	44	48	38	45	48	47	47	40	48	48	51	48	45	48	48
3)Planned working hours per year	1,946	2,696	2,080	1,856	2,129	2,147	1,988	2,192	2,280	2,176	2,048	2,220	1,768	2,295	2,373	2,198	2,248	1,972	2,410	2,296	2,432	2,364	2,190	2,544	2,320
4)Planned working days per year	252	276	277	278	266	284	254	274	285	276	279	277	233	306	287	281	290	248	301	287	287	296	292	318	290
3 Overtime allowances(% of wages)																									
1)Over 8 hours	35	33	75	50	63	37	35	30	63	50	100	53	156	0	70	75	138	25	50	50	100	25	5	67	50
2)Holidays	52	113	100	100	90	77	100	100	125	100	100	133	178	200	60	67	175	25	50	200	100	40	2	150	200
4 Shift allowances																									
1)Second shift	0	10	0	0	6	0	0	0	13	6	0	8	15	12	4	0	0	5	0	10	7	9	1	10	0
2)Third shift	4	3	25	0	18	20	18	20	35	21	22	25	21	20	14	11	0	40	50	25	7	18	1	20	5
5 Acutual operations during year																									
1)Days of operation during year	260	318	325	232	269	362	339	303	319	315	256	309	267	306	330	346	348	274	306	304	333	324	343	354	353
2)Hours of operation during	6,045	7,625	7,800	5,568	6,132	8,682	8,135	7,272	7,666	7,467	6,144	7,426	6,189	6,885	7,930	8,125	8,340	5,854	7,338	7,296	7,467	7,776	8,232	8,496	8,472

Note: * Central exchange rate of May 27, 1988
- Unknown

Table I-2-20. Labor Wages per Individual Company

	Industry					Monthly Wage (daily wage)
Japanese Companies	S-3	W-1				male 5,000 female 4,00
	S-4	W-2	K-2	F-2	D-4	5,500
	D-6					
	D-8					
	S-1		K-1		D-2	3,000 (95-100 b/day)
	S-2				D-3	2,500-3,000
	S-6	W-3			D-5	
	S-7	W-4				4,000 (135)
	S-8	W-12			D-12	
Thai Companies	S-9	W-7			D-8	4,136
		W-5				
		W-10				3,000-4,000
		W-6			D-7	
		W-8			D-9	3,000
		W-9				2,000-4,000
		W-11				(70-80)
					D-6	
					D-1	4,000
					D-10	
					D-11	

2) Unit Price of Electricity

Thailand's unit price for electricity of 1.5 baht/KWH is extremely low compared to the Japanese unit price of 15-18 yen/KWH (roughly 3-3.6 b/KWH). Nevertheless, because most advanced countries are situated north of Thailand and experience four distinct seasons, air conditioner compressors in factories in those countries operate between only 0-2 months a year. In contrast, as Thailand is situated at 5-18 degrees latitude north, compressors are in operation for more than 10 months a year, and this increases costs. Comparing electricity costs for the spinning of 40'S yarn, Thailand's cost is 950-1,050 KWH/400 lb yarn production (1,430-1,580 b/400 lb yarn) and Japan's is 600-700 KWH/400 lb yarn production (1,980-2,300 b/400 lb yarn) in Japan.

3) Import Tariffs

Import tariffs related to the textile industry which were levied on raw materials and textiles and also the high duties levied on textile machinery around 1960 in order to foster domestic industry have been very effective in achieving that purpose. But as these have

caused various types of problems in relation to export promotion these tariffs are examined in another section.

4) Polyester Staple Fiber

Purified telephthalic acid (PTA) and ethylene glycol (EG), the raw materials which are used to make polyester staple fiber, are both international commodities. They are both imported by Teijin and Melon and an import tariff of 10% of the international price is levied on these materials, thus raising the cost of textiles by only this amount. It appears that some companies use QTA which is cheaper than PTA. However, some spinning companies complain that PTA is the most expensive spinning raw material in the world. Originally, the product price was determined on the basis of demand and supply irrespective of the price of raw materials. However, with supply confined to two companies and supply falling behind demand, those wishing to import staple fiber are faced with the barrier of a 30% import tariff. As for the distribution among manufacturers by the two companies, even if it is not at all a cartel action there is no market liquidity on the price. In order to bring the principle of determining the price on the basis of the balance in demand and supply into play, the barrier of an 30% import tariff must be removed and the international market price introduced. The variation in price in Japan is shown in Table I-2-21.

Table I-2-21. Variation in Market Price of Polyester Staple (1.5d2") in Japan

1980	413 ¥/kg							
1983	383							
1984	389							
1985	374							
Mar '85	¥390/kg	(40.7b/kg)	Mar '86	¥343/kg	(50.1)	Mar '87	¥225/kg	(37.7)
Jun	380	(41.2)	Jun	275	(42.8)	Jun	225	(40.6)
Sep	343	(41.4)	Sep	225	(38.2)			
Dec	343	(46.1)	Dec	225	(36.4)			

Note: Figures in parentheses denote baht/kg calculated on the exchange rates at that time.

Notes: Export Price of Polyester Staple Made In Taiwan (Feb.'88)

Exported to Japan	110 US¢/kg	(27.5b/kg)
Exported to the continent	105	(26.3)

Source: Japan Textile Machinery Society Magazine, no.3, 1988

5) Cotton

Domestic demand for cotton and cotton imports are shown in Table I-2-22.

Table I-2-22. Demand For Cotton and Imports

	Consumption	Imports	Production	NY Fixed Quotation SLM 1 1/16"	Import Value CIF
1986	222,239 t	193,391 t	25,290 t	41.29-67.85 ¢/lb (23.79-39.09 b/kg)	23.16 b/kg
1987	256,853	249,593	25,300	56.46-74.18 ¢/lb (31.20-41.00 b/kg)	27.57

Source: TIMA, Japan Spinning Monthly

With consumption of cotton at approximately 260,000 tons and domestic production decreasing yearly so that it supplies about 10% of total consumption, the remaining 90% has to be imported. Cotton is imported from countries all around the world, including the United States, China, New Zealand, and Australia, as a result of the trading activities of Nichimen and Tomen. A 5% import tariff is placed on cotton along with a 1.5% business tax and an 11% duty on anticipated profit. As the selling price by ginners for domestically produced cotton was said to be 16 b/kg in 1986 and then 13 b/kg in 1987, the supply of domestically produced cotton must be raised in order to lower the price of raw materials for spinners and thus improve international competitiveness. To achieve this it is necessary to raise the price so as to encourage farmers to increase the size of their cotton crops.

6) Spinning

For the current survey companies were not asked their direct costs, but instead they were asked their cost component ratios. These are shown in Table I-2-23.

Table I-2-23. Composition of Manufacturing Cost of Spinning and Weaving

Name of company	S-1	S-2	S-3	S-4	S-6	S-7	S-8	S-9
Industry (standard product)	Spinning (standard)	Spinning (special)	Spinning (standard)	Spinning (standard /special)	Spinning (standard)	Spinning (standard)	Spinning (standard)	Spinning (special)
No. of spindles	30,000 sp	60,000 sp	32,000 sp	21,000 sp	109,000 sp	45,000 sp	40,000 sp	42,000 sp
No. of employees		Acrylic high bulk TC/ C	907	345	3,237	1200 (including weaving)	850	
Composition of prime costs								
Material costs	60%		60%	73%, 22	67~68%	55%		67%
Labor costs	15~20% (3,000)	(2,500~3,000)	Male 5,000 Female 4,000	12% (5,500), 3.5~4	8% (direct)	15% (4,000)		15% (4,136)
Energy	20%		40%: 30 (10, 25 ~30 (10~12)	7% (all season air conditioner), more than 2	13% (power)	10% (power)		20 (air conditioner), 16
Equipment costs	10%		40 (16)	3%, depreciation 1 or less	12%	Depreciation 10%,		Depreciation 18%,
Others				Total: 30		repair 10%		machine repair 13%

Name of company	W-1 (S-3)	W-2 (S-4)	W-3 (S-6)	W-4 (S-7)	W-5	W-6	W-7 (S-9)	W-8
Industry (standard product)	Weaving and spinning (standard)	Weaving and spinning (standard)	Weaving and spinning (standard /special)	Weaving and spinning (standard)	Weaving (standard)	Weaving (special)	Weaving and spinning (special /standard)	Weaving (standard /special)
No. of looms	824+50	318	2,512	500	22	414	384	300
No. of employees	907 (including spinning)	297		1,200 (including spinning)	40	750		280 (including dyeing)
Composition of prime costs								
Material costs		8.3+1.7, size 10%	70%	60% (including paste			70%	3.5 yen/yd (fabric processing cost)
Labor costs		7, 40% fixed	8	15			25	(3,000)
Energy		1.3, 7~8	Size + heavy oil 3 + 3	6~7			12 power + air-con., cooling 18	Defects inspection and repair 20 persons
Equipment costs		2, depreciation 10						(PVA 115 to 120 g/kg starch 3 B/kg)
Others		Total 26					Paste 3.3	

Name of company	W-9	W-10	W-11	W-12 (S-8)
Industry (standard product)	Weaving (standard)	Weaving (special)	Weaving (special)	Weaving (standard)
No. of looms	350	452	154	900
No. of employees	200	600	235	450 (including dyeing)
Composition of prime costs				
Material costs		70%		
Labor costs	(2,000~4,000)	10~15 (3,000 ~4,000)	(70 to 80 bahts/day)	
Energy		1 power		
Equipment costs		1 repair		
Others				

Note: 1. Unit cost of power for Japan is 16 yen per kWh and for Thailand 1.4 to 1.5 bahts per kWh.
2. Figures in parentheses are bahts/month.

In the case of all companies raw materials accounted for more than 60% of costs, and there was even one for which they comprised 73% of costs. Because the percentages are not absolute values, it is inevitable that if labor costs are cheap then the ratio for another set of costs rises. Companies for which fluctuating costs comprise more than 60% of their costs are considered to have a fragile management base. Also, as cotton is an international commodity, if a fluctuation takes place as a result of America's international strategy there is nothing that Thai companies can do about it. In 1986 when the United States enacted its New Agricultural Land Law it suddenly forced the price down in an attempt to protect its own cotton industry and to bring down production by overseas cotton producers. (Please refer to "Why is U.S. Cotton Cheap?", Japan Spinning Monthly, Sept. edition '86, Japan Cotton Industry Promotion Association.) (Refer to Table I-2-24.)

The Thai cotton industry can therefore do nothing in such situations because of its poor commercial capital. When the New York market rises sharply (as in March 1984 when it rose to 80¢/lb), Thai cotton spinning companies being weak in commercial capital are at the beck and call of the market because they follow the practice of buying for their immediate needs. In order for the Thai spinning industry to avoid being directly affected by changes in overseas markets and to keep operations stable and maintain export competitiveness the production of a certain amount of cotton in Thailand is required.

Table I-2-24. New York Fixed Cotton Price (SLM 1 1/16) ¢/lb

Apr 1985	66.28-65.16
Oct	60.84-61.17
Mar 1986	63.69
Apr	65.65-66.05
Jun	67.85
Sep*	41.29
Oct	47.38-45.40
Dec	56.37
Apr 1987	63.45-62.67
Oct	66.75-64.73
Apr 1988	66.05-65.85

* The U.S. New Agricultural Law was enforced in August '88.

Source: Japan Spinning Monthly, Sept. 86

Table I-2-25 shows international examples of the ratio of spinning costs comprised by raw materials. They range between 40-50% and are lower than those for Thai companies.

Let us now look at electricity costs. For the companies which were visited electricity comprised 10-20% of costs. The same percentages for overseas examples given in Table I-2-25 are lower at between 5-10%. This difference is due to the fact that in Thailand there are many companies which combine spinning, weaving and dyeing operations so it is hard to get hold of accurate electricity costs for spinning, and also because of the handicap faced by Thai companies due to the substantial use of air conditioner compressors as mentioned previously.

The percentage of total costs comprised by labor costs for four companies are 8%, 12%, 15%, and 20% respectively. These figures are not related to the fluctuation of monthly wages. Looking at Table I-2-25 which provides an international comparison, the percentage of costs comprised by labor costs in Thailand is several percentage points too high when compared to Thailand's overall level (refer Table I-2-19). The reason for this is labor productivity. That is to say, the number of employees is large when compared with output (refer to Table I-2-26).

Therefore, even though labor costs may be low, poor worker productivity leads to increased costs.

The following comments made by the manager of S-1, which is currently constructing a spinning plant of 30,000 spindles, sum up the significance of these sorts of factors when viewed from a broader perspective: "The cost component ratio for a plant of 30,000 spindles works out like this- raw materials 60%, labor costs 15-20%, electricity costs, 20%, equipment and other operating expenses 10%. With the total cost of T/C 45'S at 35b/lb and the present selling price at 45-47b/lb it will be possible to repay the cost of the plant in 3 years".

It may be conjectured that these calculations and this way of thinking are the primary reasons for the recent large number of applications to increase equipment. But what will happen if the price of yarn returns to the 1985 level of 34-38b/lb or the March 1986 level of 33-36/lb before the sharp rise in price occurred? With increased equipment there will probably be a surplus of yarn and this is expected to lower the price more. It is because of this that, fearing severe times in the near future, those wishing to expand equipment are hurrying with their orders in order to repay borrowed funds before the market price of yarn drops.

Table I-2-25. Yarn Manufacturing Costs

($/kg)

Cost item	Brazil	W. Germany	India	Japan	S. Korea	U.S.
Falling matter	0.1058 [4.0]	0.1199 [3.6]	0.1015 [4.1]	0.1195 [3.8]	0.1214 [5.0]	0.1039 [2.2]
Labor	0.1194 [4.5]	0.7414 [22.5]	0.0935 [3.8]	0.4079 [13.0]	0.1145 [4.7]	0.3591 [12.7]
Power	0.0383 (1.4)	0.2287 (7.0)	0.2219 (9.0)	0.3080 (9.9)	0.1690 (6.9)	0.1357 (5.5)
Supplementary materials	0.1216 [4.6]	0.0745 [2.3]	0.1010 [4.2]	0.1030 [3.3]	0.0861 [3.5]	0.0752 [3.1]
Capital (depreciation + interest)	0.9679 [36.5]	0.6601 [20.1]	0.7059 [28.5]	0.7383 [23.6]	0.4806 [19.7]	0.4955 [20.2]
Materials (cotton)	1.3000 [49.0]	1.4550 [44.2]	1.2500 [50.5]	1.4500 [46.0]	1.4700 [60.2]	1.2800 [52.3]
Total (index using W. Germany as 100)	2.6530 [100] (81)	3.2896 [100] (100)	2.4768 [100] (75)	3.1267 [100] (95)	2.4416 [100] (74)	2.4494 [100] (74)
Materials costs in total costs	49%	44	50	46	60	52

Source: Japan Spinning Month, April 1988

Original: ITMF International Comparison of Spinning Costs, 1987 survey

Table I-2-26. Labor Productivity in 1987

	Japan	Thailand
Cotton spinners No. of spindles (1,000 spindles)	6,474	2,068
Cotton spinners No. of employees	32,494	37,602
Spindles/employee	199	55

Sources: Japan Spinning Association; Thailand (see Table 6)

7) Weaving

The cost component ratio for weaving production is shown in Table I-2-23, and that for cotton weaving production in the major producing countries is shown in Table I-2-27. The cost of raw yarn (includes sizing) is somewhere near 70% for all companies. These costs, however, cannot be compared with those of the countries shown in Table I-2-27 due to the small size of the sample, the large number of plants which combine spinning and weaving, and the fact that some plants use dyed yarn as raw material. As weaving producers buy raw yarn from the market, a comparison was made between the market prices for raw yarn. Table I-2-28 shows a comparison of the costs of standard products (cotton yarn 40'S, T/C 45'S) in Thailand, Japan, and Taiwan. Despite the changes in the exchange rate the level of the price of yarn in Thailand and its movements are very similar to those of the Osaka market.

Table I-2-27. Fabric Manufacturing Costs

(Units: US$/yard)
Figures in parentheses indicate percentage of total.

Cost item	Brazil	W.Germany	India	Japan	S. Korea	U.S.
Labor	0.031	0.213	0.027	0.130	0.028	0.123
	(3.6)	(17.3)	(3.2)	(11.7)	(3.6)	(14.6)
Power	0.009	0.055	0.049	0.063	0.036	0.031
	(1.1)	(4.5)	(5.9)	(5.6)	(4.7)	(3.7)
Supplementary	0.036	0.054	0.050	0.048	0.051	0.042
materials	(4.0)	(4.4)	(6.1)	(4.3)	(6.7)	(5.0)
Depreciation	0.097	0.171	0.098	0.170	0.093	0.099
	(11.0)	(13.8)	(11.9)	(15.3)	(12.2)	(11.7)
Interest	0.161	0.069	0.100	.063	0.062	0.049
	(18.3)	95.6)	(12.0)	(5.7)	(8.1)	(5.8)
Material yarn cost	0.541	0.671	0.324	0.638	0.418	0.500
	(61.4)	(54.4)	(39.0)	(57.4)	(64.7)	(59.2)
Total	0.882	1.234	0.506	1.112	0.769	0.844
	(100)	(100)	(100)	(100)	(100)	(100)

Source: Japan Spinning Month, April 1988
Original: International Comparison of Spinning Costs, conducted by the ITMF in 1987

Table I-2-28. Comparison of Thai and Japanese Commercial Markets for Cotton

B/US $ rate	¥/US $ rate	¥/B rate	Date	Cotton			Thai commercial market			Osaka commercial market spot				Thai commercial market				Osaka commercial spot		
				NY periodic SLM			C 40'S		T/C 45'S	Cotton yarn 40'S		T/C 45'S		Calico		Toray fabric for shirts		Cotton fabric blend 190		
				$/lb	Index	B/lb	B/lb	Index	B/lb	100 yen/bale	B/lb	Yen/lb	B/lb	B/bolt	'85/3 100	Yen/yd	'85/3 100	Yen/yd	'85/3 100	B/yd
23.639	236.95	10.02	'84/3	80.25	121.5	19.0	37	113.0	41	155.08	38.7			360.00	100	14.50	100	118.3	87.4	11.8
			6	79.59	120.5	18.8	36-37	111.5	41	150.37	37.5			360.00	100	14.50	100	112.8	83.0	11.2
			9	64.27	97.3	15.2	34-35	105.3	39~40	148.05	36.9	378	37.7	360.00	100	14.50	100	114.2	84.4	11.4
			12	65.89	99.7	15.6	33	100.8	38.5	148.48	37.0			360.00	100	14.50	100	123.3	91.1	12.3
27.159	260.47	9.59	'85/3	66.07	100	17.9	325-33	100	37.5~38.5	142.76	37.2	315	32.8	360.00	100	14.50	100	129.9	100	13.5
	250.20	9.21	6	62.34	94.4	16.9	31.5	96.2	36.~38	131.96	35.8	312	33.9	360.00	100	14.50	100	122.1	98.5	13.3
	239.47	8.82	9	59.28	89.7	16.1	32-34	100.8	35~31	121.33	34.4	275	31.2	360.00	100	14.40	99.3	128.3	108.1	14.6
	202.67	7.46	12	61.24	92.7	16.6	30	91.6	34	105.11	35.2	265	35.5	360.00	100	14.40	99.3	115.4	114.8	15.5
26.299	180.12	6.25	'86/3	63.69	96.4	16.7	30~32	94.7	33~36	93.8	34.2	250	36.5	360.00	100	14.40	99.3	100.8	108.9	14.7
	169.07	6.43	6	67.85	102.7	17.8	32~35	102.3	36~45	86.0	33.4	213	33.1	360.00	100	14.40	99.3	84.5	97.0	13.1
	154.72	5.88	9	41.29	62.5	10.9	36~38	113.0	46~52	95.2	40.5	220	37.4	360.00	100	14.40	99.3	91.5	115.6	15.6
	162.77	6.19	12	56.37	85.3	14.8	40~44	128.2	52	124.0	50.1	285	46.0	360-475	116.0	14.40-17.12	108.7	95.3	114.1	15.4
25.273	153.43	5.96	'87/3	56.46	85.5	14.5	52-53	157.3	55~62	107.8	45.2	283	47.4	475.00	131.9	17.12	118.1	85.4	105.9	14.3
	142.67	5.55	6	74.18	112.3	19.1	52~53	160.3	56~58	110.5	49.8	278	50.1	598.33	166.2	17.12	118.1	96.3	128.9	17.4
	142.94		9				53	161.8	55~57					595-598.33	165.7	17.12	118.1			
			12				50	152.7	54~56					595	165.3	17.12	118.1			

Price of Standard Products Domestically in Taiwan (End of 1987 to 1988)

	US C/lb	B/lb
C 40'S	250	64.3
30'S	240	61.7
T/C 45'S	180	46.3
32'S	160	41.2
T/R 30/2 s	155	39.9

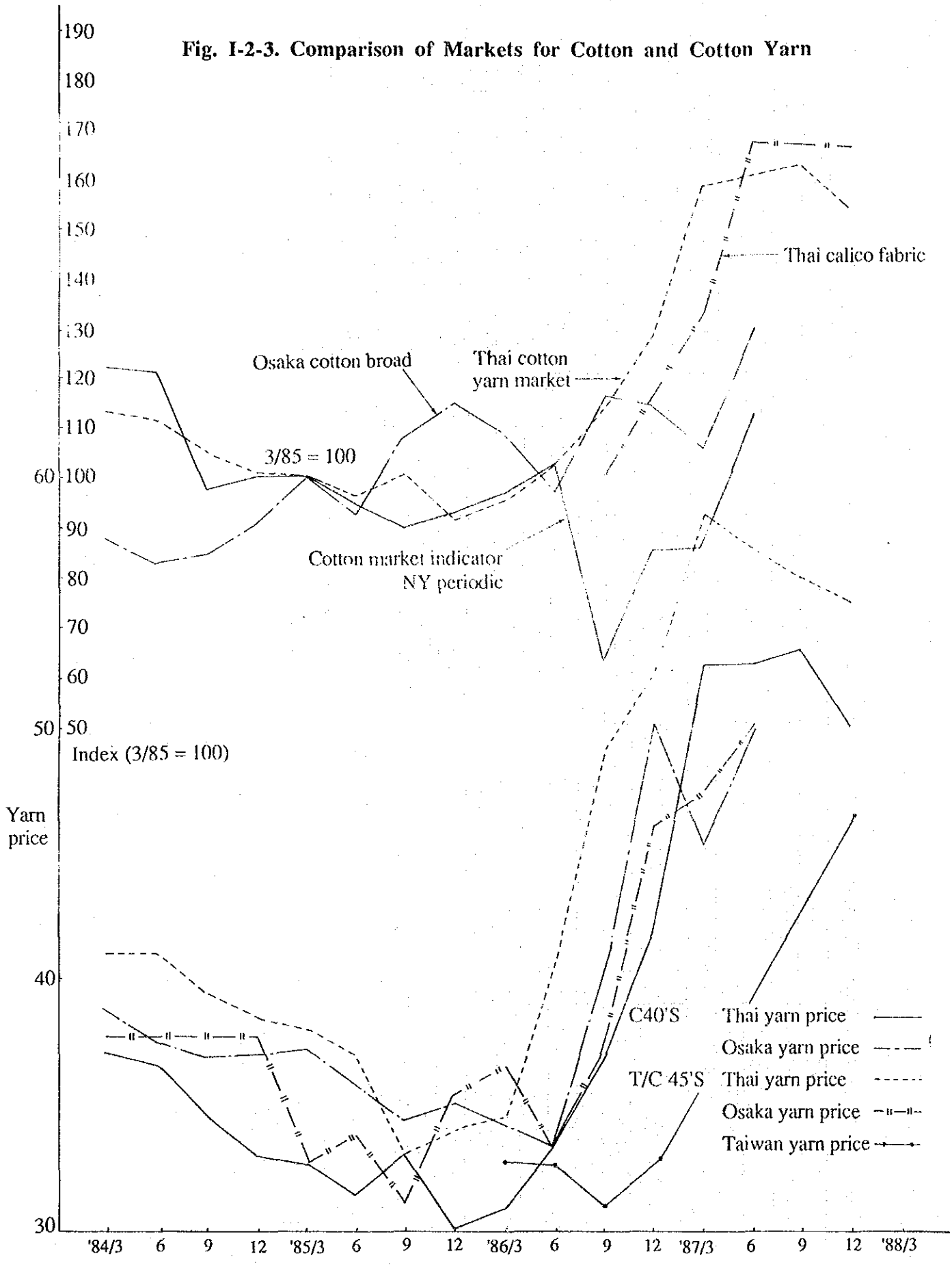
Source: Textile Machine Society Journal, 1988, No. 3, p. 49.

Price of Taiwan T/C 45'S Yarn

	US $/lb	B/lb
End of 3/86	1.249	32.8
End of 6/86	1.244	32.7
End of 9/86	1.183	31.1
End of 12/86	1.232	32.4

Source: Chemical Fiber Monthly, March 1986.

Fig. I-2-3. Comparison of Markets for Cotton and Cotton Yarn



In the case of cotton yarn 40'S, the Thai price is cheaper. (The feasibility of exporting yarn from Thailand depends on the cost of freight and other charges.) As for T/C yarn, it has remained high throughout this period. If there is not much difference between the price of synthetic raw materials and cotton the spinning costs of T/C 45'S and cotton yarn 40'S are generally regarded as being about the same. If there is usually little movement in the Thai price for yarn, the price of polyester staple is probably not international. However, as there is no breakdown for prices it is not known whether this is in fact so. The price level of Taiwan T/C 45'S is extremely low. Also, as has already been seen in Table I-2-21, the price for polyester staple is cheaper than that of the price in Japan. The reason why the cost of raw yarn comprises a high proportion of weaving costs in Thailand is because labor costs are at a relatively low level when compared internationally, while the price of raw yarn is on an international level (the price of T/C is above the international level). The result is that raw yarn accounts for a relatively high proportion of weaving costs. The price of T/C 45'S yarn was 57b/lb in early 1988 and 50b/lb in November '88. The same yarn from China is being brought into the country at 51b/lb (including import tariffs). Pure cotton yarn which costs 35-38b/kg plus import tariffs was imported, compared to the price of 46-47b/kg for the same yarn in Thailand. If a refund can be guaranteed then it is possible to import large quantities of T/R yarn, and also cotton yarn from cotton producing nations. (Note: Trends in the market price of woven fabric and a comparison between the market price in Thailand and Japan are shown in the right column in Table I-2-28. Although a direct comparison cannot be made because products are not identical, if a comparison is made by setting the March 1985 price at a value of 100, the effect of the high price of yarn is clear in that there has been considerable movement in the price of Thai standard products since December 1986 (refer Figure I-2-3).

The situation regarding productivity is shown in Table I-2-29. Productivity per machine is low in Thailand despite the fact that most Thai plants operate 24 hours a day compared to 16 hours a day for plants in Japan on which basis the productivity of Thai plants should be 3/2 of Japanese plants. This can be attributed to the delay in introducing the latest high speed machines. The number of machines per worker and output per worker are also low. The reason for the large number of workers as against equipment is due to the weft cop winding process and the use of shuttle looms which require that the weft yarn be carried. Output per worker is therefore less than half of that in Japan. Because labor wages in Japan are ¥90,000 to ¥100,000 a month per worker compared to 4,000 b/month in Thailand, labor costs are low in Thailand and added to this, equipment costs are also low. However, as the standard of wages rises, shuttle looms will prove a fatal flaw when it comes to labor productivity.

Table I-2-29. Productivity of Fabric Manufacturers

	Spinning & Weaving in Japan			Weaving in Thailand		
	1,000 m^2/ loom	No. of looms/ person	1,000 m^2/ person	1,000 m^2/ loom	No. of looms/ person	1,000 m^2/ person
1985	26.4	3.9	104.9	20.6	2.1	44.2
1986	26.8	3.9	104.8	22.5	2.2	48.3
1987	29.0	4.0	115.8	24.0	2.2	52.9

Source: The results of a survey by JETRO.

8) Dyeing

The cost component ratios of dyers that were visited are shown in Table I-2-30. The data from that table has been summarized in the table I-2-31.

Table I-2-31. Dyeing Cost Component Ratios

	Thailand	Japan
Dyes & auxiliary agents	30-40	20-25
Labor	15-25	30-35
Energy	30-40	30-35
Equipment & Other	remainder	remainder
TOTAL	100	100
Fluctuating costs	60-70	50-75

Table I-2-30. Composition of Manufacturing Cost of Dyeing

Name of company	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8
Industry (standard product)	Fabric dyeing and prints (standard)	Fabric dyeing and yarn dyeing (standard/special)	Yarn dyeing (special)	Yarn dyeing and fabric-dyeing (standard)	Fabric dyeing and prints (special)	Fabric dyeing and prints (standard)	Fabric dyeing and prints (special)	Yarn dyeing, fabric-dyeing, and finishing (standard/special)
Processing volume	3.2 mil. yd/mon	Jigger 40 units, yarn dyers 20 units	110 t/mon, hank 10 units, loose carriers 2	1.3 mil. yd/mon	6 mil. yd/mon	5.5 mil. yd/mon	700,000 yd/mon	19,500 bolts/mon
No. of employees	600	350	47	194				1,875
			Acrylic fibers, cationic dyeing					
Composition of prime costs								
Dyeing aids	30%	30%	30~35%	Fabric 21.5, dye 4.2: 40~50%		40	30 (Indonesia 20)	
Labor costs	15	25	14~15	1.5			73 (Minimum wages 25)	
Energy	30	40		1.5		15~17	1.52 bahts/KWH (1 B or less)	
Equipment costs	Depreciation completed					Print cutting 6 to 7		
Others	25	5	Wastewater treatment 5	Grand total 34 Total 8.5 (fixed costs)		Business tax 7 Comparive costs 67~68 (30)		

Name of company	D-9	D-10	D-11	D-12
Industry (standard product)	Yarn dyeing (special)	Yarn dyeing and fabric dyeing (standard)	Prints (special)	Yarn dyeing (standard)
Processing volume		1500 t/year		
No. of employees	280	310		
Composition of prime costs				
Dyeing aids		20 to 30% (aids 25 to 26)		
Labor costs		7~8		
Energy		8		
Equipment costs				
Others		Wastewater treatment costs high		

The data shows that when compared to Japan Thai dyers face problems in regard to two points. The first is that the proportion of costs comprised by dyes and auxiliary agents is extremely high. There are two manufacturers of dyes in Thailand, but because of the unstable quality of their products due to variation in the color of different lots and poor dispersal most of the time dyers choose not to use these dyes which are 10-15% cheaper than imported dyes, and instead import most of their dyes. Added together the 30% tariff on dyes, other surcharges, and business taxes take import tariffs up to about 50%. Whereas in many countries low import duties are applied, this high rate of import tariffs makes dyeing processing costs high. Although there is a system for receiving refunds for exported items, because products produced in large quantities are distributed through Sam Peng, dyers do not deal directly with exporters and therefore have difficulty in obtaining export certificates and subsequently are unable to obtain refunds on duties paid. Accordingly, dyers which deal with large quantities of standard products face hard times as they are pressured by low processing fees because their products are standard products, and also by the high cost of dyes. Unlike other countries, the high cost of dyes is a considerable handicap when it comes to international competitiveness.

The second problem is that fluctuating cost shares 60-70% of total costs due to the high cost of dyes. This results in a small profit margin, and increases in fixed costs have to be kept down as much as possible in order to allow for the worldwide fluctuation in costs. As a result, it is difficult to increase capital costs with regard to adding extra or renewing equipment. Furthermore, faced with the high cost of dyeing equipment and the more than 40% import tariff imposed on imported machinery Thai dyers can be said to be stagnating due to the considerable handicaps they face in relation to dyes and machinery compared to dyers in other countries.

In addition to constraints caused by various kinds of environmental regulations which have been imposed recently, restrictions have been placed on drawing up underground water in order to keep land subsidence in check. The subsequent use of expensive industrial water has increased dyers' costs.

2-6. Staff Training

1) Requests Concerning the Training of Company Employees

There is an extremely large number of people who complain that "Even if we take on a university graduate, once he has been given a general training he is lured away by high salary offers from other companies. I would like to see the number of graduates increased", or "There is a shortage of technicians who can become executives". Other

problems include maintaining staff, in-house training and study opportunities for company operators. These problems have been summarized and are outlined below.

i) Until recently there were very few courses on textiles offered at university and companies had no choice but to employ mechanical or electrical engineers. Once the graduates find out what the situation is like in their companies they find opportunities to shift to more suitable companies in their proper fields.

ii) Because their positions are fixed within the company they have very few chances for promotion. Those who have confidence choose to gain promotion by changing jobs.

iii) There are very few technical books, manuals, and magazines (especially related to dyeing), and there is no way that employees can learn by themselves. One good way of obtaining technical know-how is to learn the latest in technology from dyers and machinery manufacturers and to be supplied with data from these sources.

iv) Even though there was one company which showed its managers its cost analyses and carried out target management, most employers generally do not conduct training to improve the skills of their workers.

v) It is difficult for foreign technical experts to acquire long-term visas to work for companies (the application procedure and receiving approval pose particular problems). As a result, technology transfer becomes difficult.

vi) Even though company operators would like to acquire new knowledge there is no means for them to do this and they are not necessarily satisfied with the seminars which are offered.

The present situation and problems related to the above are as outlined below.

2) School Education System

In Thailand there are 14 national universities, two of which, Chulalongkorn and Tharmasart Universities, have (under planning) textile departments (refer to Table I-2-32).

The course at Chulalongkorn consists of "Polymer Science and Textiles", with most of the lectures on polymer science. At the present time there are 12 students and two lecturers. However, as one of the lecturers is overseas on sabbatical leave the course is actually taken by just one lecturer. Most of the students enter painting-related companies upon graduation. The equipment is mostly testing apparatus for experimentation using

beakers, and there are hardly any measuring machines or instruments. TID equipment is used for carrying out experiments.

Table I-2-32. Textile Education in Thailand

	Technical School			University			Total
	Certificate[1]	Diploma[2]	Diploma[3]	Bachelor's	Master's	Ph. D.	
No. of Institutes	2	2	1	*2			7
No. of Students at present	390	170	100	120			780
Total of graduates	1,091	550	77	405			2,123

1) After grade 9 and continue in tech. school = 3 years

2) " = 3 years and continue in tech. school for 2 years

3) After grade 12 and continue in tech. school for 2 years

* 2 University: Chulalongkorn University Department of Polymer Science
Tharmasart University including all textile department

Source: Textile Manufacturing Association

The system for higher technical schools is shown in Table I-2-33. Due to a lack of funds all universities and technical schools have extreme shortages of teaching staff, teaching materials, and machinery and equipment. The Textile Manufacturing Association has been asking for more equipment for universities. As is shown in Table I-2-34, the government has devised a long-term plan for increasing staff numbers and is making efforts to meet requests.

However, one university which was visited suffered from a severe lack of experimental machinery equipment, and in order to carry out regular classes it has to rely upon assistance from foreign aid funds of overseas countries and on donations from manufacturers.

Table I-2-33. System of Technical Schools

- The advanced technical schools come under the jurisdictions of four agencies:

  Ministry of Education

  —Bureau of Vocational Education 162 schools

  —Institute of Technical and Vocational Education (ITVE) 29 schools *1

  —Board of Private Education 400 schools

  Ministry of Universities - Advanced technical schools attached to King Mongkut

- *1. There are six departments, of which the Engineering Technology Department has three textile related schools:

  Engineering Technology Department

  —Textile chemical engineering

  —Garment engineering technology newly established

  —Textile engineering

- Udomsak Campus: There are three courses of study: garment technology, textile technology, and textile chemistry.
- Silipakorn University: There is a textile design course in the Visual Communication Design Department.

Shortages in teaching staff occur in most countries. In advanced countries in particular where the textile industry is a declining industry a low value is put on textile research and an increasing number of universities have stopped their courses on textiles. Therefore, even if a search was made overseas to find staff to fill the vacancies in Thailand it would probably prove difficult to find such persons. It is therefore suggested that use be made of Japanese technical experts living in Thailand. There are many competent technicians, including those dispatched by the JODC, who are in Thailand for a long period of time to provide all sorts of technical guidance and the transfer of technology. Most of these technicians have very high level Japanese academic qualifications and have been involved in the practical side for many years. Thus, even if they have had no experience in giving lectures, they nevertheless possess the knowledge required for basic university education. It should be possible for them to spend 2-3 hours half a day a week away from their jobs. While it is necessary to have full-time teaching staff, using these people in this way would provide intensive instruction.

Table I-2-34. Plans to Increase Enrolment in Fields Relating to the Textile and Garment Industries

The number of graduates in the fields relating to the textile and garment industries (Textile Engineering, Textile chemistry and garment technology) at the certificate, diploma, and degree level is increasing as shown the following Chart.

Chart: Plans to Increase Enrolement of students in the fields relating to the textile and garment industries as mentioned in the National Developing Plan No. 6 (1987 - 1993) of the Institute of Technology Vocational Education

Academic year	Diploma level				Degree level		
	Textile Engineering	Textile Chemistry	Garment Technology	Balance	Textile Engineering	Textile Chemistry	Balance
1987	35	40 (-)	20	95 (-)	20 -	15 + (-)	35 (-)
1988	35	40 (-)	20	95 (-)	24 -*	18 + (-)*	42 (-)
1989	35	40 + (30)	20 + (20)	95 + (50)	20 + (30)	20 + (-)	40 + (30)
1990	35	40 + (30)	20 + (20)	95 + (50)	20 + (30)	20 + (-)	40 + (30)
1991	35	40 + (30)	20 + (20)	95 + (50)	20 + (30)	20 + (20)	40 + (50)
Total	175	200 + (90)	100 + (60)	475 + (150)	104 + (90)	93 + (20)	202 + (110)
Balance of each Faculty	175	290	160	625	194	113	307
Increasing net in each major Faculty	-	90	60	150	90	20	110

* is the adjusted number in response to the stimulating demand for specialized programs: Chemical engineering, textile engineering. However, the net amount of each Faculty students remain the same.

3) Training of Company Operators and Controllers

At the present time the TID frequently holds seminars and training sessions which have been successful. However, various kinds of criticisms were voiced when we visited companies. Although it is not possible to meet all demands, and some of these demands were unrealistic, these seminars must cater to the needs of operators by providing them with the knowledge on new technologies which they wish to acquire. The type of information which they want to learn is not found in books, but is something close to technical know-how. As this sort of know-how is necessary for planning the future of their companies the only organization which can perform this task is the TID which provides instruction in the latest technology.

Training of controllers primarily consists of production management and quality control, and also the important job of labor management. As exports to Japan, with its strict quality and delivery requirements, increase in the future these forms of management will become increasingly important. It will also become necessary to use personal computers for keeping data records. For instance, if a personal computer is used in a spinning plant it is possible to devise production plans for various combinations in order to achieve the most efficient production of a wide range of products and to carry out process management of the beginning, production, and final stages. It will not be possible to meet future trends in wide variety small lot production and shorter delivery periods by using the old Gantt Chart system of production planning and schedule planning. Also, the system for repairs used during the time for shuttle looms will not cope with highly efficient mass production which will result from the appearance of air jet looms in weaving plants. The computer must have a system which enables forwarding without inspection and repairs, that is one where data about weaving loom stoppages and faults are put into the terminal and grading is carried out at the same time as weaving is completed. As management through computers of the personal computer and office computer class will become know-how which controllers must have, instruction by the TID will become increasingly important. The ways in which the TID can respond to such tasks are outlined in the following section.

2-7. Problems and Countermeasures

1) Problems Raised By Companies

A total of 19 spinning, weaving, and dyeing companies, 2 textile manufacturers, a ginner, and a trading company were visited in Thailand. They were asked to describe the

present situation and to tell of any problems or requests that they may have for the government. A record of these interviews is contained in Table I-2-35. The problems which were raised can be broadly classified into the following subjects: import duties levied on imported raw materials; import duties for machinery and parts; the policies of the BOI and MOI; shortage of technical experts; guidance by the TID; and the infrastructure. The main problems which have already been mentioned will be discussed here for a second time and measures for countering these problems will also be suggested.

Table I-2-35. List of Problems Raised by Companies

(Unit: No. of companies)

Masters raised	Fiber production	Spinning		Weaving and knitting		Dyeing	
	Total 2 companies	Standard total 5 companies	Special total 3 companies	Standard total 7 companies	Special total 5 companies	Standard total 5 companies	Special total 2 companies
Import duties on imported materials							
• Domestic dyes are poor in quality, making use of imports essential, but the import duties are too high. This protection of domestic products is not serving to build up national industry.						2	3
• The duties on imported materials are too high and the price of polyester staple is high.		3			1		
• The refund system cannot be used if goods go through Sanpeng.						1	
• The rebate rate has gradually been reduced from 6 to 3.2%.		1		1		1	
• Business tax is imposed even in the case of exports.						1	
• Refunds take at least three months and at the longest one year and the procedures are complicated.				1			1
• With commissioned dyeing work, the import duties on the dyes cannot be passed on and refunds cannot be received.							1
Import duties on imported machinery, equipment, and parts							
• Import duties of 30 to 50% for machinery and 30% for parts make renovation and modernization of facilities impossible. They take away the incentive for renovation and obstruct modernization.	1	2	1	2	2	2	2
• Problem of overall imposition of import duty on spare parts. There are some which are not produced domestically.		2					
• Precision type parts and consumables have to be imported, but high duties are assessed.		1					
• It is desired to establish a laboratory, but there is a 60% import duty on laboratory equipment as compared with 30% for production equipment.							1
BOI policies and MOI policies							
• Even if BOI incentives are obtained and products are manufactured for export use, the quota may sometimes already be filled or the export inspection may not be passed, forcing the products to be used for the domestic market and raising costs.		1		1			

• Facilities should inherently be expanded when one wants. If concentrated in two years, a great deal of trouble results. This is disadvantageous to persons which have previously produced for the domestic market so as to build up the national industry and do not have export markets.		2		1		1	
• BOI incentives are not available for dyeing and finishing in the Bangkok region.					1		
• The interpretation of looms for dyed yarn is unclear.					1		
• Unregistered looms and spinning machines are increasing in number, making the restrictions of facilities meaningless.					1		
Shortage of engineers							
• Engineers are scouted away, leading to shortages of engineers. There are too few graduates from universities in this field.		3	2	3	3	3	4
• BOI states that it will end guidance on technical transfers in 5 years.					1	1	
• JODC personnel should be dispatched to Japanese affiliated companies as well.						1	
• Improvement of visa extension system for long-term stay of foreign engineers.						1	
TID work							
• Government should sponsor seminars. There is no place giving technical guidance.				2			2
• Inspection system by public organization should be improved.						2	
• Support from TID necessary on new technology and new products.							1
Improvement of infrastructure							
• Improvement of ports, roads, and telephones (takes 1 to 2 months to obtain cargo after vessel enters port)	1	3		1		2	
• No more wells may be dug. Consideration given to purchasing industrial water supplies and moving factory.	1					1	
• High water charges and power costs. Power costs for wastewater treatment desired to be lowered.							1
Others							
• Quality of domestic cotton is insufficient and there is the problem of having to purchase all of it at once and thus of warehousing		3					
• There are no specialized books enabling improvement of the technical level. There is no organization for collection and dissemination of worldwide fiber information.						1	2
• The family system is strong, so workers cannot become higher executives.							
• There is no system of promotion and therefore workers seek promotions and raises by changing companies.							

2) Expansion of Equipment As a Result of Special Approvals in 1987

The problems of the expected overflow of spinning yarn, difficulties in exporting yarn, hurried orders as producers try to repay loans before the price of yarn drops, and the imbalance between spinning capacity and weaving capacity caused by the approval of a further 1,022 thousand spindles in addition to the existing 2,068 thousand spindles and 7,963 weaving looms on top of the existing 93,687 looms have all been mentioned in section 2-3) on the modernization of equipment. As the problem of the absorption of this surplus spinning yarn is related to the setting of exports targets this has been mentioned in detail in section 9. Accordingly, the suggestions made in this section will be restricted to the following.

i) It is necessary for the government to announce certain measures or to make its view known in order to dispel the feeling of insecurity about the future of the market found in most companies and the negative attitude towards business being taken by some. For instance, the period for increasing equipment could be expanded from the present two years to five in order to avoid a concentrated expansion of equipment over a short period of time, and discussions could be held with industry leaders and medium and large-scale companies planning increases in equipment on dispersing the commencement of operation of the additional equipment.

ii) Restrictions on equipment need to be removed in order to increase the number of weaving looms and circular knitting machines to meet the increase in spinning capacity, and a linkage established so that spun yarn is made into woven fabric and knit and then passed along to garment manufacturers downstream. At the same time, incentives should be offered so that sewing machines and other machinery and instruments required for sewing are put in place. Emergency measures such as removing import tariffs on machinery and financial assistance will also be necessary.

iii) It is easily estimated that a bottleneck will occur in dyeing equipment. As some disorder in the market can be expected during the considerable amount of time that will be required for solving this problem on the basis of economic principles, urgent measures such as turning industrial estates presently under construction over to dyers and establishing publicly operated waste water treatment facilities are required.

At any rate, these are problems which the government cannot neglect and it is hoped that they will be referred to the Textile Industry Policy Committee so that measures will be formulated and announced without delay.

3) Import Tariffs Levied on Raw Materials

(1) Raw Materials

Import barriers which were established for the purpose of fostering domestic industry during the period from the late 1950s through the 1960s remain today. Thus, tariffs levied on imported raw materials are still in place. As is shown in Table II-9-2 in section II-9-2 "Textile Industry Policies and Problems", the Thai tariffs are considerably higher than those imposed by other Asian countries. The 40% + alpha import tariff imposed on yarn and the 80% + alpha duty for fabric are extremely high. As can be seen in Table I-2-36, the volume of imported yarn and fabric is small due to these high tariffs. Although the tariffs have contributed to protecting the domestic market, as is shown in Figure I-2-3 in the part on weaving in section 2-5 "Cost Analysis", have allowed the sharp rise in the market price for yarn in 1986 and 1987 and the subsequent sharp rise in the price of woven fabric. As a result of this sharp rise in price, imports of yarn and fabric have increased rapidly, though the increase has not been sufficient to keep the market price down. As a result, garment manufacturers either buy domestically produced fabric at high prices, or they pay import tariffs, on the assumption that the refund system will come into play, and import cheap materials from overseas which they process and then export. In order to expand exports of yarn, fabric and garments in the future it is desirable that the prices for materials at each stage be lower than international prices. This means removing import barriers so that the prices for the various stages are controlled by international prices. With material prices which are based on international prices, Thai labor costs, labor productivity, and technical levels will make it possible to be internationally competitive.

Table I-2-36. Import Ratios for Yarn and Woven Fabric

(Units: Yarn-1,000 tons; Cloth-1.0 million yds2)

	1983	1984	1985	1986	1987
Total Yarn Production	251.6	272.2	292.9	253.6	396.7
Imports of Cotton and Synthetic Yarn	6.9	7.5	5.0	13.7	23.6
Import Ratio (%)	2.7	2.8	1.7	3.9	7.0
Total Fabric Production	1,732.4	1,864.1	1,955.6	2,140.5	2,692.1
Imports of Cotton & Synthetic Fabric	36.5	58.3	50.1	93.0	173.7
Import Ratio (%)	2.1	3.1	2.6	4.3	6.5

Source: Imports: calculated from import statistics; Production: TTMA data.

(2) Dyes

The majority of complaints related to the import tariffs shown in Table I-2-35 are about the high tariff rate for dyes and the difficulties which commission dyers have in applying for the refund system. This problem involving refunds is addressed later on in the section on dyers contained in the section on supporting industries.

4) Polyester Staple Fiber

The problem of the oligopolic system which is protected by import barriers is taken up in the section on supporting industries.

5) Delays In Modernizing Equipment

(1) The combination of total duties ranging at about 40% or so duty (30% import tariff, 5% business tax, and tax on standard profit) and the appreciation of the Japanese yen have made it very expensive to import machinery from Japan. With the exception of air jet looms which raise productivity by several times, it is not possible to receive a return on investment made in equipment for improving quality standards or renewing old equipment. As a result, equipment in the spinning, weaving and dyeing processes is not being modernized. Conversely, as has been mentioned previously, cheap used machines are being introduced in order to produce in large volumes, with the result that the majority of additional and increased equipment are old-style shuttle looms. The productivity of these shuttle looms is not only poor, but they produce low grade products which cannot be completely repaired. A problem is raised here as this runs counter to the production of international products. As already mentioned, because a considerable increase in the number of weaving looms is required in order to maintain a balance with the increase in spindles, it is suggested that the high tariff rates be removed so that the introduction of modern equipment will provide financially viable and so that funds can be allotted to this. As textile machinery manufacturers around the world are in an oligopolic situation it is virtually impossible for import barriers to promote the domestic production of textile machinery.

(2) Modernizing Equipment For The Production of High Quality Products

In order to strengthen export competitiveness it is once more suggested that preferential measures be applied to designated textile machinery and specific industries as machinery and industries which promote exports. Equipment which is defined as promoting exports is equipment mentioned in 2-3 "Modernization of Equipment" which

meets future trends in equipment and which raises quality to standards for international products and which can be expected to reduce costs and thereby contribute to international competitiveness. The specific industries are dealt with in the following section on "Problems In the Diversification of Materials".

These preferential measures aimed at manufacturers need to be implemented in order to lighten the burden of introducing equipment. In addition to removing import tariffs, they involve the provision of low-interest or no-interest finance, and exemptions in paying corporate taxes and business taxes for a certain period of time. The types of machinery and equipment which would qualify for these measures are listed below:

Spinning: comber (to meet the trend in yarns with a higher yarn count); auto-doffer for spindle (to prevent yarn breakage at the start of operation), auto winder fitted with splicer (knotless); and double twister (for rationalizing processing of double yarn).

Weaving: shuttleless looms such as the air jet loom, water jet loom, and rapier loom; dobby and yarn feeder for mounting on these looms; and mini computer for production management and quality control.

Circular Knitting Machine: circular knitting machine fitted with a jacquard, a yarn feeder for this machine, and a yarn tenser.

Dyeing Machines: auto screen printer, and computer for color matching.

Other: i) mini computer for production management (particularly for use in process management and delivery management);
ii) equipment and apparatus for use in export specification inspection;
iii) equipment for treating waste fluid from dyeing.

Taking an example of the use of high grade machinery, it is said that the only producers which can spin cotton yarn 40/2S and 60/2s for circular knitting are three Japanese companies. These yarns are used for the knitting of polo-neck shirts with pique or tucked construction and are exported. Also, the joint venture company "Thai Shikibou" was formed in November 1988 by Shikishima Spinning, C.Itoh & Co., Ltd, and the Saha Patana Group with an eye on the increase in high grade cotton yarn as high grade broad fabric becomes used as a material for high quality shirts and blouses. Thus, the production of high grade cotton yarn was launched.

6) Problems In the Diversification of Materials

Domestically produced products which account for the larger part of the market do not require wool fabric or thicker fabric due to the hot climate which continues for most of the year in Thailand. As a result, it is difficult to obtain materials which are necessary for garments exported to Japan and European countries where there are four seasons. The diversification of materials will become increasingly important in order to promote the expansion of exports. Certain measures will therefore be required in order to achieve this diversification.

One such measure is to make it possible for the downstream sector to freely obtain from overseas materials which cannot be supplied domestically. The 80% import tariff on woven fabric and the 100% tariff on imported knitted fabric pose a problem here. There is a system for refunds, but even if an allowance is received for exports, in cases where there is a full quota and where products fail export inspection the products have to be diverted to the domestic market where it is difficult to sell them due to their high price. Also, even in the case of materials which can be supplied domestically, it is not possible for international prices to quell the high price levels which are being seen on the market at the present time. Consideration is required on the matter of high import tariffs.

If it becomes easier to obtain the special materials from overseas, markets for the special material will gradually be created within the country. If this proves a profitable market, textile interests will move in, and this will gradually trace back to the upstream sector. That is, it is important for garment sectors to freely obtain the materials from overseas, and it will become necessary to simplify import procedures and to adjust the high tariff rates.

The second measure that needs to be taken is to make domestic supply possible. Under the market creation system mentioned above, it will take a considerable amount of time before diversification takes place with regard to the types of polyester fiber. Also, in regard to the supply of wool and linen, etc, it is quite hard to find materials which meet specifications. Marubeni Trading Company and Nankai Keito Wool Company have plans for establishing a wool top production base in Thailand. If there is a supply of wool top, there will be a reason for construction of a spinning mill, even though on an extremely small scale. It is possible to spin worsted yarn by installing a few intersecting gills, fore-spinning machines and fine spinning machines in a corner of a cotton spinning operation. It is therefore necessary to establish key supply projects for the domestic supply of new materials. The following priority measures for the promotion of the specific industries are therefore recommended.

The specific industries which supply special materials which are required for the export of products. Assistance is needed to enable manufacturers to set up operations because the level of demand for those materials has not yet reached a stage where production is economically viable. One such example is the wool top production mentioned above. The burden of imports of equipment and raw materials should be lightened for these specific industries and their management burden should also be lightened. Import tariffs on equipment should naturally be removed, as should import tariffs placed on raw materials. Other measures such as special financing and the exemption of corporate taxes should be adopted. These measures for assistance are to encourage the domestic supply of special materials. Examples of industries which would qualify for such measures are outlined below.

Wool products: worsted spinning, woolen spinning, weaving of worsted fabric (double width), dyeing and finishing for worsted fabric and establishment of these venture and introduction of this equipment.

Equipment (stretch breaking system) for the spinning of linen and blending of linen using the cotton spinning system, weaving looms for the mass production of filament fabric (taffeta for lining), and dye finishing machines (equipment for weight reduction processes), and production equipment for non-woven fabric for inter-lining.

In addition to the wool top example which involves these kinds of equipment and industries, there is the example of the establishment of a joint venture production and sales company for inter-lining for use in garments between Daimic and Mitsui Trading and the Thai Saha Patana Group. The company plans to start operation in February 1989 and produce 500,000 yards/day. There are two worsted spinning plants in Thailand at the present time. These are Thai Acrylic (Mitsubishi Vonnel) which has 4,000 spindles, and Mandarin Textile (originally Mitsui Trading and Toray) also with 4,000 spindles. The products of both of these companies are used in the spinning of acrylic fiber.

7) Quality Inspection of Export Products

Companies have expressed a demand for the establishment of a proper inspection system by a public organization. A quality certificate will become necessary in cases where the specifications of importers of Thai products include strict standards relating to color fastness, formalin restrictions, and flame resistance. However, there is a limit to which a public organization can take over responsibility for part of individual companies' export activities. Also, as there is a need for the results of quality inspections to be fed back to production plants as quickly as possible it is preferable that manufacturers carry out their own inspection control with a public organization providing guidance. The

preparatory stage for this is included in the following section on TID guidance. It entails the TID opening its inspection room and permitting its use for inspections by private companies. It is necessary, as previously mentioned, for import duty exemptions, special finance, and taxation measures aimed at providing assistance in the purchase of machinery and instruments for the inspection of export items.

8) Guidance by the TID

While visiting companies in Thailand, a country where sources of technical information such as technical information magazines, private sector training courses, and the presentation of papers by learned societies are scarce, it was learned that private companies expect a great deal from the technical guidance system of a public organization.

It was also learned that the TID has a staff of 140 who are involved in various kinds of activities. However, it was also learned that the division is pressed with problems such as budgetary constraints, difficulties in compiling technical know-how due to the problems faced in renewing old equipment, and an increasing workload from requests for inspections.

These problems found in Thailand are therefore to be looked at in terms of the situation surrounding public organizations in Japan and the work experience gained by the author at a research center related to textiles. A plan consisting of the reorganization of the duties of the TID is also proposed.

[1] Research System (Related with Universities) and Research Methods

The universities suffer difficulties in filling vacancies for professors and shortages in research equipment. In view of the fact that the TID is kept being with its daily work, it is necessary for the universities and TID to go beyond the boundaries of their jurisdiction and work together in research and development in the textile field, development of human resources, and technical service and consultations for companies. Toward this end, the research staff of the TID should, in principle, concurrently be professors and assistant professors of universities and give lecturers to the students so as to make up for the shortage of university equipment. Further, university professors and assistant professors should concurrently be staff members of the TID, which would allow them to use the TID equipment and further enable close liaison in research themes and joint formation of research organizations and research teams.

The research themes which relate to future issues would be handled by the university side and those which relate to current issues by the TID. For example, future issues would include the basic technology and knowledge of the Thai industry for the

next generation and current issues which require highly technical research. The basic research, regarding advanced fiber materials and composites of such advanced fiber materials with plastic, rubber, and metal, is clearly important to industry in the next generation. This composite knowhow is something which companies in the advanced countries are competing over in research and is not known matter in general and thus requires research by a public organization.

Current issues are problems which are directly related to Thai companies and consumers. They are the basic themes of seminars and training courses and the knowhow provided by guidance to companies. Two or three important themes observed through visits to companies are given below:

1) Development of spun yarn for high quality woven fabrics

Air jet looms are aimed at higher productivity through high speed operation and the production of faultless woven fabrics through elimination of stoppages in looms. Unless the warp and weft yarns are free of knots and fuzz and feature little variations in strength, nonstop operation is not possible. Breakage of the warp or weft yarn or defects caused by fuzz cannot be completely corrected even if repair is made at the inspection stage. The same is true for high speed, high density circular knitting machines. Production of such spun yarn requires introduction of expensive equipment in and a sacrifice of some of the productivity in spinning factories. It further invites rising spinning costs, so factories, spun yarn suppliers to the general market, have no intention of becoming involved in such activities. Only the spinning factories which are combined with weaving factories or knitting factories produce such yarn and only for their own use. Weaving factories which purchase yarn from the general market cannot obtain suitable yarn from the market even if they introduce air jet looms and therefore do not operate those machines. The TID must make effort to develop spun yarn for production of faultless woven fabric and provide information to spinning companies and further must provide information to companies serving as a bridge to weaving companies and spread knowledge to general companies through seminars.

2) Research on knowhow based on characteristics of dyestuff and treatment agents

Fibers of textile, both woven and knitted fabrics, have been increasing in complexity and diversity. At the same time, a demand has arisen for diverse colors and thus the types of dyestuff have diversified as well. New dyestuff characteristics can be provided by the dyestuff manufacturers, but the companies using many dyestuffs and many kinds of textiles must develop the knowhow on how to combine dyestuff with textiles on their own. The TID must equip itself

with small scale dyeing equipment to develop knowhow on combining the succession of textile materials and developed dyestuffs, and provide guidance on it through a house journal. For this reason, it is desirable that the TID own its own small scale dyeing equipment, accumulate knowhow and data on the industry situation, and open up the same for use by companies. When the cationic dyeable polyester fiber is introduced to the market in the near future it is expected to be blended with various types of fibers. The requisite data for dyeing of such blended fibers should be tremendous in volume, so joint preparation of data by fiber producers and dyestuff manufacturers will become necessary.

Knowhow will also be required on the relationship of fabric characteristics with the finishing agents for recent types of sportswear, which require waterproofing and water repellency and porosity, and resin treatment agents, for which there are tough formalin restrictions, so practical data has to be accumulated in the same way as with dyestuff.

3) Research on preparation of knowhow on air jet loom weaving

Air jet looms, which blow out the weft yarn in place, come in single nozzle types where an air tunnel is attached to the reed and the multinozzle type where the weft yarn is successively transported. Each type of loom has virtue and foible, depending on the width, warp end density and structure of the woven fabric, and the kind, fineness and quality of the spun yarn used. Therefore, it is necessary to prepare the knowhow on the types of looms and on yarns and woven fabrics, run seminars, and further provide information to companies desiring to introduce air jet looms.

4) Research on preparation of knowhow on water jet loom weaving

Water jet looms are used for weaving filament yarn. Both polyester and nylon fibers are easily damaged by high speed friction with metal. If the warp is damaged by the heald or reed, warp stripe defects occur over the entire length of the fabric. This defect cannot be found at all by the eye during the weaving, but appears after dyeing, so can mean great loss to the company. This defect occurs due to changes in the dyeability of fiber due to friction with metal. The technology for water jet looms differs from that of conventional shuttle looms. High technology is required for preparation of knowhow.

There are three kinds of filament yarn for the warp used for water jet weaving. They are regular yarn, which requires sizing or twisting, no-sizing yarn, which is treated with a special oil so that it does not require sizing, and interlacing yarn, which is made tangled. Unique weaving knowhow is required for these yarns. In particular, sizing knowhow depends upon the sizer type. Preparation of

this knowhow requires the proper machine and vast amounts of yarn, so small and medium scale companies cannot handle it. Much is expected from the TID.

It is said that production of filament yarn for water jet looms will begin in Thailand within this year. Production of taffeta for linings is becoming a hot topic, so the TID will have to hurry and acquire the required technical expertise.

5) Other research unique to Thailand

Household detergents differ in the world depending on the conditions in each country and the type of wash water. The wash water of Europe is hot in temperature and hard, while that in Japan is cold and soft. In Japan, however, tough restrictions against eutrophication* of the lakes and coasts due to drainage have resulted in special detergents used. Thailand may require special household detergents tailored to its national situation as well.

Japan has tough restrictions on formalin. Some treatment resins used to give wrinkle resistance or shrinkage resistance to cotton fabrics may break down and release formalin in the long term with high temperatures or humidities. Some standards for selection of the resins used may have to be prepared by envisioning sea transport from Thailand to Japan.

The above proposals relate to two administrative organizations. However, they should be considered so as to enable resolution of real problems.

[2] Technical Guidance System

Small and medium scale companies, which cannot engage in research and development and build up technical knowhow by themselves, ask the TID for guidance and resolution of their problems.

However, it may be very difficult for TID to establish some technical knowhow which requires experiments and equipment on the same scale as actual production. Therefore, it is recommended that the TID use a unique, new system for each of the following:

a) Introduction of equipment

Some production technology or control technology is related to the latest equipment or equipment on the same scale as actual production (the same machines as production equipment), or is able to be established with smaller scale equipment. Other technology requires research type or inspection type equipment. As it is impossible to obtain all of the required equipment, it is important to study the methods for obtaining equipment in accordance with the purpose of the required equipment.

1) Technology requiring the latest equipment

(Introduction by leasing, opening up of exhibition halls, and transferring of disposed articles)

It is necessary for TID to always be equipped with all kinds of the newest type of modernized machines which are expected to see wide use throughout the industry in the future and which require companies to compare in order to select the appropriate machine. The TID must also provide companies with information concerning the difference between each type of machine. Therefore, the following system should be used for the introduction of machines:

- Lease method

  After the lease term is completed, the machine would be returned to the manufacturer, thus facilitating replacement and further enabling new machines to be acquired through periodic payments deductible as expenses.

- Opening up of exhibition halls

  The TID would open up its space to machinery manufacturers for exhibition of their machines. The manufacturers would obtain a standing exhibition hall for promotion and sale of their own products on the condition of allowing the TID staff to use the machines for experiments.

- Transferring of the disposed machines

  Machines which have been exhibited at textile machinery fairs each year in Europe, the U.S. or other places could be transferred from manufacturers to the TID.

This method, though depending on the type and size of the machine, has the advantages of the probable ease of obtaining cooperation from manufacturers, who are conscious of competition with other companies. Machines not obtainable in this manner could be procured through leasing, then enabling the TID to be equipped with the latest machines at all times and enabling proper experiments. It is important to be equipped with as many types of machine as possible.

Machines falling under this category include the following:

- Air jet loom and water jet loom

  These looms include multinozzle type, air tunnel type, one pic type, double pic type, weft yarn air pool type, mechanical pool type, etc. The suitability of any particular type in weaving using spun yarn depends on the width of the woven fabric, the warp end density, and the yarn quality based on the fluff.

- Circular knitting machines

There are various types of pattern devices, needle numbers, and yarn feeders for circular knitting machines. Various types are necessary for experiments on circular knitting machines and product development.

2) Technology requiring same scale of machine as actual production (Utilization of ODA and other fund assistance)

Establishment of knowhow for special finishing of fabrics and sizing of warps requires machines with the same capacity as that of actual production machines. However, sizing machines require the preparing and following equipment and therefore are high in price (one set costing about 100 million yen : 20 million bahts). Further, this machine is essential in establishment of water jet loom knowhow. For obtaining this type of equipment, use of ODA or other fund assistance is recommended.

3) Technology utilizing small scale equipment (Utilization of transferring method from manufacturers or obtaining equipment for laboratory)

Production machines such as winders, fine spinning machines, draw texturing machines, and are comprised of numerous spindles. The machine manufacturers often fabricate and exhibit small scale machines comprised of few spindles for machinery exhibitions. Therefore, when a small scale machine is sufficient for the experiment it is recommended that such a machine be obtained after the exhibitions by transfer from the manufacturers or to purchase such machines for laboratories.

b) Samples for Experiments

Because experiment samples for compiling technical know-how must be obtained under actual production conditions, a large quantity of samples are required and the cost of materials becomes enormous. The provision of samples by companies which benefit from the application of the developed know-how would be a good idea. For instance, if research is carried out on technical know-how for the water jet loom weaving of filament fabric, samples could be obtained from filament yarn manufacturers which would benefit from the resulting increase in sales. Also, samples could be obtained from specific plants which make requests for the research to be carried out.

It is important that a system like this which makes it possible to compile technical know-how is established within the TID. As has been mentioned, as the know how for air jet loom weaving is related to quality know how for spun yarn and the know how for

water jet loom weaving, use of filament yarn should be developed as the total system of spinning in fiber producing, warping, dyeing and finishing. It is not something that can be done by only one manufacturer who has the equipment. The setting up of a guidance system is something which needs to be done by a public organization.

c) Guidance Methods

The staff who gather the know-how will be required to provide practical instruction and to take seminars and hold study meetings. But as such personnel will have had little experience in actual production activities it is suggested that technical experts with much experience who have retired from companies be employed. It is also suggested that a patrol system be established whereby such experts are posted in regional cities and provinces and visit companies there during the time that it takes for the technology to spread. These experts can also make preliminary investigations into problems and provide advice and guidance on how to cope with such problems.

d) Coordinated Control of Instructors

At the present time the JODC dispatches staff contracted for a two-year period to all kinds of companies. However, this involves only a very small area of all the companies found within the Thai textile industry, and in cases of technology transfer this entails being posted to just one company. It is therefore necessary to consider a way of using these experts more widely within the textile industry. One possible way to do this is to have staff who are dispatched by public organizations in Japan put under the control of the TID which then dispatches them to companies to provide guidance. The period of time required for the transfer of technology and for providing instruction will depend on the nature of each company's operations. There will be cases where intensive guidance is given for a month, after which follow-up guidance is required once a week or once a month, and other instances where suggestions and detailed plans are shown to the company's executives at the beginning and the implementation of those plans is left up to the company itself. It is thought that a full-time posting at one particular company for a two-year period will be unnecessary. Using such personnel for compiling know-how, giving seminars, and holding study meetings and posting them to regions to visit companies in order to provide guidance, as mentioned in the previous section, should prove very effective and will result in the wide-scale utilization of the technical know-how which the experts possess.

e) Seminars and Study Meetings

Reference to this subject has already been made in section 2-6 Staff Training. The only suitable way for the operators of individual companies to acquire the knowledge and technology which they require is practical experience. While kept busy with the everyday running of their companies they are keen to learn about forecasting future economic trends, technological advances, the development of products related to their own particular products, and changes in materials in order set a future direction for their companies. The task of answering such needs is a very important one. Seminars held at night which incorporate such information should be held regularly.

As for the training of controllers, as mentioned previously, they need to undergo thorough training in computer management. Although various types of software have been developed in Japan, they are not very suitable due to the different situations of each individual company. It is probably necessary to include lessons on how to make software in the courses provided.

In-service training involves the various kinds of textile machinery mentioned earlier. Practical training should be carried out by using many kinds of machinery and study meetings should be held for examining the latest data on dyes and colors which dye manufacturers supply to dyers.

f) Inspection

As has been stated earlier in terms of "Quality Inspection for Export Products", that because the task of inspection which should really be undertaken by each manufacturer has been taken over by a public organization, the proper thing to do is provide incentives for manufacturers to purchase inspection machinery and equipment and to assist in a shift over to individual inspection. However, as some manufacturers would find this difficult due to a lack of reserves for the purpose, it is proposed that the TID's inspection room be opened to the public. Under this system the TID would allow free access to its inspection machinery and equipment and the manufacturers would bring their samples for inspection and carry out the measurements and inspections themselves. The TID would be in charge of the maintenance and care of the inspection machinery and equipment, and would also provide instruction on what sort of measuring methods should be used. Where required the TID would help explain the meaning of the results of the tests. While the unfamiliarity of companies in carrying out measurements will cause some confusion at first and some of the work will be inefficient, as the type of measuring will become specialized for each company it will not take long for each company to acquire skills so that they need no longer rely on TID staff. Because of the amount of time required for measurements, unnecessary and non-urgent measuring will be dropped, and

as inspection becomes streamlined companies will start considering whether to install measuring machinery and equipment of their own.

g) Function of a Technology Information Center

There are no technical books from which to learn about new technologies and new materials. The demand made by companies concerning the absence of a facility for transmitting and gathering information on textiles from around the world is a reasonable one. It is therefore suggested that a separately organized technology information center which is an independent company be established within the TID. Technical books and journals from all over the world should be gathered here and made available to the public by establishing a library system, and by acquiring translation rights. Thai language versions could be made and a monthly magazine published which introduce these articles and summaries of articles. Information should also be transmitted in order to spread the technical know-how being compiled by the TID around the country. As well as this, the TID's ability to provide information such as marketing should be considered.

h) Equipment

As the result of observing TID equipment, the following equipment is recommended to TID because it is expected to be necessary when TID gives technical service to the industry which intends to export in the future.

Further, the recommended methods of introduction, described in a) Introduction of Equipment, are shown by rank A, B, and C.

A: Equipment for which use of overseas fund assistance is recommended

B: Equipment for which use of leasing, opening of exhibition halls, or transferring is recommended

C: Equipment for training courses or equipment for research work

- Draw texturing machine Rank B

Woven fabric manufacturers will transform from purchasers of texturized yarn to makers of it by equipping themselves with draw texturizing machines and buying POY because the draw texturized yarn results in more faults in the woven fabric due to unevenness in dyeability compared with the previous false twisted yarn.

- Stretch breaking machine for wool, silk, or linen Rank C

Along with the increase in exports overseas, materials for autumn and winter wear will become necessary and cotton spinning systems will have to handle spinning of wool, silk, linen and cotton blended with these fibers. Machines will perform stretch breaking of these fibers so as to enable use of cotton spinning machines for spinning of these fibers.

- Splicing automatic cone winders Rank B

These would enable the production of knotless yarn for use for air jet looms or high speed circular knitting machines by means of splicing yarn ends..

- Sizing system for filament yarn Rank A

Weaving of polyester filament yarn may be expected to rapidly increase in the future. As high technique was necessary for sizing of polyester filament yarn, most of the weaving companies have received technical coaching from Japanese engineers. Some of the companies have trouble with weaving due to the fact they are equipped with unsuitable sizing machines for polyester weaving. To promote the spread of polyester weaving in the future, the TID itself must acquire the relevant technique for sizing. This would further be necessary for the operation of the water jet looms installed at the TID.

- Air jet looms Rank B

There are various types of air jet looms including the air guide type, multinozzle type, and weft storage type. Suitability for the woven fabric condition and yarn kind is important.

- Water jet loom with dobby 2 nozzles Rank B

This is necessary for the establishment of knowhow on weaving taffeta lining fabric or textured yarn fabric.

- Weaving control management system Rank C, A

Air jet looms and water jet looms are designed for the purpose of production at high speeds without defects and to eliminate the need for inspection and repairing in the post-processes. In this system, the types, numbers, and locations of defects in woven fabrics are input into the centrally-controlled computer on the loom by the workers during the weaving. At the same time, the system enables a grasp of the daily state of production. Further, the accumulation of data on causes of loom stoppage enables improvement for maintenance of the looms and feedback to sizing conditions. The system is suitable for training equipment.

- Color pattern design system for dyed yarn fabric Rank C

Through computer graphics, it is possible to realize almost completely the same colors, patterns, and designs on the panel as those of actual fabrics constructed with dyed warp and weft yarns and to print them out in 140 colors. Therefore, various studies are possible before trial weaving, the number of trial weavings can be reduced, and the time required for study can be greatly cut down.

- Many kinds of dyeing machines for laboratory Rank B

To establish knowhow in dyeing through the combination of dye characteristics and textile materials, various small sized dyeing machines will be necessary:

- Package dyeing machine
- Hank dyeing machine

- Spray type hank dyeing machine
- Polyester fiber dyeing machine
- Box dyeing machine
- Jet dyeing machine for polyester fabric
- Color matching machine
- Packaged yarn drying machine

- Scanning microscopes Rank C
- X-ray diffraction systems Rank C

Both are necessary for research and experiment, so it would be desirable that the TID and universities use them jointly.

9) Fostering Technical Experts

The problems involved in fostering technical experts and suggestions for overcoming those problems are contained in section 2-6 "Training Staff". As this involves staff numbers at schools, equipment, and budgets, discussion here will be limited to the important aspect of what stance the industry should take in order to resolve this problem as it affects the industry itself.

i) First of all, a long-term estimate of the number of technical experts and skilled workers which will be required needs to be made, and a long-term plan covering a 5-10 year period which includes school education also needs to be examined cooperatively by the government and private sector.

ii) Training which cannot be received at school should be supplemented through TID training and courses aimed at fostering executives;

iii) TID staff and also staff dispatched to Thailand by the JODC should be used to help fill the shortage in university lecturers;

iv) Efforts should be made to obtain teaching materials and equipment. Donations and offers of materials and equipment should be sought from the industry;

It is proposed that the above measures, which are not just confined to the government, be examined.

10) Measures Aimed At Dyers

The problems facing the dyeing industry have already been mentioned in 2-3 on the modernization of equipment and in 2-5 which provided cost analyses. A summary of these problems is provided below:

a) Commission dyers of standard products are not making profits

i) Due to the sharp rise in the price of standard fabric cloth which is due to the sharp rise in the price of standard yarns, dyeing orders from consumers have become very rigid;

ii) Due to the poor quality of domestically produced dyes, dyers are forced to use imported dyes. However, import tariffs and surcharges take the cost up by a further 50% or so. The result is that dyes account for between 60-70% of total costs and this creates an unprofitable situation for dyers;

iii) Because the products are standard fabric, orders come from Sam Peng. This means that even though products might be ultimately exported, dyers do not receive export certificates because their products are exported indirectly. As a result, dyers do not receive rebates, and this increases costs.

b) There is no inclination to expand and/or renew equipment

i) As well as not making a profit as mentioned above, dyers have a surplus in equipment capacity.

ii) There is no domestically manufactured dyeing and finishing equipment, and as a result dyeing is dependent upon imported equipment. The various import duties for equipment add up to about 40%;

iii) Because, as mentioned above, fluctuating costs account for between 60-70% of total costs, fixed costs have to be kept down as much as possible. Therefore investment in plant and equipment is difficult because it leads to an increase in fixed costs;

iv) There are strict environmental regulations, such as restrictions on the use of well water, and there are many plants which are unable to expand operations as a result;

c) Some time in the near future a bottleneck will occur in the dyeing industry and it is feared that this will lead to chaos in the market.

The approvals for additional spinning equipment which were issued in 1987 have resulted in a 80% increase in the level of equipment prior to the approvals. Even if efforts are made to export yarn, some of the yarn will have to be made into fabric and passed downstream. When this happens it is likely that chaos will break out owing to the

bottleneck in the dyeing industry caused by a complete lack of movement towards expanding equipment.

Solutions to the above problems would normally follow market economic principles whereby the low dyeing processing fees would rise and an increase in equipment would be left to take its course. However, as some amount of chaos and a long-term solution are required the following measures are proposed:

a) Import duties on dyes be lowered to a reasonable level to improve profitability for dyers (further details are contained in the section on supporting industries);

b) Import duties on machinery be lowered to a reasonable level so as to make it easier to receive a return on investment in plant and equipment. If a balance between the dyeing sector and the spinning and weaving sectors is required urgently, thought should be given to offering special incentives (import duty exemptions, special finance, tax privileges, etc);

c) Industrial estates be established and plants in areas where it is not possible to increase equipment helped to move to these estates. Water to be supplied and waste water to be disposed of by a public corporation. Assistance be given to dyers for moving and for increasing equipment.

The results of a survey into the present location of dyeing plants are contained in Table I-2-37. They show that the 10 largest dyeing companies of the 44 which belong to the association are concentrated in Bangkok and Samut Prakarn. From the survey it was also learned that most of the 44 companies are located in the 9 provinces surrounding Bangkok, and thus have difficulty in receiving BOI incentives. Most of the companies faced high equipment costs due to present restrictions and therefore are not able to receive a return on their investment.

Table I-2-37. Location of Leading Thai Dyeing Plants

Company Name	1,000yd/month	Location
Bangkok Printing & Dyeing Co., Ltd.	3,000	Bangkok
Boonchuay Industrial Co., Ltd.	5,000	Bangkok
Capital Tricot Co., Ltd.	2,500	Nakhon Pathom
Lucky Tex (Thailand) Ltd;	5,300	Samut Prakarn
Phetchkasem Dyeing & Weaving Co., Ltd	3,000	Samut Sakorn
Thai American Printing Co., Ltd.	2,800	Nonthaburi
Thai Textile Printing Co., Ltd.	3,800	Samut Prakarn
Thai Tricot Co., Ltd.	6,500	Samut Prakarn
Tokai Dyeing Co., (Thailand) Ltd.	6,000	Samut Prakarn
Union Textile Industrial Corp. Ltd.	8,600	Samut Prakarn
Total 44 companies	145,000	

Source: Japanese Chamber of Commerce, Bangkok; Locations from separate survey.

A dyeing and bleaching plant which produces 5.0 million yards per month uses approximately 5,000 tons of water a day. If it were to use water for industrial use which costs 4b/m3 the plant would have to pay 600,000 baht per month in water fees. If it became necessary to build plants with 50% capacity of the existing total capacity in Thailand, or a capacity to handle roughly 20 million yards per month some 70,000 tons of industrial water would be required everyday. Also, in order to treat 5,000 tons of waste water a day in confined areas using a forced aeration and active slush system it would be necessary to have a sedimentation tank and two tanks with a capacity of 1,000 tons. As this increases the cost burden on the company it is necessary to put all waste water together in each region and to adopt the natural aeration system using a large area of land. This entails the establishment of industrial estates.

It will take several years before such industrial estates are completed and before dyeing plants are brought together in collective units. On the basis of the estimate that the additional spinning machinery will go into operation between 1989 and 1990 comprehensive measures for dyeing plants are urgently required with the guidance of the government.

3. Supporting Industries

3-1. Supply of Raw Materials

(1) Cotton

The Thai textile industry mainly produces cotton, T/C and T/R fabric. Domestic consumption for cotton, the primary material used to make these fabrics, was 257,000 tons in 1987 (Table I-3-1). This represents 62% of the 416,000 tons of textile raw materials. As shown in Table I-3-2, 20,000 tons of cotton was domestically produced, which is equal to a self-supply ratio of just 7.8%.

Table I-3-1. Thai Consumption of Cotton in 1987

(Unit: tons)

Production	20,041
Import	249,593
Export	163
Consumption	256,853

Source: TTMA

Table I-3-2. Production and Consumption of Cotton in Thailand

(Unit: 1000 tons)

	1980	1981	1982	1983	1984	1985	1986	1987
Production	49.9	67.4	61.5	42.7	41.7	27.8	35.5	20.0
Consumption	124.2	129.2	131.9	144.3	158.5	177.8	222.2	256.9
Exports (Million bahts)	306.2	188.2	449.3	85.3	55.0	78.0	21.0	3.8

Source: TTMA

As shown in Table I-3-3, the balance of trade for Thailand's textile industry in 1987 was in favor of 2.96 billion baht, and the added value ratio for this was just 60%. Cotton was the item of the most value among import items with a value of 7.3 billion baht. In light of the excess of imports over exports which Thailand has been recording in successive years the country needs to promote exports and to reduce its imports. For the

textile industry cotton is the item on which it needs to focus. Despite efforts by the Thai government over many years to promote the cultivation of cotton, as can be seen in Table I-3-2 output has been decreasing over the past several years.

Table I-3-3. Balance of Trade of Thai Textile Industry in 1987

(Unit: 100 million bahts)

Exports:	Textiles	116
	Garments	370
	Total	486
Imports:	Cotton	73
	Textiles	116
	Total	190
Difference (added value)		296

Source: Thailand Trade Statistics

The land and climate of Thailand are suited to cotton production. But despite the fact that consumption has been increasing yearly and that, as seen in Table I-3-2, cotton had been exported once in the past, production has been declining over the past few years. The reasons for this and associated problems will be examined below:

i) No trade warehouses

Cotton is a yearly crop, and in Thailand harvesting takes place some time between November and April, with each harvest taking about three months to complete. Ginners which have to sell their crops at the same time as they harvest due to their lack of funds do not possess trade warehouses. (An individual ginner handles 1,000 tons of cotton, or 3,000 tons of seed cotton.) The cotton is bought by spinners. If a spinning mill has 30,000 spindles it uses 3,000 tons of cotton a year. Because spinners can purchase cotton in 50 ton lots from the world market at any time they only have raw material warehouses for storing their day-to-day needs. As a result, ginners which have to get rid of their crops in a short period of time have their prices beaten down. In this connection it may be noted that cotton merchants in the United States have their own warehouses. In Pakistan the Cotton Exporting Corporation has a warehouse and as it sells throughout the year, as can be seen in Table I-3-4, its term-end stocks at the end of the season are large.

Table I-3-4. Cotton Production

	Thailand	U.S.	Pakistan	China
Total production (1000 tons)	20.0 in 87	3,230 in 88/89 (projected)	1,180 in 85/86	4300 or so
Inventory at term end (1000 tons)		2,000 End of 88		3000 or so
Planted area per farm (1000 m^2)	8 ~ 9.6	1,036	2,350	-
Yield (g/m^2)	125	50	50	-

Source: TTMA and other references.

ii) Production scale for individual farmers is small

As is shown in Table I-3-4, because the planted area per individual farmer is small the individual lots of cotton are also small. Products vary according to farmer, and because the scale of farmers operations is very small, they have to seek financial help from ginners (seed costs, cost of chemicals, etc) and thus place a heavy burden on the financial situation of ginners.

iii) Uneven quality

Cotton produced in Thailand can be divided into four broad types, and soil conditions determine which particular type is chosen. Due to the small scale of production of individual farmers ginners blend different cotton before shipping. Different types of cotton with varying fiber length and cottons of varying colors are mixed in the same bale and because uneven dyeing occurs in fabric made from 100% Thai cotton, spinners keep the ratio of Thai cotton below 30% and use other cotton or polyester for the remaining 70% or more. This is one reason for the drop in the price of Thai raw cotton.

iv) Impurities

The polyethylene tape which is used to tie the bales seeps into the bale and has become a source of complaints.

Due to the situation outlined above, the ginner selling price for cotton was 16 baht/kg in 1987 and 13b/kg in 1988 compared to an average unit price for imported cotton (CIF) of 23.16b/kg in 1986, and 27.57b/kg in 1987 (source: New Synopsis, Sep 19, '88; original: Customs Department).

As for the price in the United States, the government has set a purchasing price and farmers are guaranteed a minimum price. The government meets the difference between this price and the price at which farmers sell to shippers. The New Agricultural Act of 1986 guaranteed farmers growing cotton an income of 81¢/lb, and also provided shippers with an export subsidy of about 20¢/lb. The cotton is sold at a CIF price of 35¢ (source: Japan Spinning Monthly, Sep. '86). In Pakistan the Cotton Exporting Corporation buys cotton at a price of 38¢/lb and this is exported at a CIF price of 28¢. In China a system for subcontracting based on production quotas and a system of incentives for increasing production have been implemented and purchasing prices have been set. As we have just seen, even the governments of major world powers intervene and adopt protectionist policies.

In the past the Thai government has taken all sorts of measures to raise the price of cotton. These include making it compulsory for spinners to use domestically produced cotton and providing financial assistance to producers. Ginners have also carried out thorough control of different types of cotton in seed cotton warehouses, and as well as preventing the mixing of different strains have forbidden the use of polyethylene tape and have changed over to jute yarn. They have also tightened supervision so as to get rid of impurities in ginning. But despite these efforts the lack of trade warehouses, the small financial capacity of ginners, and the lack of a purchasing organization such as there is for rice have all affected the situation with the result that the cheap selling price of cotton has not been improved in anyway. The number of ginners has decreased from 55 five years ago to 22 today, and farmers are turning to the production of different crops.

As this topic exceeds the bounds of textiles, the subject of the survey, only the problems have been pointed out. The examination of countermeasures has been omitted.

(2) Man-made Fiber

The suppliers of man-made fibers used for textiles, are shown in Table I-2-10 ("Modernization of Equipment"). The suppliers of polyester staple which is the main material are Teijin Polyester and Thai Melon Polyester. Problems concerning polyester staple have already been dealt with in "Trends in Equipment in the Textile Manufacturing Industry", and in the section on "Cost Analysis" under "Polyester Staple Fiber". These problems have been brought together and are presented for a second time below:

i) In the past the increase in production capacity lagged behind demand with the result that imports were relied upon to meet the shortfall. However, as additional equipment will be brought into operation in 1989 and in 1990, it is possible that there may be an overflow in the short-term even though a balance may be reached in the longer term;

ii) The demands for new materials downstream and in some parts of the midstream sector are not being met by the upstream sector;

iii) As supply is restricted to two sources segregation has taken place and with the barrier of a 30% import tariff there are suspicions that the price is too rigid.

(3) Dyes, Auxilary Agents, & Other Secondary Materials

In regard to dyes, the two Indian companies Thai Ambica and Thai Matangi import intermediate chemicals and produce dyes with Indanthrone, reaction, sulfuration, dispersal, and vat processes. Although the price is 10-15% less than that for imported dyes, there are the problems of unstable quality, differences in the color of individual lots, and also dispersing-ability is poor. Not one of the 12 dyers which were visited used domestically produced dyes, and instead used imported dyes. Nevertheless, because of the existence of domestic producers the duties imposed on imported dyes amount to nearly 50% when surcharges are added. The fluctuating cost of dyes comprises as much as 60-70% of total costs which puts pressures on the profitability of dyers. The subsequent loss of a positive attitude towards business is mentioned in detail in 2-5 "Cost Analysis".

Because import tariffs are also imposed on intermediate substances, this problem cannot be solved by improvements in quality alone as long as the two companies continue to import intermediate substances. It is basically a problem involving import tariffs and the system.

There are no problems in regard to auxilary agents, and domestically made products are used.

The other main type of secondary material is sizes. In the days when cotton was the main material and slow speed shuttle looms were used corn starch was sufficient. However, today when high speed looms and blended synthetic yarns are used PVA has become the main type of substance used. Also, acrylic sizing is essential for weaving synthetic filament.

While corn starch is produced domestically and sells cheaply at just over 3 baht/kg, the prices of PVA and acrylic sizing are extremely expensive as they are not produced in Thailand. (PVA costs between 115-120b/kg.) It has been reported that the price of PVA has suddenly doubled.

3-2. Supply of Machinery and Parts

(1) Machinery

No textile machines, including dyeing machines, are manufactured in Thailand, and as a result machines made in Japan, Europe, and Taiwan are imported into the country for use in the industry. Also, many used machines are imported from Japan. The problem involving these machines is that while there are no domestically made machines high tariffs of 40% are levied on imported machinery. In today's climate where there are restrictions on equipment which keep demand for textile machinery down it is only natural that no textile machinery manufacturers have appeared. There is therefore little hope that machines will be produced within Thailand. Because the high duties imposed on imported machinery raise equipment costs and raise fears of unprofitability little progress is made in renewing and modernizing equipment. Conversely, used old-style machines are introduced and this distorts the structure of an enterprise. The likelihood of this causing an imbalance in capacity at the dyeing stage has been mentioned in other sections.

(2) Parts and Machine Parts

The majority of parts for machines and equipment are manufactured within Thailand. The fact that machines which were made 10-30 years ago are still in use reflects the high level of manufacturing technology for parts in Thailand. Accordingly, it is only natural that high duties and surcharges have been imposed on parts and machine parts in order to foster and protect local industry. Nevertheless, there are some parts which are not made domestically, or cannot be made domestically. For instance, as a plastic cop for the fine-spinning process is produced domestically a duty of 80% is levied on imported items. However, a cop for the fine-spinning process which is used for spinning yarn and which must be twist set by steaming must be made of heat resistant plastic. But because heat resistant plastic is not yet made in Thailand heat resistant cops for the fine-spinning process have to be imported. An inconsistency arises here as a 80% tariff is levied on the imported cop.

One example of where imported items are used, despite the fact that the same products are made domestically, is the shuttle. This is due to poor quality and precision. While shuttle looms can be repaired within the country it would appear that technology for repairing shuttleless looms has not yet been developed.

3-3. Problems and Countermeasures

(1) Oligopoly of Polyester Staple Fiber

The problem caused as a result of there being only two polyester staple fiber manufacturers has been described in 1-3-1. An increase in the number of polyester fiber producers in Thailand cannot be expected over the next several years. Hopes therefore must rest on overseas producers setting up operations in Thailand. If the 30% duty levied on imported polyester staple fiber is lowered to a reasonable level so that spinners in Thailand can obtain fiber at international prices, the problem stemming from the oligopolic situation will be solved and the difficulties faced in obtaining special materials will be solved at the same time.

(2) Import Tariffs and Taxes Levied on Petrochemical Product Inductors

The high tariffs imposed on dyes are not connected to fostering or protecting dyers, but rather have led to harder times for dyers. As these organic chemicals are petrochemical derivatives they cannot be produced on their own. The surcharges placed on these items as well as import duties must be examined in order to foster their production along with the development of the petrochemical industry.

The production of sizes and other plastic-related items must be fostered in tandem with the creation of a petrochemical industry in just the same way as dyes. A wide variety of sizes which vary in the degree of polymerization and in the degree of saponification are required and the user must choose a kind which matches the conditions in which it is to be used. It is therefore difficult for small-scale manufacturers to produce sizes on their own. Until these kinds of items can be produced imported products have to be accepted.

(3) Import Tariffs For Machinery

The present tariff rates are suppressing the modernization of the industry and are forcing the structure of enterprises to retrogress. Furthermore, today when every country is facing problems in making the manufacture of textile machinery and dyeing machinery viable on its own and so undertake such production in conjunction with the production of machine tools or automobile parts, or launch into the export of those products. Fostering the production of such machines in Thailand is therefore a very difficult task. If measures related to imported machinery are not seen from the perspective of the necessity of importing machines the basic issue will be misunderstood.

In 4) "Delays in Modernizing Equipment" under section 2-7 "Problems and Countermeasures Related to Production Activities and Technology" specific kinds of textile machinery have been named as contributing to the promotion of exports, and

suggestions for priority measures which will contribute towards modernization and international competitiveness have been made.

It has also been proposed that in going about the introduction of the next generation of equipment, equipment should not simply be viewed in terms of gathering machines, but should be seen as one part of an efficient production system. In the context of production management efforts must be taken so that software can be easily introduced, and consideration also needs to be given to the matter of duties so that ordinary small-scale companies can introduce equipment. (In Japan, special depreciation privileges are offered for equipment with electronic devices.)

(4) Move Away From the General Application of Tariffs

The danger of applying import tariffs to just items has been shown in the example of the heat resistant plastic cop for fine-spinning mentioned earlier. The burden is placed on companies for the reason that it is difficult to implement a system with detailed categories. High rates for duties are levied because the burden which this will cause has the effect of forcing a move over to domestically produced products from imported products. It is therefore necessary when implementing tariffs to conduct a very detailed survey so that they are applied to individual items so as to not cause any unfairness.

The problems which have been pointed out in this section and the countermeasures which have been proposed have been mainly concerned with import tariffs. When shifting away from the older system of substitution of imports, and the measures for fostering and protecting domestic industry which were first implemented in 1960, to export promotion and becoming part of the world community, it is inevitable that reforms to the exisiting system have to be made and new systems adopted. It should be understood that the purpose for making such changes is to make the upmost use of Thailand's strong international competitiveness which has been made possible by materials priced at international levels, the country's superior labor resources, orderly guidance by the administration, and the spread in technical levels.