FEASIBILITY STUDY ON THE RENOVATION OF CIPADUNG/BANJARAN MILLS, P.T. INDUSTRI SANDANG I IN THE REPUBLIC OF INDONESIA

DECEMBER, 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct the Feasibility Study for Renovation of Cipadung and Banjaran Mills, P.T. Industri Sandang I and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Indonesia a study team headed by Mr. Masayoshi Wada, Manager, Toyobo Engineering Co., Ltd. from February 1991 to March 1991.

The team held discussions with the officials concerned of the Government of the Republic of Indonesia and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

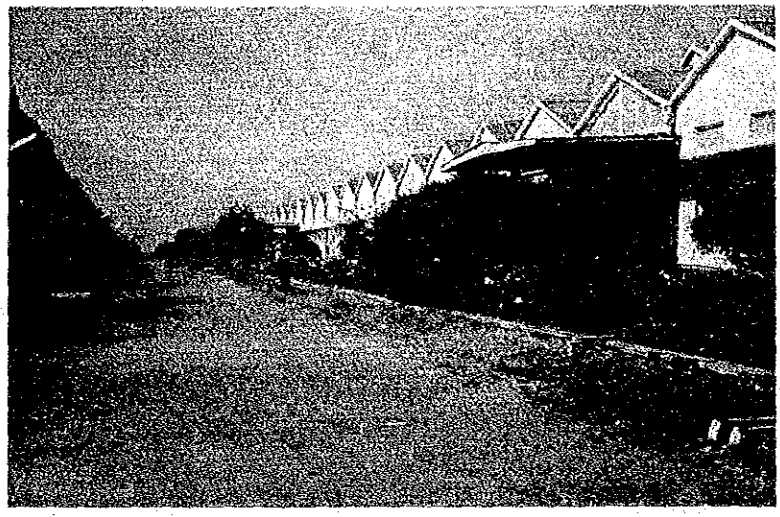
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relationship between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

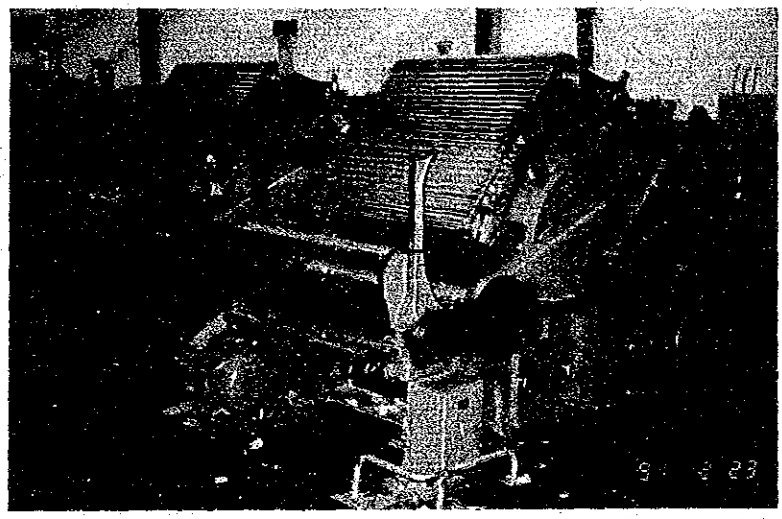
December, 1991

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency



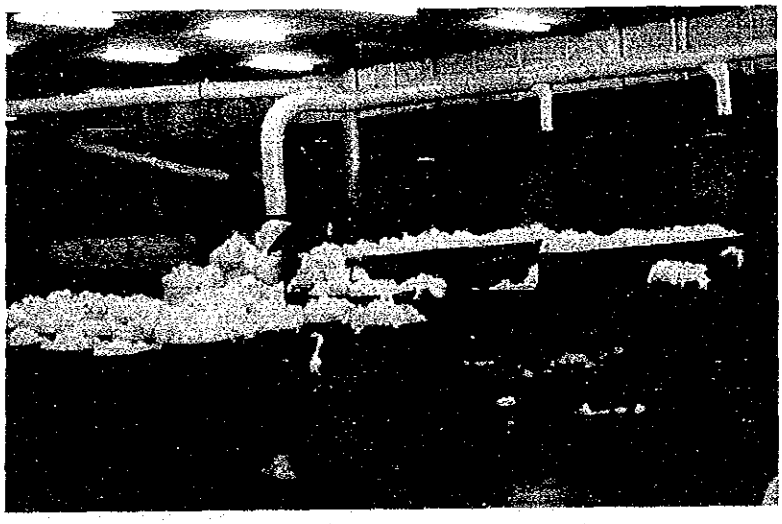
1. Exterior View of Banjaran Mill



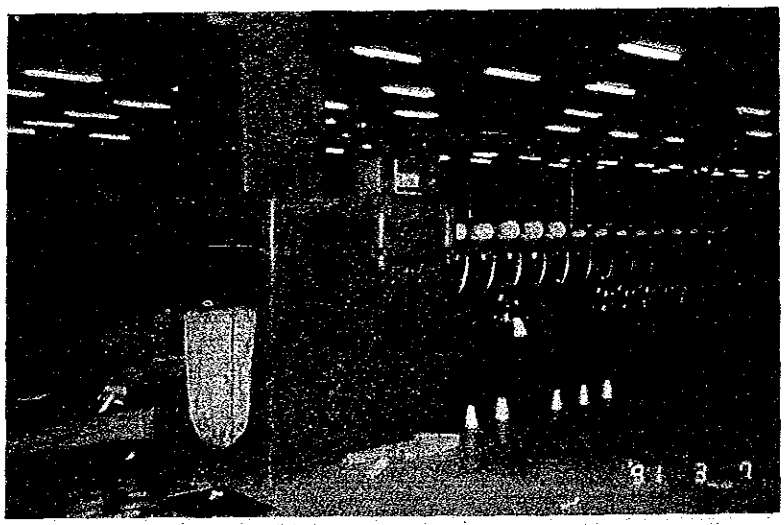
2. Carding Machines of Banjaran Mill

3. Winding Room of Banjaran Mill

4. Front of Cipadung Mill



5. Blow Room Process of Cipadung Mill



6. Autowinder of Cipadung Mill

SUMMARY OF REHABILITATION PLAN

〔Outline of Rehabilitation Plan〕

	Banjaran I		Banjaran II		Cipadung Mill	
	Present	Post rehabilitation	Present	Post rehabilitation	Present	Post rehabilitation
Production Equipment	China-made machines of 1964 and 1965 74 Ring frames(416 spindles) 30,784 spindles 9,000 rpm	Introduction of new machines and modification of existing carding machines 35 Ring frames(960 spindles) 33,600 spindles 14,000～16,000 rpm Establishment of combing system	Japan-made machines of 1974 78 Ring frames(432 spindles) 33,696 spindles 11,800 rpm	Rehabilitaion of existing machines 78 Ring frames(432 spindles) 33,696 spindles 15,000 rpm Production specialized in P/C Ne 45	UK-made machines of 1962 79 Ring frames(372 spindles) 29,388 spindles 9,300 rpm	Introduction of new machines and modification of card 50 Ring frames(720 spindles) 36,000 spindles 13,500～14,000 rpm Production specialized in synthetic fibre by 2 inch spinning
Production Quantity	12,200 bales (1989)	23,016 bales	13,881 bales	18,824 bales	14,738 bales	35,673 bales
Product Mix	CE Ne 40 55.8% CE Ne 40 22.5% C/P Ne 20 6.1% P/C Ne 40/2 4.8% P/C Ne 20 0.9% Average Ne 30.3	CM Ne 32 28.4% CM Ne 40 23.7% CM Ne 50 15.6% P/C Ne 20 6.7% P/C Ne 40 4.7% P/C Ne 40/2 4.4% C/P Ne 20 7.0% C/P Ne 40 4.9% C/P Ne 40/2 4.6% Average Ne 34.7	P/C Ne 45 64.2% P/C Ne 40 6.5% C/P Ne 40 11.2% CM Ne 40 16.6% Average Ne 40.5	P/C Ne 45 100%	P/R Ne 45 26.5% P/R Ne 30 8.3% R Ne 30 28.1% OE Ne 20 15.0% Average Ne 40.5	P/R Ne 20 43.9% P/R Ne 30 27.5% P/R Ne 40 13.5% P/R Ne 45 10.0% P/R Ne 40/2 5.0% Average Ne 28.0
Contract power supply	4,000 KVA	6,600 KVA	Included in the supply to Banjaran I		2,770 KVA	3,500 KVA
Required water volume	500 m³/day	1,700 m³/day			400 m³/day	900 m³/day

Note : CE : Cotton carded yarn, CM : Cotton combed yarn, P/C : Polyester/Cotton 65/35 blended yarn, C/P : Polyester/Cotton 35/65 blended yarn, R : Rayon, OE : Open end spun yarn

〔Financial & Economic Evaluation〕

Case 1 ··Rehabilitation in Banjaran Mill only, Case 2··Rehabilitation in Cipadung Mill only, Case 3··Rehabilitation in both Mills, Case A··100% loan, Case B··70 % loan 30% equity

	Case 1-A	Case 1-B	Case 2-A	Case 2-B	Case 3-A	Case 3-B
INVESTMENT (MILLION RP)	92,152	90,323	67,981	66,914	160,133	157,237
〃 (HUNDRED MILLION YEN)	65	64	48	47	113	111
ROI BEFORE TAX (%)	31.73	32.52	27.48	25.31	28.81	29.48
ROI AFTER TAX (%)	28.69	28.18	22.53	21.86	26.11	25.53
ROE BEFORE TAX (%)	—	34.38	—	25.98	—	30.83
NPV AFTER TAX (10%)	80,637	77,435	38,417	36,006	119,054	113,442

	Case 1	Case 2	Case 3
ACCUMULATED COVER RATIO (YEAR)	1.92	1.58	1.77
PAYBACK PERIOD (YEAR)	3.1	3.8	3.6
SALES REVENUE (M.Rp)	67,101	45,010	112,111
PROFIT AFTER TAX (%)	10.67	8.89	9.95
BREAKEVEN SALES AT 5TH YEAR (M.Rp)	51,922	38,032	89,870
BREAKEVEN OPERATION RATIO AT 5TH YEAR(%)	77	84	80
ERR (%)	38.52	30.79	35.24

Constant price in 1991

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Abbreviation

Unit

D	Denier
Ne	English Yarn Count.
Bale	400 pounds
V	Volt
KV	Kilovolt
A	Ampere
VA	Volt-ampere
KVA	Kilovolt-ampere
MVA	Megavolt-ampere
W	Watt
KW	Kilowatt
KWH	Kilowatt-hour
HZ	Hertz
rpm	Revolution per Minute
ϕ	Diameter
mmH	Height
mmW	Width
mmL	Length
mm	Millimeter
cm	Centimeter
m	Meter
km	Kilometer
in	Inch
mm^2	Square Millimeter
cm^2	Square Centimeter
m^2	Square Meter
km^2	Square Kilometer
m^3	Cubic Metre
ℓ	Litre
g	Gram
gf	Gram Force

Kgf	Kilogram Force
Kg	Kilogramme
ton	Ton
lb	Pound
cal	Calorie
Kcal	Kilocalorie
USRT	US Refrigerating Ton
mmAq	Millimeter Aqua (H_2O)
hr	Hour
min	Minute
sec	Second
Y	Year
M	Month

Technical Terms

HT	High Tension
LT	Low Tension
DB	Dry Bulb (Temperature)
WB	Wet Bulb (Temperature)
RH	Relative Humidity
OA	Outer Air
DA	Dry Air
CV%	Coefficient of Variation
U%	Uster%
IPI	Imperfection Indiator
BL	Blowing
CE	Carding
Pr-CM	Pre Combing
CM	Combing
Pr-DF	Pre Drawing
DF	Drawing
FF	Roving
RF	Ring Spinning

AW	Auto Winder
DW	Double Winder
RTW	RT Winder
DTW	Double Twister
RT	Ring Twister
BC	Blow Cleaner
SS	Steam Setter
DC	Dust Collector
AJL	Air Jet Loom

Textile Terms

P	Polyester
C	Cotton
P/C	Polyester/Cotton
P/R	Polyester/Rayon
CB	Cotton Combed Yarn
CD	Cotton Carded Yarn

Financial & Economic Terms

FOB	Free on board
¥	Japanese Yen
Rp	Rupiah
Th. Rp	Thousand Rupiah
M. Rp	Million Rupiah
BEP	Breakeven Point
DBEP	Discounted Breakeven Point
EMIP	Equivalent Maximum Investment Period
DCF	Discounted Cash Flow
NPV	Net Present Value
FRR	Financial Rate of Return
DRR	Economic Rate of Return
ROI	Return on Investment
ROE	Return on Equity

CRR	Capital Rate of Return Ratio
SCF	Standard Conversion Factor
SWR	Shadow Wage Rate
CIF	Cost, Insurance & Freight
GDP	Gross Domestic Product

INTRODUCTION

This is the report of the feasibility study on the renovation of Cipadung and Banjaran Mills in P.T. Industri Sandang in the Republic of Indonesia (thereafter referred to as the "Study"). The objective of the Study was to diagnose the present conditions of the Banjaran and Cipadung Mills of P.T. Industri Sandang I and to prepare renovation plans with emphasis on upgrading of product quality, stabilization of production and rationalization of production process, thereby strengthening its market competitiveness and contributing to its sound development.
The study was also aimed at providing technical guidance in terms of production control and maintenance in the course of the field study.

The study consisted of a field study conducted in Indonesia and analytical work performed in Japan. During the field study, the facilities and equipment of both mills were examined in detail and various information collected. On-site technical guidance was also conducted by the members of the study team. The renovation plans were formulated through analyses of the data and informations collected in the field study.

The field study lasted from February 4, 1991 to March 5, 1991. The members of the study team were as follows:

Name	In charge of	Belongs to
1. Masayoshi WADA	Team leader, Market survey	Toyobo Engineering Co. Ltd
2. Kengo TSUMORI	Financial/economic analysis Cost calculation	ditto
3. Hiroo MATSUBARA	Analysis of raw material, Production control	ditto
4. Teruo KINOSHITA	Product analysis, Design of equipment	ditto
5. Toshihiko YAMAMORI	Utility and Electricity	ditto
6. Yasuyuki MUKUNOKI	Economy and industrial survey, Architecture	ditto

In the course of the field study, the team visited and met following authorites/companies and its personnel concerned in Indonesia in order to obtain data and information necessary for the study.

1) Departamen Perindustrian

Directorate General for Multifarious Industries

Mr. Ir. A. Karim Sudibyo	: Director for Program Development
Mr. Ir. Agus Setiadi	: Sub-Director for Program
Mr Ferry Yahya Msc.	: Sub-Directorate Manager for Program
Drs. R.A.R. Soerilanata Djoemena, Teks. Ing.	: Director for Textile Industry
Mr. Ir. Achayar	: Sub-Directorate Manager for Textiles

2) P. T. Industri Sandang I

Mr. I Sumedi Wignyosumarto	: President Director
Mr. Wibowo Moerdoko C. Text. F.T.I.	: Director for Development
Mr. Sapei Prawiradilaga Bk. Teks.	: Production Director
Mr. Azizun Ramli S. Teks.	: Marketing Director
Mr. Ir. Poernomo Madenan	: Bureau Manager of Innovation Development
Mr. Soenarjo Soebandi Bk. Teks.	: Bureau manager of Production

3) Patal Cipadung

Mr. Soehani Prawirosoewito BK.Teks.	: Mill Manager
Dr. Sucahyo	: Medical Partner
Mrs. Busyra Bk. Teks.	: Planning & Control Manager
Mr. Anggarjito	: Utility/Electric Manager
Mr. Suwandi	: Financial Manager
Mr. Haryono	: General Affair Manager

4) Patal Banjaran

Mr. Harinto Soebandhi Bk. Teks.	: Mill Manager
Mr. Fachri Syarif Bk. Teks.	: Patal 1 Production Manager
Mr. M. Setijono S. Teks.	: Patal 2 Production Manager
Mr. Amir Hamzah	: Technical & Utility Manager
Mr. Djasari	: Personnel Manager
Dr. Adenil	: Medical Partner
Mr. Suryono	: General Affair Manager
Mr. Ruchiyat	: Finance Manager

Mr. Sunari S. Teks. : Planning Manager

5) Pabriteks Senayan

Mr. Daufril Bahir Bk. Teks. : Mill Manager

6) Patal Bekasi

Mr. M. Djamhari : Utility Manager

7) PLN Pusat

Mr. Ir. Sambodho Sumani : Head of Transmission & Distribution Operation

8) PLN Cabang Bandung

Mr. Hilwin Manan : Technical Chief

9) Indonesia Investment Coordinating Board (BKPM)

Mr. Samuel J. Tiwow : Bureau Manager of Industrial Application Bureau

Mr. Yus' an : Department Manager

10) Pertenunan Pawitan II (Small scale weaver in Majaraya)

Mr. Oman Ratman : Owner

11) P. T. Pusaka (Small scale weaver in Majaraya)

12) The Bank of Tokyo Ltd., Jakarta

13) P. T. Teijin Indonesia Fibre Corporation

14) P. T. Asuransi Tokio Marine Indonesia

15) Indonesian Textile Association (API)

Mr. Ir. Irwandy Muslim : Assistant Secretary General

CONCLUSION

The results of financial analysis are as follows :

1) Financial and economic feasibility

It is concluded that all these cases are financially feasible.

Case 1 FRR (ROI) after tax : 28.69%

Case 2 FRR (ROI) after tax : 22.53%

Case 3 FRR (ROI) after tax : 26.11%

2) The results of economic analysis are as follows :

Case 1 ERR : 38.52%

Case 2 ERR : 30.79%

Case 3 ERR : 35.24%

3) Moreover, rehabilitation/renovation plans of Banjaran and Cipadung Mills will contribute to stable employment and stimulation of economy in the region.

Therefore, it is recommended that the renovation plan should be implemented.

ADVICE

It is necessary to carry out a renovation plan to modernize spinning mills, to produce yarn of high quality with high productivity and to gain high profits.

Special attention is required to the following points. As for these points, large investment is not required.

1) Materials, cotton in particular, should be purchased as efficiently and energetically as private companies, by taking quality and productivity into consideration for the purpose of cost reduction and quality upgrading.

2) In Japan, "5-S" principles are put forward to manage mills, that is "Seiri" (Arrangement), "Seiton" (Tidiness), "Seisou" (Cleaning), "Seiketsu" (Cleanliness) and "Shitsuke" (Discipline). Also in Indonesia, the management must provide comfortable working environment and let employees clean their workplace every day. Then, they will increasingly love their mill and jobs.

3) It is proposed to make an effort to simplify the organization of the mill and to reduce

the labor cost by reducing the number of workers. At the same time, the bounds of responsibility and authority should be clarified. Since the management section, in particular is overstaffed, it needs to be improved.

4) It should be clarified that the mill is responsible for quality control and take measuros according to measurement data.

5) The most important factor is the"man"among"4Ms"(i.e. man, material, method and machine) in a manufacturing plant. Since the basic organization and system for education and training have been already established, it is suggested to improve the current methods as pointed in this report. Giving incentive, for example, may be effective to enhance employees' will to work and prevent them from changing their employment.

6) Plenty of electric power is necessary to carry out the renovation plan.

CHAPTER 1 TEXTILE INDUSTRY IN INDONESIA

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CHAPTER 1 TEXTILE INDUSTRY IN INDONESIA

1-1 National Development Plans and Textile Industry

Indonesia is now in its third year of the Fifth 5-Year Plan (from April 1989 to March 1994). The First 5-Year Plan was started in 1969, and during the 20 years covering the period from the First to the Fourth 5-Year Plan, the economic growth of Indonesia underwent a number of vicissitudes. Overall, the economy of Indonesia has achieved a substantial growth rate.

Table 1-1 Average Annual GDP Growth Rate

(Unit:%)

Period	Total GDP	GDP per capita	Agriculture	Manufacturing	Others
1969-1973	8.4	7.8	4.1	13.3	11.9
1973-1981	7.9	4.3	4.2	14.4	9.0
1982-1985	4.0	3.4	3.8	9.2	3.0
1986-1989	6.0	3.8	3.4	10.2	5.7

Source : B.P.S. (Biro Pusat statistik)

In the Fifth 5-Year Plan which is now in progress, economic development is given priority, and the central themes of the Fifth 5-Year Plan consist of two main pillars:

(1) agricultural development with the main targets aimed at becoming self-sustaining in foodstuff and in diversification of agricultural products and

(2) industrial development to promote export to increase employment opportunities for the labor force, to spread agricultural processing technology, and to develop the machinery industry.

The growth in the industrial sector of Indonesia during the previous Fourth 5-Year Plan has been at a high rate of approximately two times the average GDP growth rate. For the Fifth 5-Year Plan, the target for the growth rate of the industrial sector has been set to the highest level of 8.5% in comparison to the annual average growth of 5%. During the initial stage, the policy of shifting from imports to domestic products for self-sufficiency and exports has been steadily solidifying from the later half of 1980. One of the main pillars of the post petroleum policy since 1983 has been the industrial sector, and policies that directly and indirectly support the promotion of exports have been successively implemented

despite the devaluation of the rupiah in 1983 and its tremendous impact on the economy of Indonesia in 1986.

Indonesia is striving to promote export competitiveness in its non-petroleum industries, and among these non-petroleum industries, the textile industry has been lately developing at a rapid rate, and a promising increase in the export of textile products and the creation of work opportunity are surfacing.

Table 1-2 Sectoral Growth Rates and Structural Change

Sector	Estimated Share in GDP 1983	Average Annual Growth Rate, Repelita V	Projected Share in GDP 1993
Agriculture	23.2	3.6	21.6
Mining and Quarrying	15.9	0.4	12.6
Manufacturing	14.4	8.5	16.9
Construction	5.6	6.0	5.8
Trade	15.9	6.0	16.7
Transportation and Communication	5.7	6.4	6.0
Others	19.3	6.1	20.4
Gross Domestic Product(GDP)	100.0	5.0	100.0

1) Based on 1983 constant prices. Source: Richard Mann, Business in Indonesia

The 5-Year Plans that started in 1969 and that carried out for 5 terms will be considered the basic period for the economic jump for Indonesia. The established goals to be achieved by the textile industry sector during this period are as follows:

(First 5-Year Plan: from April 1969 to March 1974)

(1) Renovation of facilities;

(2) Promotion of domestic production to replace import;

(3) Expansion of labor force;

(4) Vitalization of regional economy; and

(5) Popularization of technology.

With the implementation of the above, the important points are as follows:

(a) To minimize structural imbalance among the types of work;

(b) To promote productivity; and

(c) To reach a textile production volume of 900 million meters (the production target of the 5-Year Plans at completion).

(Second 5-Year Plan: from April 1974 to March 1979)

(a) To become capable of distributing clothing in sufficient quantities with good quality standards at affordable prices for the people of Indonesia.

(b) To have the proper facilities to undertake export.

(Third 5-Year Plan: from April 1979 to March 1984)

(a) To continue the policies established for the previous 5-Year Plan.

(b) To transform from the stage of replacing import with domestic products and to export.

(Fourth 5-Year Plan: from April 1984 to March 1989)

(a) To further solidify the foundation by strengthening the previously established targets and policies.

(b) To implement and promote export plans.

(Fifth 5-Year Plan: from April 1989 to March 1994)

(a) To maximize the rate of utilization capacity for existing machinery and equipment.

(b) To establish an export target, and for the purpose of achieving this, to foster and strengthen the related industries (such as parts, dye, chemicals, ancillary materials, and other industries.)

(c) To foster and promote R&D capability.

(Sixth 5-Year Plan: from April 1994 to March 1999)

(a) To reduce the dependency on import of raw and other materials and to further fortify relationships and ties among industries.

(b) To achieve complete growth throughout the textile industry network.

(c) To gain visible growth among non-oil/gas exports of textile products.

(d) To be capable of providing support for the continual expansion of the textile industry in the structure of R&D to be organized.

(e) To have an adequate number of specialists and management personnel.

(Source: JICA Pre-Survey Report)

Tables 1-3 and 1-4 show the details of the development and outlook of the textile industry.

Table 1-3 Development and Outlook of the Textile Industry (Equipment)

(Number of Equipment)

Industry	Unit	Pre PELITA	End of PELITA I (73/74)	End of PELITA II (78/79)	End of PELITA III (83/84)	End of PELITA IV (88/89)	Estimate PELITA V (93/94)
Fiber making	Unit		3	5	11	13	18
Spinning	Spindle	481,780	729,620	1,741,110	2,464,000	3,480,000	5,800,000
Weaving	Loom	35,335	53,691	68,272	96,350	118,499	180,000
Knitting	Machine	5,853	6,720	8,400	10,788	18,917	20,000
Garment	Machine	3,527	6,250	12,800	44,556	93,051	128,000

Source : API (Asosiasi Pertekstilan Indonesia)

Table 1-4 Development and Outlook of the Textile Industry (Production)

Unit: Ton

Type of products	1965	1970	1975	1980	1985	1989	End PELITA V
Fiber							
Viscose Rayon					34,200	66,055	73,700
Polyester			3,846	53,790	74,950	104,638	203,500
Yarn (total)	14,058	33,032	80,795	214,777	340,540	617,868	750,900
Weaving Yarn	14,058	33,032	75,852	179,500	265,660	481,960	535,100
Polyester Fil.				25,159	63,200	123,195	183,800
Nylon Filament			4,943	10,118	11,680	12,713	32,000
Fabric (total)	61,290	60,349	136,706	281,451	335,846	603,926	727,100
Woven					285,470	513,392	618,400
Knitted					50,376	90,534	108,700
Garment				61,600	94,680	139,800	485,900
Dyestuff					630	3,982	7,000

Source : API

1-2 Current Situation of the Textile Industry

1-2-1 Summary

Although the Indonesian economy suffered from the reverse oil shock (oil price fall down) in the mid-1980's, the economy showed recovery after 1987 and the growth rate was 3.6% for that year. The economy has been reflecting a rapid substantial growth since then, and in 1988 it recorded a growth of 5.7% and in 1989 the rate reached to 7.4%.

It is reported that the main factors contributing to the Indonesian economy achieving such favorable growth are,first, rapid expansion of exports of products other than petroleum and gas; second, increased direct investment from foreign countries; and third, increase of personal consumption and higher domestic business investments since 1987. The supporting factors included the policy of the Indonesian government to relax its regulations and the devaluation of the rupiah in September 1986. The international economy on the whole being healthy and having favorable conditions in Indonesia also have contributed to the current prosperity.

When we look at the textile industry, we note that the export has been rapidly increasing. With the revaluation in the currency of South Korea and Taiwan both of which are textile exporting countries and the subsequent rise of labor cost in these countries, inquiries directed to Indonesia for textile goods have been prevalent. At the same time, investment in the textile industry from foreign countries including South Korea and Taiwan has increased, and the production capacity in this industry has grown.

Although the export of textile goods was a mere US$144 million in 1980, it had increased to US$1.025 million in 1987 and to US$1.426 million in 1988, and it further rapidly increased to US$2.032 million in 1989. The textile export recorded US$2.917 million in 1990.

The export of non-petroleum and non-gas products that Indonesia is seeking to expand was more than 50% of the export amount in 1987 and more than 60% in 1988. Among the non-petroleum and non-gas products, textile products replaced natural rubber to take second place following plywood exports. The balance of trade of the textile products is more than US$1 billion in surplus, and textile exports have been contributing to the acquisition of foreign currency of Indonesia. The export market also expanded to the U.S.A., Europe, Middle East, and Japan.

The production volume continues to increase year by year as seen in Table 1-4,

and in 1989 the domestic production record of textile raw material was 100,000 tons for polyester fiber, 120,000 tons for polyester filament, 14,000 tons for nylon filament, 58,000 tons for rayon fiber, and 33,000 tons for cotton -- a total of 325,000 tons. In addition, imported raw material amounted to 352,000 tons of which cotton was the main import totaling 266,000 tons. Also yarn and fabric imports reached 144,000 tons. The total of all these have been fed into the textile industry as the raw material. In respect to trade balance, imports consisting primarily of raw material added up to 496,000 tons and amounted to US$1 billion (average US$2 per kg) while the export was 243,000 tons at the amount of US$2 billion (average US$8 per kg). The figures clearly reflect that the textile industry in addition to supplying to the domestic consumption has been earning a significant amount of foreign currency and contributing to the international balance of payment to Indonesia.

1-2-2 Production Capacity

As shown in Table 1-3 which indicates the textile machinery situation, plans for installation of new additional machinery are being aggressively implemented supported by the favorable conditions in the export market, and it is just a matter of time before 4 million spindles will become a reality in the spinning industry. In the weaving industry, new weaving machines are replacing the old ones especially among mills that export goods. In addition, the recent acceleration in the garment industry has been prominent due to the industries from South Korea, Taiwan, and Hong Kong advancing into Indonesia where the labor cost is still cheap. The points of issue lie in equipment that still remains in considerable number of old facilities that have been in service for more than 15 years in certain sectors as shown in Table 1-5 and in Figure 1-1. This is expected to become a major obstacle to meet future market demands for upgrading product quality. It can also be clearly seen from this table which sectors in the textile industry have recently been adding new machinery and achieving a healthy growth.

Geographically, along with 60% of the population of Indonesia is concentrated in the island of Java, and as noted in Table 1-6, centralization of textile industry on Java island is substantial. Industries related to synthetic textile have particularly been concentrating in western Java.

Table 1-5 Condition of Textile Machinery

1988/1989

Industry	Total	Years of Machine							
		0-5 years	%	5-10 years	%	10-15 years	%	>15 years	%
Fiber Making (Unit)	12	5	41.7	3	25.0	4	33.3	0	0.0
Spinning (Spindle)	3,454,545	880,544	25.5	1,463,355	42.4	178,671	5.2	931,975	27.0
Weaving (Loom)	118,499	23,634	19.9	20,111	17.0	23,754	20.1	51,000	43.0
Knitting (Unit)	18,917	8,306	43.9	3,492	18.5	3,278	17.3	3,841	20.3
Garment (Sewing M)	93,051	51,107	54.9	32,690	35.1	8,226	8.8	1,028	1.1

Source: API

Table 1-6 Location of the Textile Industry According to the Industrial Zones

	INDUSTRIAL ZONE	STAPLE FIBRE (Ton)	FILANENT FIBRE (Ton)	YARN (Ton)	FABRICS (Ton)	GARMENTS 1,000Doz
Sumatera	MEDAN	-	-	466	6,417	483
	PAKAN BARU	-	-	-	-	325
	PADANG	-	-	2,139	2,504	-
	PALEMBANG	-	-	4,456	101	35
West Java	JABOTABEK	122,570	106,170	133,272	122,968	27,765
	CIKAMPEK-PURWAKARTA	40,750	4,320	10,467	208	-
	BANDUNG RAYA	-	22,040	94,839	228,326	21,934
	CIREBON	-	-	8,632	2,183	22
Central Java	TEGAL PEKALONGAN	-	-	9,962	55,158	101
	CILACAP	-	-	8,912	903	90
	SEMARANG	5,000	47,960	22,418	48,757	1,998
	YOGYAKARTA-SURAKARTA	-	-	46,882	67,400	1,575
East Java	MADIUN-KEDIRI	-	-	-	2,860	37
	KERTOSUSILO	-	-	15,453	25,009	1,635
	MALANG-PASURUAN	-	-	22,397	15,347	1,295
Sulawesi	UJUNG PANDANG	-	-	-	601	348
		168,320	180,490	380,274	568,742	57,643

Source: Directorate General of Multifarious Industry.
Ministry of Industry.

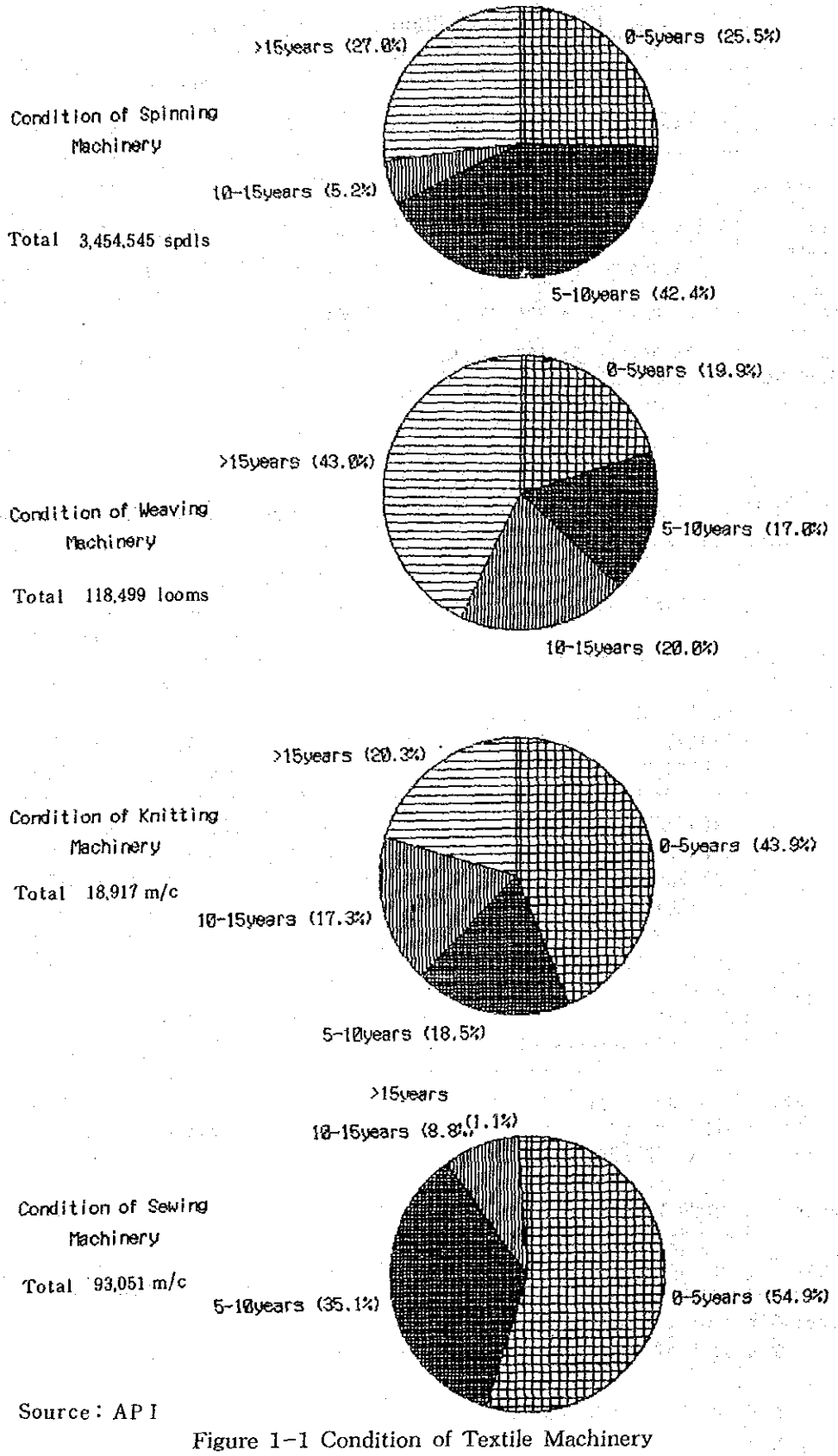

Figure 1-1 Condition of Textile Machinery

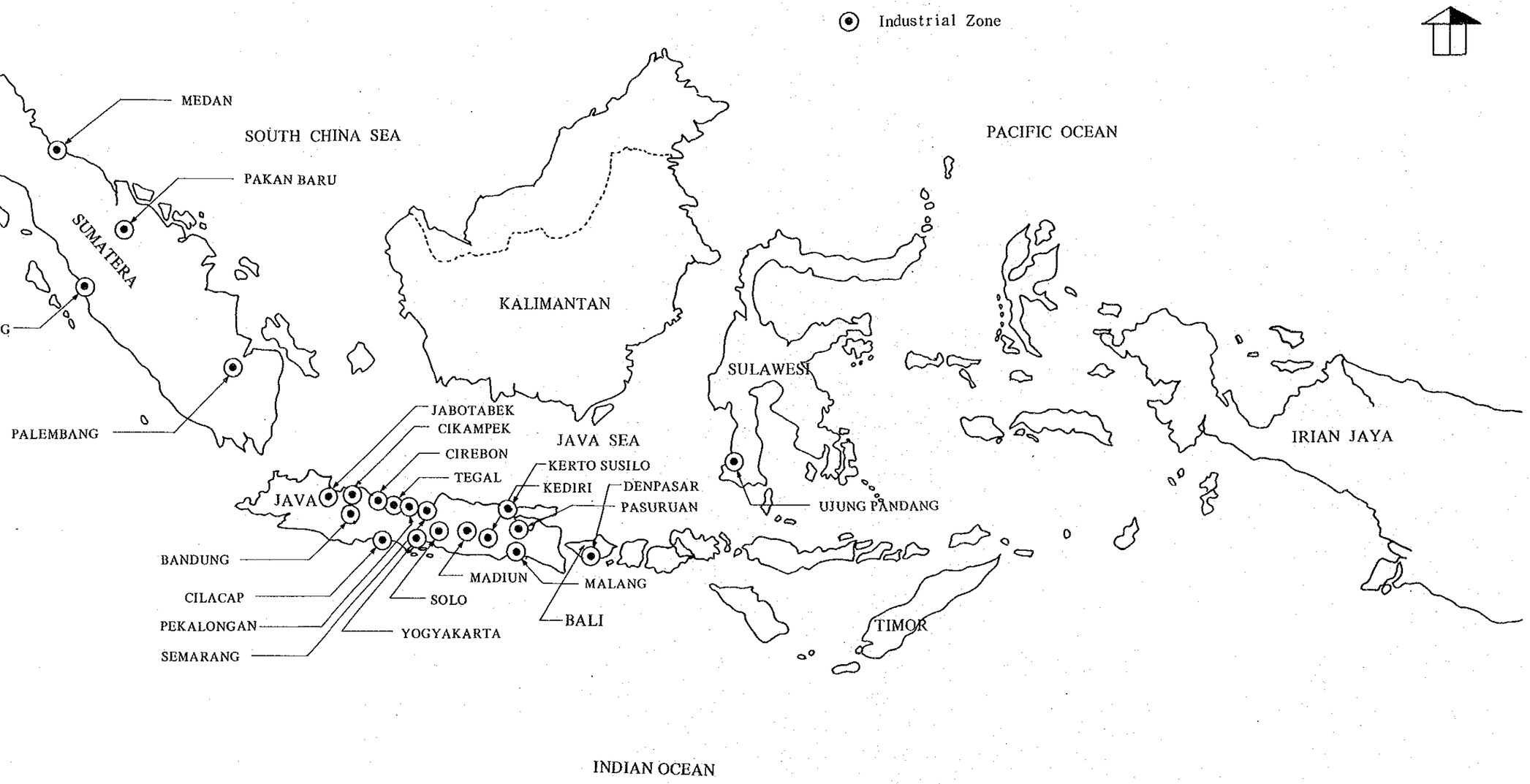

Figure 1-2 Location of the Textile Industry

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CHAPTER 2 MILL HISTORY AND CONDITIONS OF MILL LOCATION

2-1 P.T. Industri Sandang I

P.T. Industri Sandang I is one of the two textile corporations under the jurisdiction of the Ministry of Industry and possesses five mills consisting of four mills in the western part of the state of Java and one mill in the island of Sumatra. This is shown in Figure 2-1. The direct predecessor of Sandang I is PNPR Leppin Karya Yasa which was established in 1961, and it was succeeded in 1967 under the name of PN Industri Sandang as the only state-owned spinning enterprise. In 1978 PN Industri Sandang was divided into two companies: P.T. Industri Sandang I with its jurisdiction west of western Java and P.T. Industri Sandang II with its jurisdiction east of middle Java. To this date, the two companies have continued. The summary of P.T. Industri Sandang I is as follows:

Established	1977
Location of Head Office	JL Patal Senayan I No. 5 Jakarta
Capital	US $45 million
No. of spindles	222,998 spindles/1,200 rotors
No. of employees	7,000 (approx.)

2-1-1 Scale of Facilities and Production Volume

Sandang I consists of five mills and nine units, and the number of facilities and its record of production volume (for the year of 1990) are listed in Table 2-1.

Table 2-1 Facilities and Production Volume of Sandang I (1990)

		No. of Facilities		Production Volume		No.of Unit
		No. of Spindles	No. of Looms	Yarn(bales /Month)	Cloth(1000m /year)	
1	Pabriteks Senayan	60,240	508	28,904	14,200	4
2	Patal Banjaran	64,570	-	24,025	-	2
3	Patal Cipadung	29,388 (+1,200rotors)	-	12,752	-	1
4	Patal Bekasi	39,600	-	8,911	-	1
5	Patal Palembang	29,200	-	111,552	-	1
Total		222,998 (+1,200rotors)	508 (All Shuttle)	86,144	14,200	9

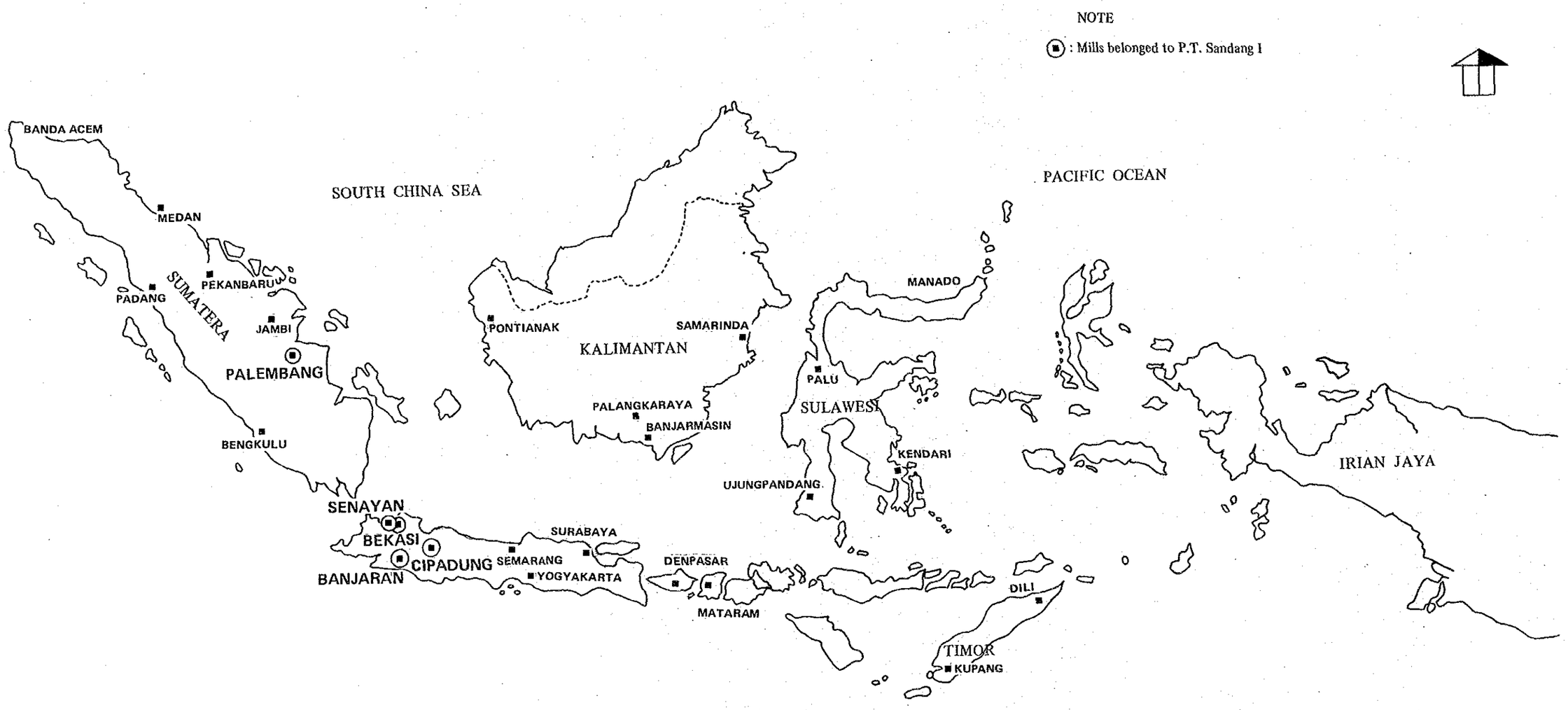

Figure 2-1 Mill Location of Sandang I

Of the five mills owned by Sandang I, only Pabriteks Senayan possesses a fully-integrated process plant with spinning, weaving, and finishing facilities. However as mentioned in the Corporate Plan, with the municipalization and urbanization advancing in the Senayan districts in Jakarta where the Pabriteks Senayan Mill is located, plans to transfer it to Karawan is in progress so that they are environment-friendly.

The scale of the spinning facilities of Sandang I which holds approximately 230,000 spindles is nearly equal to the facilities of Sandang II, and accounts for almost six percent of the total spinning facilities of Indonesia (there are approximately 3,800,000 spindles as of 1990). The products produced are mainly cotton yarn and a polyester/cotton blended yarn of Ne. 20 to Ne. 40, all of which are directed mostly to the domestic market. The spinning facilities of Indonesia have been showing a sharp increase mainly among the private enterprises, owing to a favorable spinning market during these past several years. The state-owned spinning enterprises (P.T. Industri Sandang I and P.T. Industri Sandang II), which accounted for more than 20% of the spinning facilities in 1984, now only occupy a little more than 10%.

With the rapid expansion in the private textile field, the competition in the textile market has become keen. In the effort for enterprises in the textile industry to survive, enterprises are concentrating on revamping the efficiency of its organization as well as modernizing its facilities and improving the quality of its products. Under these circumstances, Sandang I has been forced to review its business, to devise a means to reinstigate its organization, and to modernize its facilities. In January of 1990, a new business plan consisting of the following major points was announced as the "Corporate Plan" in compliance with the above requirements.

1) To transfer Senayan Second Spinning Mill to Bekasi.
2) To move other Pabriteks Senayan to Karawan.
3) To rehabilitate Patal Banjaran, Patal Cipadung, Patal Bekasi and Patal Palembang.

The subject of this renovation plan includes both the the Patal Banjaran and the Patal Cipadung Mills.

2-1-2 Earning Capability

The production amount, sales amount, and gross profit on sales during the past three years (from 1988 to 1990) of Sandang I group are shown in Figure 2-2.

The textile industry from 1987 to 1989 was active, and each of the mills of Sandang I group was able to show considerable profits during this period. Unlike these years, 1990 became a time when conditions such as higher raw material cost and lower product prices were encountered. These factors have caused weaker enterprises, which also competed poorly in the market, to fall into deficits.

Despite this severe time, Sandang I was somehow able to show a profit in the entire group. As far Patriteks Senayan, Patal Cipadung, and Patal Palembang, they were forced to operate at deficits, as their machinery were obsolete efficiencies were poor.

In contrast, Patal Banjaran was able to earn a profit exceeding 3,000 million Rupiah during this period which was realized mainly by the production of the polyester/cotton blended yarn at the relatively new Second Mill. The sewing thread produced at the Patal Bekasi also enjoyed steady sales and recorded a profit of 1,100 million Rupiah.

As stated in the Corporate Plan, disassembling and transferring Pabriteks Senayan and undertaking the rehabilitation of the Banjaran First Mill, Patal Cipadung and Patal Palembang would be considered valuable steps to reorganize the structure of Sandang I into a strong and competitive enterprise that could even endure a recession period.

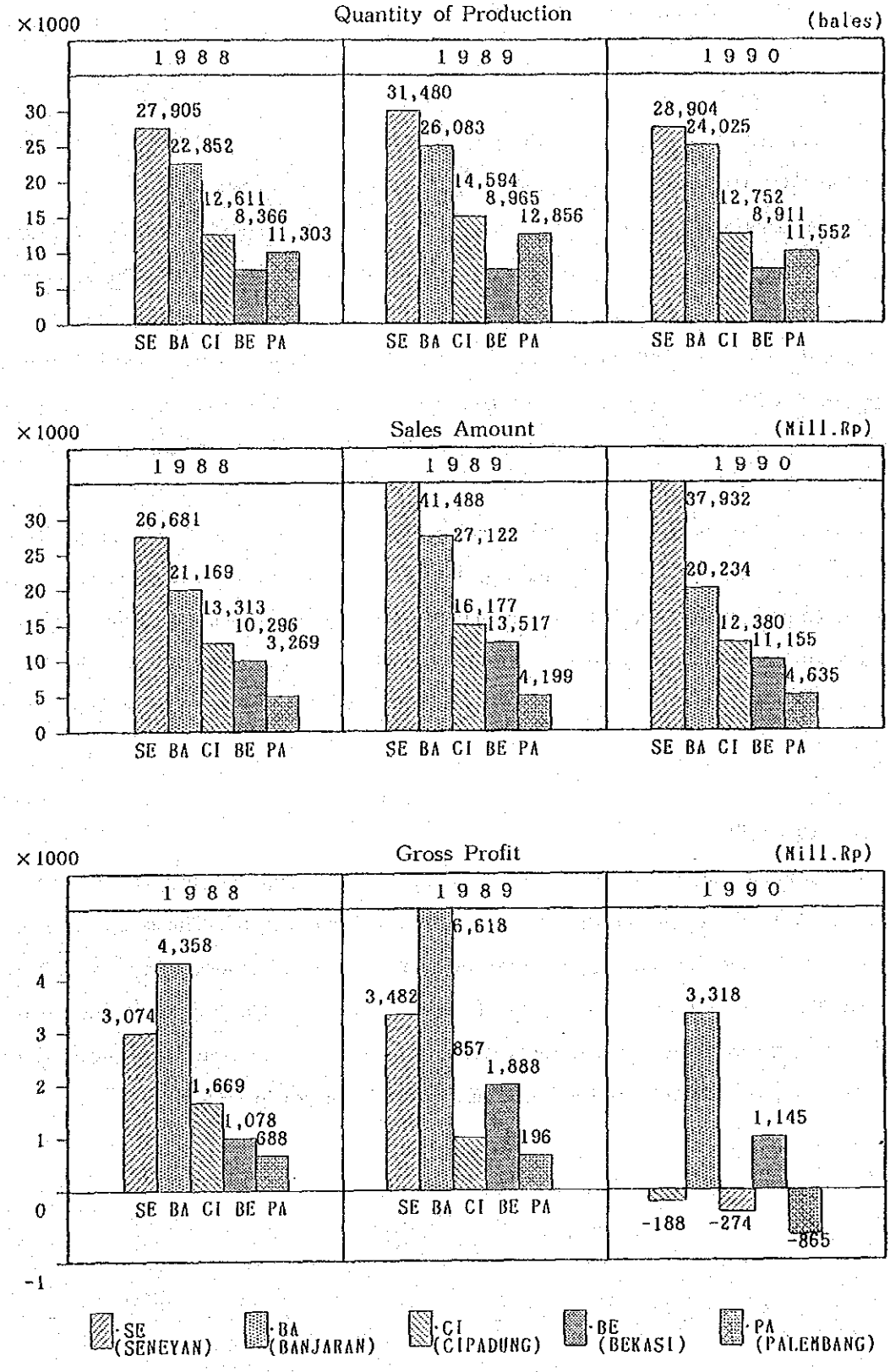

Figure 2-2 Production, Sales and Gross Profit : Sandang I

2-2 History of Banjaran and Cipadung Mills

2-2-1 Banjaran Mill

Patal Banjaran, a spinning mill, is located 20 km south of the city of Bandung, and consists of the First Mill (30,874 spindles) and the Second Mill (33,696 spindles).

The construction of the First Mill started in 1965 with reparation funds from the Japanese government being used in part but mainly with the financial aid from China. Operation of this mill commenced with the scale of 30,000 spindles in 1967 and full scale operation began in 1968. 12,199 bales/year and 10,931 bales/year of cotton carded yarn and polyester/cotton blended yarn (average yarn count No. 30.3) were spun respectively in the years 1989 and 1990 mainly using machinery and equipment that were made in China.

The construction of the Second Mill began in 1971 with financial assistance from the Japanese government, and production commenced in 1973. In 1979, the number of spindles increased to 3,000 and reached the current production scale. The production equipment are entirely made in Japan, and production of cotton combed yarn and polyester/cotton blended yarn (average yarn count No. 40.5) reached 13,880 bales in 1989 and 13,093 bales in 1990, respectively.

2-2-2 Cipadung Mill

Patal Cipadung, located 13 km east of Bandung city, is a spinning mill that was constructed in 1961 with the technical and financial assistance from England. The facility is equipped with 29,388 spindles and 1,200 rotors of open-end spinning machinery. In 1969 some machinery was imported from Japan for polyester/rayon blended yarn, and currently polyester/rayon blended yarn, rayon yarn, cotton open-end yarn are being produced. Production reached 14,594 bales in 1989 and 12,730 bales in 1990.

2-3 Conditions of Mill Location

2-3-1 Weather Conditions

Indonesia extends for approximately 2,000 km from 6° north latitude to 11° south latitude, and expands for more than 5,000 km from the east to the west. Indonesia is a part of the Malay archipelago consisting of 13,667 islands and falls into the tropical rain forest climate.

Indonesia has a rainy and dry season. The season from October to March is the rainy season, and from April to September is the dry season for the major areas of Indonesia including Jakarta, the capital of Indonesia and Bandung, the state capital of west Java. However, due to the world-wide climatic changes in recent years, the dry season and the rainy season are becoming less distinct.

The temperature along the coastal region does not vary to any great degree throughout the year. However, the Bandung district where Patal Banjaran and Patal Cipadung are located is a basin situated at approximately 750 meters above sea level. The climate here is typically characterized with an average annual temperature of about 23℃, a temperature considerably cooler than Jakarta's average of 27℃. The humidity, however, is high at 75% to 85% throughout the year with rainfall of more than 2,000 mm/year which is considerably higher than the average rain fall in Japan. Generally, west winds blow during the rainy season while winds from the east blow during the dry season. The winds are generally not very strong.

Meteorological records for 1989 of Bandung is shown in Table 2-2.

2-3-2 Geographical Location, Transportation and Population

Bandung is the state capital of west Java and located at 6°55' south latitude and 107°35' east longitude. The city stands at 750 meters above sea level and is located 120 km southeast of Jakarta. Bandung occupies the center of a highland basin surrounded by four volcanoes, Tankubanpurau and Buranran which are to the north and Patoha and Marabaru to the south. The city was originally a small town built by the Sultan Agun of Cirbon and which gradually developed, and in 1864 Bandung became the state capital of Puriangan state. With the construction of the railway connecting Bandung to Jakarta in 1909, the city rapidly

developed as a sightseeing spot and a summer resort. With the First Asian African Conference being held in Bandung in May, 1954, the city immediately gained international fame. In recent years, various research institutions such as the Bandung Institute of Technology have been established, and Bandung now occupies an important position as a city of educational institutions. Many industries of various sizes are constructed in the peripheral areas, taking advantage of the location such as the abundant supply of water and the pleasant climate. The development of textile industry in particular has been prominent, and Bandung district has now become the outstanding production site for textile products together with Tangeran in the suburb of Jakarta.

Table 2-2 Meteorological Conditions of Bandung (1989)

MONTH	TEMPERATURE (℃)			RAIN FALL (mm)	RAIN'G DAYS	RH (%)	WIND VELOCITY		
	AVRG	MAX	MIN				AVRG	DIRECT-ION	MAX
JAN	22.7	27.6	19.1	346.8	23	85	1	W	3
FEB	22.6	27.1	19.3	134.5	22	82	2	W	5
MAR	23	28.3	18.9	184.6	19	78	2	W	4
APR	23.2	28.7	18.8	260	20	80	2	W	4
MAY	22.5	27.8	19	301.5	25	83	2	W	3
JUN	22.6	27.8	18.7	111.5	17	79	2	W	4
JUL	22.5	28.2	18.1	46.5	15	77	2	W	4
AUG	22.5	28.2	17.4	138.5	7	73	2	E	4
SEP	23.5	29.1	17.7	22.2	5	65	3	E	5
OCT	23.6	29	18.5	93.4	14	74	2	E	4
NOV	23.7	28.8	19.1	109.3	15	78	2	W	5
DEC	23	27.8	18.5	421.7	23	84	2	W	4
TOTAL				2170.	205				
AVRG	22.95	28.2	18.6	180.8	17.1	78.1	2	W	4

(Source: Meteorology and Geophisic Board, Bandung Station)

Table 2-3 shows the population and the population density of Bandung and the surrounding districts in comparison with the entire Indonesia. In Indonesia the influx of population from the agricultural districts into the large cities has developed into a problem, and the Bandung region is no exception where the population has been increasing at a very high rate, consequently, causing urban problems, for example, traffic congestions.

Table 2-3 Population and Population Density

	Population(people)	Population density
Bandung	1,393,879	17,208 /㎢
Banjaran District	110,519	1,435
Ujunberun District	183,780	2,187
Bandung District Total	2,737,598	1,013
West Java Total	34,953,500	791
Java Island Total	91,200,000	829
Indonesia Total	179,340,000	93

(As per census of 1990)

2-4 Electricity and Water

2-4-1 Electricity Situation

(1) Power Supply Capacity of National Electric Power Corporation (PLN)

For the past several years, the rapid increase in the investment in plants and equipment in Indonesia, particularly in the island of Java, has brought about a sharp increase in the demand for electricity. The demand for public use has also increased along with improvement of living standards. Under these circumstances, the electric power supply capacity of PLN has now reached its limit, and PLN is in no position to accept any new contracts for supply of industrial electric power nor to increase the power supply of its current contracts for the time being.

As a result, enterprises that are being newly constructed have been forced to install small to medium sized diesel engine-driven generators for their own use.

PLN is currently constructing a 1,800 megawatt thermal power plant in the eastern part of Java, and when this plant starts to generate power in 1993, the supply and demand of electricity is expected to ease and improve.

There is no particular problem existing in power transmission and substation facilities

that may hinder the supply of electricity in Bandung and surrounding areas.

(2) Supply of Power to Mills and Power Supply Contracts

In the island of Java, the main power transmission lines of 500 kV runs from east to west. Within the West Java district, there is a power transmission network of 150 kV, and these electricity supply networks of extra-high voltage and special high voltage are well equipped and maintained. Banjaran Mill and Cipadung Mill both receive supply of electricity exclusively through buried cables that supply 20,000 volts from the PLN substation located near the Mills.

For these reasons, power supply failures are infrequent and power failure by reason of maintenance is done only two to three times per year. The range of voltage fluctuation is within ±2.5%, and this fluctuation presents no problem for practical use.

The power supply contract and electricity demand situation for both Mills are as follows:

a) Power supply contract and the maximum demand of electricity of Banjaran Mill

- Power supply contract: 4,000 KVA
- Maximum electricity demand: 2,700 to 2,800 kW or 3,000 to 3,100 KVA

(plus private power generation from 6 pm to 8 pm: 300 to 400 kW)

Power demand is approximately 75% of the contracted supply amount with PLN.

b) Power supply contract and the maximum demand of electricity of Cipadung Mill

- Power supply contract: 2,770 KVA
- Maximum electricity demand: 1,800 to 1,900 kW or 2,000 to 2,100 KVA

The electric power demand is approximately 72 to 75% of the contracted supply amount with PLN.

The contract supply amount is excessive to the current load of both Mills, but this must be accepted when normal operation is considered.

Both Banjaran Mill and Cipadung Mill have their own diesel-engine generators, but due to the facilities becoming obsolete and aging , their operation at full capacity is difficult. It is also difficult to rely upon these facilities for the operation of the Mills due to the problems involved in obtaining their parts.

Figure 2-3 shows the Power transmission system diagram to Banjaran Mill and Cipadung Mill.

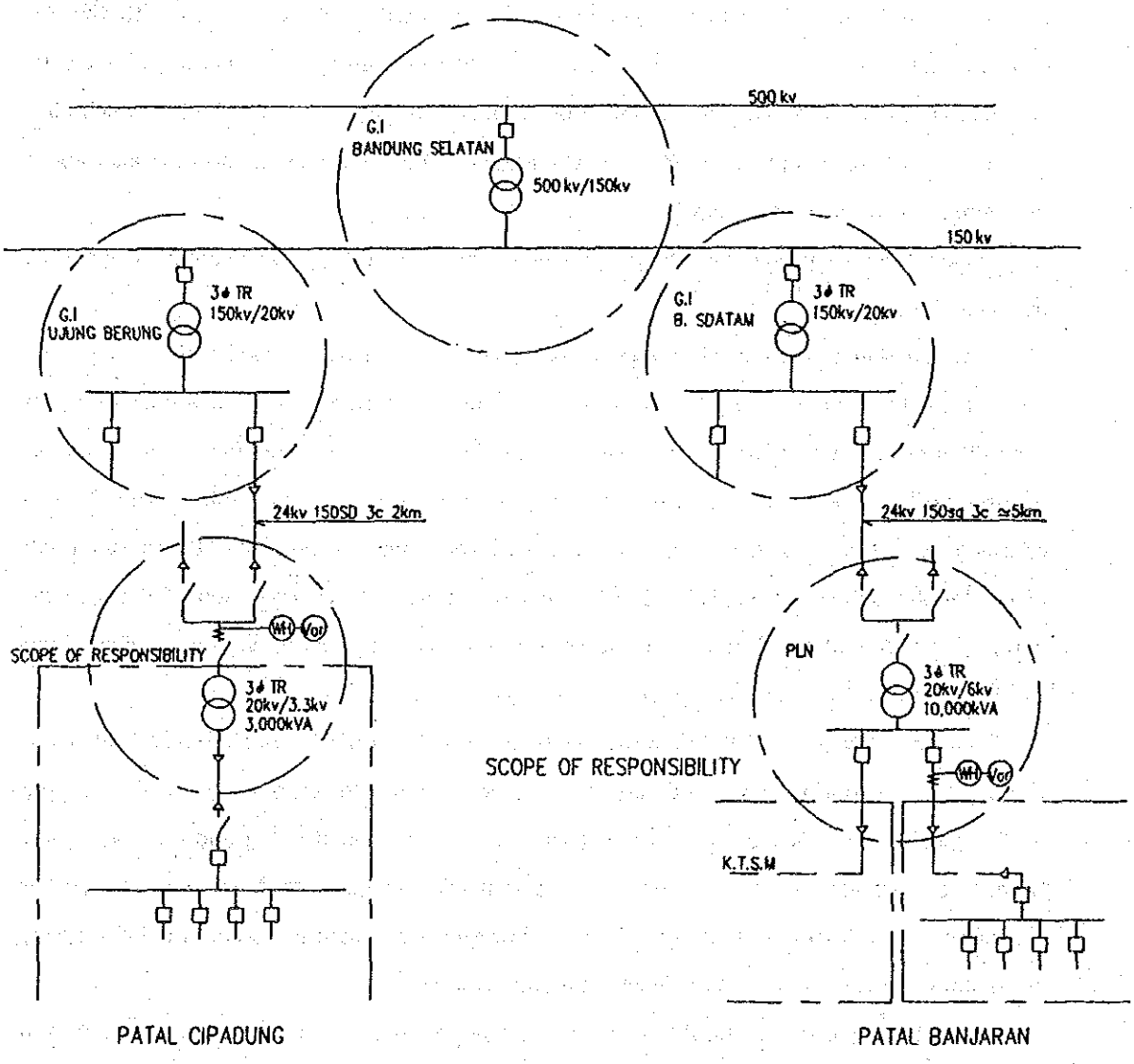

Figure 2-3 Power Transmission System Diagram to Banjaran Mill and Cipadung Mill

(3) Power Consumption and Power Consumption per Unit

Power requirement and power consumption per unit for spinning mills vary with the differences in the product types, product-mix, and processes. What has great influence

in power consumption and the amount of power is the revolving speed of the spindles of the spinning frames and the electric power consumption of facilities resulting from modernization and automation. In this respect, the amount of electric power required for the new advanced mill generally is high.

The rate of increase of electric power consumption by modernization and automation has been higher than the rate of production capacity increase in comparison with the old conventional type of machinery for each process. Power consumption increases also with dust collectors and waste collecting equipment. Higher revolving speed of spindles in spinning process as well as compressors and exhaust air equipment in winding process also affect on increase in power consumption.

Comparison of power consumption between Banjaran Mill and Cipadung Mill is shown in Table 2-4.

At the Banjaran First Mill there is no increase in the power consumption that may result from the new advanced high speed machinery; therefore, the power cosumption per unit indicates a low range. However, the range of power consumption at the Banjaran Second Mill is considerably higher. When power consumption per unit of this Mill is compared with that of a newly constructed and advanced mill in Indonesia, the consumption of the former is 1088.5 kWh/bale, 13.6% higher regardless of the revolution of the spindles being about 87% of the latter. This is considered to be caused by the fixed loads such as air-conditioning, etc. and poor production efficiency.

At the Cipadung Mill the power consumption per unit is considerably high even though the production machinery are old and production efficiency is poor. This is due to the considerably high power consumption from the air-conditioning and electric lights. Since the electricity cost is a part of the manufacturing costs, reduction in the power consumption would substantially contribute to lowering manufacturing costs. In this respect, controlling power consumption is of vital importance.

In other words, it should be considered to install measuring instruments, which enables to divide overall power consumption into individual consumption of production machinery air-conditioning and refrigerators, water supply equipment, etc. Preparing portable measuring instruments that would measure electricity consumption for each individual machine in each respective process and establishing appropriate organization for power control are steps to lowering power consumption.

2-4-2 Water Conditions

At the Banjaran Mill, water from the nearby Cisankui River is taken and supplied approximately 2 km by an underground pipes to the Mill site.

The Cisankui River originates from streams in the mountains around the towns of Soreang and Ciwiday which are located about 20 km northwest of Banjaran Mill. A number of these streams flow together near the town of Banjaran. When the river reaches near Banjaran Mill, the river has enlarged to a mediumsized river with a width of about 10 meters. The water level of the rivers varies substantially with both the seasons and the climatic conditions but the river never dries up throughout the year.

Like other rivers in Indonesia, the river is described as a muddy-yellow, opaque colored waterway.

Except for some suspended solids, there seems to be little problem with the quality of the water. The water is used in the Mill for air-conditioners, as cooling water for refrigerators and compressors and for potable water. Before use the water is treated by means of coagulation and sedimentation process and filtration with treating agents such as calcium chlorite, aluminum, sulfate, and caustic soda.

The treated water is suitable for the above applications, but potable water is further treated by chlorine. The water contains little heavy metal ions and presents no problem for practical use.

At Patal Cipadung, there are two deep wells, and the water rom these wells is pumped up and used. The wells are 100 and 150 meters deep respectively, and approximately 1,000 cubic meters of water is pumped and consumed daily which is adequate for the requirement of the Mill. The water is used for air-conditioner, as cooling water for refrigerators, for compressors (expected to be required in future), and for potable water. The water is treated in the water treatment unit by using treating agents such as calcium chloride, aluminum sulfate and caustic soda through coagulation, sedimentation and filtration processes.

Table 2-4 Comparison of Power Consumption per Unit

		PATAL BANJARAN		PATAL CIPADUNG	Newly Constructed Spinning Mill
		B-I	B-II		
	Spinning Capacity	30,784 sp (416sp×74F)	33,696 sp (432sp×78F)	29,388 sp (372sp×79F)	34,200 sp (456sp×75F)
	Ring Frame's rpm	9,000 rpm	11,800 rpm	9,000 rpm / O.E.S 6 F	13,500 rpm
1988	Production Bale	11,065 /Y	11,937 /Y	12,609 /Y	
	Power Consumption KWH	21,594,136 /Y		10,629,000 /Y	
	Power per Bale KWH/bale	938.8		835.0	
1989	Production Bale	12,199 /Y	13,880 /Y	14,594 /Y	
	Power Consumption KWH	22,203,662 /Y		13,237,700 /Y	
	Power per Bale KWH/bale	851.4		907.1	
1990	Production Bale	10,931 /Y	13,093 /Y	12,730 /Y	18,228 /Y
	Power Consumption KWH	6,779,215 /Y	14,251,325 /Y	11,720,000 /Y	17,472,000 /Y
	Power per Bale KWH/bale	620.2	1,088.5	920.7	958.5
	Total of Mill No.1 and No.2	21,030,540 KWH 875.4 KWH/bale			
				Consumption by Dept.	Consumption by Dept.
	Production Machinery			65,740,041 KWH/Y 56.1%	899,300 KWH/Y 61.8%
	Air Conditioning Chiller			4,362,502 KWH/Y 37.2%	503,000 KWH/Y 34.5%
	Lighting			579,902 KWH/Y 4.9%	53,700 KWH/Y 3.7%

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CHAPTER 3 MILL DIAGNOSIS (BANJARAN MILLS)

3-1 Raw Material, Production and Quality

The production equipment and facilities of Banjaran Mill was basically designed under the following concept:

The First Mill was equipped with machinery to spin yarn for weaving, i.e pure cotton yarn (carded yarn and combed yarn), polyester/cotton blended yarn, and doubled yarn for work clothes (military uniforms).

The Second Mill was equipped with machinery to spin polyester/cotton blended yarn (carded yarn and combed yarn) for selling purposes.

3-1-1 Types of Raw Material and Their Consumption

The types of raw material that are currently used and the results of analyzing the quality of the raw material are as follows:

(1) Raw cotton

Production district	Grade	Fiber Length
Arizona U.S.A.	SM	1 3/32"
P.R.China Shandang 129	SM	1 3/16"
INDONESIA 2136	SM	1 7/64"
Texas, U.S.A. 1	SM	1 5/16"
Texas, U.S.A. 2	M	1 5/16"
INDONESIA SLMLS	SM	1 7/64"
INDIA	M	1 7/64"

(2) Man-made fiber

Type: Polyester fiber

Denier: 1.3

Fiber length: 38 mm semi-dull

Dealer: PT TEIJIN INDONESIAN FIBER (TIFICO)

(3) Details of Raw Material Used

Table 3-1 Raw Materials Used at Banjaran Mill

	Product Type	Materials
Banjaran 1st Mill	Cotton Ne 40 Cotton Ne 30 C/P Ne 20 P/C Ne 40/2	Cotton M - SM $1^{1}/_{16}$" - $1^{3}/_{16}$"
Banjaran 2nd Mill	P/C Ne 45 P/C Ne 40 C/P Ne 40 Cotton combed yarn 40	Cotton M - SM $1^{1}/_{16}$" - $1^{1}/_{8}$" Polyester 1.3 denier 38 mm

(4) Quantity of Raw Cotton Used per Bale

Table 3-2 indicates the amount of raw cotton used per bale and the waste ratio that is obtained from P.T. Sandang I.

Table 3-2 Quantity of Raw Material Used and Waste Ratio.

Name of Mill	Main Product	Used Volume of Raw Cotton (kg/bale)	Waste Ratio %
Banjaran 1st Mill	CD Ne 40 CP Ne 20	C 196.2 P 65.5 C 127.5	C 7.5% P 3% C 7.5%
Banjaran 2nd Mill	CB Ne 40 PC Ne 45 CP Ne 40	CB 235.6 P 121.5 CB 82.5 P 65.5 CB 153.5	P 3% CB 23%

The waste ratio of cotton may vary depending on the kind of materials used. It is necessary to blend various kinds of cotton appropriately so that waste ratio is stabilized. The waste ratio of man-made fiber shown in Table 3-2 is in excess, and an effort must be made to restrict its ratio within 2%.

(5) Quality Analysis of Cotton Used

Table 3-3 shows the results of a quality analysis using a High Volume Instrument (HVI) manufactured by SPINLAB, on cotton being used at Banjaran and Cipadung

Mill.

The stock of cotton being used at these Mills is very small, and also the types of cotton are limited. The followings are an evaluation made through the results of the analysis.

a) Arizona, U.S.A.: Although the uniformity is not very favorable, this cotton had good results with a small amount of trash and a high degree of whiteness. It can be used as the major cotton for combed yarn of Ne 40.

b) P.R. CHINA Shandan 129 (first grade 29 mm): This has a small amount of trash and nep, and higher whiteness. It is good enough for combed yarn of Ne 40, but it may not be very convenient to use at the site due to its smaller package (100 kg average/bale).

c) INDONESIA 2136: The trash and nep are less, and uniformity is fairly good. However, it contains quite a few foreign matters, which may affect the coloring ability, in the finishing process. In order to prevent contamination of foreign matters, the special attention shall be paid by hopper operators. It can be used for combed yarn of Ne 40.

d) U.S.A. Texas 1: This cotton has a stronger redness, and requires special care when being blended with other cottons. A small amount can be blended for spinning a coarse count of yarn. The trash amount is low.

e) U.S.A. Texas 2: Although this cotton has a rather lower trash, the whiteness is poor. It can be used for a coarse count of yarn (below Ne 20).

f) INDONESIA SLMLS: The trash amount is rather high, and worm spots are noticeable. It has a reddish color, and the ginning is inferior. It is not appropriate to use for major cotton for combed yarn of Ne 40 due to its amount of foreign matter.

g) INDIA cotton: This roller gin cotton has a larger amount of trash and noticeable stains. Thus, it needs careful attention to open the cotton and to remove the trash.

Table 3-3 Results of Quality Analysis of Cotton Used

(measured by H.V.I)

Kind of Cotton		U.S.A Arizona	P.R.CHINA Shandang	INDONESIA 2136	U.S.A Tex.-1	U.S.A Tex.-2	INDONESIA SLMLS	INDIA
L	Trash Code(1~6)	1	1	2	1	1	2	2
Area%	Trash Area %	0.01	0.03	0.03	0.03	0.04	0.05	0.08
Cnt	Trash Count	3	5	6	2	5	7	8
Len	2.5% Span Length/inch	1.09	1.19	1.10	0.92	0.9	1.11	1.12
Un	Length Unifomity	44.0	47.0	48.5	44.4	45.6	46.8	49.4
Str	1/8-inch Gage Strength g/tex	27.0	26.3	29.0	21.5	21.2	28.4	28.4
El	Elongation %	6.6	6.4	6.6	5.7	5.5	6.3	6.5
Mik	Fineness	4.5	4.2	4.6	4.1	4.2	4.3	4.0
Rd	Grayness(Reflectance %)	78.7	77.7	76.6	72.3	70.8	74.3	73.6
b	Yellowness	8.5	9.3	9.9	13.0	10.9	10.8	10.4
C.G.	Color Grade (Standard Box)	21-2 (SM)	21-4 (SM)	21-4 (SM)	13-4 (SM)	33-2 (M)	22-2 (SM)	32-1 (M)
SBr	Skein Break Strength (Projected Strength Ne22)	126	140	139	93	90	135	143
Rs	Category of Ring Span SBr	11	13	12	8	8	12	13

(6) Quality Analysis of Cotton Used

Basically it is difficult to improve the quality of yarn through using high qnality cotton, because it is usually purchased on "A Type Basis Contract" in Indonesia. However, an advantage of this method is that the supply and stock of the main raw cotton is very stable throughout the year. At least 40% of purchased cotton must meet the expected grade, staple length and other quality levels. The rest of 60% cotton for blending has to be selected to match to the major cotton considering the economic feasibility. It is not easy to get a market evaluation of cotton presently used at the Mills due to the limited popularity in the country. However, the results of use at the mill and other information show that the last year's Australian cotton had darker hue. It often winds around the roller, probably due to its immature fiber. (It seems to be better in 1991.)

Russian cotton, according to the Mill experience, did not have a favorable spinning ability, probably due to its poor opening ability.

Though Indonesian 2136 cotton is capable of being used as a blended cotton for combed yarn of Ne40 because of its fair coloring, and stable staple lenght, it is very difficult to remove such foreign matter as polypropylene strings which disturbs dyeability.

Though some Chinese cotton has good coloring and other good qualities, it is not convenient for use due to its small packaging.

Samples of the Mexican and the Brazilian cottons were not available, but as a general comments, Mexican cotton can be used for Ne 40, although its staple length is relatively short. Brazilian cotton has quite a few red-spots, which adversely affect dye-ability,but it is usable for thick yarn spinning.

(7) Quality Analysis of Polyester Fiber Used

The polyester fiber currently used at the First and the Second Banjaran Mills is 1.3 denier and 38 mm cut semi-dull from Teijin Indonesia (TIFICO). Analysis was performed in Japan, and the results are as follows:

Cut length:	37.9 mm
Denier:	1.34
Dry tenacity:	6.88 g/d
Elongation:	18.6 %
Knotting strength:	5.49 g/d
Number of crimps:	14.4 /25mm (1")

Index of crimps:	12.4 %
Percentage of absorbed oil:	0.107 %
Stick fiber:	0
Dark point:	0.1 mg/100 g
Fiber/fiber	
Friction coefficient	
-Static:	0.377
-Dynamic (90 cm):	0.222
-Dynamic (2400 cm):	0.413
Fiber/metallic	
Friction coefficient	
-Static:	0.23
-Dynamic (90 cm):	0.214
-Dynamic (2400 cm):	0.413
Melting point:	257.4 ℃

(8) Evaluation of the Results of Analysis

The results of analysis generally show the favorable physical characteristics. The number of crimps is slightly high, and the percentage of absorbed oil is rather small, but this will probably not effect the spinning ability. The small number of dark points where the majority of these lies in the cutting section when the staples are stretched and enlarged, is quite favorable. The friction coefficiencies of the fiber/fiber affect the draft or the convergence of the spinning, and those of the fiber/metallic affect the wrapping of the bottom roller.

3-1-2 Production Plans and Actual Results

(1) Production Plans and Actual Results of the Banjaran First Mill.

Operation conditions consist of four groups working 24 hours per day under three shifts, although the actual length of working time for each shift is 7 hours 30 minutes. Table 3-4 shows production plans and actual production results from 1986 to 1990.

Table 3-4 Production Plans and Actual Results at the Banjaran First Mill

	1990		1989		1988		1987		1986	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Cotton										
Ne 1						153		517		697
Ne 30	678	742	2,533	2,751						233
Ne 40	7,890	7,973	6,613	6,812	6,597	6,352	6,237	5,708	5,629	4,825
Ne 40/2		59		41		62		7		
Ne 20			538	634						
Sub-total	8,568	8,774	9,684	10,238	6,597	6,567	6,237	6,232	5,629	5,755
(%)		80.2		83.9		59.3		54.8		51.1
Polyester/ cotton										
Ne 20	174	149	117	107	518	476	2,070	1,341	210	297
Ne 40						29		333		
Ne 40/2			497	583	986	1,082	1,903	1,522		
Sub-total	174	149	614	690	1,504	1,587	3,973	3,196	210	297
(%)		1.5		5.7		14.3		28.1		2.6
Cotton/ polyester										
Ne 20	1,176	1,363	676	744	1,375	1,192	385	427	1,333	1,052
Ne 40/2			73	61	1,076	1,311	874	270	2,516	2,167
Ne 40				6				578		
Sub-total	1,176	1,363	749	811	2,451	2,503	1,259	1,275	3,849	3,219
(%)		12.4		6.6		22.6		11.2		28.6
Polyester										
Ne 20									568	438
Ne 20/3									165	201
Ne 30									724	428
Ne 40/2										60
Sub-total									1,457	1,127
(%)										10.1
Reused waste										
Ne 20	88	646		460		409		579	600	837
Polyester/ Haraniai										
Ne 20							230	90		20
Sub-total	88	646		460		409	230	669	600	857
(%)		5.9		3.8		3.7		5.9		7.6
Total	10,007	10,932	11,048	12,199	10,552	11,066	11,699	11,372	11,745	11,256
Average count	36.4	35.4	35.3	34.6	36.4	35.7	35.4	33.9	34.5	31.9

a) By annual changes in the proportion of materials, the production of p/c and c/p which accounted for around 35% of production until 1988, has decreased to as little as 13%. On the other hand, the proportion of the cotton carded yarn increased from 51.1% in 1986 to as much as 80% in 1990.

Furthermore, 3.7-7.4% of Ne20 is being produced from reused waste alone.

b) Because the production of cotton yarn and polyester/cotton blended yarn shall change according to the projected market conditions, it should be accommodated within the capacity of the production machinery. While some of Ne 20 is being spun from reused waste alone, since this is equivalent to having an extra product-mix, measures must be devised to reduce the amount of waste.

c) If the amount of generated waste is around 5%, mix it together with raw cotton at the mixing process. It must be remembered, however, that if the amounts of waste mixed in is uneven, parts of the produced yarn will contain more reused waste than other parts, which consequently results in the lack of uniformity in the quality of yarn. The single yarn strength weakens at those parts with larger amounts of reused waste, for instance. Also, a greater amount of fly is generated at the roller when there is more reused waste contained. The fly may be at times mixed into the product in lumps and cause trouble in the subsequent processes. For these reasons, the method of mixing waste together with raw cotton should not be adopted if it is found impossible to maintain evenness of the mixture. On the other hand, to prevent the generation of waste, eliminate the troubles within the processes (i.e. winding round the roller, sliver breakage, etc.)and reduce the instances of defective products being produced due to malfunction of the machinery. Also effective is to plot on a graph the amounts of waste generated by different processes and shifts, and to concentrate on devising measures to improve particularly those processes or shifts showing larger amounts of waste generation.

(2) Production Plans and Actual Results at the Banjaran Second Mill.

Table 3-5 indicates production plans and actual production record from 1986 to 1990.

Operation conditions consist of four groups working 24 hours per day under three shifts although the actual length of working time for each shift is 7 hours 30 minutes.

Table 3-5 Production Plans and Actual Results at the Banjaran second Mill

	1990		1989		1988		1987		1986	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Cotton combed										
Ne 40	3,465	2,933	2,386	2,300	1,562	1,405				
Ne 30										
Ne 32								6		
carded										
Ne 40	638	517								
Sub-total	4,103	3,450	2,386	2,300	1,562	1,405				
(%)		26.3		16.6		11.8				
Polyester/ cotton										
Ne 40	1,274	1,526	819	896		3	2,013	1,110	252	293
Ne 45	4,563	4,797	8,903	8,914	10,025	9,695	11,958	11,919	13,820	12,840
Ne 20	327	335	218	211						
Sub-total	6,164	6,658	9,940	10,021	10,025	9,698	13,971	13,029	14,072	13,133
(%)		50.8		72.2		81.2		100.0		100.0
Cotton/ polyester (65/35)										
Ne 40	2,156	2,318	1,476	1,559	924	834				
(55/45)										
Ne 30	591	694								
Sub-total	2,747	2,962	1,476	1,559	924	834				
(%)		22.6		11.2		7.0				
Polyester Ne 40		22								
Total	13,014	13,093	13,802	13,881	12,512	11,937	13,971	13,035	14,072	13,133
Average count	40.8	40.8	42.9	42.9	44.0	44.1	44.3	44.6	44.9	44.9

a) For 1989 - 1990, the actual production amount achieved 100.6% of the amount planned. The average yarn count, on the other hand, decreased from 44.9 in 1986 to 40.9 in 1990, indicating an increase in the production of coarser yarns.