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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

FEASIBILITY STUDY
ON
INTEGRATED TEXTILE MILL PROJECT
IN
BANGLADESH

PROJECT NO. US/GLO/92/006
CONTRACT NO. 92/228

AUGUST 1993

UNIDO

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ABBREVIATIONS

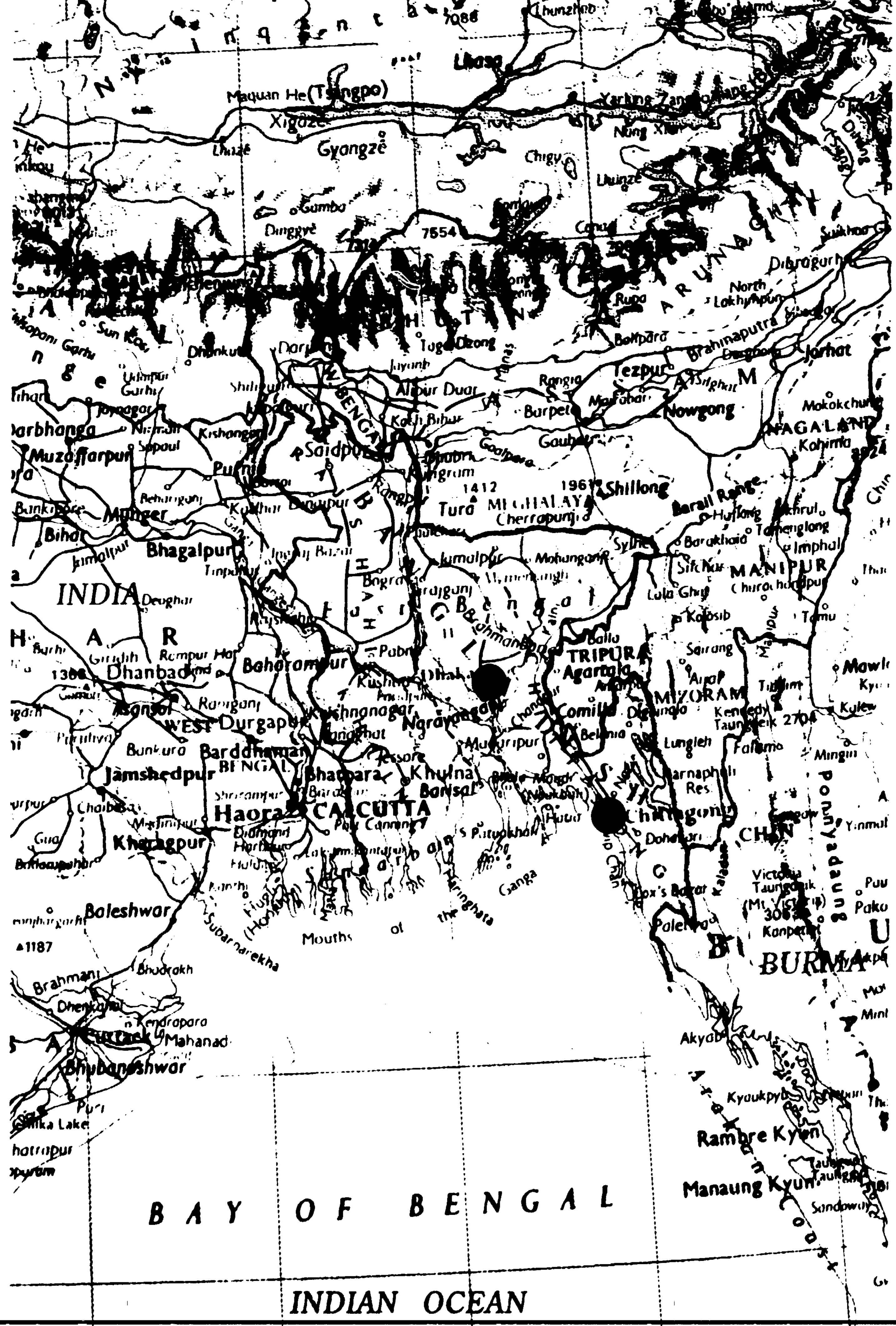
Unit Terms		Technical Terms	
B. BL	Bale (400 pounds)	CV %	Coefficient of Variation
Ne. 's	English Yarn Count	U %	Percentage of Unevenness
lb. LB	Pound	IPI	Imperfection Indicator
oz	Ounce	QC	Quality Control
g	Gram	Max.	Maximum
Kg	Kilogram	Min.	Minimum
ton	Ton	BL	Blowing
gf	Gram Force	CE	Carding
Kgf	Kilogram Force	Pr-CM	Pre-combing
V	Volt	CM	Combing
KV	Kilovolt	Pr-DF	Pre-drawing
A	Ampere	DF	Drawing
VA	Volt-ampere	FF	Roving
KVA	Kilovolt-ampere	RF	Ring Spinning
MVA	Megavolt-ampere	AW	Auto Winding
W	Watt	RTW	RT Winding
KW	Kilowatt	BC	Blow Cleaner
KWH	Kilowatt-hour	DC	Dust Collector
MW	Mega-watt	MCC	Metallic Card Clothing
Hz	Hertz	SP	Spindle
rpm. r/m	Revolutions per Minute	LP	Large Package
dia. φ	Diameter	ME	Motor End
mm	Millimeter	GE	Gear End
mm H	mm Height	OE	Out End
cm	Centimeter	F. f	Frame
m. M	Meter	D. d	Drum
km	Kilometer		
in. "	Inch		
YD. y	Yard	WP	Warping
mm	Square Millimeter	SZ	Sizing
cm	Square Centimeter	TY	Tying
m	Square Meter	RE	Reaching
km	Square Kilometer	M/C	Machine
m	Cubic Meter	CK	Cooking Kettle
l	Liter	AJL	Air Jet Loom
℃	Degree Centigrade	P	Polyester
° Be	Degree of Baume	C	Cotton
°	Degree (Angle)	PC. P/C	Polyester Cotton blended
'	Minute (Angle)	SV	Supervisor
psi	Pounds per Square Inch	NO., No.	Number
Cal	Calorie	pc	Piece
Kcal	Kilo-calorie	S	Shift
USRT	US Refrigerating ton	HT	High Tension
mmAq	Millimeter Aqua (H O)	LT	Low Tension
ppm	Part per Million	DB	Dry Bulb
pH	Potential of Hydrogen	WB	Wet Bulb
sec	Second	RH	Relative Humidity
min. m	Minute	OA	Outer Air
h. hr. Hr	Hour	DA	Dry Air
D. d	Day	S/S. ss	Sub-station
M. m	Month		
Y. y	Year		

Financial & Economic Terms

¥	Japanese Yen
TK	Bangladesh Taka
$	US Dollar
BEP	Break-even Point
IRROI	Internal Rate of Return on Investment
IRROE	Internal Rate of Return on Equity
LIBOR	London Inter-Bank Offered Rate

Others

RMG	Ready-Made Garment
EPZ	Export Processing Zone
BEPZA	Bangladesh Export Processing Zones Authority
BGMEA	Bangladesh Garment Manufacturers & Exports Association
EPB	Export Promotion Bureau
BTMA	Bangladesh Textile Manufacturing Association
BTMC	Bangladesh Textile Manufacturing Corporation
BOI	Board of Investment
ADB	Asian Development Bank
IBRD	International Bank of Reconstruction and Development
UNIDO	United Nations Industrial Development Organization


Lhasa
Maquan He(Tsangpo)
Xigaze
Gyangzê
Nung Xian
Chigy
Gumba
Dinggyê
7554
Dibrugarh
North Lakhimpur
Brahmaputra
Jorhat
Tezpur
Nowgong
Mokokchung
NAGALAND
Kohima
Rangia
Burpeta
Gauhati
Shillong
Barail Range
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MEGHALAYA
Tura
1412
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MANIPUR
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Darbhanga
Muzaffarpur
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Purnia
Kishanganj
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Cox's Bazar
Paletwa
BURMA
Akyab
Kyaukpyu
Ramree Kyun
Manaung Kyun
Sandoway
Boleshwar
Subarnarekha
Mouths of the Ganga
Haringhata
Ganga
Brahmani
Dhenkanal
Kendrapara
Mahanadi
Cuttack
Bhubaneshwar
Puri
Chilka Lake
1187
1384
BAY OF BENGAL
INDIAN OCEAN

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CHAPTER 1 : EXECUTIVE SUMMARY

1.1 Project Background and Basic Idea

1.1.1 Project Background and History

1) Economy and Industry in General

Industry in Bangladesh is still dependent on agriculture, which employs 60 % of the working population. The country's Gross Domestic Product (GDP) in 1992 was US$ 190, ranking it among the poorest countries in the world. As a consequence, reliance on foreign aid and assistance is chronic. Some factors considered to be the reason for retarded industrial development are:

- Unstable political situation which results in massive demonstrations (Hartal) from time to time
- Frequent flood devastation damaging the Dacca and Chittagong area
- Limited natural resources
- Insufficient infrastructural services

In order to overcome and cope with such economic difficulties, the government of Bangladesh has established the "Fourth Five-Year Plan (1991-1995)" and "Industrial Policy 1991," stressing the importance of industrial development and the creation of jobs.

2) Investment Climate

Since the most effective way to achieve the goal of industrialization was by invitation of local and/or foreign investors, the Bangladesh Export Processing Zones Authority (BEPZA) and the Board of Investment (BOI) were established. Export-oriented and import-substituting industries were especially welcomed. Despite the fact that the number of investments realized during the last 5 years was less than expected, a dramatic increase in the number of companies in the ready-made garment (RMG) industry was prominent (Figure 1-1). This is the result of an availability of an abundant and cheap labor force and the great demand for textile products during the years between 1987 and 1991.

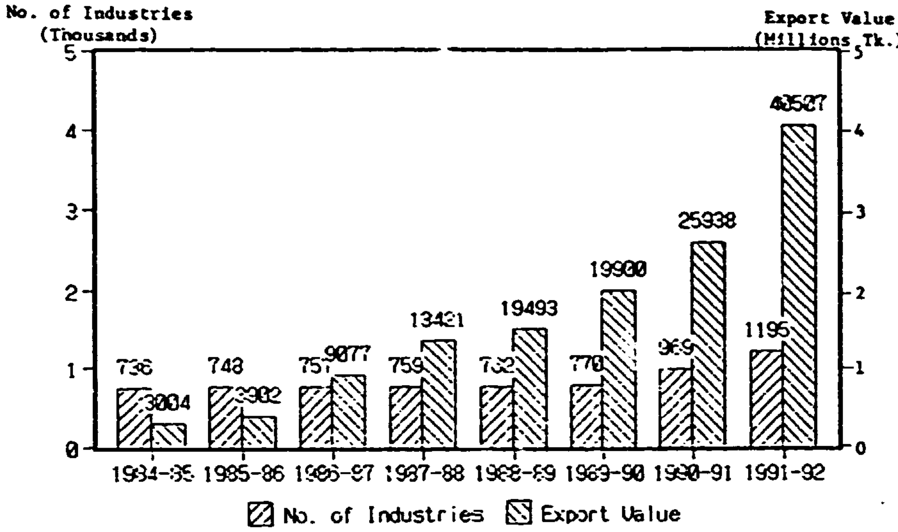


Figure 1-1 : YEARLY DEVELOPMENT OF RMG INDUSTRY

In 1992, garments and apparel exported by the ready-made garment industry accounted for more than one billion US dollars, which was equivalent to 50 % of the total exports of Bangladesh. However, the RMG spent 70 % of its foreign earnings to import raw fabrics because of the unavailability of high quality, domestical-made fabrics. This is the primary reason why this project is being considered.

1.1.2 The Project

1) Project History

This project was conceived four years ago as a joint-venture based spinning mill project by the local sponsor, A. K. Khan & Co., Ltd. The company then asked possible foreign collaborators and international institutions/banks to participate in the project.

In early September 1992, Nichimen Corporation (Japan), Toyobo Engineering Co., Ltd. [TBEC] (Japan), Japan International Development Organization Ltd. [JAIDO] (Japan), and Gabungan Koperasi Batik Indonesia [GKBI] (Indonesia) gathered in Dacca in response to the request of A. K. Khan to hold a so-called "kick-off" meeting. Representatives of the Asian Development Bank and the Bank of Tokyo also attended as observers. An agreement was reached to compile a feasibility study report on the proposed project.

At the end of November 1992, UNIDO's team of consultants, consisting of Toyobo Engineering staff members, visited Bangladesh to carry out the field survey for the preparation of this report.

2) Project Name

The Integrated Textile Mill (ITM) Project in Chittagong, Bangladesh

3) Different Scenarios on Product-mix and Production Capacity

During the field survey carried out in November, 1992, it was agreed that the feasibility of the project should be examined for the following four cases:

(Case 1)

An integrated textile mill with a production capacity of:

- Spinning : 24,960 spindles
- Weaving : 96 Air-Jet looms
- Finishing : 1 line of finishing equipment

Super and/or high quality of broadcloth, gaberdine and poplin fabrics, all 63 inches in width, will be produced.

(Case 2)

An integrated textile mill with the same production capacity as in Case 1. Applicable products, all conventional types of fabrics, 63 inches in width will be produced.

(Case 3)

A spinning mill, producing cotton combed yarn and cotton carded yarn with a spinning capacity of 24,960 spindles.

In view of present depressive conditions of textile market in the world, the only way to make project viable seems to produce super or high quality fabrics such as "Broadcloth" and "Gaberdine."

From the above, Case 1 has been selected for the detailed study throughout this report. The results of the investigation on Case 2 and Case 3 will be shown in Appendix 2 and Appendix 1 respectively for reference.

(Case 4)

In addition, the preliminary meeting held in Dacca in mid-June 1993 with government officials and prospective investors, including financial institutions, suggested that the UNIDO study team investigate the project viability of another project concept, i.e. taking out the spinning operation from Case 1.

This has been done as Case 4 and is attached in Appendix 4.

4) Project Promotors and Sponsors

The following companies, institutions and banks have shown their interest in this project and participated in the aforementioned preliminary meeting.

- A. K. Khan & Co., Ltd. (Bangladesh)
- Nichimen Corporation (Japan)
- Toyobo Engineering Co., Ltd. (Japan)
- Japan International Development Organization Ltd.(Japan)
- Gabungan Koperasi Batik Indonesia (Indonesia)
- International Finance Corporation
- Asian Development Bank
- Asian Finance and Investment Corporatin Ltd. (AFIC)
- Islamic Development Bank
- Commonwealth Development Corporati

1.2 Market Analysis and Marketing Concept

For a new project to become successful nowadays, the corporation or company which the project plans to establish should orient its strategy toward the market under the keyword of "Customer Satisfaction." The customer-oriented marketing concept should be the basis on which the company elaborates marketing strategy to determine what kinds of commodities and services are required to enjoy profits and secure the satisfaction of customers.

1.2.1 Marketing Research

1) Target Markets

According to the findings of the market research and subsequent analytical work, it was concluded that the main targets should be the export garment manufacturers (RMG) in Bangladesh and several selected fabric export markets overseas.

a) Garment Manufacturing Sub-Sector

Supplying materials to the export-oriented RMG industry, the most thriving sub-sector in Bangladesh, is the most urgent national requirement for the textile industry. This is because the domestic RMG industry must import 97 % of its fabrics due to the poor quality of domestically produced fabrics. For this reason, establishing a new company to produce high-quality fabrics will provide "backward linkage" to the existing RMG industry. This market will be the primary target of this project.

b) Fabric Export Market

The value-added fabrics that the project will try to produce should look for overseas markets for the time being. The primary market should be Japan, which has a large demand for high-qulity, sophisticated fashion items. One of the major Japanese trading houses, a proponent of this project, has shown an interest in buying back a considerable portion of the fabrics produced in the project.

The second market should be Indonesia. There is a possibility that the Indonesian proponent of this project would import some fabrics into Indonesia for garment production.

And the third market would be southeast Asian countries, such as Philippines, Malaysia, Singapore and Sri Lanka, where fabric availability is relatively low.

Details of the survey on the fabric requirements of the export-oriented RMG industry can be seen in Appendix 3.

2) Analysis of Competition

According to the "Statistical Pocket Book of Bangladesh 92," the supply-demand relationship of fabrics in Bangladesh is illustrated as follows:

mill-made local fabric production	:	69 million m
+) fabric production by other sectors	:	984 million m
+) imports of fabric	:	92 million m
-) exports of cloth	:	12 million m
Net available fabric for consumption		1,133 million m

The actual supply from local production is said to be 950 to 960 million meters. At any rate, the supply and demand gap is filled by imports.

On the other hand, the yarn requirements of the woven and knitted fabric production sectors are estimated at around 100,000 tons. The present production of yarn is regarded to be about 85,000 tons. This shortage is also complemented by imports.

It was concluded that the existing industrial units cannot become threatening competitors vis-a-vis the project due to their domestic-oriented marketing policy and their technical constraints, as follows:

- Equipment catering to the production of exportable quality goods cannot be found.
- Equipment is extremely obsolete and lacks technical control.
- The quality is very low because of the lack of a quality control mindset.
- Yarns of good quality are difficult to obtain in the local market.
- The entrepreneurs are content with local transaction profits only, with no sense of competiting with foreign rivals and an unwillingness to sell the products to the RMG industry.

As for the existing finishing factories, they are unlikely to supply materials catering to the export garment industry due to the technical constraints related to finishing quality, color fastness and color matching.

As for newcomers to the textile industry, it is reported in the World Bank study that 15 new spinning units with approximately 300,000 spindles are coming on line. Many new finishing units are also reportedly planned, which will use the grey fabrics imported on a bonded warehouse basis. Such newcomers may become more or less competitors of the project.

3) Fabric Demand Forecast

The fabric demand of the export-oriented apparel manufacturers (RMG) is not included in the present demand and supply situations in 2) above. It is their fabric requirements, which are presently met only by imported fabric, that make up most of the projected future demand for the project's products.

The present annual demand for fabrics by the garment sector is estimated at 900 million meters. If it is possible to supply all the demand of this sub-sector, replacing the imported fabrics, a large market of 900 million meters will open up to the Bangladesh fabric manufacturers. The annual growth rate projected is assumed to be 18 %, half of the actual growth rate of 36 % (the average of the period from 1987/88 to 1991/92). A forecast of woven fabric demand by the garment sector is estimated to be 1,062 mil. meters (1992/93), 1,253 mil. meters (1993/94) and 1,478 mil. meters (1994/95) respectively.

1.2.2 Marketing Concept

On the basis of marketing analysis findings, the basic strategy or objectives of the project will be as follows:

- to set up a composite textile mill, laying emphasis on the dyeing and finishing process and downscaling spinning and weaving processes
- to promote the growth of RMG manufacturers by supplying them with the fabrics they need
- to contribute to the economic development of Bangladesh by creating new employment
- to cooperate with the government's backward linkage policy for the RMG industry
- to contribute to Bangladesh's industrialization policy through investment
- to be a model in the textile industry in Bangladesh, and thus attract investment by local and foreign investors
- to stimulate regional economic activity by establishing the plant

1) Marketing Strategy

The marketing strategy of the project developed within the framework of the project strategy is summarized as follows:

(1) aiming at the ready-made garment manufacturers (RMG)
(2) differentiation policy under the market expansion strategy
(3) 100% export-oriented company privileged to import yarn and other inputs duty-free under bonded warehousing
(4) high quality oriented

2) Marketing Mixes

a) Product Mix [Case 1]

The study hereafter was carried out on the basis of the product mix under Case 1 as aforementioned. The annual production volumes at full production are as below :

- Cotton broadcloth	359,800 m/month
(bleached, dyed and yarn-died)	(4,317,600 m/year)
- Cotton gaberdine (dyed)	264,200 m/month
	(3,170,400 m/year)
- P/C poplin	1,876,000 m/month
(bleached, dyed and yarn-died)	(22,512,000 m/year)

b) Price Policy

(1) P/C poplin

- Penetrating price policy:
  to rid the market of imported cloth, underquoting from the outset

(2) Cotton broadcloth/gaberdine

- Overlaid price policy combined with differential price policy;
  to fix an image of a high price, quoting a high price at the beginning and then lowering that price on allowing the price to fluctuate in accordance with market situations by adopting a differential price policy (discount and other sales incentives)

c) Distribution Policy

The sales channels which the project should adopt are direct sales to the selected users (garment makers) and through selected wholesalers. And for the sake of a smoothly functioning distribution channel system in the future, establishiment of a sales firm and construction of a vertical channel system should be taken into account. The sales firm serves as the core of this channel system, coordinating the product flow through the channel members.

d) Promotion Mix

The sales promotions which the project should adopt as an effective promotion mix are:

- internal sales promotion
- sales promotion for sales agents
- sales promotion for users

In addition, direct sales by salesmen will also contribute to the effectiveness of the promotion mix.

1.2.3 Marketing Costs and Revenues

The marketing costs for the project and sales revenues in the normal operation are as follows:

[marketing costs (fixed costs)]

- labour costs	US$ 9,300	(local cost)
- other costs	49,200	(")
(travel/advertising/ dealer helps/samples, etc.)	67,000	(foreign cost)
total	US$ 125,500	

[sales revenue]

	1st year	2nd year	3rd year
- cotton broadcloth	1,264,000m	3,886,000m	4,318,000m
- cotton gabardine	1,015,000m	3,090,000m	3,170,000m
- P/C poplin	17,630,000m	23,164,000m	22,512,000m
sub-total	19,809,000m	30,140,000m	30,000,000m
unit price	@1.496	@1.752	@1.787
amount	US$29,634,260	US$52,805,280	US$53,610,000
- cotton waste	97,000kg	268,000kg	268,000kg
unit price	@0.39	@0.39	@0.39
amount	US$ 37,830	US$ 104,520	US$ 115,050
total amount	US$29,672,090	US$52,909,800	US$53,725,050

Since the unit price varies to a great extent among different products, the above unit price is a weighted average value and the details are discussed in Chapter 3.

1.3 Raw Materials and Supplies

1.3.1 Raw Cotton

Raw cotton will be the main raw material used in this project. In Bangladesh, cotton from the U.S., Pakistan, Sudan, Russia, and Egypt is used at present.

The spinning department manufactures 910 tons of cotton combed yarn Ne 80/2 per year. As the ultimate use will be in the RMG industry for exporting finished textile goods, quality is naturally given the highest priority in the yarn stage as well. As the quality of the raw cotton directly affects the quality of the yarn, it is indispensable to purchase raw cotton of a good quality, which is compatible with the yarn, through reliable dealers. Also, in order to manufacture yarn of a stable and consistent quality throughout the year, several kinds of readily procurable raw cotton should be blended and used.

For producing high quality yarn of Ne 80, the following values for the major characteristics of raw cotton should be maintained :

- staple length : 1-7/16"
- micronaire degree : 3.8 - 4.3

- Pressley strength : 105.000 psi

1.3.2 Yarns and Grey Cloth

1) Yarns

The raw material for the weaving department will be yarn which will be supplied either from the spinning department or outside. In this project. the spinning department will supply only combed yarn Ne 80/2 (5.019 bales/year) for cotton broadcloth ; therefore. it will be necessary to purchase combed yarn Ne 60/2 (4.671 bales/year) and polyester cotton blended yarn Ne 45 (3.279 bales/year) in order to manufacture cotton gaberdine and P/C poplin. At present. export-quality yarns of both Ne 45 and Ne 60/2 are easily purchased from Pakistan and southeast Asian countries at an economical price.

The minimum quality standards needed for this project are as follows:

- U % to be less than 12.8 for polyester/cotton blended yarn Ne 45
- No unevenness of twist for combed yarn Ne 60/2

Some of the yarns shall be dyed by the yarn dyeing machine in the finishing department prior to weaving. as follows:

- yarn (internal yarn) to be dyed: 1.804 bales out of 5.019 bales/year
- yarn (imported) to be dyed : 3.279 bales out of 7.950 bales/year

2) Grey Cloth

Grey cloth shall be utilized as a raw material for the dyeing and finishing department. In this project. only grey cloth of P/C poplin (19.4 million meters/month) shall be purchased from outside. Although it seems to be possible to procure high quality cloth of this class cheaply from neighboring Asian countries (for example. Indonesia and Korea). an appropriate system for checking the quality of imported fabrics will be necessary for this project.

3) Auxiliary Materials

Auxiliary materials are readily available from many places. so the decision of whether to procure them from local or foreign markets will be based on the cost. quality and stability of supply.

1.3.3 Cost of Raw Materials and Supplies (in the 5th year of operation)

1) Raw Materials (foreign)

	Q'ty	Unit price	Amount
			US$1.000
raw cotton	1.206 tons	2.094	2.525
returned waste	-295 tons		-115
yarn	7.950 bales		9.892
grey cloth	19.365.000 m	0.656	12.703
total			US$25.005

2) Other Raw Materials

sizing material	US$ 204.000	(foreign)
chemicals/dyestuffs	2.624.000	(foreign)
packing materials. etc.	654.000	(local)
water treatment material	154.000	(local)
total	US$ 3.636.000	

3) Energy Costs (local)

electricity	US$ 1.517.000
natural gas	1.395.000
water	3.000
total	US$ 2.915 000

4) Spare Parts

foreign	US$ 660.000
local	252.000
total	US$ 912.000

1.4 The Location. Site and Environment

1.4.1 The Location

In addition to the geographical position and level of industrialization. the most suitable location for this particular project was considered to be in the Chittagong area for the following reasons:

- Chittagong is a main port city and is convenient for importing and exporting.
- RMG industries which use high quality imported fabrics as raw materials. and which would be the primary customers. are located mostly in this area.
- A. K. Khan Group. a local proponent of the project. has had a strong business

foundation in this area since its establishment in 1945. They have also suggested Chittagong as the best location for the project.

1.4.2 The Site

1) Method of Site Selection

The site was chosen based on a comparative value analysis method.

This analysis was carried out in the following order:

- Step 1 : Preliminary selection
- Step 2 : Detailed evaluation
- Step 3 : Recommendation

2) Site Selection Process

During the field survey, three prospective sites were proposed by the local partner as follows:

- Harban
  Remote country location, 60 km south of Chittagong
- Mazirchar
  South of the Karnaphuli River and between the KAFCO and CUFL mills
- A. K. Khan's STM site
  In the hub of the city, south of A.K. Khan's existing spinning and jute mills

In the course of Step 1, Harban was eliminated and thereafter, in compliance with a strong request by the Chairman of BEPZA, the area in the EPZ was added. Since the present EPZ is fully occupied, Phase 2 development of the EPZ will take place in the near future south of the Karnaphuli River. Therefore Step 2, the detailed evaluation, was carried out by comparing three prospective sites, i.e. Mazirchar, A.K. Khan's STM and the EPZ. The EPZ scored the highest marks in the value analysis, and is therefore recommended in Step 3 as the most suitable site for the project. Figure 1-2 graphically indicates the outcome of the value analysis of the sites.

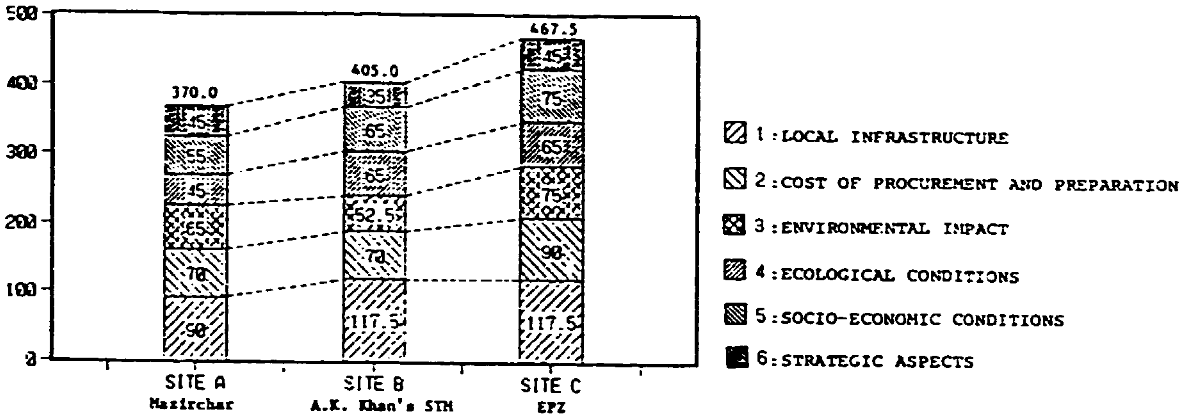


Figure 1-2 : RESULTS OF SITE SELECTION

3) The Site Selected for the Study

In spite of the aforementioned favorable assessment of the EPZ (Phase 2). A. K. Khan's STM site was selected for the sake of this report since the implementation plan of EPZ (Phase 2) has not been clearly indicated by the Government.

1.4.3 Environmental Study

The government of Bangladesh set up its first environment-related regulations in 1991, which were called the "Environmental Quality Standards (EQS) for Bangladesh."

Textile industries generally generate few pollutants, with the exception of dyeing mills from which large quantities of colored water are discharged. It is also necessary to pay some attention to air pollution from exhaust gas from boilers and power generators. Therefore, these two factors, i.e. industrial effluent and exhaust gas, were especially scrutinized during the field survey. Taking the above into account, the environmental impact on the surrounding area was studied, assuming that this project will be established at A. K. Khan's STM site. The environmental impact will be minimal even in the case of the EPZ (Phase 2), because the area is less developed and human habitation is still limited.

1) Industrial Effluent

Approximately 3,000 m^3/day of effluent would be discharged from the dyeing mill. The basic concept for designing the effluent treatment plant is to avoid sophisticated and complicated systems as much as possible considerating the unavailability of necessary chemicals in the local market and the difficulties of maintaining such systems. It is also important to maintain the quality of the treated water at much higher standards than those specified in the EQS.

From the above, the following systems were adopted in the study:
- biological oxidation treatment to reduce BOD and COD
- coagulation reaction treatment for decoloring

Figure 1-3 shows the processing flow chart of the effluent treatment plant for the project, and Table 1-1 indicates the comparative figures of the estimated water quality among the untreated water, the treated water, the present quality of the receiving ditch, the assumed quality of the receiving ditch after mill operation, and the EQS.

Table 1-1 : ESTIMATED WATER QUALITY

	Q1	Q2	Q3	Q4	Q5
pH	9 ~ 12	6 ~ 9	6 ~ 9	6 ~ 8	6 ~ 9
BOD mg/l	600 ~ 800	40 ~ 60	250	80 ~ 120	50 ~ 70
CODmn mg/l	700 ~ 900	100 ~ 140	400	60 ~ 100	90 ~ 110

(Remarks)

Q1 : Estimated effluent quality from the new mill (before treatment)

Q2 : Estimated water quality from the new mill (after treatment) : 3,000m^3/day

Q3 : Allowable water quality under "EQS"

Q4 : Water quality of the present ditch near the site : 500m^3/day

Q5 : Estimated water quality of the ditch after receiving the treated effluent from the new mill : 3,500m^3/day

From the comparison between Q4 and Q5 in the above table, the following are observed:
- BOD : To be slightly improved
- COD : To be slightly worsened
- Color : No change

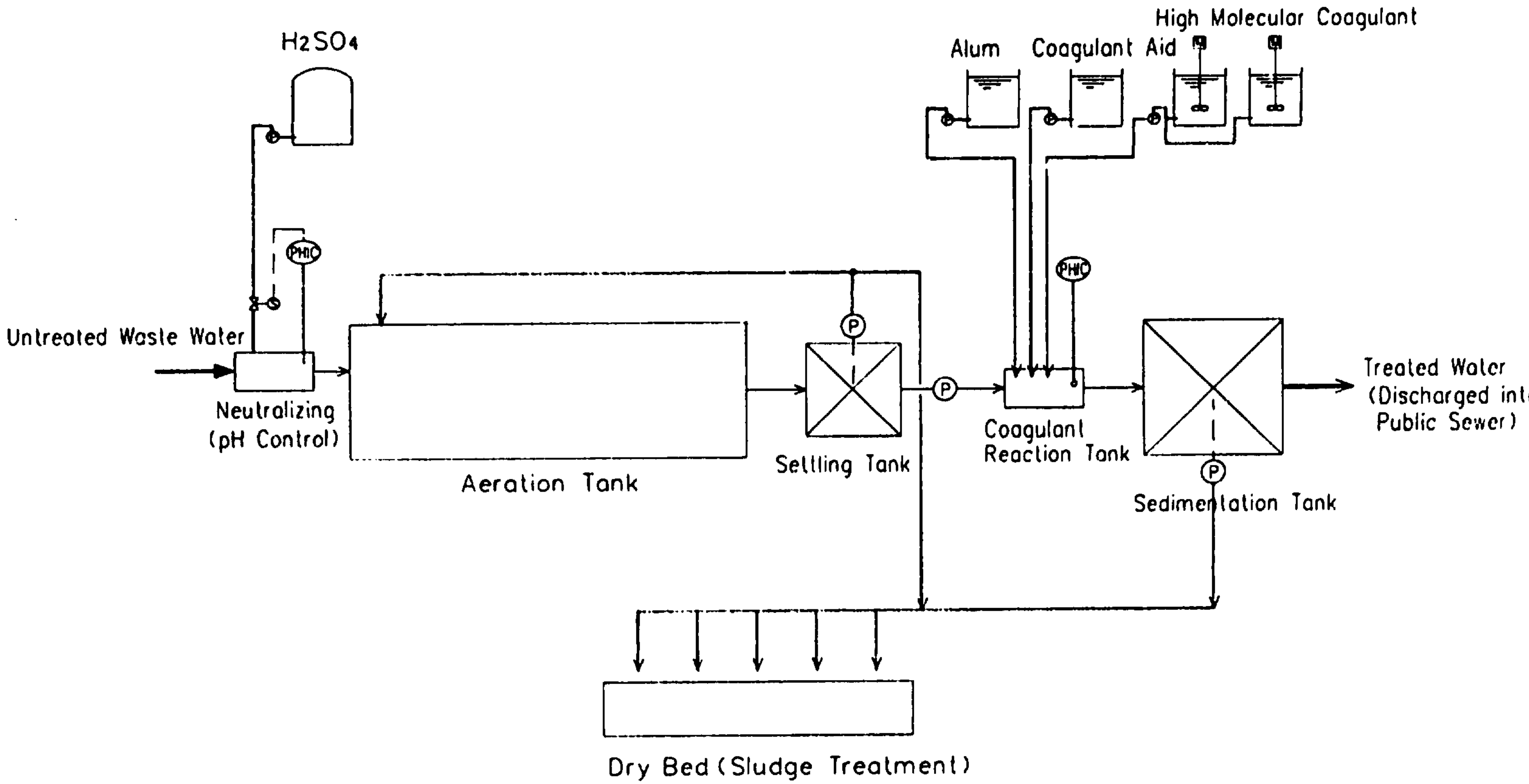


Figure 1–3 : PROCESSING FLOW CHART OF EFFLUENT TREATMENT

2) Exhaust Gas

Natural gas shall be used as a heat source for the plant. Since the quality of Bangladeshi natural gas is very good, exhaust gas from the plant should generate very little pollutants, and the concentration is much less than the allowable value specified in the EQS

1.5 Engineering and Technology

1.5.1 Outline of Production Program and Plant Capacity

1) Basic Concept

In this project, each production process has been planned and designed under the following four basic concepts in order to set up a new integrated textile mill for spinning, weaving, and dyeing and finishing processes.

a) The final products planned here should be aimed at the world market.

b) Machinery and equipment currently best suited to the conditions and environment of Bangladesh should be adopted.

c) The machinery and equipment should be selected so as to create maximum efficiency and smooth material flow.

d) The production capacity among processes should be balanced and able to respond flexibly to periodic fluctuations in economic conditions.

2) Production Program and Product Mix

The dyeing and finishing department's production plan and product mix, as well as the production plan and product mix for the intermediate products (which include the purchased textiles for the dyeing and finishing department and the purchased yarn for the weaving department) are shown in Table 1-2. Figures appearing in this table combine production capacity and raw material requirements at each stage.

Figure 1-4 indicates graphically the proportion of final products to be produced by the dyeing and finishing department of the mill.

3) Overall Layout

The overall layout of the spinning, weaving, and dyeing and finishing departments is shown in Figure 1-5.

Table 1-2 : PRODUCTION CAPACITY AND RAW MATERIAL REQUIREMENTS AT EACH STAGE

Production Capacity Final Products	Stage III Dyeing & Finishing 30,000 km/y		Stage II Weaving 96 Loom		Stage I Spinning 52 Frame		Raw Materials Procured from Outside
Ne 80/2 Broad 4,318 km/y	2,820 km/y	←	26 Loom	←	34 Frame	←	Raw Cotton 773 ton/y
	1,498 km/y	←	14 Loom	←	18 Frame	←	Raw Cotton 433 ton/y
Ne 60/2 Gaberdine 3,170 km/y	3,170 km/y	←	24 Loom	←			Yarn 4,671 BLS/y
Ne P/C 45 Poplin 22,125 Km/y	3,300 km/y	←	32 Loom	←			Yarn 3,279 BLS/y
	19,212 km/y	←					Fabric 19,366 km/y

Yarn-Dyed   Others

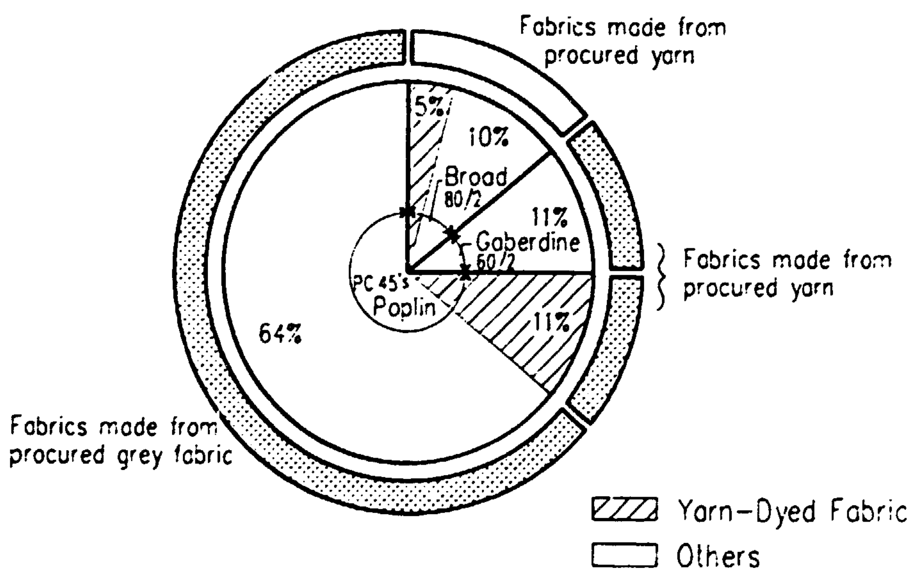


Figure 1-4 : PRODUCTION OF FINAL PRODUCTS AND PROSPECTIVE MATERIALS

1.5.2 Spinning

1) Production Plan

High quality cotton combed yarn Ne 80/2 will be manufactured in the spinning department. The production amount at full production will be 5.019 bales/year.

2) Spinning Machinery and Equipment

In selecting the production machinery, the level of quality control and minimization of the initial investment costs were taken into account. The layout of spinning machinery can be seen in Figure 1-6.

1.5.3 Weaving

1) Production Plan

As the spinning department will be able to supply only 40 % of the yarn necessary for weaving production, the remaining 60% will be purchased. Also, the weaving department will manufacture only 36 % of the dyeing and finishing capacity in production meter. The production plan in the weaving department is as follows:

a) Broadcloth : 4.35 million meters/year by 40 looms (raw yarn comes from internal spinning department)

b) Gaberdine : 3.20 million meters/year by 24 looms (raw yarn to be imported)

c) P/C poplin : 3.33 million meters/year by 32 looms (raw yarn to be imported)

2) Weaving Machinery and Equipment

The layout of weaving machinery can be seen in Figure 1-7. In selecting weaving machinery, production efficency and quality of purchased yarn are particularly taken into account.

1.5.4 Dyeing and Finishing

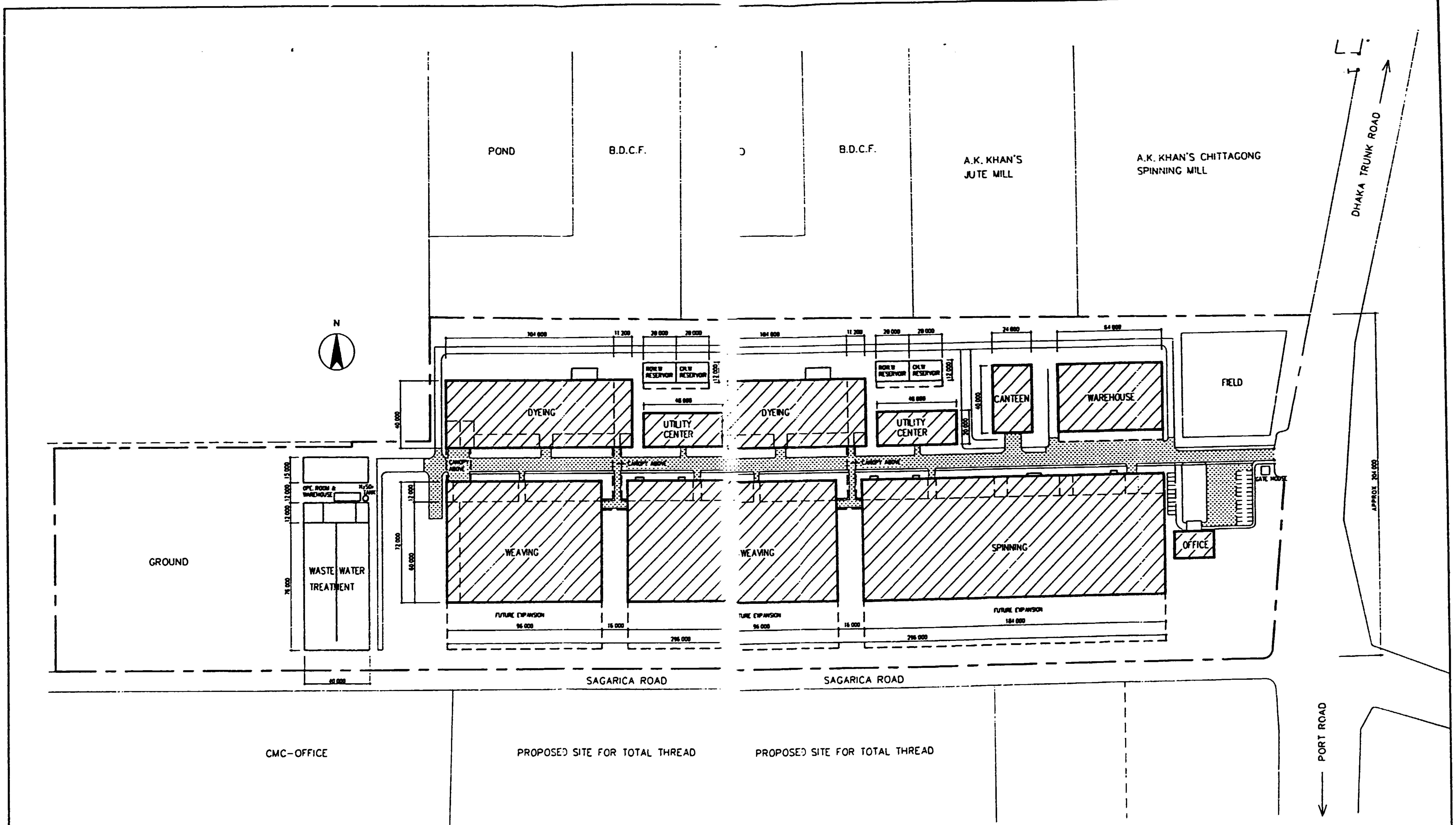
1) Production Plan

Overall views of the production plan and the product mix can be seen in Table 1-2 aforementioned.

2) Dyeing and Finishing Machinery and Equipment

The layout of dyeing and finishing machinery is shown in Figure 1-8.

Machinery was selected to enable stable operation at high efficiency. The ability to manufacture high-quality products consistently was also taken into consideration.



SECTION 1

Figure 1-5 : BLOCK PLAN OF Pi ure 1-5 : BLOCK PLAN OF PROPOSED MILL

SECTION 2

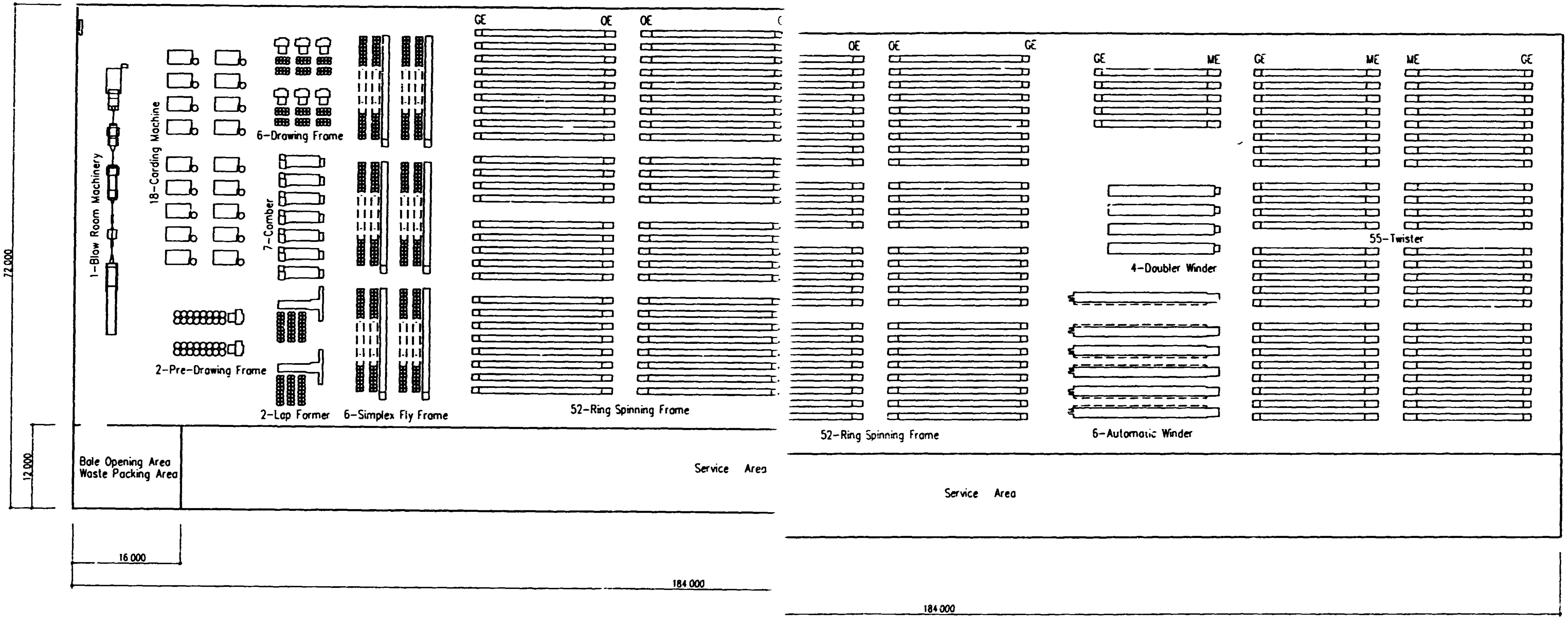
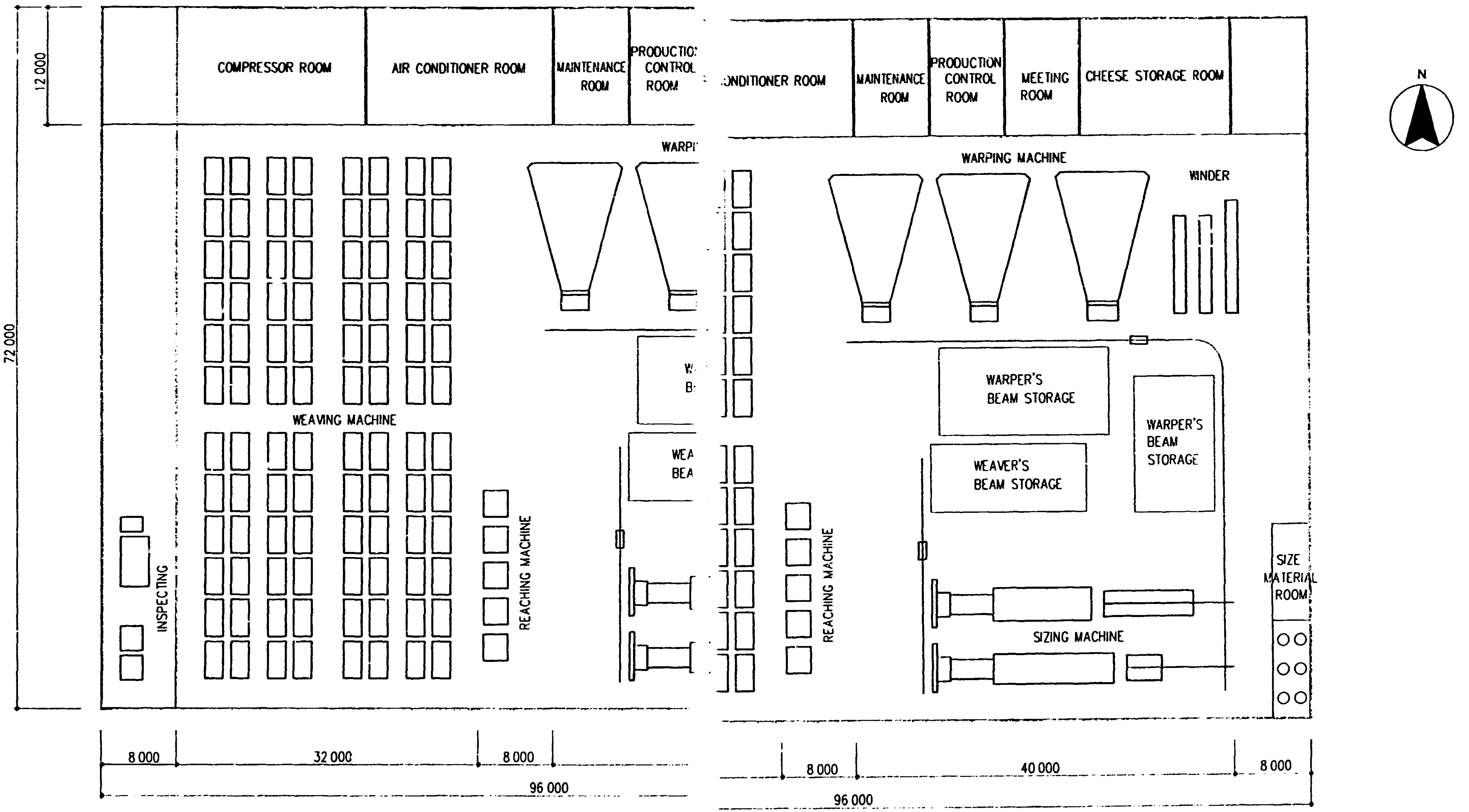


Figure 1–6 : LAYOUT OF PRODUCTION MAC

LAYOUT OF PRODUCTION MACHINERY – SPINNING MILL

SECTION 1

SECTION 2



SECTION 1

Figure 1–7 : LAYOUT OF PRODUCTION MACHINERY - JT OF PRODUCTION MACHINERY – WEAVING MILL

SECTION 2

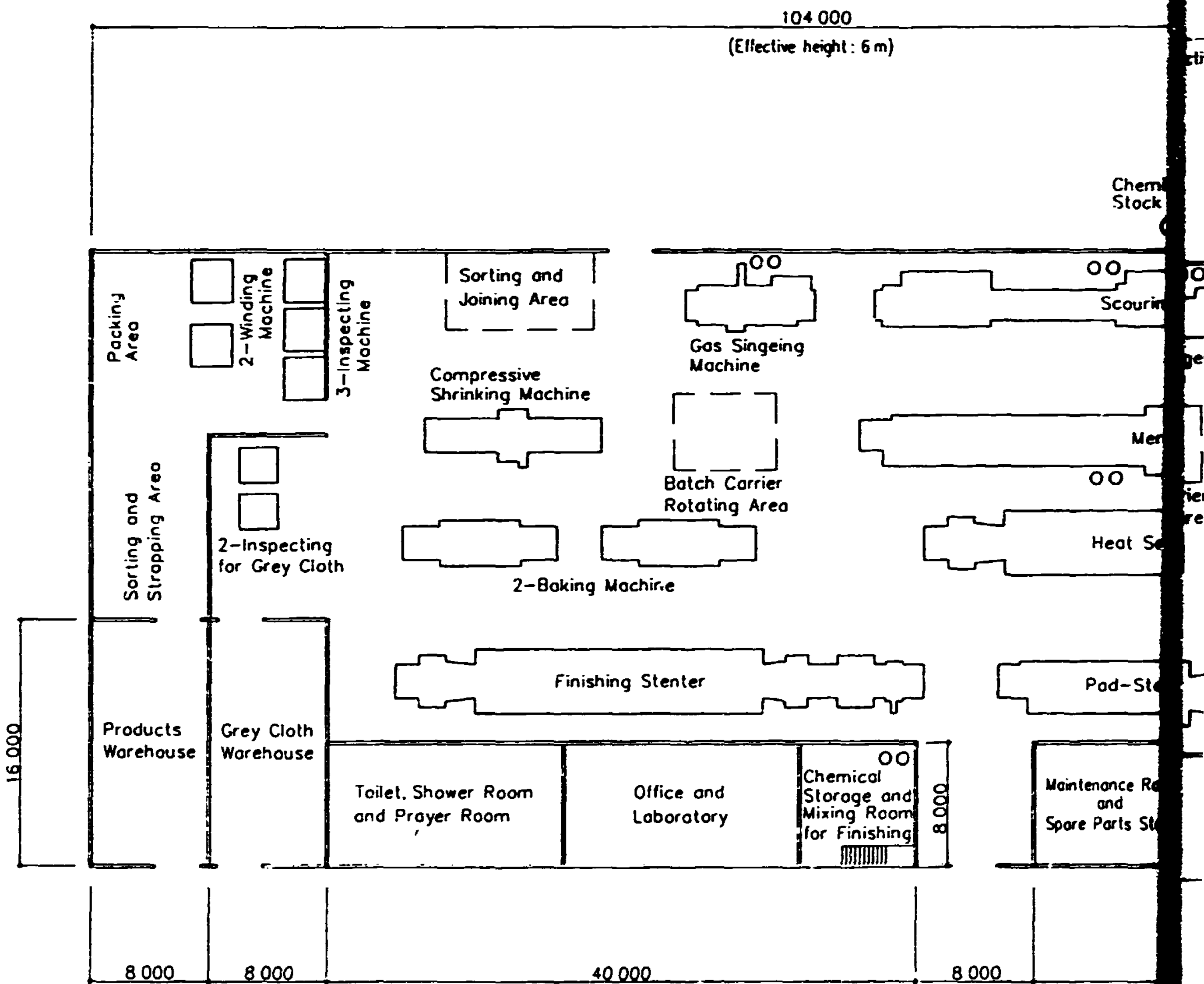
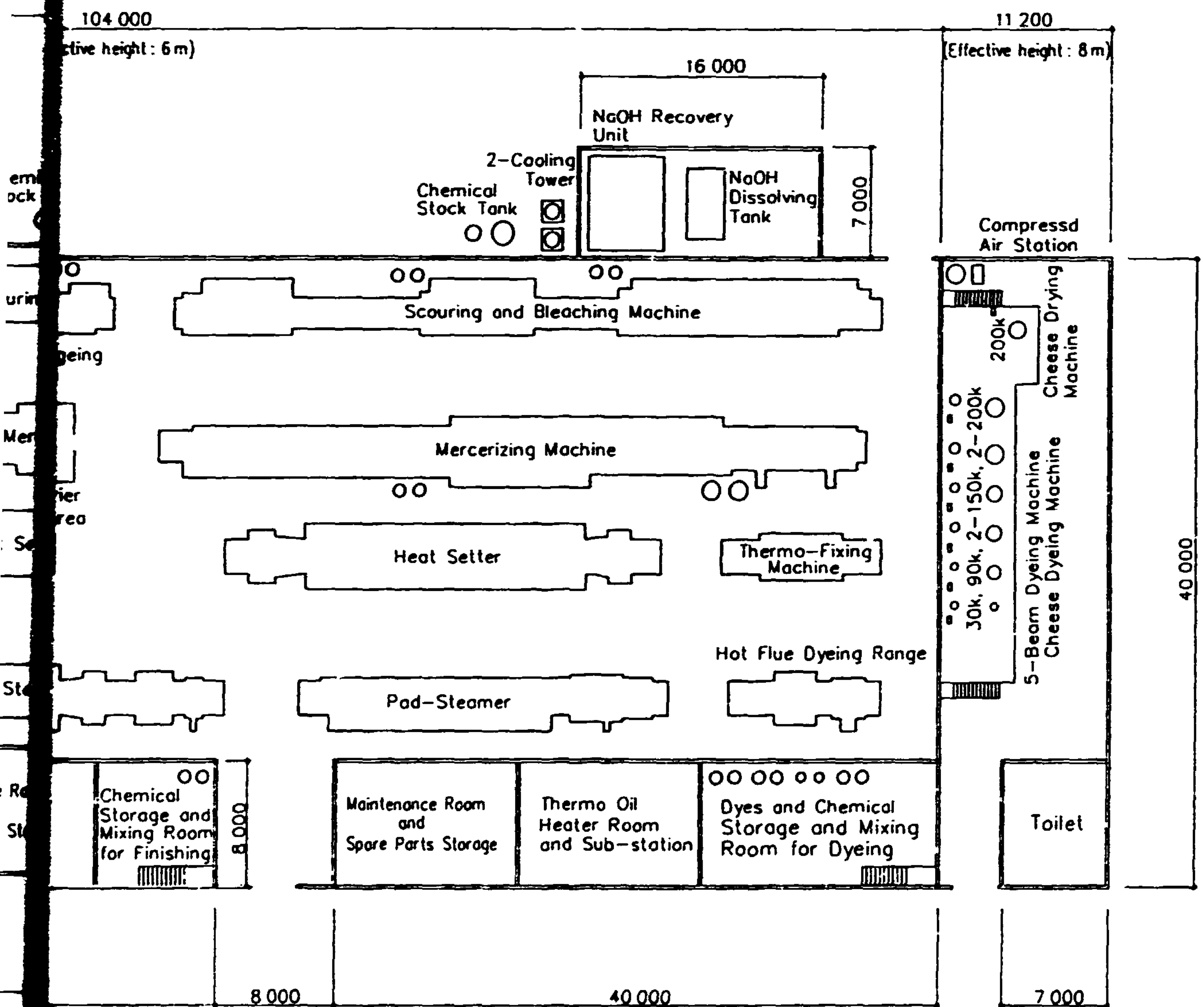


Figure 1-8 : LAYOUT OF PRODUCTION MACHINERY

SECTION 1



OF PRODUCTION MACHINERY – DYEING AND FINISHING MILL

SECTION 2

1.5.5 Electrical and Mechanical Engineering Works

1) Electrical Equipment

The estimated load of electricity required for the new integrated textile mill is shown in Table 1-3.

Table 1-3 : ELECTRICITY LOAD

Department		Demand kw	Mean of Load kw
Spinning	Summer Winter	3,853 3,145	3,651 2,988
Weaving	Summer Winter	1,453 1,226	1,380 1,165
Dyeing	Summer and Winter	1,156	1,050
Total	Summer Winter	6,452 5,527	6,071 5,193

The gas engine power generation equipment, using natural gas, will be used together with electricity from the BPDB (Bangladesh Power Development Board). The load sharing between power reception from BPDB and in-house power generation is shown in Table 1-4.

The BPDB power reception system and the power generation system are normally run separately. In view of decreasing the running costs, maximum use of generated power is recommended.

Table 1-4 : ALLOTTED ELECTRICITY LOAD

Department	Season	BPDB's Power kw	In-house Generation kw
Spinning	Summer Winter	3,843 3,145	Chiller 660 Production 700
Weaving	Summer Winter	Nil Nil	1,226+230 (Chiller) 1,226
Dyeing	Summer Winter	Nil Nil	1,156 1,156
Total	Summer Winter	3,843 3,145	3,272 3,082

2) Air Conditioning Equipment

Employment of air conditioning equipment in both the spinning and weaving departments is essential for maintaining a constant relative humidity and temperature. Improvement of the working environment by air conditioning is another advantage.

The design conditions of air conditioning are as follows:

a) Air conditioning in the spinning mill

- Pre-spinning	max. 30 ℃	RH 60 %
- Ring spinning	max. 31 ℃	RH 55 %
- Winder	max. 29 ℃	RH 65 %

b) Air conditioning in the weaving mill.

- Warper room	max. 30 ℃	RH 64 %
- Air jet loom	max. 29 ℃	RH 68 %
- Inspecting room	max. 31 ℃	RH 60 %

3) Other Mechanical and Electrical Equipment

In addition to the aforementioned equipment, a large quantity of additional mechanical and electrical equipment is required for the project. All of these are listed in Section 6.5, Chapter 6.

1.5.6 Civil Engineering Works

The necessary civil and building works are as follows:

a) Site preparation work
- Soil test
- Reclamation of the land
- Demolition of existing buildings
- Site levelling

b) Building construction works

A total built-up area of 30,198 m^2 will be needed for construction, including 13,248 m^2 for the spinning mill, 6,912 m^2 for the weaving mill and 4,608 m^2 for the dyeing and finishing mill.

c) Civil works related to mechanical and electrical work

Machine plinth, air conditioning chamber, etc.

d) External work

Fencing, paving, etc.

1.5.7 Fixed Investment Costs

A summary of fixed investment costs, excluding pre-operational expenses, is shown in Table 1-5.

Table 1-5 : SUMMARY OF FIXED INVESTMENT COSTS

Unit : 1,000.US$

Department	Investment Cost			Reference
	Foreign	Local	Total	
Land, Site Preparation, Development				
Land		3,088.7	3,088.7	
Site Preparation and Development		398.3	398.3	Table 6-36
Sub-Total		3,487	3,487	
Buildings and Civil Works				
Building Construction Works	2,268.6	5,814.1	8,082.7	Table 6-36
Civil Works		705.0	705.0	-ditto-
External Works		83.0	83.0	-ditto-
Provisional Sum		440.0	440.0	-ditto-
Sub-Total	2,269	7,042	9,311	
Auxiliary and Service Facilities				
Utility	11,851	981	12,832	Table 6-35
Environmental	355	454	809	Table 5-11
Sub-Total	12,206	1,435	13,641	
Incorporated Fixed Assets				
Office Equipment		391	391	Table 6-37
Plant Machinery and Equipment				
Spinning	18,135		18,135	Table 6-32
Weaving	9,789		9,789	Table 6-33
Dyeing and Finishing	10,262	13	10,275	Table 6-34
Sub-Total	38,186	13	38,199	
Total	52,661	12,368	65,029	

1.6 Organization and Overhead Costs

1.6.1 Organization

The ideal organizational system of any company is always simple, with all personnel having a clear understanding of the responsibilities and authority of each personnel. In order to be nearer to this ideal concept, it is important to employ an open communication system, a two-way decision-making system (top-to-bottom and bottom-to-top), as well as to introduce of TQC (Total Quality Control) giving some incentives to those who achieve the targets. Under the above-mentioned philosophy, the company's organization is divided into three departments, i.e. Administration, Sales/Marketing and Production, headed by their respective directors. It is also necessary, in view of the technological status of the Bangladeshi textile industry, to employ some expatriate staff in the Production Deparment to supervise and train local employees for some time after start-up. However, the number of expatriate staff should be gradually reduced once the transfer of technology has been completed.

The recommended organization of the new company to be established on a joint-venture basis is shown in Figure 1-9.

1.6.2 Overhead Costs

In general, overhead costs of a company are grouped into a) administrative overhead costs and b) factory overhead costs, which arise in connection with the operation of the company. However, the amount of overhead costs seems to be insignificant and accounts for only a small percentage of the total production costs. The estimated overhead costs for the 5th year of operation are as follows:

[Factory Overhead]

indirect labour US$ 55,000 (local)

The wages for personnel of the utility/electricity division (indirect fixed costs) are appropriated as factory overhead cost.

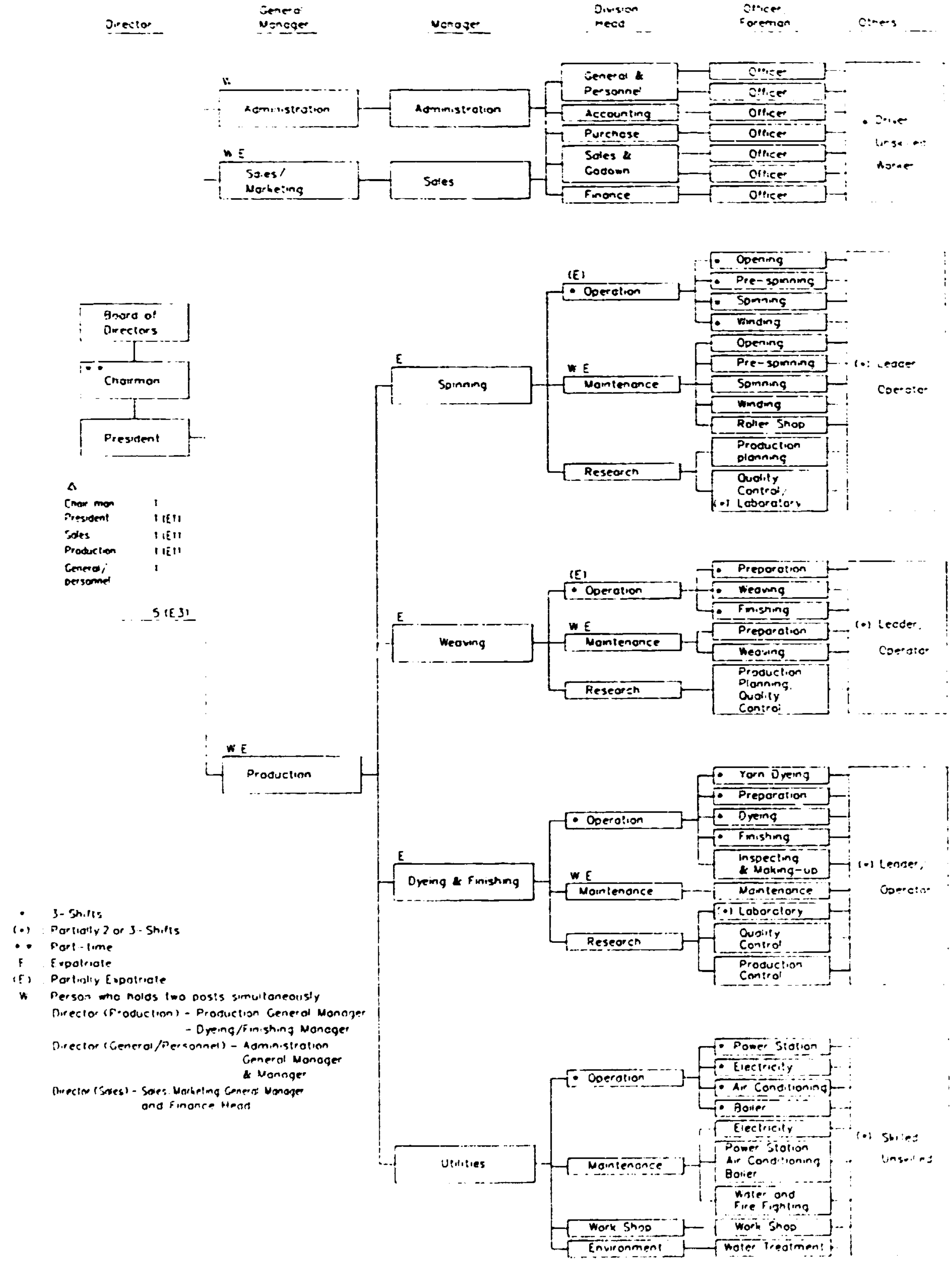


Figure 1-9 : COMPANY ORGANIZATION

[Administrative Overhead]

- management costs (3 expatriate directors/ 5 exp. managers/2 exp. division heads)		US$ 1,008,000	(foreign)
- administrative labor		20,000	(local)
office	20,000		
- administrative non-labor		19,000	(local)
office supplies	5,000		
utility/transport	2,000		
communication	2,000		
property insurance	2,000		
property tax	8,000		
total		US$ 1,047,000	

[Marketing Overhead]

- marketing labor	US$ 9,300	(local)
- marketing non-labor	67,000	(foreign)
(costs for training/travel/ advertising/dealer helps, etc.)	49,200	(local)
total	US$125,500	

Management costs for expatriate directors/engineers are earmarked as administrative overhead costs because the upper limit of wages per person is fixed by Bangladesh law.

1.7 Human Resources

Bangladesh has a population of more than 110 million, with an unemployment rate of 1.2 %, according to The Statistical Pocket Book 1992. Since the country is based on agriculture, the actual unemployment rate seems to be much higher, and cheap labor is abundantly available. This is a primary reason why foreign entrepreneurs for labor-intensive industries find investment in this country attractive.

The project will require more than 1,100 employees, including approximately 110 at the level of a foreman or higher. No problem has been observed in recruiting this number of employees, but the question will be their qualifications. In order to cope with this problem, it will be necessary to employ an appropriate training scheme performed by training experts. This will be crucial for consistently producing top and/or high quality fabrics.

The recruiting of the necessary personnel must start soon after the establishment of the new company. The number of employees, including managerial staff, will reach 349 at the end of the construction period and increase up to 1,105 by the time full operation commences. Details of the recruiting schedule are shown in Table 8-5, Chapter 8.

The salaries of division heads, formen and skilled/unskilled workers are earmarked as direct labor costs. Managers and some division heads of the direct division are supposed to be expatriates and their salaries are earmarked as overhead costs. Direct labor costs in a normal year of operation is as follows:

wages for spinning	376	persons	US$ 219,900
" " weaving	267	"	156,540
" " dyeing/finishing	354	"	212,520
total	997	"	US$ 588,960

1.8 Implementation Schedule

1.8.1 Project Implementation

Project implementation is categorized into three groups as follows:

- Stage 1: Company formation and initial project management
- Stage 2: Construction period at site
- Stage 3: Official operation period

An overall view of the implementation schedule can be seen in Figure 1-10.

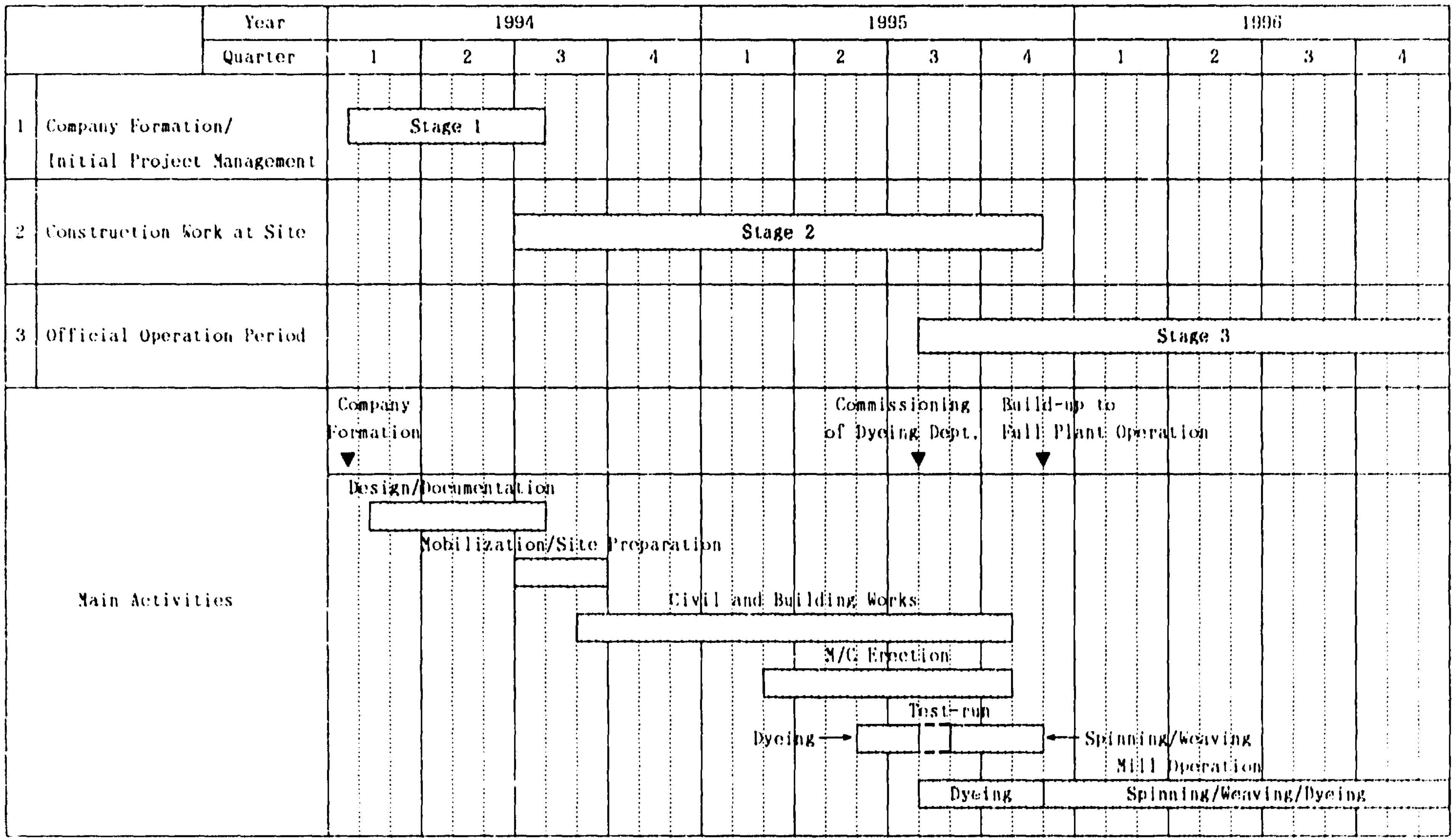


Figure 1-10 : OVERALL VIEW OF PROJECT IMPLEMENTATION SCHEDULE

This schedule was prepared based on the following assumptions :

a) The basic agreement to establish the new company is to be concluded by the end of 1993.

b) BEPZA or BOI's investment approval is to be obtained within a month of investment application.

c) Site acquisition is to be completed by the end of April 1994.

d) There will be no abnormal weather which would adversely affect the smooth progress of the civil works.

1.8.2 Implementation Budget

The summary of the budget necessary for the project's implementation is as follows (unit: US$ 1,000) :

	foreign	local	total
management fees and administrative expenses	508.8	37.0	545.8
pre-study cost	120.0		120.0
consulting/engineering fee	2,196.0	46.3	2,242.3
erection cost	900.0	125.5	1,025.5
raw materials for test run	294.4		294.4
other pre-operational expenses		75.0	75.0
Subtotal	4,019.2	283.8	4,303.0

1.9 Summary of Financial Evaluation

1.9.1 Basic Conditions for Financial Calculations

The following are the basic conditions and criteria applied in financial calculations.

a) Currency exchange rate
US $ 1.0 = J. Yen 125.0 = Taka 40.0

b) Construction start and duration
1994, two years

c) Project life
15 years

d) Loaning conditions
- Local loans
  * interest : 12 % per annum
  * grace period : 2 years
  * repayment : yearly, 10 years
- Foreign loans
  * interest : 10 % per annum
  * grace period : 0 year
  * repayment : yearly, 10 years

e) Depreciation
Straight line method

f) Dividends
Dividends will be deferred until the accummulated net cash flow figures show a surplus in the 5th year of operation. The rate is 20 % of net profit.

g) Tax and duties
It was guaranteed by the Government that the project can enjoy a tax holiday for 10 years, even if its site is outside the EPZ.

1.9.2 Financial Evaluation

1) Financial Outlook

a) Initial investment

- total investment : US$ 78.57 million

  (1st year : US$ 18.13 ")

  (2nd year : US$ 60.44 ")

- Machinery/equipment accounts for 66% of the total investment amount.

b) Source of finance

- debt/equity ratio : 70/30
- fund raising plan

  1st year : US$ 18.13 million

  2nd year : US$ 60.44 million

- The bank overdraft amounting to US$ 0.426 million in the first year of operation is not earmarked in the equity/loan plan, and it should be financed by an additional equity or through short-term borrowing.

c) Production costs

- US$ 45,123,910 for the 5th year of operation
- raw material costs 55%

raw material costs	55%
depreciation	14%
financial costs	10%
energy costs	7%
other costs	14%
	100%

d) Net income statement

- contribution margin : 40.3 % from 1998 onward
- net profit ratio : over 10 % from 1997

e) Working capital requirement

- US$ 8.7 million

  This working capital requirement (19 % of the total production costs) is high, taking into account the likelihood of inefficient acquisition of raw materials, chemicals/dyestuffs and imported spare parts. This ratio is about two times greater than the working capital requirements of a textile mill in Japan, but it is reasonable for a textile project which will be established in a developing country like Bangladesh.

2) Financial Evaluation

a) Break-even point

- break-even ratio including financial costs : 60.2%

  break-even ratio excluding financial costs : 40.1%

- If a project's break-even ratio is less than 60%, it is recognized as a "safe" project.

b) Debt-service ratio

1 st year	0.94	8 th year	2.38
2 nd	2.68	9 th	2.56
3 rd	1.76	10 th	2.77
4 th	1.86	11 th	2.23
5 th	1.96	12 th	2.39
6 th	2.09	13 th onward	-
7 th	2.22		

- The repayment potential of the project is evaluated as sound.

c) Cashflow analysis

- bank overdraft in operation period (1996)

  US$ 0.426 million

  [breakdown]

sales revenue	US$ 29.672 million
accounts payable	1.643
accounts receivable/ other assets	-3.476
operating costs excld. depreciation	-21.566
principal repayment	-0.962
financial costs	-5.726

This amount should be financed somehow, as aforementioned in 1-b. Financial outlook, Source of Finance.

- Cumulated net cashflow will become positive in the 5th year of operation.

d) Internal rate of return (IRR)

- 19.15 %
- This is acceptable for an industrial project in a country like Bangladesh.

e) Sensitivity analysis of IRR

- 6 % increase in sales : 22.84 %
- 6 % decrease in sales : 15.14 %
- 6 % decrease in operating costs : 21.58 %
- 6 % increase in operating costs : 16.60 %
- 6 % decrease in initial investment : 20.47 %
- 6 % increase in initial investment : 17.95 %
- Reduction in initial investment does not significantly improve the IRR . The sales price will likely be raised in the future and production costs can be curtailed. Therefore, attention should be paid to the sales price and production costs when considering the variator on IRR.

1.9.3 Conclusion of Financial Evaluation

Based upon the aforementioned evaluation, the project can be judged financially sound.

1.10 Conclusion

The project should be implemented in accordance with the basic project design and implementation schedule because :

a) The project is feasible from the financial standpoint.

b) Attractive incentives and full support from the Government should be made available to ensure financially sound operation as assessed in this report.

c) Participation of foreign traders such as GKBI and Nichimen will be strongly recommended in order to secure a firm marketing position for this project's products.

d) The project can enjoy the status of "first one in." Namely, it will be the first modern integrated textile mill in Bangladesh, which would be one of the advantageous aspects of the project.

e) The project will take a leading role in the development of the textile industry in Bangladesh, if it is successfully implemented.

CHAPTER 2 : PROJECT BACKGROUND AND BASIC IDEA

2.1 Country Profile

The People's Republic of Bangladesh lies in southern Asia, surrounded completely by India, except for its southeastern tip which is adjacent to Burma. Its southern coastline faces the Bay of Bengal. The country has a land area of 143,998 km^2 with an estimated population of 120 million. It is one of the most densely populated countries in the world.

Most of Bangladesh is flat, being located in the Hindustan Plains, although there are small hills in the northeast and southeast. The land is generally fertile along the Ganges-Brahmaputra delta.

The principle urban center is Dacca, the capital, with a population of approximately 5 million, followed by Chittagong with 2 million. Bengali is the official language, but English is widely used in government, commerce and industry.

The Ganges delta has a typical monsoon climate with an average precipitation exceeding 2,500 mm annually which falls mainly between July and October.

2.2 Economy and Industry in General

2.2.1 Industrial Policy and the Fourth "Five-Year Plan"

Bangladeshi economic foundation still rests on agriculture. Agriculture, which employs about 60 % of the working population, contributes some 40 % of the Gross Domestic Product (GDP), while the manufacturing industry only accounts for 10 %. Agriculture-related products such as jute and jute products are also used as the principle raw materials in the manufacturing industry. However, a country with an agriculture-based industry has a weak economic foundation since weather conditions have a dramatic effect on national output.

The country's per capita GNP in 1992 was about US$ 190 which ranks it among the poorest countries in the world. The economy of Bangladesh has quite a few serious problems such as high unemployment, a considerable food-population gap, a low tax-GDP ratio, etc., and thus Bangladesh is dependent on foreign aid and assistance. Furthermore, a scarcity of natural resources, with the exception of natural gas, is also a big disadvantage for economic development and self-reliance. The key economic indices, the GDP shares by each sector of industry and the transition of GDP, can be seen in Table 2-1, Table 2-2 and Figure 2-1 respectively.

Table 2-1 : KEY ECONOMIC INDICATORS

Items	1986/87	1987/88	1988/89	1989/90	1990/91
Population (mil.)	105.28	107.76	110.29	113.01	N.A. *
Annual Rise of GDP(%)**	4.2	2.9	2.6	6.6	3.4
Total Imports (CIF mil.Tk)	68,496	91,588	95,075	113,305	111,550
Total Exports (FOB mil.Tk)	33,682	41,161	42,688	51,415	62,711
Balance of Trade (mil.Tk)	-34,814	-50,427	-52,387	-61,890	-48,839
Price Index (1969/70=100)	1,080	1,180	1,241	1,370	1,498
International Reserves (mil.$)	477.3	711.7	845.3	904.9	N.A.
External Debt (mil.$)	8,032	9,892	10,389	10,713	N.A.
Per Capita GNP in Tk	5,459	5,734	5,896	6,472	7,156

(Source : Statistical Bulletin of Bangladesh 1992)

*) N.A. : not available

**) GDP : at constant market price (1985/56)

Table 2-2 : GDP BY INDUSTRY AT CONSTANT (1984/85) PRICES (mil.Tk)

Industry	1988/89	1989/90	1990/91	
1.Agriculture	173,037	190,354	193,421	(37.5%)
2.Mining & quarrying	3	66	80	(0.1)
3.Manufacturing	45,927	49,256	50,423	(9.8)
4.Construction	28,816	29,749	31,087	(6.0)
5.Power, gas, water etc.	4,822	5,561	6,704	(1.3)
6.Transp. and storage	56,611	59,024	60,840	(11.8)
7.Trade services	43,663	44,965	46,707	(9.1)
8.Housing services	36,811	38,030	39,316	(7.6)
9.Public adm. and defence	19,839	20,363	22,334	(4.3)
10.Banking and insurance	9,417	9,523	9,755	(2.0)
11.Miscellaneous services	47,657	50,636	53,775	(10.5)
GDP at constant market price	466,603	497,527	514.442	(100%)

(Source : Statistical Bulletin of Bangladesh 1992)

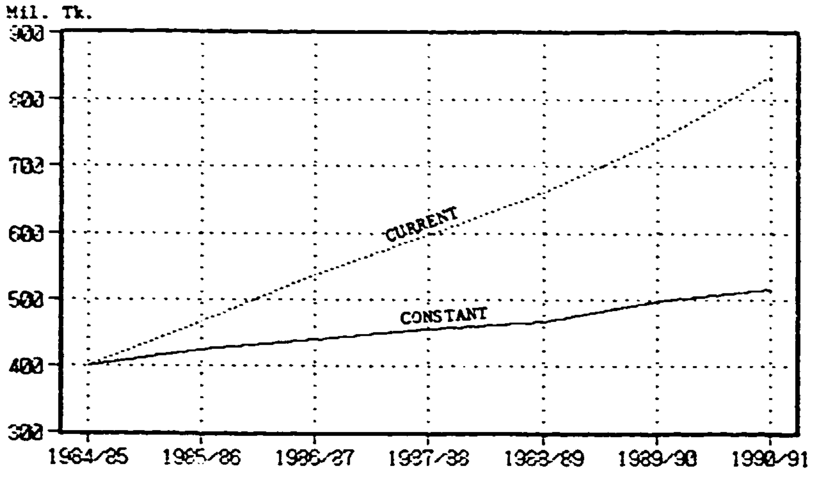


Figure 2-1 : TRANSITION OF GDP

The government of the People's Republic of Bangladesh has been struggling with the aforementioned economic difficulties since its independence in 1971, with little success to date. In order to cope with and overcome the present difficulties, the government established the "Fourth Five-Year Plan," covering the period between 1991 and 1995. It also established the "Industrial Policy 1991," aiming at :

- maximization of the contribution of the industrial sector to the growth of the GDP and total employment generation
- improvement of the balance of payments to achieve self-reliance
- development of sound technology through research and adaptation

The main objectives of this Industrial Policy are to solve existing problems in the industrial sector and, at the same time, to assist industrial growth in the medium and long term. It is expected that the successful achievement of the aforementioned Plan and Policy will trigger rapid economic growth within a decade. During the Fourth Five-Year Plan, the average target growth rate of GDP is projected to be 5 % (agriculture: 3.6 %, industry: 9.1 %), but it seems that this target will be very difficult to achieve.

Table 2-3 represents the production of selected industrial items.

Table 2-3 : PRODUCTION OF SELECTED INDUSTRIAL ITEMS

Item	Unit	1986-87	1987-88	1988-89	1989-90	1990-91
Jute goods	tons	540	527	510	528	434
Cotton Yarn	1000 tons	45	47	49	51	56
Cotton cloth	mil. m.	60	62	65	69	60
Garments	doz	10,222	8,400	8,250	11,143	14,064
Sugar	tons	182	178	110	184	246
Tea	tons	39	40	42	41	44
Cement	tons	310	310	344	337	275
Cigarettes	million	14,762	14,031	14,088	12,289	13,604
Paper	tons	43	42	42	47	43
Newsprint	tons	47	50	44	46	47
Fertilizer	tons	878	1,409	1,599	1,621	1,533

(Source : Statistical Pocket Book of Bangladesh 1992)

2.2.2 Imports and Exports

The dependence of the economy on aid and assistance is quite pronounced. The balance of payments shows a great deficit during the last ten years (Please refer to Figure 2-2.). It is, therefore, very important for Bangladesh to augment its earnings in foreign exchange to offset this imbalance. This is why the necessity of export-oriented and import-substituting industries is stressed in the Industrial Policy 1991. In this respect, nurturing the growth of export-oriented industries that can compete in the international market is indispensable, and the recent phenomenal development of the Ready Made Garment (RMG) industry has paved the way. Table 2-4 indicates the principle commodities exported by Bangladesh. It is noted that RMG industry makes up almost 50 % of the total exports.

2.2.3 Investment Climate and Incentives

The Bangladesh Export Processing Zones Authority (BEPZA) was founded in 1980 to foster and generate economic development by encouraging and promoting foreign investment in the Export Processing Zone (EPZ). The government also enthusiastically invited investment in the country by laying down the "Industrial Policy 1986." In 1988, in order to simplify procedural matters related to investment, the Board of Investment (BOI) was established. In spite of these efforts by the government, the number of investment projects realized was much less

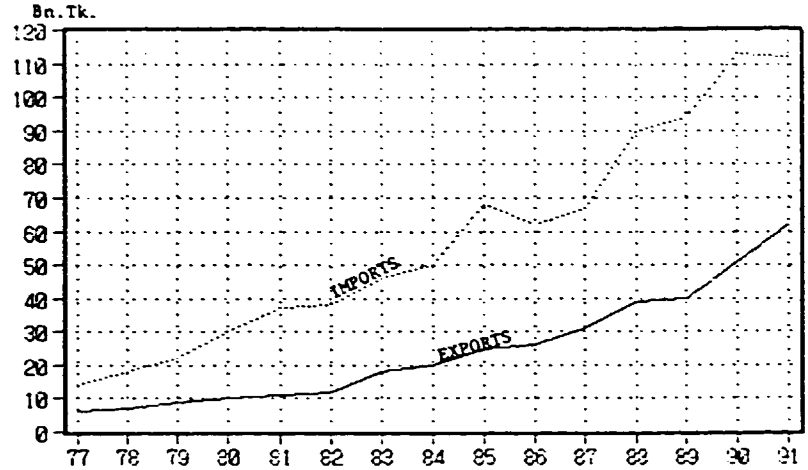


Figure 2-2 : EXTERNAL TRADE

Table 2-4 : EXPORTS OF PRINCIPLE COMMODITIES

Industry	1987/88 Value (mil.Tk)	1988/89 Value (mil.Tk)	1989/90 Value (mil.Tk)	1990/91 Value (mil.Tk)	1990/91 Proportion (%)	1990/91 Comp. to prev.year (%)
1.Frog legs	428	633	152	83	0.14	-45.4
2.Prawn & shrimp	4,422	4,730	5,036	5,004	8.30	- 6.0
3.Tea	1,293	1,208	1,201	1,544	2.56	+28.5
4.Spices	2	5	3	–	–	–
5.Hides & skins	3	–	3	–	–	–
6.Raw Jute	2,486	2,813	3,444	3,231	5.36	-6.2
7.Jute yarn	1,204	1,215	1,431	1,049	1.74	-26.7
8.Jute mfg.total	8,127	8,046	9,484	8,946	14.84	- 5.7
9.Leather & leather manufacturing	4,585	4,514	5,952	4,422	7.34	-25.7
10.RMG	14,842	14,448	21,239	29,941	49.68	+41.0
11.Handicrafts	140	110	128	146	0.24	+14.1
12.Others	3,629	4,964	3,342	5,905	9.80	+77.0
Total Exports	41,161	42,686	51,415	60,271	100.00	(17.2%)

(Source : Statistical Pocket Book of Bangladesh 1992) than expected. The number of investment projects and their respective investment amounts in Bangladesh from 1976 to August 1992 and foreign investment in the EPZ from 1990 ~ 1993 can be seen in Table 2-5 and Table 2-6 respectively. There have only been 48 investment projects, amounting to TK. 120 million, in the EPZ since its establishment in 1983. This figure represents a realization of only 60 % of total applications. This high ratio of cancellation or suspension was probably due to the cyclone which struck the Chittagong region in 1988 and 1991, as well as to the frequent general strikes in the area which are the result of political instability.

In 1991/92, the foreign investments approved (outside the EPZ) by BOI were:

1. Switzerland : Tk. 240 million (Dairy Products)
2. Britain : Tk. 84 million (Leather and Food Processing)
3. Hong Kong : Tk. 79 million (Garments)
4. Singapore : Tk. 31 million (Garments)
5. Malaysia : Tk. 31 million (Garments)
6. Japan : Tk. 21 million (Wood Processing/Garments)
7. Sweden : Tk. 17 million (Machine Parts)

Considering the various manufacturing industries invested in, the increase in the number of investments in the garment and apparel industries from NIES and/or ASEAN is noteworthy. Figure 2-3 shows the development in this sector by year.

Table 2-5 : FOREIGN INVESTMENT BY INDUSTRY (1976 ~ Aug. 1992)

Industry	No.	Amount (Mil.Tk)	Proportion
Garments	37	3,191	36.66%
Textiles	24	1,173	13.46%
Electric goods	11	1,240	14.23%
Plastic goods	4	390	4.48%
Chemical goods	18	1,119	12.84%
Hides and skins	4	26	0.30%
Pesticides	7	69	0.79%
Papers/pulps	1	43	0.49%
Medicaments	5	281	3.23%
Machines	5	168	0.19%
Tanneries	5	311	3.57%
Metals	12	476	5.46%
Food processing	19	1,705	19.56%
Services	11	1,329	15.25%
Glass products	3	130	1.49%
Others	12	87	0.99%
Total	178	8,714	100.00%

(Source : BOI/JETRO Investment Report 1993)

Table 2-6 : FOREIGN INVESTMENT IN EPZ BY INDUSTRY

(mil.Tk)

	1990/91		1991/92		1992/93	
Industry	No.	Amount	No.	Amount	No.	Amount
Textiles	4	6,823	1	1,660	0	0
RMG	1	140	2	3,050	0	0
Hides and skins	3	7,710	0	0	0	0
Packing	3	2,742	1	268	0	0
Glass lenses	1	1,560	0	0	1	1,255
Toys	2	770	0	0	0	0
Car goods	1	722	0	0	0	0
Food processing	1	971	0	0	0	0
Construction materials	1	525	0	0	0	0
Chemicals	0	0	0	0	0	0
Plastic goods	0	0	1	100	0	0
Medical instruments	0	0	0	0	0	0
Sporting goods	0	0	2	16,000	0	0
Electric products	0	0	1	1,039	1	596
Total	17	21,963	10	22,117	1	1,851

(Source : BEPZA/JETRO Investment Report 1993)

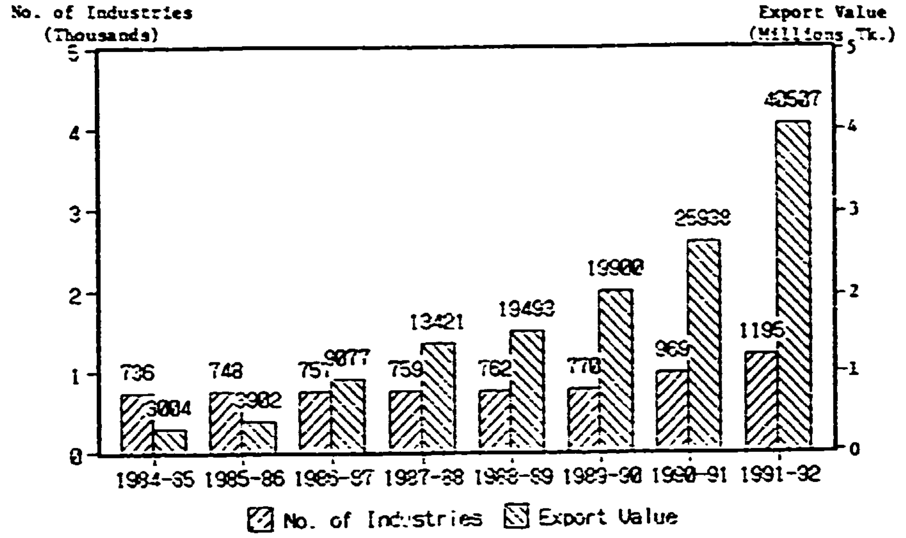


Figure 2-3 : YEARLY DEVELOPMENT OF RMG INDUSTRY

As shown in Figure 2-3, there are now as many as 1,200 RMG industries in Bangladesh, and in 1992, their exports accounted for more than one billion US dollars. However, so far approximately three-quarters of the foreign earnings have been spent for importing raw fabrics, since the quality of domestic fabrics is not satisfactory.

Therefore, this project, which aims at substituting imported raw fabrics with domestic-made, high quality finished fabrics, is just in line with governmental policy.

Investment motivations of the project are as follows:

a) Strong support with attractive incentives by the government such as:
   - 10-year tax holiday (available in EPZ or equivalent site)
   - no duties/taxes on imported machinery/equipment, raw materials and supplies, etc. (same as above)
   - exemption of import duties by EC countries on Bangladesh garments (General System for Preference :GSP)
   - preferential treatment of quota allocation on those fabrics made from more than 15 % of locally made fabrics

b) Abundant, conscientious and inexpensive human resources

c) Probable enjoyment of various benefits as a pioneer in this work

There is also no doubt that this project will create momentum in the development of textile industries in Bangladesh, if it attains a successful operational state and performance level after start-up.

2.3 The Project

2.3.1 Project History

This project was conceived around four years ago by A. K. Khan & Co., Ltd., which is one of the oldest and largest private sector organizations in the Republic of Bangladesh. It has more than 25 years of experience in such fields as cotton textiles, jute processing, tannery, plywood, etc. It employs approximately 7,000 persons and its annual turnover, excluding international trade, exceeds Tk 500 million. It has recently established the following three joint ventures :

- Khan Elin Corporation, Ltd. (with an Austrian firm)
- Bengal Fisheries, Ltd. (with a Japanese firm)
- Tootal Thread (BD), Ltd. (with a British firm)

Through these joint venture companies, A. K. Khan & Co., Ltd. has widened and strengthened its sphere of business.

The following is a brief history of the project :

1) In anticipation of huge domestic demand for textile products in Bangladesh, A. K. Khan entrusted Turkish consultants to carry out a feasibility study for a new spinning mill. It was submitted to the client in September, 1991 with a favourable result in terms of financial assessment.

2) Responding to requests by A. K. Khan in July, 1992, Nichimen Corporation and Toyobo Engineering Co., Ltd. dispatched project experts to Bangladesh to check on the possibility of participating in the project. During the preliminary survey by these experts, it was found that the project should be designed as an integrated textile mill, aiming at export-oriented and import-substituting industries for the Ready Made Garment (RMG) sector.

3) On the 2nd of September, 1992, the following prospective investors took part in a so-called "kick-off" meeting in Dacca, and reached an agreement to compile a feasibility study report on the possible establishment of an integrated textile mill

(hereafter called ITM project):

- A. K. Khan & Co., Ltd. (Bangladesh)
- Gabungan Koperasi Batik Indonesia: GKBI (Indonesia)
- Japan Investment Development Organization: JAIDO (Japan)
- Nichimen Corporation (Japan)
- Toyobo Engineering Co., Ltd.: TBEC (Japan)

Representatives from the Asian Development Bank and the Bank of Tokyo also attended the meeting as observers.

4) In October, 1992, in accordance with the agreement reached at the aforementioned meeting, Bangladeshi authorities approached UNIDO for possible funding of costs covering the feasibility study of the project, and obtained UNIDO's approval.

5) In late November, 1992, TBEC's study team, which was entrusted by UNIDO to conduct the study, visited Bangladesh to carry out the field survey.

6) In early February, 1993, one of TBEC's team members made a supplementary visit to Bangladesh for negotiations with concerned authorities aimed at alleviating certain problems pertaining to the site selection and project incentives.

7) The preliminary draft report was submitted to UNIDO headquarters in mid-May, 1993. It was reviewed by UNIDO, and also by the prospective investors and Bangladeshi government officials, at the preliminary meeting held June 14-15, 1993.

8) The final report was compiled on the basis of the discussion at the aforementioned preliminary meeting in Dacca and on the basis of subsequent comments on the draft report provided by UNIDO headquarters.

2.3.2 Project Idea

The project originally envisaged dealing with spinning only to target the domestic yarn market. However, with the initial survey of the present textile market, it was found that the project should aim at export orientation and import substitution for RMG industries and should produce super and/or highly value-added products.

Taking into account the background, the project idea is as follows:

1) Name of the Project

The Integrated Textile Mill (ITM) Project in Chittagong, Bangladesh to be established in joint-venture with foreign companies and international institutions.

2) Different Scenarios on Product-mix and Production Capacity

During the field survey carried out in November 1992, it was agreed that feasibility should be examined for the following three cases :

(CASE 1)

An integrated textile mill with a production capacity of:

- Spinning : 24,960 spindles
- Weaving : 96 air-jet looms
- Finishing : 1 line of dyeing and finishing equipment

Applicable products, all 63 inches in width, are:

a) Broadcloth : $\frac{\text{CM } 80/2 \times \text{CM } 80/2}{127 \times 73}$

b) Gaberdine (Twill 2/2) : $\frac{\text{CM } 60/2 \times \text{CM } 60/2}{131 \times 60}$

c) Poplin : $\frac{\text{P/C } 45 \times \text{P/C } 45}{110 \times 76}$

Case 1 will produce as much as 2,500,000 m of fabric per month, 15 % and 10 % of which are to be allocated for super quality fabric (Boardcloth) and high quality fabric (Gaberdine) respectively. The remaining 75 % will be high quality, popular and conventional polyester cotton blended fabric for the RMG industry. In order to maximize full utilization of finishing capacity and to minimize investment costs, it is planned to purchase some yarns and grey fabrics from outside.

In view of the present recession in the world textile market, the only way to make the project viable seems to be to produce super or high quality fabrics such as "Broadcloth" and "Gaberdine." This is why Case 1 is being considered.

(CASE 2)

An integrated textile mill with the same production capacity as in Case 1. Applicable products, all 63 inches in width are:

a) Poplin : $\frac{\text{CD } 40 \times \text{CD } 40}{133 \times 76}$

b) Twill (Twill 3/1) : $\frac{\text{CM 40/2} \times \text{CM 40/2}}{108 \times 58}$

c) Poplin : $\frac{\text{P/C 45} \times \text{P/C 45}}{110 \times 76}$

In Case 2, all the fabrics are conventional and widely utilized in the present RMG industry. In spite of a large projected demand for these fabrics, competition in the international market seems to be very keen, which will inevitably pull down the saleable price, resulting in a poor financial assessment.

(CASE 3)

A spinning mill, producing cotton combed yarn and cotton carded yarn with a spinning capacity of 24,960 spindles.

a) Cotton carded yarn
   - Ne 30 : approx. 887 tons/year with 6,240 spindles
   - Ne 40 : approx. 602 tons/year with 6,240 spindles

b) Cotton combed yarn
   - Ne 80 : approx. 226 tons/year with 6,240 spindles
   - Ne 100 : approx. 164 tons/year with 6,240 spindles

Case 3 was selected upon strong request by the local partner, and a brief feasibility study has been carried out. The result also shows poor financial cashflow and returns.

(CASE 4)

In addition, it was suggested at the preliminary meeting held in Dacca with government officials and prospective investors (including financial institutions) that the UNIDO study team investigate the project viability of another project concept, i.e. taking out the spinning operation from Case 1.

This has been done as Case 4 and is attached in Appendix 4.

2.3.3 Project Promoters/Sponsors

As mentioned in 2.3.1, quite a few companies, institutions and banks informally expressed their interest in participating in the project, as long as it yields lucrative results. They are as follows:

- A. K. Khan & Co., Ltd. (Bangladesh)

- Nichimen Corporation (Japan)
- Toyobo Engineering Co., Ltd. (Japan)
- Japan Investment Development Organization (Japan)
- Gabungan Koperasi Batik Indonesia: GKBI (Indonesia)
- International Finance Corporation
- Asian Development Bank
- Asian Finance and Investment Corporation Ltd. (AFIC)
- Islamic Development Bank
- Commonwealth Development Corporation

The roles of these prospective participants are as follows :

1) A. K. Khan & Co., Ltd.

   A.K.Khan is a local promoter who will take part in local procedural matters such as obtaining licences and permits, being responsible for administrative and personnel divisions of the company and for marketing and sales in the domestic market.

2) Nichimen Corporation

   It is a very large, international trading firm, dealing with a variety goods, among which textiles are a major item. Nichimen is to be responsible for financial control and marketing and sales in the international market. Some of the products from the project will be sold through existing Nichimen distribution channels.

3) Toyobo Engineering Co., Ltd.

   TBEC is an engineering firm specializing in the field of textiles, backed by Toyobo Co., Ltd. which is one of the biggest textile enterprises in the world. It is going to be responsible for overall mill management, mainly from a technical standpoint.

4) Gabungan Koperasi Batik Indonesia (GKBI)

   GKBI is a large textile manufacturer based in Indonesia, and it will dispatch two to three textile engineers/foremen to the mill to look after the production department under the production manager. It is also expected to deal with sales of some fabrics in cooperation with Nichimen.

CHAPTER 3 : MARKET ANALYSIS AND MARKETING CONCEPT

3.1 Marketing Research and Methodology Applied

The role of marketing research is to obtain, analyze and interpret various market information to provide the basis for decisions of a strategic or marketing nature. As many written materials as possible (such as statistical resources, publications and bulletins from official agencies and private associations, some sectoral opportunity studies conducted by international organizations, local and international consultants, international banks' and institutions' reports, laws and regulations, etc.) were collected within and outside Bangladesh as for market research. The observation method and interviewing [questionnaire] method were used. Selected key persons and organizations interviewed by the study team at the time of the field survey for the purpose of the marketing study are as follows:

<u>Interviewees at the time of the Field Survey</u>

[Authorities & Institutions]

Mr. Zahiruddin Khan, Planning Minister
Mr. Rezaul Hayat, Secretary, Ministry of Textiles
Mr. Mustafizur Rahman, Executive Chairman, BOI
Mr. Akira Kuroki, Advisor, BOI
Mr. M.S.A.Gazi, Vice-Chairman, EPB
Mr. Shoaib Ahmed, Director General (Textiles), EPB
Mr. Akmal Hossain, Director General (Operations), EPB
Mr. S.B.Chakma, Deputy Director, Department of Textiles
Mr. Sayed Yusuf Hossain, Chairman, BTMC
Mr. Salahuddin Kasem-Khan, former chairman, BTMA
Mr. Mohammad Mosharraf Hossain, President, BGMEA
Mr. Abu Sayed Choudhury, Secretary, BGMEA
Mr. Syed Shahabuddin Ahmed, Chairman, BEPZA
Mr. Geert Van Der Linden, Resident Representative, ADB
Mr. Masanori Abe, Chief Representative, BOT
Mr. Mr.Naoyoshi Noguchi, Representative, JETRO
Mr. Zobdul Hoque, Joint Director, BBS

[Textile Manufacturers]

Chittagong Textile Mills Ltd., Prime Textile Spinning Mills Ltd., Silva Group, Modern Textile Mills, Tootal Thread Bangladesh Ltd., Pahartali Textile & Hosiery Mills, Eagle Star Textile Mills Ltd., Mita Textile Ltd.

[Garment Manufacturers and Trading Agents]
Sidko Ltd., Elegant Garments Ltd., Bhaiya Garments Ltd.,
Golden Garments Ltd., Regency Garments Ltd., Newage Garments Ltd.,
Dream Bengal Garments Ltd., Youngone (CEPZ) Ltd., KDS Garment
Industries Ltd., Azim & Son (PVT) Ltd., Intra-World Ltd.

In order to supplement the field survey conducted by the study team, and to collect data necessary for filling in any information shortfall to construct a marketing synopsis, an additional detailed marketing field survey was conducted again by the study team, making use of local consultants from time to time. The supplimentary report dealt mainly with the proposed target market and demand projection is attached as Appendix 3 titled "Survey on Fabric Requirements of Export-Oriented RMG Industry."

3.1.1 Target Marketing

1) Market Segmentation

In the case of fabric manufacturing, minute and detailed market segmentation seems to be unnecessary because the products of the project do not reach directly to the consumers' market. Rather they are used as materials by garment manufacturers, for instance. In this section, market segments to be proposed for the project will be identified, based on the findings of the field survey.

The most promising target market must be selected and/or combined from the following markets:

- export garment manufacturers
- export yarn/fabric market
- domestic yarn/fabric market

It was concluded that the main targets should be the export garment manufacturers in Bangladesh and the fabric export market overseas, as described hereafter.

a) Garment Manufacturing Sub-Sector

The export-based clothing industry is the most healthy industry in the Bangladesh economy. The export earnings from textile made-up goods totalled Tk 22.78 billion (US$ 760 million) in the first five months (July-November) of the current fiscal year (1992-93), showing a rise of 48.5% over the corresponding period of the last FY, according to figures released by the Export Promotion Bureau (EPB) of Bangladesh. Of the Tk 22.78 billion, ready-made garments accounted for Tk 20.1 billion (88%). Export earnings from the clothing industry are expected to reach US$ 1.5 billion for all of 1992. It is noteworthy that the materials for the most thriving sub-sector in Bangladesh are provided by the domestic textile sub-sector to only a negligible extent (3% of total demand) due to sub-standard technical parameters which make it impossible to cater to the quality demand of their customers. This situation is described in detail in section 3.2.2.

Supplying materials to the export garment sub-sector, that is, establishing so-called "backward linkage," is the most urgent, nationwide requirement for the textile industry. This market will be what the captioned project targets first of all. The striking and even spectacular growth of the ready-made garment industry (which did not even exist in 1979), and its contributions to Bangladesh's economic development, are shown in Figure 3-1 and 3-2. Bangladesh is the major supplier of woven shirts and T-shirts to the EC and the seventh-ranked supplier of garments to the USA. This growth is attributable to the following factors:

- ready availability of a cheap, abundant and diligent work force (predominantly female)
- reasonably developed infrastructure
- investment required is low (High investment/turnover ratio)
- back to back L/C as well as a bonded warehouse system that does not require large amount of working capital for payment of material imports and import duties
- quota-free access to EC market (up to the end of 1993)
- partly restricted access to US market (28 quota categories out of 84 categories) - privilege of Bangladeshi garment exporters to export 30 quota categories at between 6 % to 10 % growth to the USA.
- being a beneficiary of the Generalized System of Preference (GSP) scheme introduced by the industrially advanced nations
- facility of Multi-Fiber Agreement (MFA) provided under the Uruguay Round
- govermental assistance and promotion for the development of the apparel industry

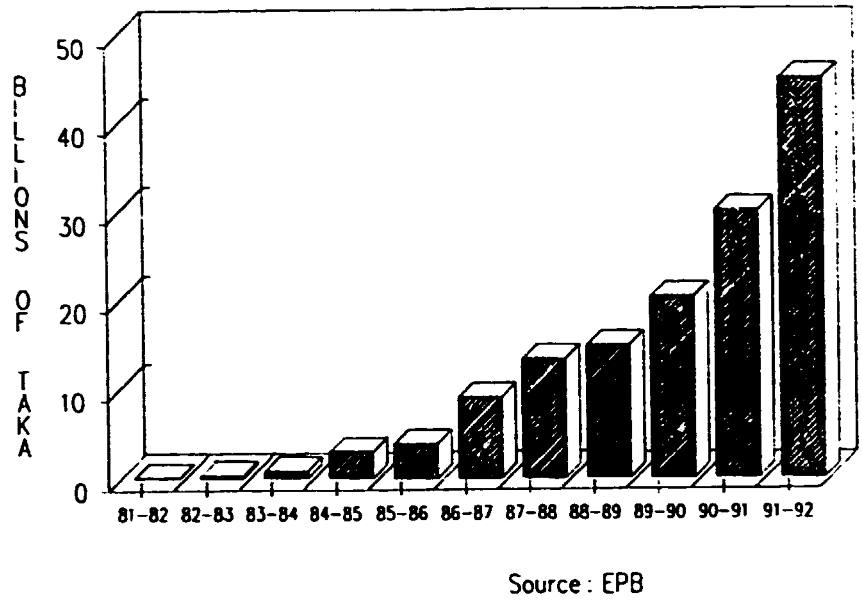


Figure 3-1 : BANGLADESH GARMENT EXPORTS

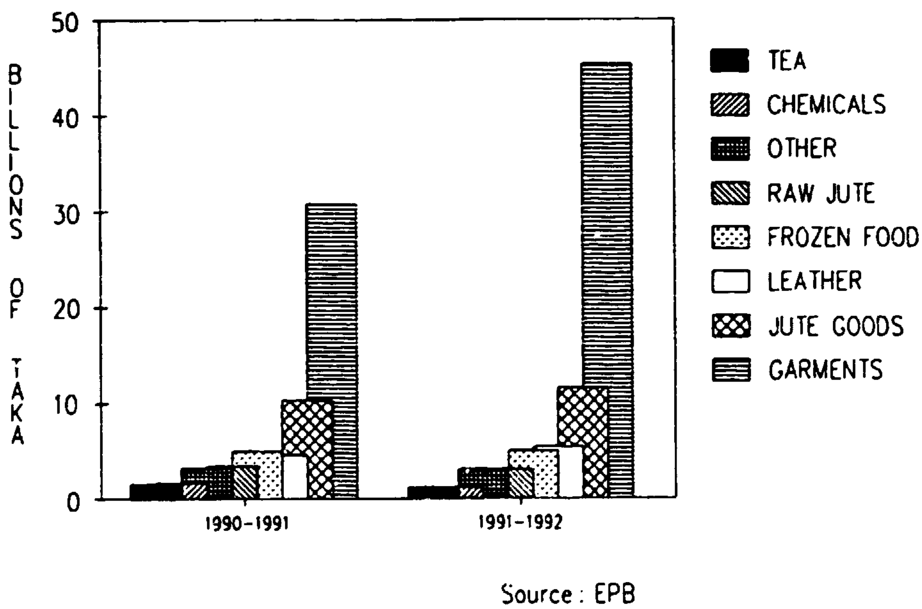


Figure 3-2 : BANGLADESH EXPORTS

In regard to the aforementioned governmental assistance, the government is trying to promote foreign investors to set up integrated textile mills capable of supplying the fabrics needed by the garment sector. The Fourth Five Year Plan envisages a budget to assist in the establishment of 25 new integrated mills in the private sector under the BMRE (Balancing, Modernization, Rehabilitation & Expansion) program.

Prospects for future growth in this sub-sector are bright, realizing the diversification of products, exploiting of new markets and change into higher-value and more profitable fashion lines. Possible import quota restriction by the EC in the future will force them to improve the present situation in order to free themselves of the current low profits from earning only CMT (cut, making and trimming), overcome allowing them to any new and different conditions and constraints expected in the future. What is most necessary for this industry is the adoption of more aggressive marketing to expand sales and provide better services to customers.

b) Yarn/Fabric Export Market

The ready-made garment industry in Bangladesh is identified as one of the most promising markets to be targeted by the project. But to rely on only one market is risky for a project, so the possibility of other markets will be analyzed in this section.

(1) Yarn Export Market

The massive number of spindles throughout the world has resulted, above all, from the recent investment rush in Asia and it has caused the oversupply of yarn in the world yarn market. On top of this, the world economic recession has brought about a low price for yarn everywhere.

Price per bale of yarn

		1991	1992
CD40	Japan	¥100,000	¥66,000
TC45	Indonesia	Rp 1,250,000	Rp 1,100,000

Generally speaking, the downturn of yarn prices will continue for years to come. For the time being, there will be a market atmosphere which is more conducive to buying yarn than selling it. On the other hand, the price of cotton will remain stable on the whole, as it is an agricultural product whose supply will probably not increase suddenly. As the share of raw material costs in cotton yarn production costs is relatively high, the export of cotton yarn is not as profitable for a cotton-purchasing country like Bangladesh as it is for cotton-producing countries like Pakistan, China and India.

Nowadays, the growing exporter of yarn is Indonesia which after installing 4.5 million spindles, has exported 4,094 tons of yarn to Japan, becoming the fifth major exporting country of yarn to Japan behind Pakistan, Korea, China and India. Indonesian spinners have the advantage of being able to export fine count combed yarn to Japan. It will be rather difficult for the project to become a yarn exporter in the Asian market, taking this situation into consideration. Therefore, the yarn export market is least likely to be targeted.

(2) Fabric Export Market

The export of fabrics is more significant than that of yarn for this project, as fabrics are more value-added. The export-oriented ready-made garment industry has been identified as the most promising target market for the project in this chapter. To succeed in its business, roughly speaking, two conditions must be clarified that is, quality and price competitiveness. The principal commodities of the Bangladeshi garment exporters are basic items rather than fashion items. Therefore, at present, the highly value-added fabrics are not required as raw material for standard garment items as much as TC45 110x76 poplins, for instance, which do not generate much profit for fabric manufacturers.

As such, the value-added fabrics that the project attempts to produce should look for overseas markets for the time being. The primary market should be Japan, which has been gradually increasing its import of fabrics from developing Asian countries since the mid-80's.

Japan's Import of Cotton Fabrics

Unit: 1,000 m^2

	1988	1989	1990	1991
Korea	29,603	30,706	19,455	16,468
China	567,664	600,857	432,406	523,116
Indonesia	29,614	54,497	36,044	41,028
Pakistan	15,294	42,574	44,264	26,840
India	6,255	7,217	7,496	7,530
ex-USSR	1,858	9,454	16,908	12,807
Others	38,303	52,779	45,617	40,923
Total	688,591	798,084	602,190	668,712

Source : Financial Ministry of Japan

In Japan, fabric weaving, in general, has gradually become less profitable, although there is a large demand for high-grade and sophisticated fashion items. Japan is therefore a suitable market for the project to export high value-added and profitable textile goods. One of the major Japanese trading houses is a proponent of this project and has shown an interest in buying back a considerable portion of the fabrics produced in the project.

An alternative market for the fabrics is Southeast Asian countries. It is said that textile goods worth about US$ 100 billion are exported from this area out of a total world-wide trade of US$ 200 billion for textile commodities (yarn, fabric and secondary products). Out of this US$ 100 billion, it is reported that Japan trades $8 billion, and NIES, ASEAN and China/Vietnam trade $50 billion, $25 billion and $10 billion respectively. The textile production base in Asia seems to have shifted from NIES (Taiwan, Korea, Hong Kong) to ASEAN (Thailand, Indonesia, Philippines, Malaysia), China and Vietnam. These countries, which became the new production bases for the Japanese, Korean and Hong Kong garment industries, have shown salient growth. But, in the Philippines, Malaysia, Singapore and Sri Lanka, the finished fabrics used as raw materials seem to be difficult to procure domestically and must be imported. As explained so far, the target should be put on the garment industry abroad utilizing export processing free zones and bonded warehouses in the country where fabric availability is relatively low. There is the possibility that a proponent of this project will import a part of the production into Indonesia as the base cloth for high-grade batik garments.

Non-quota countries outside the bilateral agreements will be a yard-stick for market choice. Japan, Singapore, and Middle-Eastern countries like UAE are non-quota countries. And the EC, which so far has not imposed quotas on the import of fabrics from Bangladesh, is a good market for the export of finished fabrics.

c) Yarn/Fabric Domestic Market

This market was determined to be negative for the new project considering the following findings:

- Many industrial inputs necessary for operation, such as raw materials, spare parts, consumable goods, etc. must be imported due to domestic non-availability and they are subject to taxes due to trade protection and tariff policy.

- The analysis shows that achieving backward linkage to the RMG industry and supplying the necessary fabrics cannot be achieved without utilizing the bonded warehouse system. If this system is adopted for the project, sales to the domestic market is prohibited.
- The domestic fabric market is not a stable and attractive one, and smuggled goods are readily available. Importance is not attached to the quality of products in this market.
- Domestic demand is, for the most part, for the materials for lungi and saree, and this demand is satisfied by handloom production.

2) Target Market Structure

a) Market Definition

As explained earlier, the market is defined as:

- Export-oriented ready-made garment manufacturers' group in Bangladesh (Dacca and Chittagong)
- Importers or converters of fabrics in Japan and South-East Asia

b) Structure of Domestic Target Market

Branch structure	Name of suppliers :	Manufacturers and exporters of ready-made garments (shirts, T-shirts, blouses, trousers)
	Association :	Bangladesh Garment Manufacturers and Exporters Association (BGMEA) - To receive quota for US and Canadian markets and for obtaining export licences and certificates of origin, a manufacturer is required to prove its membership in this Association. - Main activities are: quota information & transfer service/trade information, promotion & development/fabric utilization service/research/publication/arbitration/membership management, etc.
Customer profile	Name of customers :	Customer's profile is stated in Appendix 3.

Employment and Competition	Employment : About 1,250 garment factories employ over 600,000 workers of which 85% are women. Competitors : India, Sri Lanka, China, Pakistan, Indonesia, Philippines,Malaysia Means of competition : Price competitiveness, product assortment of low price zone
Structure of distribution	Channel of distribution: through foreign buyers' agents based abroad/ inland/ a few direct transactions

3.1.2 Analysis of Competition in Domestic Market

1) Installed Capacity of Textile Industry in Bangladesh

As the competitors of the project are the existing or newcoming textile industries, the current situation of the textile industry in Bangladesh should be reviewed. The actual flow of textile business can be seen roughly in Figure 3-4, on the basis of which the installed capacity, supply-demand gap, potential, etc. will be verified. Table 3-1 shows the installed capacity and operation status of the textile industry in Bangladesh. The comparison of the spinning and weaving capacity of Bangladesh with that of other Asian countries according to recent data is shown in the Table 3-2.

Spinning equipment in all of Asia is said to have exceeded 100 million spindles with China's 38 million spindles in the lead. Thus, the majority of the world's spinning equipment has been concentrated in East and West Asia which has become the greatest spinning production base in the world. The position of Bangladesh in this area, as shown in Table 3-2, is almost negligible, having a share of only one percent and regarded as a domestically-suppliable industry.

2) Supply Capacity and Technical Constraints of Competitive Sub-Sector

Table 3-3 shows the actual relation between the textile demand and supply in Bangladesh (1990/1991). It can be said that the demand which the domestic supply fails to satisfy is complemented by imports. It should be noted that the adopted figure changes constantly as time goes by according to changes in social and economic conditions. The demand for fabrics by the RMG sector will further increase, if this sub-sector continues to expand at the present surprising rate.

a) Fabric Manufacturing Sub-Sector

It is estimated that the present total domestic demand for cloth is about 1.200 million meters (Table 3-3). This figure seems to be based on the per-capita cloth consumption of 11 m multiplied by the population of 109.9 million (1991 census). The "Statistical Pocket Book of Bangladesh 1992" tries to prove it by the per-capita availability of cloth.

Mill-made local cloth production	69	million m
plus other cloth production	984	"
plus imports of cloth	92	"
less exports of cloth	- 12	"
Net available cloth for consumption	1,133	"
divided by population		107.5 million
Per-capita availability of cloth		about 11.0 meters

The actual supply by local production is said to be 950 to 960 million meters and the gap is filled by imports. On the other hand, the cloth demand by the export-oriented apparel manuacturers is not included here. Their cloth requirements should be added to the demand figure which, at the moment, are satisfied only by fabric imports using back-to-back L/C (the supply by local makers is of a negligible extent).

(1) Industrial Loom Sub-Sector (BTMC & BTMA Textile Mills)

Direct competitors against the project for the targeted market belong to this sub-sector. Each data source has a different figure for the production capacity of this sub-sector. According to Table 3-3, the total yearly cloth output of BTMC & BTMA composite mills is 63 million meters from about 4.400 looms in operation. The weaving speed of one loom under operation of 300 working days in three shifts is computed as 2 m/hr. If the weft insertion is assumed to be 60 picks/inch, weaving speed is estimated to be 80 picks per minute. This speed is considered a bit slow for mill power looms.

It is said that 24 disinvested mills out of 44 BTMA members are not doing well because of non-settlement of loan liabilities inherited from their past owner.

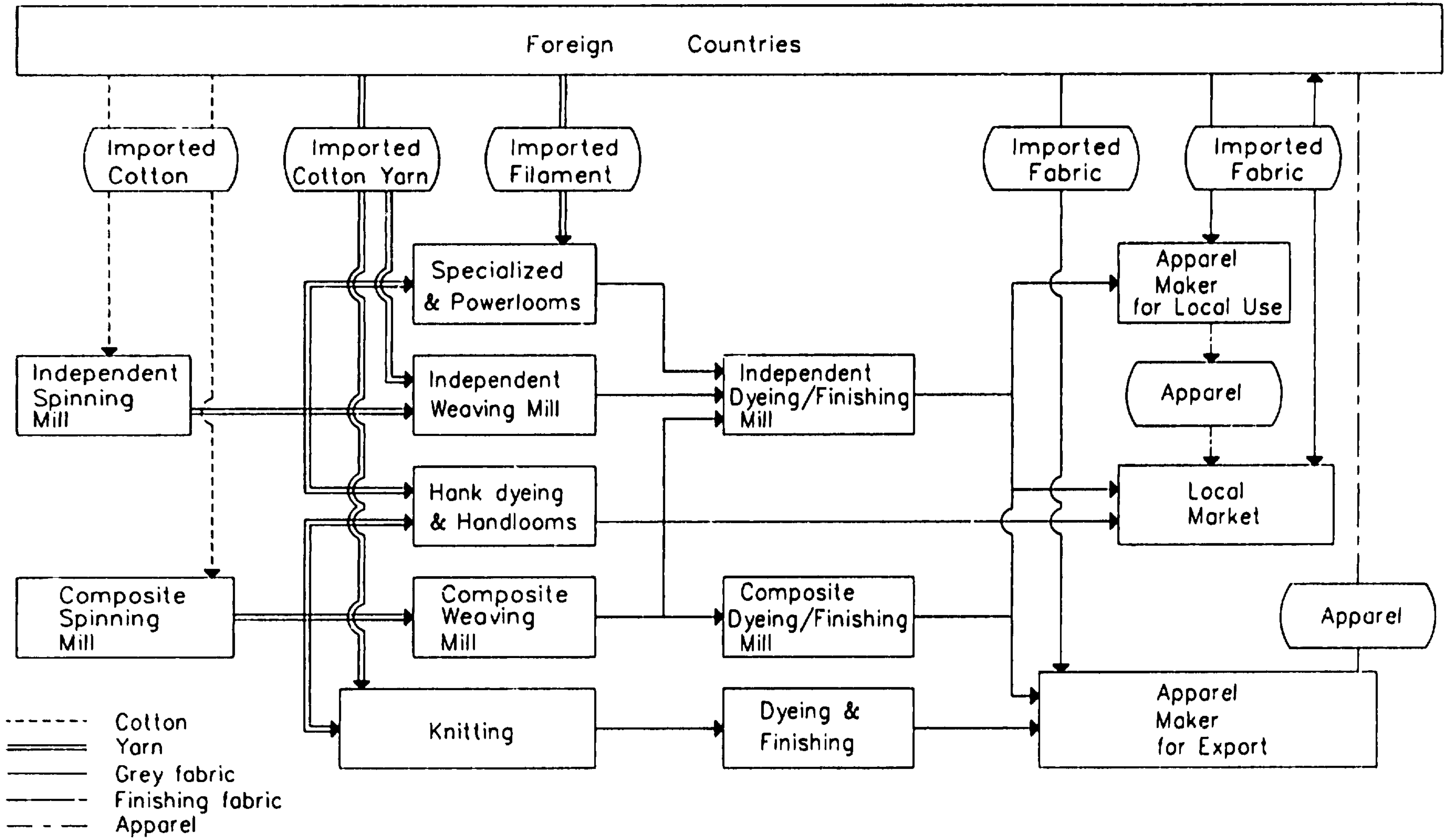


Figure 3-3 : FLOW OF TEXTILE MATERIALS/PRODUCTS IN BANGLADESH

Table 3-1 : INSTALLED CAPACITY OF TEXTILE INDUSTRY IN BANGLADESH

	Private Sector (BTMA & Others)	Public Sector (BTMC)	Total
Installed Spindles	929,630(1)	773,788(2)(3)	1,703,418
Spindles in Operation	633,200(3)(5)	640,000(3)	1,273,200
Installed Looms(BTMC/BTMA)	3,284(1)	3,626(3)(5)	6,910
Looms in operation	1,552(3)	2,863(3)	4,415
Installed Handlooms	514,400(3)(4)(5)		514,400
Looms in Operation	327,300(3)(4)(5)		327,300
Specialized & Powerlooms	34,000(3)(5)		34,000
Looms in operation	8,500(3)(5)		8,500
Knitting Machines	4,429(2)		4,429
	or 5,050(3)		5,050
Processing Units A	133(2)(5)	13(2)	146
Processing Units B *	193(2)(5)		193
Dyeing Capacity			420,610,000m/year

Source : (1) BTMA Annual Report-1991
(2) Textile Digest , 1992 (Dept. of Textiles)
(3) IBRD, Textile Industries Restructuring Study, 1992
(4) Statistical Pocket Book of Bangladesh 92 (Bangladesh Bureau of Statistics)
(5) UNIDO Report, Nov. 1992

Note : Processing Units A : No. of Units with mechanized processing
Processing Units B : No. of Units with semi-mechanized processing
* : includes garment washing units (rotary washer, etc.)

Table 3-2 : INSTALLED CAPACITY OF TEXTILE INDUSTRY IN ASIA

Installed Capacity	Japan	NIES Countries			ASEAN Countries				
		Korea	Taiwan	Hong Kong	Thailand	Indonesia	Philippines	Singapore	Malaysia
Spun Spinning Spindles (Thousand sps.)	7,675	3,648	3,678	189	3,000	4,500	1,473	80	466
Power Looms	192,000	55,000	40,900	10,380	64,000	140,000	16,000	1,000	9,000

Installed Capacity	Southwest Asian Countries						Other Countries		Total
	India	Pakistan	Iran	Sri Lanka	Nepal	**Bangladesh**	China	Vietnam	
Spun Spinning Spindles (Thousand sps.)	27,270	5,445	1,100	260	*	**1,700**	38,000	*	98,484
Power Looms	177,000	15,000	23,800	10,200	1,300	**40,900**	866,000	20,000	1,682,480

Source : Textile Handbook, Dec. 1992
Japan Chemical Fibres Association Report, Jun. 1992
Asian Textile, Oct. 1992

Note : * Not clear
Handlooms not included

Table : 3-3 ACTUAL TEXTILE DEMAND & SUPPLY IN BANGALDESH

	Demand	Supply	
		Domestic Supply	Import
Grey Fabric (milion m)	1,210	960 BTMC 47.3 BTMA 15.8 Hand loom 675 Specialized Power looms 175 Knitting 46.9	250
Yarn (tons)	109,000	85,000 BTMC 43,500 BTMA 30,300 Others 12,200	24,000
Fabric for Export Garments (million m)	785～945	23～28	764～917

Source : BTMA Annual Report, 1991
UNIDO Report , Nov.1992
Techno-economic report by local consultant
IBRD Study, 1992
JTN 1992,1993
JCI report, 1991

As the hand-woven fabrics are mainly destined for the local cloth market as sarees and lungis, this sector, which produces 675 million meters (70% of country's fabric production), plays an important role in the local distribution of textiles.

Besides the handlooms, there are about 2,000 small, specialized textile mills with about 30,000 power looms. Such mills, with 20 looms or less, appeared like mushrooms after the rain in the 1980's to reap the harvest of the booming business of filament fabrics. According to official sources, 1,200 out of 2,000 mills were driven out of business and the surviving 800 were made moribund by smuggled goods. According to the World Bank report, the annual production of this sub-sector is 175 million meters by 8,000 looms in operation, but this figure seems to be unrealistic because a loom speed of 133 picks/min is too high considering the low speed weaving with unsized yarns which is common in this sub-sector. The very poor working ratio of these power looms can be explained by the fact that the low quality yarn finds its way to the handloom sector where stringent technical parameters are not required.

(3) Knitting Sub-Sector

According to the World Bank report, the knitting industry and garment industry in Bangladesh share the fame of being the fastest growing textile sector, mainly because of the relatively low capital requirement, relatively easy procurement of material yarns of acceptable quality through foreign and partially local suppliers, and strong demand for knitted fabrics to serve both domestic needs and the export garment industry. The interest of textile entrepreneurs who recently have set up new spinning mills, and those who are going to set up new spinning mills, is supported by the existence of this sub-sector.

If the yarn requirement of this sector is calculated on the basis of the estimated figures of knitting sub-sectors in the World Bank report, circular knitted fabrics of a diameter less than 18 inches and more than 18 inches will require 14,400 tons and 18,900 tons of yarn respectively per year.

The output of 22,000 tons is obtained from the above requirements of 33,000 tons with an efficiency of 60 %.

b) Yarn Manufacturing Sub-Sector

According to the World Bank report, annual year production is 66,000 tons. This is computed from 1,178,600 spindles producing 56 kg per spindle per year. On the other hand, according to UNIDO reviews, 85,000 tons were produced by 1,743,000 spindles producing by 49 kg per year. As this number of spindles is the installed number, its utilization ratio as well as the working efficiency is already included. In this case, the capacity per spindle is assumed to be 75 kg at 100 % working efficiency. The capacity per spindle per annum of a brand new ring spinning frame at about 15,000 rpm can be 96 kg at 92 % working efficiency. When this figure is applied to equipment that is generally deteriorated and superannuated in the spinning mills in Bangladesh, it should be decreased by 30 % to 67 kg. Then, a production of 85,000 tons per annum is obtained by multiplying 1,273, spindles by 67 kg.

The relationship between the output and input requirements of each of the fabric manufacturing sub-sectors summarized by the two reports of IBRD and UNIDO are as follows:

	Source	Output (m)	Weight/m	Yarn-rqmt.(t)
BTMC/BTMA	1	not specified	-	11,600
	2	90,000,000	94	8,500
Handlooms	1	675,000,000	85	57,400
	2	675,000,000	97	65,500
Power looms	1	175,000,000	50	9,000
	2	175,000,000	125	22,000
Knitting	1	22,000 t	-	14,000
	2	not specified	-	33,300
Total (tons)	1	92,000	2	129,300

Source : 1 UNIDO
2 BRD

The assessment of UNIDO is less than that of IBRD by 30,000. The demand-supply figures for yarn seem more or less balanced, taking into consideration the smuggled yarn. It is doubtful if an effective utilization of this many spindles and an effectively balanced production can be achieved by the existing spinners. Attempts by the BMRE to upgrade the yarn quality to a passable grade for the export market will not be fruitful due to the enormous investment. The existing manufacturers will have to find a way to satisfy the needs of the domestic market.

Our findings on the technical situations of a few existing spinning mills in Dacca and Chittagong are as follows :

- Machinery and equipment are obsolete and superannuated. Investment for the modernization and renewal of the equipment seems to be scarce.
- The significance of subsidiary equipment such as building, air-conditioning, dust collecting, production auxiliary equipment and laboratory equipment, which play an important role in the quality of products, seems to be neglected.
- The combing process seems to be adopted not for refining the yarn quality, but only for making the yarn slender. The Ne 80 combed yarn in production lines had many slubs and is not competitive quality-wise in the international market.

Domestic demand will increase along with the growth of the national economy, and a potential demand for the standard quality yarns as materials for high quality fabrics sold to the export garment manufacturers must wait for newcomers. In fact, a number of new spinning mills and some of the old ones, that have undergone BMRE, are entering into the private sector. It is reported in the World Bank study that 15 new spinning units with approximately 300,000 spindles are going to come on stream. Sreepur Textile, one of these newcomers, has already chosen Chinese-made machines, splicing winders, travelling cleaners, etc. were contracted from Japanese makers. What is feared regarding such modernized new mills is that there may be some specificational omissions which might bring about defects in yarn quality.

At any rate, these brand new spinning mills could be competitors for the project and careful analysis of the situation is required.

c) Dyeing and Finishing Sub-Sector

The grey cloth output shown in Table 3-3 deals with cloth in the state of being finished (dyed, printed, finished or yarn-dyed) and ready for immediate use in the market (cloth consumers, apparel makers). The independent fabric processing industries and processing mills attached to the composite textile mills take charge of processing the grey fabric output from the independent and integrated mill weaving units, specialized textile mills and the power loom industry. The yarn in hank form used for handloom weaving is very simply dyed by hand in small containers and air-dried before weaving in the cottage industry, and the woven fabrics are simply wet finished in the above fabric processing industries. The bleaching and dyeing of the knitted fabrics are probably done inside the knitting factories or in independent finishing units exclusively for knitted fabrics.

As shown in Table 3-1, there are approximately 133 mechanized dyeing, printing and finishing units in the industry, and 193 semi-mechanized units, with a dyeing capacity of about 420,610,000 meters per annum (285,330,000 m of which is used for synthetic fabric processing), out of which 29 units with a processing capacity of about 227,210,000 meters are candidates for upgrading to produce export quality fabrics, according to the investigation conducted by UNIDO in November, 1992. It is judged from this figure that for the grey fabrics produced in the country, the door to subsequent finishing processing, either by the commission finishers or of the composite textile plant, is now open. Also, the finishing capacity balance for the domestic market may be balanced more or less, taking into account the case of hand-woven fabrics using hank-dyed yarns which are only finished in the final process in such finishing plants.

However, the case is different in the export market. The existing finishing plants, presently, cannot meet the demand of the export garment industries because of their sub-standard finishing quality. In the reports of both UNIDO and IBRD, some technical problems such as colour fastness or colour matching are pointed out. Our observation on a few existing finishing factories with relatively new equipment and obsolete equipment (half and half) confirmed the unlikelihood of supplying materials catering to the export garment industry due to the following technical constraints inherent to the existing processing factories in Bangladesh:

(1) Finishing Quality

- Defects originating in yarns and grey cloth are often observed.
- It is feared that shrinkage properties of finished cloth have an adverse effect on the shape and size stability of garments.
- Cloth handling or feel is too rough and therefore, unsuitable for garments.
- Finishing is done without mercerizing.

(2) Color Fastness

Low color fastness (anti-friction or colour-stained) is often observed, especially in dark colors (direct dyes, naphthol dyes and sulfuric dyes are often used) due to inappropriate selection of dye stuffs and imperfect post-finishing (chemical treatment, strong washing). This is conspicuously observed in yarn-dyed fabrics where the white base cloth is often stained and blotted by dyed yarn.

(3) Color Matching

Recipe searching is practiced at the Tootal Sewing Thread Mill, Chittagong. This is the only factory having color matching equipment. One recipe out of about 60 recipes which are input in one standard color is determined based on delta E and metamerism measurements. In some factories, color standardization is being carried out using their own pattern cards for the standard colors. But, in almost all factories, it is judged that the color matching operation is done relying only on the experience and sixth sense of the technicians in charge.

There are plans for some two hundred processing units of various sizes to be set up to seek the market chance in the export garment industry. It is reported that some of them will come on line in 1993. Such new units will become competitors for the project, as their production costs will be fairly improved compared with those of the existing units, using the grey cloth imported on the bonded warehouse basis.

3.1.3 Demand Forecast

The past and present fabric demand and supply in the garment sub-sector has been indentified, as follows, based on the production growth of garment pieces :

Recent Fabric Consumption

	1984/85		1985/86		1986/87		1987/88	
	million pcs	million m	million pcs	million m	million pcs	million m	million pcs	million m
Garment	207	414	292	584	255	510	286	572
	1988/89		1989/90		1990/91		1991/92	
	million pcs	million m	million pcs	million m	million pcs	million m	million pcs	million m
Garment	296	592	325	650	[illegible]	700	450	900

In this table, the production of garments (pcs) from 1984/85 to 1988/89 is based on data from the Department of Textiles. Production from 1989/90 to 1991/92, data of which are not available, is a presumed figure. The present annual demand for fabrics by the garment sector is estimated at 900 million meters.

The above demand is filled by the import of fabrics and domestic supply. The proportion of imported quantity is 90 % to 97 %. A big market of 900 million meters will open up to the Bangladeshi fabric manufacturers who are presently supplying only 3 % to 10 % of the total demand.

According to data released by BGMEA, garment exports have experienced rapid growth from the mid-1980's, showing a rise of about 36 % on the average in each fiscal year ending in June over the preceding fiscal year from 1987/88 to 1991/92 on the sales amount basis. Estimating the growth rate applicable from 93/94, the following factors may prove to be negative :

- The development of the garment sector, beginning in the mid-1980's, was very rapid, and it may slow down.
- Quota restrictions by the USA and Canada may be intensified.
- There is no knowing what will happen to the current advantage of Bangladesh in exporting to EC.
- MFA may terminate in the end of 1993.
- Intensification of competition in garment exports among exporter countries like China, India, Sri Lanka, Pakistan, Indonesia, Malaysia, Philippines
- Bangladesh lags behind the aforementioned countries in respect to advanced, sophisticated technology using computerized systems as well as in respect to marketing technology.

Because of these negative factors, it may be wise to use an annual growth rate which is cut in half. Forecast estimates of garment exports (amount-wise) based on BGMEA sources are shown in Figure 3-4.

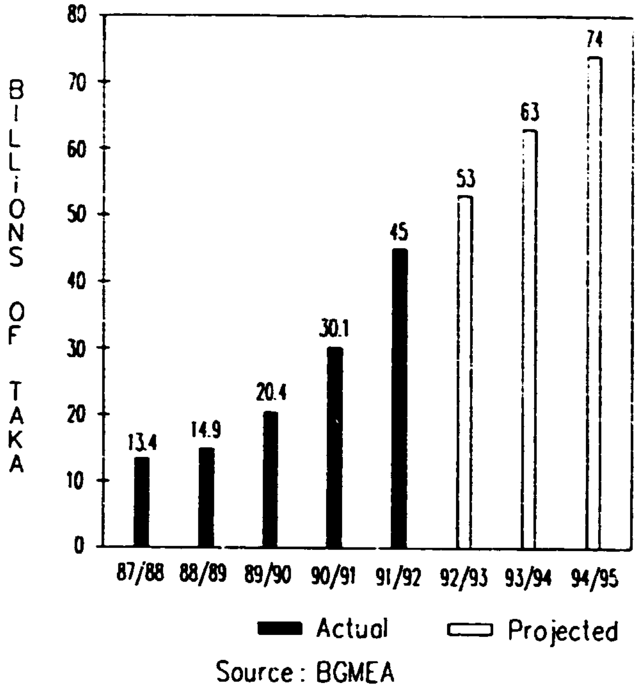


Figure 3-4 : FORECAST OF GARMENT EXPORTS

The annual projected growth rate is assumed to be 18 %, half of the actual growth rate of the 36 % average during the period from 1987/88 to 1991/92. The forecast of woven fabric demand by the garment sector will be assumed as follows according to the outlook of figure 3-4.

1991/92	900 million meters
1992/93	1,062 "
1993/94	1,253 "
1994/95	1,478 "

3.2 Marketing Concept

On the basis of marketing analysis findings, the basic strategy or objectives of the project will be considered as follows:

- to promote the growth of RMG industries by supplying them with the fabrics they need
- to contribute to the economic development of Bangladesh by creating new employment

- to cooperate toward the achievement of the government's backward linkage policy for the RMG industry
- to contribute to Bangladesh's industrialization policy through investment
- to offer an investment chance to local and foreign investors
- to contribute to regional activation by establishing a plant

The marketing concept for the project is comprised of the specific marketing strategies and measures and means required to achieve these project objectives in a chosen market.

3.2.1 Marketing Strategy

The marketing strategy of the project developed within the framework of the project strategy is summarized as follows:

1) Product Target Group
The ready-made garment manufacturers, which there are now more 1,200, are the main target market. About 100 top-rated companies will form the target group.

2) Technological Requirements
The project envisages the production of excellent quality, low cost products, which will realize the marketing strategy of differentiation even for low price products, introducing ultra-modernized production equipment making the most of computerized systems from time to time. The leading technology for production management and quality control will be introduced and implemented in the project by expatriate staff in order to beat the competition of actual and potential competitors of the project. Furthermore, the project intends to set up a composite textile mill, laying emphasis on the process of dyeing and finishing with a computerized color matching system and an automatic color dispensing system in order to cater to the requirements of users. Processes on upstream, weaving and spinning, are downscaled, utilizing imported yarns and grey fabrics of good quality.

3.2.2 Marketing Mix

The marketing mix which the project should adopt is analyzed hereafter.

1) Product and Product Policy

a) Product Mix

Development of a new product is done along the following lines :

- to collect ideas and information relating to a new product
- to identify it from the viewpoint of business philosophy, corporate objectives or strategy
- to make the product's concept clear
- to establish marketing strategy for the product.

Such steps have all been verified in this study and resulted in the following product mix and production programme:

Number, Kind and Quantity of Products

Cotton broadcloth	$\frac{\text{CM80/2 x CM80/2}}{\text{127 x 73}}$	359,800 m/month
Cotton gabardine	$\frac{\text{CM60/2 x CM60/2}}{\text{131 x 60}}$	264,200 m/month
Polyester/cotton blended poplin	$\frac{\text{P/C45 x P/C45}}{\text{110 x 76}}$	1,876,000 m/month
Total		2,500,000 m/month

Product Assortment

Cotton broadcloth	Bleached fabric	135,000 m/month
	Dyed fabric	100,000 m/month
	Yarn-dyed fabric	124,800 m/month
Cotton gabardine	Dyed fabric	264,200 m/month
P/C poplin	Bleached fabric	950,000 m/month
	Dyed fabric	651,000 m/month
	Yarn-dyed fabric	275,000 m/month
Total		2,500,000 m/month

b) Product Policy

Differentiated products prevail in the marketing strategy, as seen in the proposed product mix where mechanically weaved and finished cotton broadcloth and gabardine are yet being used as the material for export garments in Bangladesh. Therefore, its supply to the RMG industries must wait for some time until the merchandise lineup of garments is more diversified and upgraded. Until then, the target markets for such sophisticated commodities are the more advanced countries in Asia like Japan or ASEAN countries. Even P/C poplin, although already an established and popular item, will be a differentiated product in this project with the same quality and price as that imported from advanced countries in Asia.

2) Price Policy and Pricing

a) Price Policy

It was previously mentioned that the project should have differentiation strategy. This should be applied in the case of low-priced items. At present, many companies in the existing textile industry have not succeeded in selling their fabrics to the RMG industry because they lose money due to low sales price and high costs. In fact, domestically produced fabrics cannot compete with bonded fabrics imported by RMG manufacturers because domestic textile manufacturers have to pay fairly high protective import duties on the imported materials and spare parts used in the products. If it is certified that such domestically produced fabrics are used for exported garments, they are allowed to claim duty drawback for duties and taxes already paid. But, in reality this system is hardly functional and only a portion of the money paid is ever refunded after a delay of months and even years.

In order for the project to have price competitiveness and earnings derived from low costs, it should aim to become a 100 % export-oriented manufacturer which is privileged to import yarn and other materials duty-free under bonded warehousing.

After narrowing the targeted market down to the RMG industry, the following price policy has been established, taking competition with imported fabrics into consideration :

P/C poplin	Penetrating price policy
Cotton broadcloth/gabardine	Overlaid price policy combined with differential price policy

This is because:

- P/C poplin is required to deprive the market of the imported cloth, underquoting it from the outset.
- For cotton fabrics to play a leading part in the differentiation policies, it is necessary to fix an image of high price, quoting high prices at the beginning. Then, as the sales quantity increases, the initial price should be lowered or altered with elasticity in accordance with the situation, adopting a differential price policy (discount and rebate). The infiltrating price policy should be adopted for products exported to Japan or Southeast Asia.

b) Price Setting

It is necessary to adopt methods of price setting that differ according to product. Low price setting from the viewpoint of competition is adopted for P/C poplin so as to compensate for disadvantages brought on by imported fabrics as well as to acquire market share over a short period. On the other hand, at present, it is unclear just how much gabardine and cotton broadcloth is being used by the RMG industry, but gabardine and broadcloth are high-grade fabrics which require high-quality production technology. Therefore, it is only natural that the price will be relatively high. The project should initially set a fairly high price on these items. It is considered inappropriate at the outset to adopt the cost-plus method of price-setting by multiplying production costs by a fixed rate for any of the project's products.

3) Distribution

A new company should initially try to secure an advantage in the market by differentiating its own products from those of its competitors. Then, it should maintain stable and lucrative prices for its products. According to the field survey, the current distribution channels for fabric manufacturers in domestic transactions are as follows:

a. Maker ---→Users (Market)
b. Maker -------------------------------------→Users (Garment makers)
c. Maker -------------------------→Retailers --------→ Users (Market)

d. Maker ----▸Wholesalers ----▸Retailers -------▸ Users (Market)

e. Maker ----▸Wholesalers ------------▸ Users (Garment makers)

Channels to be adopted for this project are "b" and "e" above. The "b" channel has financial risks, and should only be used for trustworthy users having ample funds. The "e" channel should be widely practised. As for the width of the channel, a selection-type channel rather than open-type one should be adopted. The company should concentrate on sales efforts by giving priority to business with selected, potent sales agents or wholesalers.

In order for the distribution channel system to function smoothly in the future, a sales firm should be established to create a vertical sales network. The sales firm should serve as the center of this channel system among the channel members.

Distribution logistics that totally control not only commercial distribution but also procurement distribution, production distribution and sales distribution, should be considered.

4) Promotion Mix

This mix lays emphasis on "sales promotion" and "man-power sales".

a) Sales Promotion

The sales promotion is a tactical promotion tool aimed at short-term demand effect and the project should adopt the following sales promotions:

- internal sales promotion; smooth communication inside the firm, sales meetings, preparation of a sales manual, etc.
- sales promotion for sales agents; dealer helps, various allowances
- sales promotion for users; sampling service, commodities exhibition, showroom service, offer of brochures and catalogs, etc.

b) Man-Power Sales

"Man-power sales" involve face-to-face contact between salesmen and their customers in order to get the customers to buy commodities and conclude a sales contract. This is one of the most important factors in determining the success or failure of the project. Man-power sales can contribute remarkably to sales activity success for following reasons :

- Customer needs can be accurately ascertained.
- Careful and flexible sales activities are possible through the direct communication and dialogue.

- The information obtained can be fedback to the planning department in a short time (quick response)

3.3 Marketing Costs and Revenues

3.3.1 Marketing Costs

The projected marketing costs comprising all cost components are summarized in Table 3-4.

3.3.2 Sales Revenues

The projection of sales revenues are summarized in Tables 3-5, 3-6, 3-7, and 3-8.

Table 3-4 : ESTIMATE OF TOTAL MARKETING COSTS

Product/Cost centre: ITM in Bangladesh	Full Operation Cost/Year		Currency: U.S.$ Units: 1,000.-	
Cost item	Local costs		Foreign costs	
	Variable	Fixed	Variable	Fixed
Labour		9.3		
Training		5.2		5
Travel		1		20
Advertising		3		
Publicity		1		
Dealer helps		5		10
Dealer premium		2		10
Dealer allowance		3		10
Samples		1		2
Exhibition and showroom costs		5		
Brochures, leaflets, posters and other sales kits		5		10
Discounts and rebates		8		
Others		10		
Total unit costs				
Total units per period				
Total costs per period	0	58.5	0	67
Total marketing costs	58.5		67	

Table 3-5 : PROJECTED SALES PROGRAMME

Product/Cost centre: ITM in Bangladesh		Market Export Garment Industry Export market		Currency : U.S.$ Units : 1,000
Year	Exports			
	Product Name	Units sold (1,000m)	Unit Price (US$ 1,000/1,000m)	Revenues
1	Cotton Broadcloth			
	· Bleached	405	2.8	1,302.0
		10	2.1	21.0
	· Dyed	345	2.9	1.000.5
		7	2.2	15.4
	· Yarn-dyed	428	3.2	1,369.6
		9	2.4	21.6
	Sub-total	1,264		3,730.1
	Cotton Gabardine			
	· dyed	995	3.9	3,880.5
		20	2.9	58.0
	Sub-total	1,015		3,938.5
	P/C Poplin			
	· Bleached	9,581	1.2	11,497.2
		196	0.84	164.6
	· Dyed	6,564	1.32	8,664.5
		134	0.9	120.6
	· Yarn-dyed	1,034	1.44	1,489.0
		21	0.96	20.2
	Sub-total	17,630		21,956.1
	Total	19,809	1,496	29,634.3

Table 3-6 : PROJECTED SALES PROGRAMME

Product/Cost centre: ITM in Bangladesh		Market Export Garment Industry Export market		Currency : U.S.$ Units : 1,000
Year	Exports			
	Product Name	Units sold (1,000m)	Unit Price (US$ 1,000/1,000m)	Revenues
2	Cotton Broadcloth			
	· Bleached	1,429	2.8	4,001.2
		29	2.1	60.9
	· Dyed	1,058	2.9	3,068.2
		22	2.2	48.4
	· Yarn-dyed	1,321	3.2	4,227.2
		27	2.4	64.8
	Sub-total	3,886		11,470.7
	Cotton Gabardine			
	· dyed	3,028	3.9	11,809.2
		62	2.9	179.8
	Sub-total	3,090		11,989.0
	P/C Poplin			
	· Bleached	11,600	1.2	13,920.0
		237	0.84	199.1
	· Dyed	7,949	1.32	10,492.7
		162	0.9	145.8
	· Yarn-dyed	3,152	1.44	4,538.9
		64	0.96	61.4
	Sub-total	23,164		29,357.9
	Total	30,140	1.752	52,805.3

Table 3-7 : PROJECTED SALES PROGRAMME

Product/Cost centre: ITM in Bangladesh		Market Export Garment Industry Export market		Currency : U.S.$ Units : 1,000
Year	Exports			
	Product Name	Units sold (1,000m)	Unit Price (US$ 1,000/1,000m)	Revenues
	Cotton Broadcloth			
E	· Bleached	1,588	2.8	4,446.4
A		32	2.1	67.2
C	· Dyed	1,176	2.9	3,410.4
H		24	2.2	52.8
	· Yarn-dyed	1,468	3.2	4,697.6
Y		30	2.4	72.0
E	Sub-total	4,318		12.746.4
A	Cotton Gabardine			
R	· dyed	3,107	3.9	12,117.3
		63	2.9	182.7
A	Sub-total	3,170		12.300.0
F	P/C Poplin			
T	· Bleached	11,172	1.2	13,406.4
E		228	0.84	191.5
R	· Dyed	7,656	1.32	10,105.9
,		156	0.9	140.4
3	· Yarn-dyed	3,234	1.44	4,657.0
~		66	0.96	63.4
15	Sub-total	22,512		28,564.6
	Total	30,000	1.787	53,610.0

Table 3-8 : PROJECTED SALES PROGRAMME

Product/Cost centre: ITM in Bangladesh	Market Local Market		Currency : U.S.$ Units : 1,000	
Year	Local Sales			
	Product Name	Units sold (1,000kg)	Unit Price (US$1,000/1,000kg)	Revenues
1	Cotton waste	97	0.39	37.8
2	Cotton waste	268	0.39	104.5
EACH YEAR, 3 ∫ 15	Cotton waste	295	0.39	115.1
TOTAL				1,639

CHAPTER 4 : RAW MATERIALS AND SUPPLIES

4.1 Raw Cotton

Raw cotton will be used in the spinning department. In Bangladesh, cotton from the U.S., Pakistan, Sudan, Russia, Egypt, etc. is used at present. In this project, only imported raw cotton is to be used.

The spinning department manufactures 910 tons per year of cotton combed yarn Ne 80/2. The entire amount is supplied to the weaving department. With the ultimate use being RMG for export, quality is naturally given the highest priority in the yarn stage as well. As the quality of the raw cotton directly affects the quality of the yarn, it is desirable to purchase raw cotton of a good quality, compatible with the kind of yarn, through a reliable dealer. Also, in order to manufacture yarn of a stable and identical quality throughout the year, several kinds of readily available cotton should be blended and used.

The standard values for the major characteristics of raw cotton are to be staple length 1-7/16, micronaire degree 3.8 - 4.3 and Pressley strength 105,000 psi.

The amount of raw cotton required per year is calculated (according to the conditions of the calculation table shown in chapter 6, section 6.2 "Engineering and Technology/ Spinning") to be 143.5 kg/hr. or 1,206,000 kg/year. The raw cotton price at the end of 1992 of C&F 95 cent/kg was used.

Dropped waste generated through the processes is saleable. It is priced differently according to its kind (comber waste - 20 Taka/kg, blow/carding waste - 5 Taka/kg, yarn waste - 15 Taka/kg). Meanwhile, the dropped waste generation rate is affected by the kind of raw cotton, the kind of yarn to be manufactured, the required degree of quality of the manufactured yarn, etc. The dropped waste generation rate in each process was assumed as shown in the aforementioned calculation table. The average sales price (weighted mean) of dropped waste was calculated accordingly to be 15.6 Taka/kg. The generated amount, which also agrees with the value obtained by subtracting the annual production amount from the aforementioned amount of raw cotton required per year, is 1,206,000 - 911,000 = 295,000 kg/year.

Incidentally, the amount of cotton required at operation start-up is calculated to be about 50,000 kg.

4.2 Yarns and Grey Cloth

4.2.1 Yarns

The material for the weaving department is the yarn supplied from the spinning department. In this project, the spinning department supplies only combed yarn Ne 80/2, so it is necessary to purchase combed yarn Ne 60/2 and polyester cotton blended yarn Ne 45 in order to manufacture aimed textiles. To achieve the required export quality, however, it is necessary to procure yarn of a quality appropriate for the purpose. Namely the quality of the yarn need not always be the highest, but it should be high enough to meet the required quality. However, the quality must meet the world standard, and yarn of this kind has been marketed. At present, it is possible to freely purchase yarn of export quality in Southeast Asia.

As to polyester cotton blended yarn Ne 45, there is already a compatible product available in Indonesia.

Common sense quality standards are as follows:

- U % less than 12.8 max., strength 275 gr min. for PC Ne 45
- no unevenness of twist for CM Ne 80/2 and CM Ne 60/2

4.2.2 Grey Cloth

Excluding yarn dyed fabrics, 1,601,000 m/month (actual purchased amount: 1,613,800 m/month = 110.8 m x 14,565 pcs) of P/C poplin, which accounts for 75 % of the amount of the production plan, is to be imported from neighboring countries.

It is possible to procure high quality cloth of this class cheaply from other Asian countries (for example, Indonesia and Korea). It must be evaluated constantly to make sure that it complies with the quality level of the new mill. A system to pass imported grey cloth into the mill after quality inspection has been adopted. For that, two cloth inspection machines have been installed.

Regarding yarn dyed fabrics, it has been decided to purchase raw yarn in view of quality, e.g. coloring, design and color fastness, and to perform yarn dyeing, etc. at the project's mill.

4.3 Auxillary Materials

4.3.1 Packing Materials

Transporting products from the mill to the garment factories is much simpler than transporting products for export. The product is wound (110 m/roll) on a paper tube (5 cm dia.) and is transported, strapped with a polypropylene band (19 mm width), 6 rolls/carton.

The cloth end and carton face indication screens, the paper tubes and the carton boxes are locally procurable. Their prices, however, are almost the same as in Japan.

A six month's supply of polypropylene strapping bands (2,000 m x 50 rolls) has been budgeted as a machine-attached consumable.

4.3.2 Sizing Materials

Sizing materials most suitable for the kind of the textile, the material of the yarn to be used and the loom to be adopted, must be chosen. In high-speed looms, effective sizing is particularly important.

The size is to be prepared and cooked with the following objectives in mind to improve and maintain weavability :

- Improving yarn strength
- Laying yarn fluff
- Improving yarn flexibility
- Improving yarn smoothness
- Improving abrasion resistance

To attain these results, adequate moisture absorptiveness is supplementally given or a surface active agent is used to mix sizing materials evenly as well as adding a chemical for long-term storage of the textile and so on.

In concrete terms, PVA (polyvinyl-alcohol), starch, acryl, oil and grease material, wax, mildew preventative, etc. are used.

4.3.3 Chemicals and Dyestuffs

Of the necessary chemicals, only three (urea, sulfuric acid and sodium silicate) are procurable in Bangladesh, although the surface active agent, the softening agent and finishing resin are locally bottled after being imported.

Domestically-produced chemicals are priced as high as imported products, and some are priced even higher.

Dyestuffs account for somewhat different percentages according to the product type. For cotton, reactive dye accounts for 90 % and vat dye 10 %. For polyester, disperse dye is used.

All dyestuffs must be imported. At present, mostly imported products from Europe are used. This lack of inexpensive, domestically produced chemicals and dyestuffs is a negative factor in performing the dyeing and finishing in Bangladesh.

4.3.4 Consumables and Spare Parts

To maintain the machinery in good condition, it is necessary to replace worn parts, repair breakdowns and replenish consumable parts precisely according to the process and the machine.

Lubrication and maintenance should be performed regularly as specified in the manufacturer's manual. Parts for use in machine failure or breakage resulting in shutdown, and parts or consumables requiring a lengthy import time must be stocked in sufficient quantities.

1) Spinning Department

Various consumables required for operation and maintenance work and machine parts for maintenance are said to cost about US$0.70 per spindle per month. In this project, however, very large twisting equipment will be used, so $0.80/sp/month is essential. This totals up to 480 x 52 x 0.8 x 12 = $239,600 per year. Of this, the cost of the replacement parts used in maintenance accounts for a large percentage. It was assumed to account for 85 % of the total at this time. For spare parts (which are delivered at the same time as the main equipment for an equivalent of 2 years' consumption), the cost of replacement parts was estimated at only 40 % for the 1st year and 60 % for the 2nd year.

2) Weaving Department

While the loom's consumables have largely decreased with the adoption of an air jet loom, local procurement of consumables such as oil, rag, etc. is being considered .

An equivalent of 2 years' consumption of spare parts has been procured together with machinery and equipment. Costs are estimated to be generated at 40 % in the 1st year, at 60 % in the 2nd year and fully in the 3rd year and beyond.

3) Dyeing and Finishing Department

Such consumables as sewing threads for end stitching, special pins for cloth end indication, guide cloth for the production machine, guide tapes (of cotton or polyester filament), covering films, chemical preparing instruments, forms such as control cards, etc., writing implements, and protective gear for safety (goggles, gloves, boots, etc.), are necessary.

An equivalent of 2 years' consumption of spare parts has been secured for the time being. An equal amount will be purchased in the 3rd year and beyond.

4.4 Utilities

4.4.1 Electric Power

1) Power Supply by BPDB

In Bangladesh, power generation and power transmission and distribution have been monopolized by the Bangladesh Power Development Board (BPDB).

With the country's electric power supply/demand situation being very tight, BPDB's overall supply availability rate is currently almost none. BPDB's electric power supply/demand condition is shown in Table 4-1.

Table 4-1 : BPDB'S POWER SUPPLY AND DEMAND

	Capability	Max. Demand	Reserve Margin	Reserve Factor
1988	1850 KW	1300 KW	550 KW	30%
1989	1950	1400	550	28%
1990	1820	1500	320	18%
1991	1700	1650	50	3%

The Chittagong area, where the transmission line network capacity from the power generation zone has been insufficient, is in a very tight supply/demand condition due to damage of the transmission line network by a cyclone in April, 1991.

BPDB's power generation composition is shown in Figure 4-1. Power generation using natural gas as energy accounts for 88 % of the total.

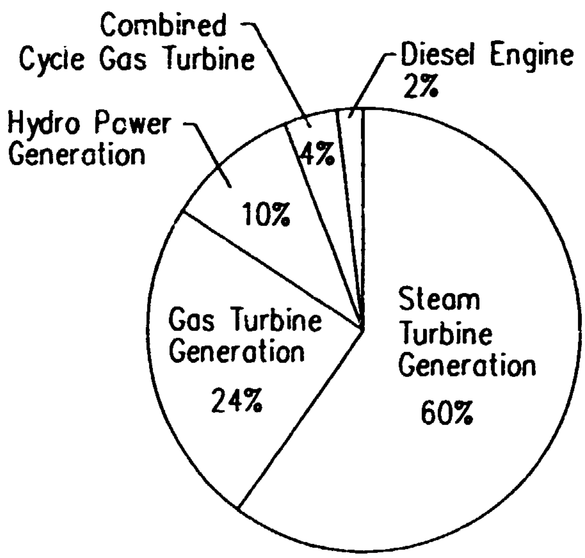


Figure 4-1 : INSTALLED CAPACITY COMPARISON OF BPDB GENERATION

2) Electric Power Consumption Mode

The electric power consumption mode is a complete first night peak type. The peak load occurs from PM 6:00 to PM 11:00. This accounts for 37 % of the load. This is due to the fact that the electric power requirements for the public (for home and commercial industry) are very high. (Refer to Figure 4-2.)

Power generation equipment is being reinforced to cope with the present tight supply/demand situation. The following are planned to start up in the near future:

- Ghorasal Steam Turbine 210 MW planned for Dec.,1993
- Chittagong Steam Turbine 210 MW planned for April,1993

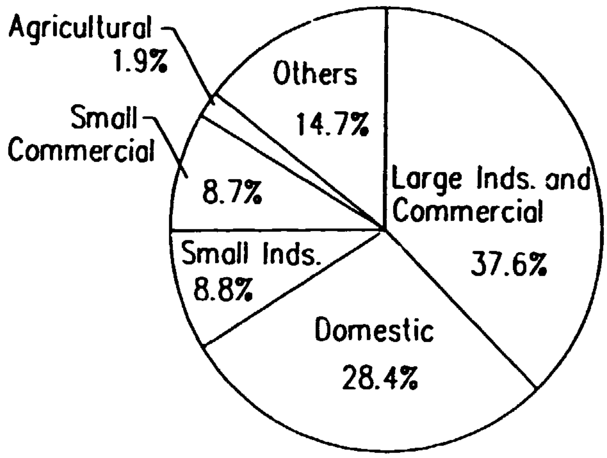


Figure 4-2 : CONSUMPTION

It is expected, therefore, that the tight supply/demand situation will be lessened considerably by the end of 1993, when these power plants are completed. There is also a transmission line reinforcement plan under which a 230-kV transmission line will reach Chittagong. Its concrete implementation plan is not known at this time, however.

3) Electric Power Stability Condition

Interruptions in the national grid power supply according to the BPDB's data is shown in Table 4-2. It can be seen that there are interruptions in the power supply fairly often in some areas.

Table 4-2 : INTERRUPTION OF NATIONAL GRID POWER SUPPLY

Type of Fault	Total Number of Faults		Total Duration (hours)	
	1989/90	1990/91	1989/90	1990/91
1. Partial power failure due to generation trouble/load shedding	12	88	6	113
2. Partial grid failure due to transformer/breaker trouble	30	85	22	195
3. Partial grid failure due to fault in transmission line	48	187	24	157
4. Partial grid failure due to lightning/stormy weather	12	19	4	65
5. Partial grid failure due to fault in east-west inter-connector	5	2	1	1
6. Total grid failure	1	0	1	0
Total	108	381	58	531

An unstable power supply becomes a big negative factor, both in production and in quality, in a modern textile mill. The power supply situation in Chittagong has serious problems in quantity and quality.

4) Power Receiving Cost (According to BPDB's Electricity Tariff)
There are industrial electric power categories of E, F and H as shown in Table 4-3.

Table 4-3 : ELECTRICITY TARIFF OF BPDB

		Category E	Category F	Category H
Voltage	KV	Low Tension	11	33
Sanctioned load	KW	~ 50	~ 5,000	~ 15,000
Off-peak hours use (23h-24h 0h-17h)	TK/KWh	2.45	1.9	1.75
Peak hours use (17h-23h)	TK/KWh	6.0	4.8	4.50
Demand charge	TK/KW	20	40	35
Service charge	TK/M	Single Ph 5T 3 Ph 400V 25	350	400
Govt. electricity duty	TK/KWh	0.15	0.15	0.15

With the maximum electricity demand in a textile mill being normally less than 5,000 KW, category "F" (11-KV power) is the most applicable category.

Although the figures may vary depending on the electricity use conditions, the average unit price is 2.7 TK to 3.0 TK/KWh (if run almost continuously with the number of days when the operation is stopped being about 10 - 15 days per year).

4.4.2 Natural Gas

Bangladesh is endowed with natural gas. The country relies on it for the majority of its energy needs. Recently, natural gas has often come to be used as a raw material in fertilizers, chemical products, etc.

The drilling and distribution of natural gas has been monopolized by the Bangladesh Oil, Gas & Mineral Corporation (PETRO BANGLA).

The present amount of natural gas drilled and future natural gas drilling plans are:

- Present Amount Drilled : 600 million f^3/day (17 million m^3/day)
- In the Year 2000 : 1997 million f^3/day (56.55 million m^3/day)

Natural gas is drilled mostly in the northeastern part of Bangladesh. It is not drilled in the western part of Bangladesh or around Chittagong.

Natural gas is sent from Baknrabad to Chittagong through a pipeline. There is no problem at all in quantity regarding the amount to be used in the new project.

With the pipeline pressure being 150 psi, there is no need for boosting for use in the gas engine, etc., so the conditions are very favorable, as shown below.

Sulfuric Oxide (SOX)	Nil
Nitric Oxide (NOX) emission	Little (10% of diesel engine)
Particles of soot	Little

The composition of Bangladesh's natural gas is shown in Table 4-4. It is of good quality and is easy on the environment as an energy source for gas engines, steam boilers, etc.

Table 4-4 : QUALITY ANALYSIS OF NATURAL GAS

METHANE	94.10 %
ETHANE	3.65
PROPANE	0.74
ISO-BUTANE	0.22
N-BUTANE	0.10
ISO-PATANE	0.04
N-PATANE	0.02
HEXANES	0.06
HEPTANES	0.17
OCTANE	0.11
NONANE	0.03
CARBON-DIOXIDE	0.34
NITROGEN	0.42
HYDROGEN SULPHIDES	0.00
Total	100.00 %
CALCULATED GRAVITY	0.392
GROSS CALORIFIC VALUE	1057 Btu/ft^3 (39.38KJ/m^3)
NET CALORIFIC VALUE	960 Btu/ft^3(35.79KJ/m^3)

Compared with the diesel engine fuel of Indonesia which is an oil-producing country, in terms of cost, Bangladesh's natural gas for petrogas is much cheaper, so it is highly competitive with other countries in terms of energy. The light oil produced in Indonesia and the natural gas produced in Bangladesh are compared in Table 4-5.

Table 4-5 : COMPARISON OF COSTS

	Light Oil of Indonesia	Natural Gas of Bangladesh
Net Calorific Value	approx. 9600 Kcal/kg	8543 Kcal/m^3
Unit Price	360RP/m^3 0.1748US$/ m^3	3.31Tk/m^3 0.08275US$/m^3
Cost US$/10,000Kcal	0.180247 US$	0.09686 US$
Comparison of Cost	1	0.537

4.4.3 Industrial Water

While Chittagong has its own city water supply, it is very difficult to use it as industrial water in view of cost. Therefore, the textile mill must rely on underground water for its industrial water.

Chittagong City and its vicinity are estimated to be on a complete alluvium. The available pumping rate is judged to be about 15 m^3/hr at a depth of about 150 m. Water quality analysis values of a well currently in use (at a spinning mill belonging to A.K. Khan) in Chittagong City are shown in Table 4-6.

Table 4-6 : ANALYSIS OF DEEP WELL WATER IN CHITTAGONG

		Tested Value of Deep Well Water	Standard Value of Industrial Water
(1) pH	7.8	6 ~ 9.5	
(2) Colour	degree	6	Normal
(3) Turbidity	degree	0.4	50
(4) Total Hardness(as CaCo3)	mg/	100	250
(5) Total Alkalinity(as CaCo3)	mg/	236	N Y S
(6) Dry Residue	mg/	269	1500
(7) Total Ferrous (Fe(II)+}Fe(III))	mg/	0.05	0.5
(8) Mn	mg/	0.01	0.1 ~ 1.0
(9) Cu	mg/	less than 0.01	N Y S
(10) Zn	mg/	less than 0.01	N Y S
(11) Ca	mg/	16.0	N Y S
(12) Dissolved Silica	mg/	23.5	N Y S
(13) Chlorine ion (Cl-)	mg/	3.3	N Y S
(14) Sulfuric ion (SO42-)	mg/	15.1	N Y S
(15) NH4-N	mg/	0.31	N Y S
(16) NO2-N	mg/	0.008	N Y S

Note : NYS = Not Yet Set

4.4.4 Supplies for Utilities

1) Availability

The results of the field survey for the procurement of utility equipment are shown in Table 4-7.

Table 4-7 : SOURCE OF MECHANICAL/ELECTRICAL EQUIPMENT

Name of Machines and Materials	Summary
Electric equipment	All equipment more than 10KV to be imported
Power generating equipment	Imported
Distribution/control panels	Mostly imported
Light panels, switch boxes	NCCB etc. assumed to be imported (local ones possibly utilized)
Electric wires & cables	Locally made wires/cables to B.S. will be utilized.
Lighting equipment	Fluorescent lamps in the mill assumed to be imported. (local ones possibly utilized) Hg lamps in the mill assumed to be imported.
Wiring materials	Imported or locally made as available
Air-conditioners, chillers, pump compressors, boilers, etc.	Mostly imported
Piping materials and related parts	Mostly imported: particularly galvanized pipes and parts will have to be imported.
Vinyl and related parts	Locally made pipes for drainage and returns of chilled water without pressure to be utilized
Ducting materials for air-conditioner	Pre-fabricated galvanized plates to be imported. Connections and special framing to be done at site.
Structural steel	Mostly imported

2) Workability

The survey results for workability are as follows:

a) There is no problem in the sub-station and power distribution equipment as long as a reliable electric contractor in Bangladesh is used. The power generation equipment is judged as workable as long as a contractor having skillful engineers in the country is used under the guidance of a supervisor from the manufacturer.

b) There is no problem in low-tension power wiring, lighting wiring, etc.

c) For airconditioning equipment, installation and duct work is possible under the guidance of the supervisor of the equipment manufacturer. It is desirable to import a prefabricated duct. It is desirable to import pre-fabricated duct and to assemble it at the site in view of the finishing and the working period. For piping work, an excellent welder is required to install pneumatic and steam pipes with a maximum diameter of about 10" and a pressure of 8 kg/cm^2. There are several contractors having skilled welders in Dacca and Chittagong.

4.5 Cost Estimate of Raw Materials and Supplies

The cost estimates of mill operation in each department regarding raw cotton, yarns, grey cloth, sizing and packing materials, dyestuffs and chemicals, consumables, spare parts, electricity, natural gas, industrial water and water treatment materials are shown in Tables 4-8, 4-9. Operation costs in the 1st and 2nd year are expended nearly in proportion to operation degree, so the cost fluctuation ratio is shown in Table 4-10. The estimated total cost for this project's operation is summarized in Table 4-11.

Table 4-8 : ESTIMATE OF COSTS OF RAW MATERIALS AND SUPPLIES

Product/cost centre : ITM in Bangladesh	Full Operation Cost/Year				Currency : U.S.$ Units : 1,000.-$	
Item description	F L	Quantity	Unit	Cost per Unit	Total cost	Sub-Total
1.Spinning						
Raw cotton	F	1,206	ton	2.094	2,525.4	
Waste cotton	L	295	ton	-0.390	-115.1	
Consumables	L	12	month	3.0	36.0	
Spare parts	F	12	month	17.0	204.0	2,650.3
2.Weaving						
Raw materials						
Cotton yarn (Ne 60/2')	F	4,670	bale	1.500	7,005.0	
Polyester/Cotton						
Blended yarn (Ne 45')	F	3,280	bale	0.880	2,886.4	
Sizing materials	F	86.09	ton	2.373	204.3	
Consumables	L	12	month	1.317	15.8	
Spare parts	F	1	year	174.3	174.3	10,285.8
3.Dyeing and Finishing						
Raw materials						
PC (Ne45') grey cloths	F	19,365	1,000m	0.656	12,703.4	
Packing materials						
Cotton broad, bleached	L	1,620	1,000m	0.019	30.8	
Cotton broad, dyed	L	1,200	1,000m	0.019	23.4	
Cotton broad, yarn dyed	L	1,497.6	1,000m	0.019	28.4	
Cotton gaberdine, dyed	L	3,170.40	1,000m	0.020	63.4	
P/C poplin, bleached	L	11,400	1,000m	0.018	205.2	
P/C poplin, dyed	L	7,812	1,000m	0.018	140.6	
P/C poplin, yarn dyed	L	3,300	1,000m	0.018	59.4	
Dyestuffs and chemicals						
Cotton broad, bleached	F	1,620	1,000m	0.031	50.2	
Cotton broad, dyed	F	1,200	1,000m	0.092	110.4	
Cotton broad, yarn dyed	F	1,497.6	1,000m	0.142	212.7	
Cotton gaberdine, dyed	F	3,170.40	1,000m	0.267	846.5	
P/C poplin, bleached	F	11,400	1,000m	0.026	296.4	
P/C poplin, dyed	F	7,812	1,000m	0.078	609.3	
P/C poplin, yarn	F	3,300	1,000m	0.138	455.4	
Auxiliary agent						
Cotton broad, bleached	L	1,620	1,000m	0.0032	5.2	
Cotton broad dyed	L	1,200	1,000m	0.0044	5.3	
Cotton broad yarn dyed	L	1,497.6	1,000m	0.0032	4.8	
Cotton gaberdine, dyed	L	3,170.40	1,000m	0.0036	11.4	
P/C poplin, bleached	L	11,400	1,000m	0.0028	32.0	
P/C poplin, dyed	L	7,812	1,000m	0.0036	28.1	
P/C poplin, yarn dyed	L	3,300	1,000m	0.0028	9.2	
Cunsumables	L	1	lot	57.6	57.6	
Spare parts	F	1	lot	129.6	129.6	16,118.7
4.Utility						
Spinning department						
Electricity (BPDB)	L	21,426.6	MWH	70.8	1,517	
Natural gas for electricity	L	1,729.1	1,000m³	0.0827	143	
City water	L	13.2	1,000m³	0.0758	1	
Consumables	L	12	month	2.92	35	
Spare parts	F	12	month	5.58	67	

ESTIMATE OF COSTS OF RAW
MATERIALS AND SUPPLIES

Product/cost centre : ITM in Bangladesh	Full Operation Cost/Year				Currency : U.S.$ Units : 1,000.-$	
Item description	F L	Quantity	Unit	Cost per Unit	Total cost	Sub-Total
Weaving department						
Natural gas for electricity	L	2,757.0	1,000m³	0.0827	228	
Natural gas for stem	L	1,632.9	1,000m³	0.0827	135	
City water	L	7.9	1,000m³	0.0758	1	
Consumables	L	12	month	4.17	50	
Spare parts	F	12	month	0.83	10	
Dyeing and Finishing department						
Natural gas for electricity	L	2,243.8	1,000m³	0.0827	186	
Natural gas for stem	L	7,099.4	1,000m³	0.0827	587	
Natural gas heat transfor medium	L	1,292.6	1,000m³	0.0827	107	
Natural gas for gas singeing	L	108.2	1,000m³	0.0827	9	
City water	L	11.2	1,000m³	0.0758	1	
Consumables	L	12	month	3.25	39	
Spare parts	F	12	month	6.25	75	
Water treatment materials	L	1	year	154.0	154	3,345.0
Total costs					32,400	32,400

Table 4-9 : ESTIMATE OF COSTS OF RAW MATERIALS AND SUPPLIES

Product/Cost centre: ITM in Bangladesh	Full Operation Cost/Year		Currency: U.S.$ Units: 1,000.-	
Item description	Local costs		Foreign costs	
	Variable	Fixed	Variable	Fixed
1.Spinning				
Raw cotton			2,525.4	
Waste cotton			-115.1	
Consumables		36.0		
Spare parts			204.0	
Sub-Total		36.0	2,410.3	204.0
2.Weaving				
Raw materials				
Cotton yarn (Ne60/2's)			7,005.0	
Polyester cotton blended yarn (Ne45's)			2,886.4	
Sizing materials			204.3	
Consumables		15.8		
Spare parts				174.3
Sub-Total		15.8	10,095.7	174.3
3.Dyeing and Finishing				
Raw materials				
PC (Ne 45's) grey Cloths			12,703.4	
Packing materials	551.2			
Dyestuffs and chemicals			2,580.9	
Auxiliary agent	96.0			
Consumables		57.6		
Spare parts				129.6
Sub-Total	647.2	57.6	15,284.3	129.6
4.Utility				
Spinning department				
Electricity (BPDB)	1,517.0			
Natural gas for electricity	143.0			
City water	1.0			
Consumables/spare parts		35.0		67.0
Weaving department				
Natural gas for electricity	228.0			
Natural gas for steam	135.0			
City water	1.0			
Consumables/spare parts		50.0		100.0
Dyeing and Finishing department				
Natural gas for electricity	186.0			
Natural gas for stem	587.0			
Natural gas heat transfor medium	107.0			
Natural gas for gas singeing	9.0			
City water	1.0			
Consumables/spare parts		39.0		75.0
Water treatment materials	154.0			
Sub-Total	3,069.0	124.0		242.0
5.Labour				
Spinning				
Unskilled	170.6			
Other than unskilled	49.3			

ESTIMATE OF COSTS OF
RAW MATERIALS AND SUPPLIES

Product/Cost centre: ITM in Bangladesh	Full Operation Cost/Year		Currency: U.S.$ Units: 1,000.-	
Item description	Local costs		Foreign costs	
	Variable	Fixed	Variable	Fixed
Weaving				
Unskilled	120.4			
Other than unskilled	36.1			
Dyeing and Finishing				
Unskilled	151.2			
Other than unskilled	61.3			
Utility				
Unskilled		6.5		
Other than unskilled		48.5		
Sub-Total	588.9	55.0		
Total costs	4,305	288	27,790	750

Table 4-10 : COST FLUCTUATION OF RAW MATERIALS AND SUPPLIES

Product/Cost Centre : ITM in Bangladesh			
Item description	Cost Projection Year	% to Full Operation	
		Local Costs	Foreign Cost
1.Spinning			
Raw cotton	1st		33 %
	2nd		91 %
Waste cotton	1st		33 %
	2nd		91 %
Consumables	1st	50 %	
Spare parts	1st		20 %
	2nd		60 %
2.Weaving			
Raw materials	1st		35 %
	2nd		98 %
Sizing materials	1st		40 %
	2nd		98 %
Consumables	1st	40 %	
	2nd	95 %	
Spare parts	1st		40 %
	2nd		60 %
3.Dyeing and Finishing			
Raw materials	1st		86 %
	2nd		104 %
Packing materials	1st	65 %	
	2nd	99 %	
Dyestuffs and chemicals	1st		50 %
	2nd		97 %
Auxiliary agent	1st	65 %	
	2nd	99 %	
Consumables/Spare parts	1st	50 %	
	2nd	97 %	
4.Utility			
Spinning Department	1st		
Electricity (BPDB)		40 %	
Natural gas (Electricity)		50 %	
Others		100 %	
Weaving Department	1st		
Natural gas (Electricity)		40 %	
Natural gas (Steam)		50 %	
Others		100 %	
Dyeing and Finishing Department	1st		
Natural gas (Electricity)		70 %	
Natural gas (Steam)		80 %	
〃 (Singeing)		65 %	
Others		100 %	
Consumables/Spare parts	1st	100 %	11 %
	2nd	100 %	34 %
Water treatment materials	1st	65 %	
	2nd	99 %	
5.Labour	1st		
Spinning			
Unskilled		66 %	
Other than unskilled		68 %	
Weaving			
Unskilled		83 %	
Other than unskilled		89 %	

COST FLUCTUATION OF
RAW MATERIALS AND SUPPLIES

Product/Cost Centre : ITM in Bangladesh			
Item description	Cost Projection Year	% to Full Operation	
		Local Costs	Foreign Cost
Dyeing and Finishing			
Unskilled		83 %	
Other than unskilled		92 %	
Utility			
Unskilled		100 %	
Other than unskilled		100 %	

Table 4-11 : ESTIMATE OF FACTORY COSTS

Product/Cost centre: ITM in Bangladesh	Full Operation Cost/Year			Currency: U.S.$ Units: 1,000.-
Item discription	Local costs		Foreign costs		Total
	Variable	Fixed	Variable	Fixed	
1.Raw materials (a)			25,005.1		25,005
2.Raw materials (b)	647.2		2,785.2		3,432
3.Utility	157.0				157
4.Energy	2,912.0				2,912
5.Labour : Direct	588.9				589
6.Labour : Indirect		55.0			55
7.Repair, Maintenance		233.4			233
8.Spare Parts				749.9	750
Total unit costs	4,305	288	27,790	750	33,133

CHAPTER 5 : LOCATION, SITE AND ENVIRONMENT

5.1 The Location

5.1.1 Geographical Position

Bangladesh is located on the north end of the Bay of Bengal, lying between 21°0' and 26°5' latitude, and between 89°0' and 92°5' longitude. It lies in the delta area of the Ganges, Brahma Putra and Meghna Rivers. Except for a small part of the southeast border where it touches Burma, all of Bangladesh borders India. Apart from hills covered in bamboo forests in the southeast, more than 80 % of the land is on a fertile alluvial plain; thus, the economic foundation is still based on agriculture.

5.1.2 Climate

The Ganges delta has a typical monsoon climate. From June to September, the winds blow from the south over the Bay of Bengal, bringing more than 2,500 mm/year of heavy rain. Due to the low altitude of the country, flood devastation occurs from time to time which creates very serious problems for the people and disrupts the stable output of agricultural production. The dry season starts in October and ends in May. January is the driest and most comfortable month, with winds blowing from the continental north. April is the hottest month of the year, and temperatures remain high throughout the monsoon season. Figure 5-1 graphically indicates the monthly changes in average temperatures in Chittagong.

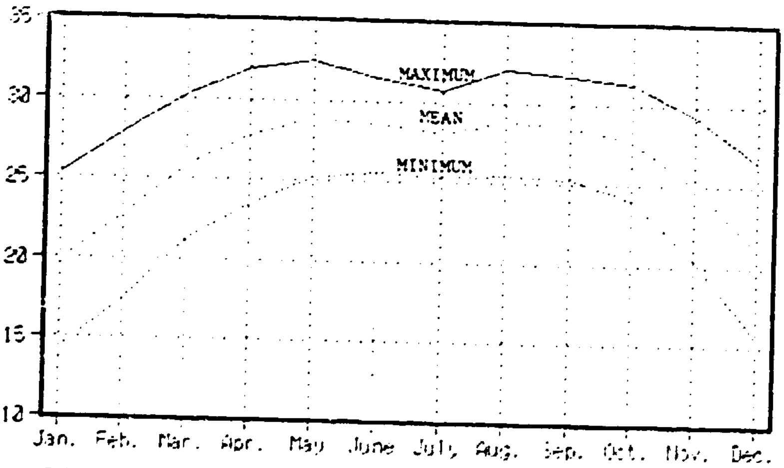


Figure 5-1 : AVERAGE TEMPERATURE IN CHITTAGONG (1990 - 1992)

The meteorological records of the Chittagong region for the last three years are shown in Table 5-1.

Table 5-1 : METEOROLOGICAL RECORDS IN CHITTAGONG

(Averages for 1990 ~ 1992)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (℃)	max.	25.3	27.9	30.3	32.0	32.5	31.5	30.8	32.1	31.8	31.3	29.4	26.5
	min.	14.3	17.4	21.3	23.5	25.2	25.6	25.3	25.5	25.3	24.1	20.4	15.5
	mean	19.8	22.7	25.9	27.8	28.9	28.6	28.1	28.8	28.6	27.7	25.0	21.1
Humidity (%)		77	76	78	78	79	84	86	84	85	83	80	78
Rainfall (mm)		6	53	18	126	166	671	725	251	264	293	59	28
Wind	Speed (knots)	4	5	7	9	7	8	8	7	6	5	4	4
	Direction	NE	NE	S	S	SE	SE	SE	SE	SE	SE	NE	NE
Hours of Sunshine (hr.)		9.4	9.6	9.1	8.9	7.6	4.5	4.1	5.1	6.6	8.3	8.4	9.4

(Source : Bangladesh Meteorological Department)

5.1.3 Location Study

In the study of the location, in addition to technical and commercial/financial factors, the social and environmental impact a project might have should also be considered. In Bangladesh, due to the limited availability and convenience of infrastructural services, it is very difficult to find a suitable location for the project site other than in the area of Dacca and Chittagong, especially for a large scale project as is under consideration. This project requires a proximity to customers and easy access to the port for import and export conveniences. It is also noted that Ready-Made Garment (RMG) industries which are going to be potential customers of the project are mainly located in the area of Dacca and Chittagong.

In this sense, the location study for this particular project means a comparison between Dacca and Chittagong, but taking some of the following reasons into account, the best project location is considered to be in the Chittagong area.

- Chittagong is the biggest port city and has many conveniences in regard to the import of raw materials and export of products.
- In Chittagong, the first export processing zone (EPZ) has already been devel-

oped, where quite a few foreign projects, including some RMG industries, have started operation.

- A. K. Khan Group, one of the promoters of the project, has had a strong business foundation in Chittagong since 1945, and actually all of its manufacturing bases are located in Chittagong. A. K. Khan Co., Ltd. also suggested Chittagong as the best location for the project.

5.2 The Site

5.2.1 Method of Selection and Evaluation Criteria

The success of the project is deeply dependent upon the appropriate selection of the site. A number of prospective sites were offered by the local partner during the field survey. Careful study and detailed analysis of each offered site were carried out.

The method of site selection and the evaluation criteria applied are listed below in order:

- STEP 1 : Preliminary Selection

  By applying the following primary criteria, and through referring to experiences from similar projects, the number of prospective sites shall be reduced to 2 or 3 sites.

  (Local Infrastructure)
  - Power supply
  - Water supply

  (Cost of Procurement)
  - Cost of land and site preparation

  (Environmental Impact)
  - Effluent receiving river and/or drainage

  (Socio-Economic Conditions)
  - Available incentives

- STEP 2 : Detailed Evaluation

  A look-see investigation at each selected site shall be carried out and detailed assessment shall be made by using the value analysis method. Evaluation criteria will be selected by the study team based upon their experiences from similar projects, while referring to the guidelines of UNIDO's manual as well. Comparison among prospective sites will then be made and tabulated. Thereafter, weighting factors are given to each criterion prior to value-wise analysis as shown in Table 5-2.

- STEP 3 : Recommendation

  The tabulated results obtained in STEP 2 shall be further examined to make a firm recommendation on the most suitable site.

5.2.2 Process and Result of Site Selection

The following five places were studied, all located in the Chittagong area.

- Harbang
- Mazirchar
- A. K. Khan's STM
- Existing EPZ
- EPZ (Phase 2)

1) Step 1: Preliminary Selection

Step 1 was a quick, weeding-out method for reducing the number of prospective sites as mentioned before. Harbang is located 60 km south of Chittagong City facing the main road to Burma. Although the road is mostly paved, rough surfaces are observed here and there. Furthermore, there are three or four one-way traffic bridges in between. Therefore, the trip from Chittagong City to Harbang may take more than two and a half hours by car. This will adversely affect the smooth transportation of the materials necessary for project implementation and mill operation. The site area is 20 ha, which seems to be sufficient for the project, even when future expansion is taken into account. Within the premises of the site, there is a small village which needs to be relocated in advance. There is a small hill (approx. 40 - 50 meters in height) in the middle of the site, and this also has to be excavated to make it flat. Since there is no sub-station nearby, and no natural gas pipeline running under the adjacent road, electricity procurement or power generation for the plant will be a big question mark. Apart from these unfavorable conditions, water supply through deep wells seems adequate in terms of both quality and quantity. There are also some advantages to this site such as cheap land and the fact that there will be only a fairly small environmental impact because it is a remote area.

Because of the aforementioned negative aspects, i.e. power procurement and transportation problems, the "Harbang" site was eliminated from the subsequent site evaluation study.

2) STEP 2: Detailed Evaluation

The land of the present EPZ of Chittagong has been almost completely occupied or committed, and the geographical location is not suitable (low altitude and very near to the sea). However the land south of the Karnaphuli River, where the second EPZ (EPZ : Phase 2) is scheduled to be developed in the very near future, remained as a prospective EPZ site. Consequently, a detailed evaluation was carried out on the three sites; i.e. - Site A : Mazrichar, Site B : A. K. Khan's STM and Site C : EPZ. The location of each site is shown in Figure 5-2.

Some comments and descriptions on each site are summarized in Table 5-2 and the value-wise analysis is given in Table 5-3 and Figure 5-3.

As can be seen in Table 5-3, the total marks obtained by Site A, Site B and Site C were 370.0, 405.0 and 467.5 respectively. Each site ,however, has some disadvantages.

For instance, Site A faces a fear of flood devastation, which will require costly reclamation work in advance. Land acquisition costs for Site B will be quite high, in addition to its having limited possibilities for future expansion and relatively fewer incentives. Site C enjoys a number of incentives and advantages, including being flood-free and "hartal-free" (strike-free) while having the potential for factory expansion. But two aspects of Site C, (a) land acquisition and (b) the extension of the gas pipeline, are still under discussion with the concerned authorities and are not yet solved.

3) STEP 3: Recommendation and Further Considerations

Site C: EPZ (Phase 2) is recommended allowing the following reservations for more careful study :

- timing of land acquisition
- leasing fee of the land
- extension of the natural gas pipeline for power generation

If the site C will not be made available to meet the suggested implementation schedule of this project, this site may have to be set aside.

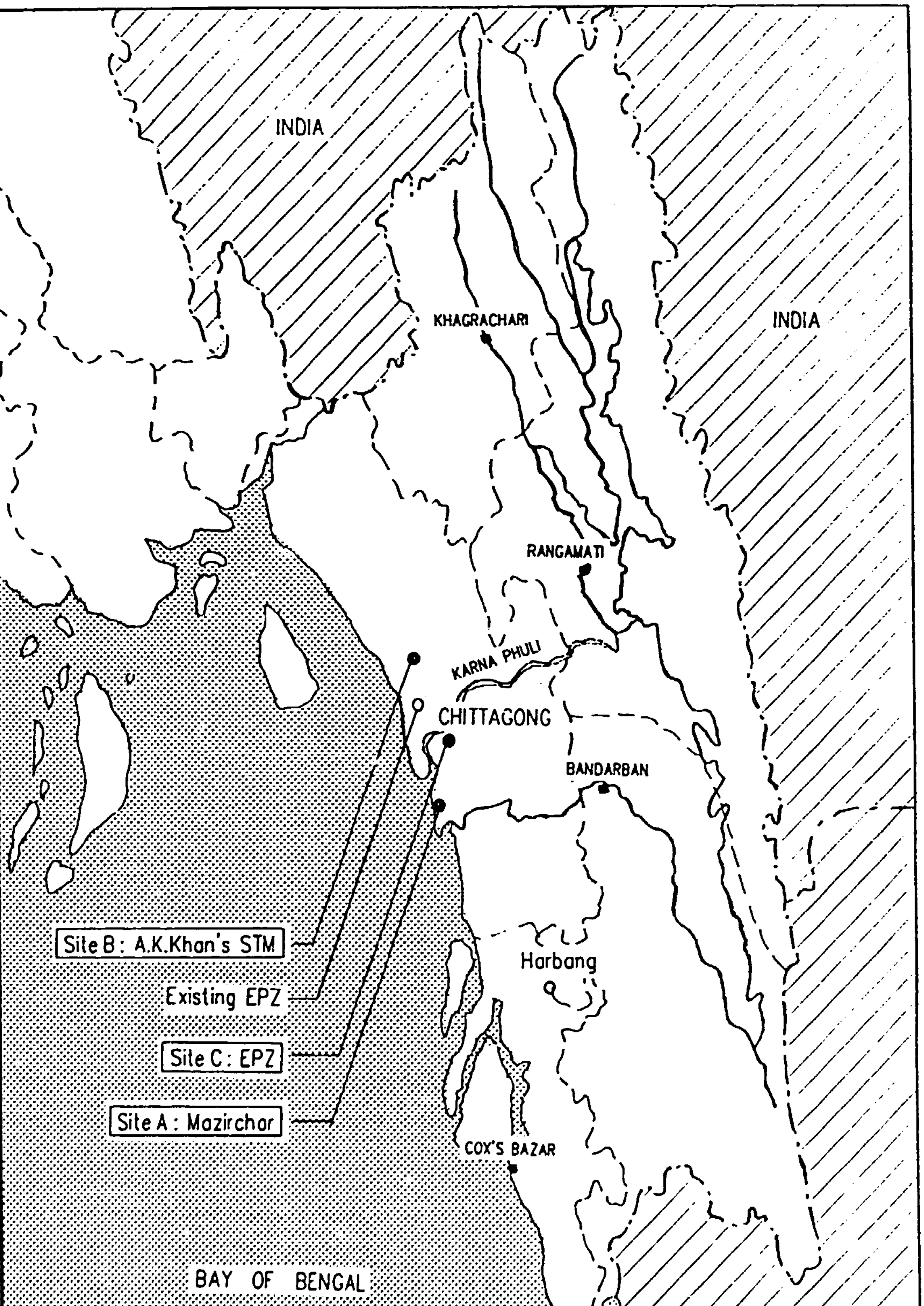


Figure 5-2 : LOCATION OF PROSPECTIVE SITES

Table 5-2 ASSESSMENT OF PROPOSED SITES (1)

SITES / ITEMS ASSESSED	SITE A (MAZIRCHAR)	SITE B (A.K. KHAN)	SITE C (E.P.Z)
1. LOCAL INFRASTRUCTURE			
1) Water Supply (approx.3,000ton/day is required)	Available by deep well	Available by deep well (Partially by city water)	Available by deep well (Partially by city water)
2) Power/Natural Gas Supply (approx.6,000kVA is required)	4~5km to main sub-station Gas readily available	Main sub-station nearby Gas readily available	Main sub-station nearby Gas readily available
3) Transportation	8km south of the city	City center	4km south of city center, across the river
4) Human Resources	Available	Available	Available
5) Availability of Critical Inputs	Available but insufficient	Available but insufficient	Available but insufficient
2. COST OF PROCUREMENT AND PREPARATION			
1) Cost of Land	Tk. 1,000,000/acre = US$ 6.2/m^2	Tk. 5,000,000/acre = US$ 30.9/m^2	Rental Fee = US 1.0/m^2·Year
2) Cost of Site Preparation	Reclamation(H=3.0m) required (approx.Tk 150/m^3)	Reclamation(H=1.2m) required; (approx.Tk.60/m^3) demolition cost of Tk. 6,000,000 required	Reclamation required;cutting may not be required for levelling
3. ENVIRONMENTAL IMPACT			
1) Effluent and Waste Disposal	Karnaphuli River nearby but 1km channel to be constructed for discharge	Discharged effluent(treated) runs 2km through residential area to Bay of Bengal	Bay of Bengal and Karnaphuli river nearby
2) Noise/Air Pollution	Between two fertilizer plants	In the residential/industrial area	Specialized industrial area
3) Laws/Regulations	To be promulgated soon	To be promulgated soon	To be promulgated soon

Table 5-2 ASSESSMENT OF PROPOSED SITES(2)

	ITEMS ASSESSED \ SITES	SITE A (MAZIRCHAR)	SITE B (A.K. KHAN)	SITE C (E.P.Z)
4.	ECOLOGICAL CONDITIONS			
	1) Sub-soil Conditions	Piling foundation required	Soil bearing power sufficient	Soil bearing power sufficiet
	2) Site Hazards	Access height limited due to existing overhead conveyor facilities	STM building/residential houses presently existing	Nil
	3) Climate	Flood protection to be considered	Nil	Nil
5.	SOCIO-ECONOMIC CONDITIONS			
	1) Incentives — Tax Holiday	7 Years	5 Years (10 Years)	10 Years
	Import Duties	10%(2.5% duty draw-back is expected)	(2.5% duty draw-back is expected) (The same incentives as EPZ may be applied in the future)	All kinds of duty exempted including construction materials Many other incentives
	2) Restrictions/Requirements	Nil	Nil	Nil
6.	STRATEGIC ASPECTS			
	1) Future Expansion	Area available	Site area for expansion limited	Area available
	2) Supply and Marketing Policy	Inconvenient	Very convenient	Convenient
7.	OTHERS			
	1) Authority for Issuing Approval	Board of investment(BOI)	Board of investment(BOI)	Bangladesh Export Processing Zones Authority (BEPZA)
	2) Site Area	200,000m²	100,000m²	More than 200,000m²
	3) Access to the Site	35~40 minutes by car (After completion of the bridge, it will be 10-15 minutes from the city center)	Located in the city center	20 minutes by car, after completion of bridge repairs

Table 5-3: SITE SELECTION - VALUE ANALYSIS

	CRITERIA	WEIGHTING FACTOR	SITE A		SITE B		SITE C	
			MARK	WEIGHTED TOTAL	MARK	WEIGHTED TOTAL	MARK	WEIGHTED TOTAL
1.	LOCAL INFRASTRUCTURE							
	1) Water Supply	7.5	4	30.0	5	37.5	5	37.5
	2) Power/Natural Gas Supply	7.5	4	30.0	5	37.5	5	37.5
	3) Transportation	5.0	3	15.0	5	25.0	5	25.0
	4) Human Resources	2.5	4	10.0	4	10.0	4	10.0
	5) Availability of Critical Inputs	2.5	2	5.0	3	7.5	3	7.5
	Sub-Total	25.0	—	90.0	—	117.5	—	117.5
2.	COST OF PROCUREMENT AND PREPARATION							
	1) Cost of Land	10.0	5	50.0	3	30.0	4	40.0
	2) Cost of Site Preparation	10.0	2	20.0	4	40.0	5	50.0
	Sub-Total	20.0	—	70.0	—	70.0	—	90.0
3.	ENVIRONMENTAL IMPACT							
	1) Effluent and Waste Disposal	10.0	4	40.0	3	30.0	5	50.0
	2) Noise/Air Pollution	2.5	5	12.5	4	10.0	5	12.5
	3) Laws/Regulations	2.5	5	12.5	5	12.5	5	12.5
	Sub-Total	15.0	—	65.0	—	52.5	—	75.0
4.	ECOLOGICAL CONDITIONS							
	1) Sub-soil Conditions	5.0	3	15.0	4	20.0	5	15.0
	2) Site Hazards	5.0	3	15.0	4	20.0	5	25.0
	3) Climate	5.0	3	15.0	5	25.0	5	25.0
	Sub-Total	15.0	—	45.0	—	65.0	—	65.0
5.	SOCIO-ECONOMIC CONDITIONS							
	1) Incentives	10.0	3	30.0	4	40.0	5	50.0
	2) Restrictions/Requirements	5.0	5	25.0	5	25.0	5	25.0
	Sub-Total	15.0	—	55.0	—	65.0	—	75.0
6.	STRATEGIC ASPECTS							
	1) Future Expansion	7.5	5	37.5	3	22.5	5	37.5
	2) Supply and Marketing Policy	2.5	3	7.5	5	12.5	3	7.5
	Sub-Total	10.0	—	45.0	—	35.0	—	45.0
	Total	100.0		370.0		405.0		467.5

[REMARKS] Full Mark : 500

Weight(Gravity)

1: Unsuitable 2: Suitable but major restrictions

3: Suitable but minor restrictions 4: Suitable 5: Most Suitable

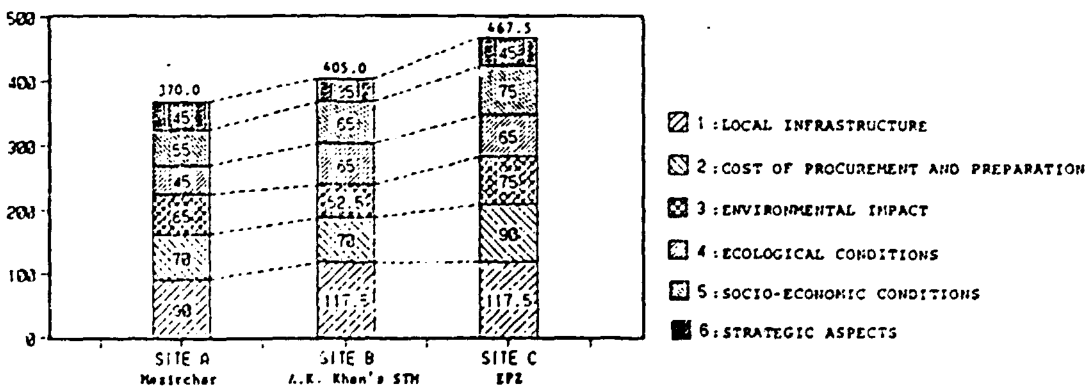


Figure 5-3 : GRAPHIC COMPARISON OF SITES

5.2.3 Site Selection for Study

Site B, which received the second highest evaluation, was chosen for the purpose of expediting the study.

Site B is located in the industrial area, a hub of the city, facing east on the Dacca-Chittagong Trunk Road. Some parts of the site are being utilized under the name of A. K. Khan's STM (Specialized Textile Mill), a finishing mill, but its production is very small due to obsolete machinery. A. K. Khan's Spinning and Jute mills are situated north of the site. From them, the new plant is expected to enjoy some infrastructural services. South of the site, over the Sagarica Road, there are theaters, residential houses, Tootal/Khan's joint-ventured sewing thread mill and some office buildings. West of the site, there are also some industries and residential houses scattered all the way to the coast for about 2km. Industrial effluent will have to be discharged into the sea through this area.

5.3 Environmental Assessment

The Department of Environment established "Environmental Quality Standards (EQS) for Bangladesh" in July, 1991. Environmental administration has now just begun, and Bangladesh is in a stage of "wishing to construct an advanced sewage treatment system" by researching the systems of developed countries like Japan.

Two major factors, i.e. the effluent and exhaust gas from the integrated textile mill now being planned will need to be carefully studied in respect to environmental impact assessment. Other environmental factors such as noise, traffic problems, etc. were briefly investigated during the field survey.

5.3.1 Industrial Effluent

1) Effluent Quality Check in Chittagong

a) Dyeing mill's effluent

Effluent quality was sampled in an open channel relatively close to the A. K. Khan mill. (Agricultural water flow and miscellaneous waste water flow into this channel.)

- pH = 8.2 (Field measurement using pH meter)
- CODmn = 50mg/l (Field measurement by simple measurement method)
- Color = slightly dark reddish purple

b) Colored effluent just before being discharged into the sea

Water quality in a drainage channel near the coastline (outside the flood protection embankment)

- pH = 7.7 (Field measurement using pH meter)
- CODmn = 30 mg/ (Field measurement by simple measurement method)
- Color = slightly dark reddish purple

2) Effluent Properties from the Project

a) Outline of production

(1) Raw materials

Cotton: .... 25 %

Polyester/cotton blended: .... 75 %

(2) Bleaching and dyeing ratio

Bleaching: .... 43 %

Dyeing (including yarn dyeing): .... 57 %

b) Effluent properties (predicted values)

(1) Total effluent quantity : Q = 3,000 m^3/day

(2) Both effluent discharging time and treatment time = 24 hours

(3) Water quality (estimated values)

The estimated water quality of both untreated water and treated water is shown in Table 5-4.

Table 5-4 : WATER QUALITY OF UNTREATED WATER AND TREATED WATER

Item		Untreated Water	* Treated Water for Discharge into Public Sewage System
pH		9 ~ 12	6 ~ 9
BOD	mg/l	600 ~ 800	250
COD	mg/l	700 ~ 900	400
SS	mg/l	250 ~ 400	500
Oil & grease	mg/l	70 ~ 90	50
Colour Harzen Number		Colored	Not to be unpleasant

* Standard values for industrial effluent of the "EQS" set up by the Department of Environment in July, 1991 are shown.

c) Concept of effluent treatment

(1) Remove BOD and COD based on biological oxidation treatment (the activated sludge process). Temperature in Chittagong throughout the year is suitable for biological oxidation.

(2) For the decoloring of effluent, conduct coagulation reaction treatment by chemicals after the biological oxidation treatment to achieve the standard value for treated water "not to be unpleasant".

(3) In view of the dyeing and finishing process and the material to be finished, (polyester/cotton blended ratio will be 75 % and the dyeing ratio 57 %), decoloring by coagulation reaction treatment will be fairly effective, but in case of complete decoloring, higher-level treatment is to be necessary.

d) The processing flow chart and views of the effluent treatment facility can be seen in Figure 5-4 and Figure 5-5 respectively.

e) Equipment (major equipment)

(1) Reinforced concrete tanks

(a) Aeration tank : 9,000 m^3 (75m x 40m x 3m in depth)

(b) Sedimentation tank : [450 m^3 (13m x 13m x 3m in depth)] x 2 tanks

(2) Equipment

(a) Aerators : 4 units

(b) Pumps : 8 units

(c) Piping : 1 lot

(d) Wiring and control panel : 1 set

5.3.2 Air Pollution

The heat source of power plants, fertilizer factories, general factories, etc. in Bangladesh is domestically produced natural gas. About 1.7 million m^3/day are produced in Bangladesh at present.

The integrated textile mill being planned will also use natural gas for power generation and the heat source.

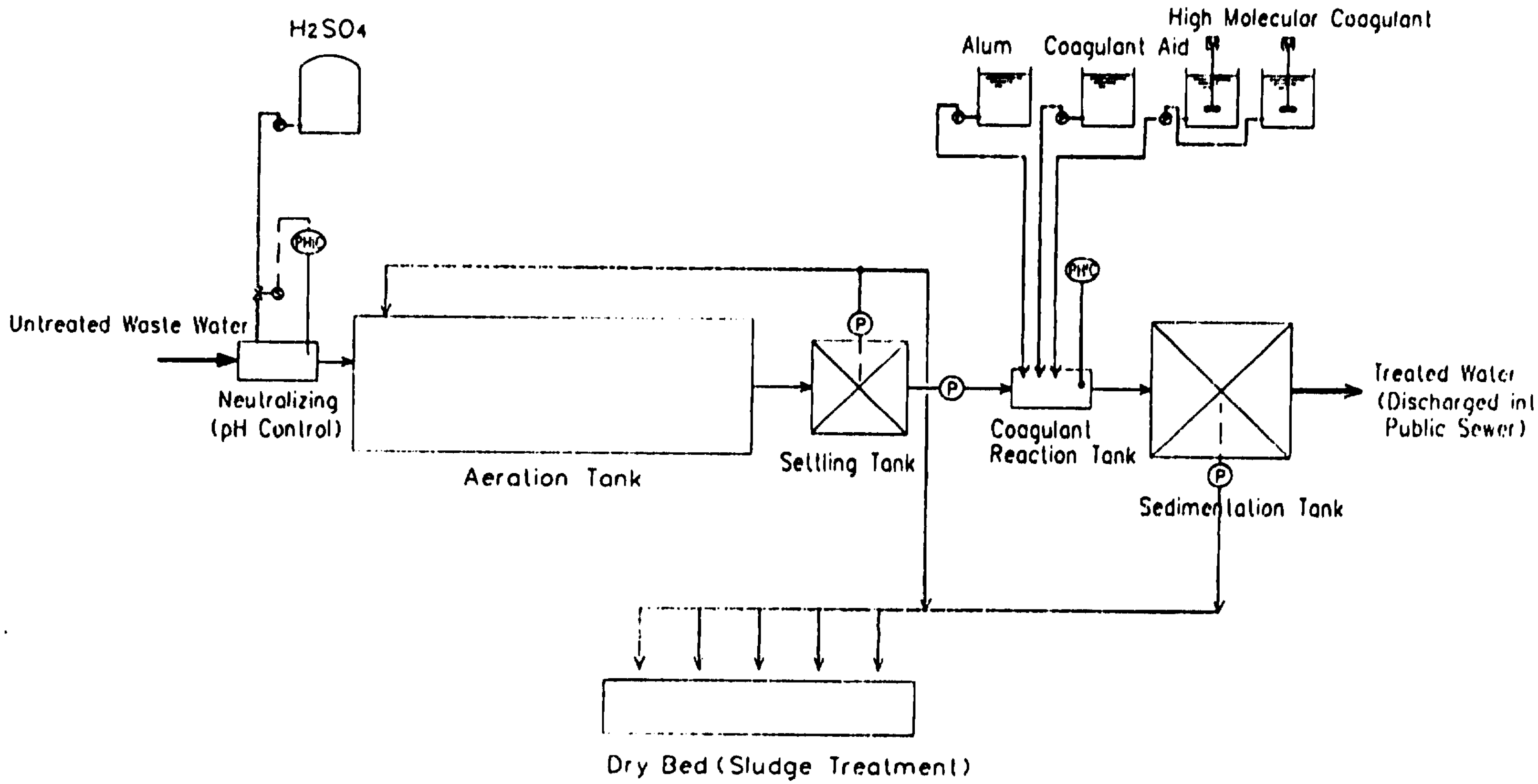
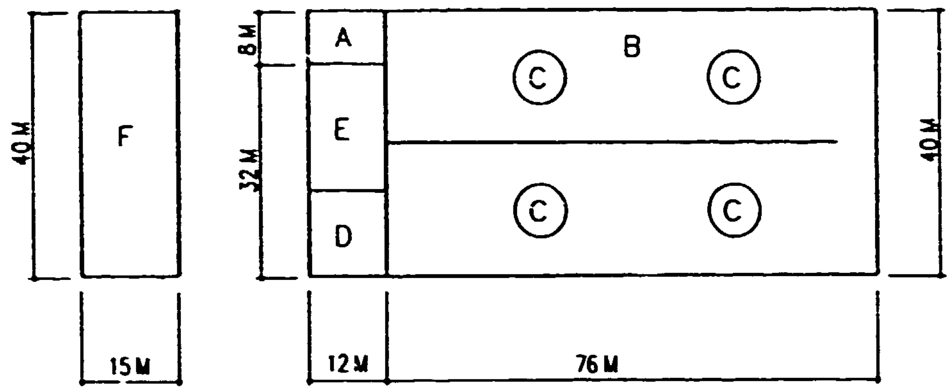
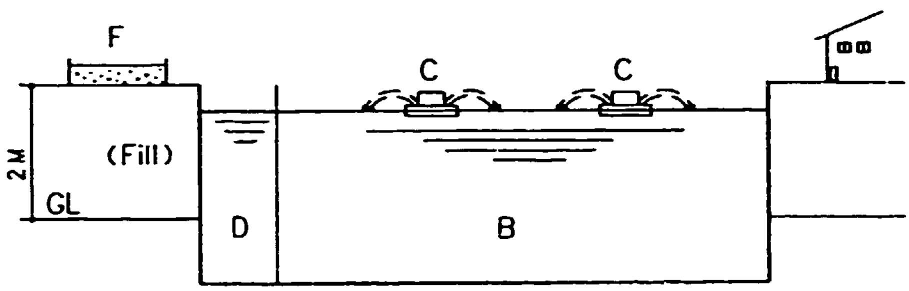


Figure 5-4 : PROCESSING FLOW CHART OF EFFLUENT TREATMENT



PLAN



SECTION

A : Neutralizing Tank
B : Aeration Tank
C : Aerator
D : Settling Tank
E : Sedimentation Tank
F : Dry Bed

Figure 5-5 : VIEWS OF EFFLUENT TREATMENT FACILITY

1) Natural Gas Composition (Locally Procured Data)

The composition of the natural gas supplied by Bangrabad Gas System. Ltd. is shown in Table 5-5.

This natural gas, which forms carbon dioxide (CO_2) and water (H_2O) through combustion, is a clean fuel which does not generate pollutants.

Table 5-5 : NATURAL GAS COMPOSITION

Methane	94.10 %
Ethane	3.65 %
Propane	0.74 %
Iso-Butane	0.22 %
N-Butane	0.10 %
Others	1.19 %
Total	100.00 %

2) Air Pollution Standards

The pollution standards stipulated by the Department of Environment, Bangladesh, are shown in Table 5-6.

While the textile mill being planned will release little air pollution, care should be taken if the mill is sited near a residential area, hospital, school, etc.

Table 5-6 : AIR POLLUTION STANDARDS

	Pollutant Concentration : Microgramme/m^3			
	SPM*	SO_2	CO	NO_x
Industrial zone and mixed area	500	120	5000	100

* SPM : Suspended Particulate Materials

5.3.3 Sewage

Sewage was sampled in an open sewer adjacent to the A.K. Khan mill, and its water quality was analyzed in Japan as shown in Table 5-7.

Table 5-7 : SEWAGE QUALITY IN OPEN SEWER

(Bangladesh)

Characteristics		Sewage Quality	Standard Values for Sewage Effluent
(1) pH		7.3	–
(2) Suspended Solids (SS)mg/l		46.0	100
(3) CODMn	mg/l	38.6	–
(4) BOD	mg/l	90.0	40
(5) Ammonium ion (NH4-N)	mg/l	24.2	–
(6) Nitrite-ion (NO2-N)	mg/l	0.007	–
(7) Oil & Grease	mg/l	1.1	–
(8) Ferrous : Fe (II)	mg/l	1.98	–
(9) Mn (dissolved)	mg/l	0.53	–
(10) Zn	mg/l	0.01	–
(11) Cu	mg/l	less than 0.01	–
(12) Ca	mg/l	17.1	–

(The water quality analysis was conducted by an authorized analysis institution.)

Regarding the quality of the water sampled in the surrounding residential area, the sewage BOD is estimated to be 160 - 180 mg/l. Therefore, a sewage treatment plant having a treatment capacity of a BOD removing rate of a minimum of 80 % will be necessary to achieve a BOD less than 40 mg/l.

5.3.4 Industrial Water

Deep well water (G.L.: - 500 ft) in the A.K. Khan mill was sampled, and its water quality was analyzed in Japan as seen in Table 5-8.

Table 5-8 : DEEP WELL WATER QUALITY

(Bangladesh)

Characteristics			Quality of Deep Well Water	Standard Values for industrial Water
(1)	pH		7.8	6 ~ 9.5
(2)	Colour	degree	6	Normal
(3)	Turbidity	degree	0.4	50
(4)	Total Hardness (as $CaCo_3$)	mg/l	100	250
(5)	Total Alkalinity (as $CaCo_3$)	mg/l	236	*** NYS
(6)	Dry Residue	mg/l	269	1500
(7)	Total Ferrous (Fe(II)+Fe(III))	mg/l	0.05	* 0.5
(8)	Mn	mg/l	0.01	** 0.1 ~ 1.0
(9)	Cu	mg/l	less than 0.01	NYS
(10)	Zn	mg/l	less than 0.01	NYS
(11)	Ca	mg/l	16.0	NYS
(12)	Dissolved Silica	mg/l	23.5	NYS
(13)	Chlorine ion (Cl^-)	mg/l	3.3	NYS
(14)	Sulfuric ion (SO_4^{2-})	mg/l	15.1	NYS
(15)	NH_4-N	mg/l	0.31	NYS
(16)	No_3-N	mg/l	0.008	NYS

* Textile dyeing 0.25 mg/l

** Textile dyeing 0.20 mg/l

*** Not yet set

(The water quality analysis was conducted by an authorized analysis institution.)

This deep well water is suitable for the textile mill's industrial water.

5.3.5 Drinking Water

Water from the community water supply at the A.K. Khan mill was sampled, and its water quality was analyzed in Japan as seen in Table 5-9.

Table 5-9 : DRINKING WATER QUALITY

Characteristics		* Community Water Supply	(Bangladesh) Standard Value for Drinking Water	** Reference	
				Hotel (Chittagong)	Hotel (Dhaka)
(1) pH		7.5	6.5~9.5	7.7	7.0
(2) Colour	mg/l	6	Harzen unit 15	–	–
(3) Turbidity	mg/l	1.6	10	6.8	80~100
(4) Total Hardness (CaCo3)	mg/l	50	200~500	–	–
(5) Total Alkalinity (CaCo3)	mg/l	224	NYS	–	–
(6) Dry Residue	mg/l	88	1000	–	–
(7) Total Ferrous	mg/l	0.11	0.3~1.0	<0.2	<0.2
(8) Mn	mg/l	0.01	0.1	–	–
(9) Cu	mg/l	less than 0.01	1.0	–	–
(10) Zn	mg/l	0.05	5.0	–	–
(11) Ca	mg/l	10.1	75	–	–
(12) Dissolved Silica	mg/l	13.4	NYS	–	–
(13) Chlorine ion (Cl-)	mg/l	3.2	150~600	–	–
(14) Sulfuric ion (SO42-)	mg/l	9.6	400	–	–
(15) NH4-N	mg/l	less than 0.01	NYS	–	–
(16) No2-N	mg/l	0.004	<1	<0.02	<0.02
(17) CODmn	mg/l		4	0~3	0~4
(18) Residual chlorine	mg/l		0.2	0	0

(The water quality analysis was conducted by an authorized analysis institution in Japan.)

* Underground water is put through precipitation separation for a fixed period of time in a regulating pond and then chlorinated and supplied, according to the Department of Environment, Dhaka.

** The restroom water at each hotel was measured on the spot by the simple measurement method.

5.3.6 Noise

The field measurement results using a sound level meter are shown in Table 5-10.

Table 5-10 : SOUND LEVEL

Measurement Point	Measurement Time	Measurement Result (dB)
Dacca Trunk Road (in front of A.K.Khan mill)	13:00	63 ~ 71
Near A.K.Khan mill's outer wall	13:20	55 ~ 57
4m outside A.K.Khan's boiler room	13:45	65 ~ 70
Mill site boundary	16:45	45 ~ 50
In front of Hotel Agrabad	21:00	52 ~ 57
On road in front of Hotel Agrabad	21:30	55 ~ 67

Since the main noise source, i.e. power generation equipment, will be positioned at the center of the site, the maximum noise level at the border should be much less than the allowable noise level specified in EQS. (less than 75dB and 70 dB in the day time and at night respectively).

5.3.7 Traffic Problems

The traffic volume of the Dacca Trunk Road (Chittagong City) was counted.

- Measurement place: in front of A.K.Khan's STM gate
- Measurement time: 15:30 - 16:00
- Motored vehicles (trucks, buses, cars, motored tricycles, motorbikes) --- Total: 54 units
- Man-powered tricycle --- Total: 136 units

It is estimated that the number of motor vehicles at busy times is roughly 100-150, so there should be very little effect from the new mill.

5.3.8 Industrial Waste

While it is conceivable to burn or bury the mill waste (residual raw materials, by-products, packaging materials, food leftovers, etc.; industrial effluent and exhaust gas are excluded from this item), it is desirable to recycle as much waste as possible.

5.4 Cost Estimates

5.4.1 Cost estimates Related to the Site

1) Cost for land acquisition

A. K. Khan's STM site: 100,000 m^2 at the rate of 5 Mil. Tk/acre is needed for the land acquisition.

2) Cost for Site Preparation

Cost for site preparation, such as reclamation of land, demolition of existing buildings and obstacles, etc., is mentioned in Section 6.8, Chapter 6.

5.4.2 Cost Estimates Related to the Environmental Assessment

The cost required for constructing necessary effluent treatment facilities is shown in Table 5-11. Other environmental factors such as air, noise, and industrial waste put no financial burdens on this project.

Table 5-11 : COST/ESTIMATE : WASTE WATER TREATMENT PLANT

Project	ITM Bangladesh		Currency U.S. Dollar (x1,000)		
Department	Waste Water Treatment Plant		1US$ = Tk40		
Work Description	Unit	Unit Cost	Foreign (x1,000)	Local (x1,000)	Total (x1,000)
1) RC Tank	9,900 m^3	1,300 Tk/m^3	–	372.0	372.0
2) Chemical Tank (ss)	3.4 ton	35,000Tk/ton	–	3.0	3.0
3) Scraper in Settling Tank	5.0 ton	35,000Tk/ton	–	4.4	4.4
4) Piping Works	2,000 m	140 Tk/m	–	7.0	7.0
5) Wiring Works (including operation panel)	1 lot		–	37.5	37.5
(Imported Items CIF)					
6) Aerator	4 pcs	6,800 US$	272.0	–	272
7) Sludge Pump	3 pcs	6,400 US$	19.2	–	19.2
8) Agitator for Chemical Tank	6 pcs	4,800 US$	28.8	–	28.8
9) Agitator for Reaction Tank	1 pc	14,400 US$	14.4	–	14.4
10) Chemical Pump	3 pcs	4,800 US$	14.4	–	14.4
11) PHIC	2 pcs	3,200 US$	6.4	–	6.4
12) Erection for Imported Machinery	1 lot	–	–	30	3.0
Total			355.2	453.9	809.1

CHAPTER 6 : ENGINEERING AND TECHNOLOGY

6.1 Basic Concept and Production Program

6.1.1 Basic Concept

In this project, each production process has been planned and designed with four basic concepts in mind. These basic concepts have been created to meet the policies of the Bangladesh government as well as to create an example of the best model for the textile industry of the future in Bangladesh. In other words, the project is aimed at helping to supply appropriate products according to the market survey conducted by the investigation team.
The basic concepts are as follows :

1) The final products planned here should be aimed at the world market. The products should be of high quality, to meet world demand, and low cost, for export competitiveness.

2) Machinery and equipment best suited to the conditions and environment of Bangladesh should be adopted.

   a) While it is important to have machinery and equipment which is easily operated and maintained, it is also necessary to be able to easily train workers and transfer technology to perform these functions.

   b) Bangladesh's advantages, e.g. low labor costs, should be fully taken into consideration and utilized in lieu of the sophisticated and expensive labor-saving machinery and equipment used in advanced countries.

3) The machinery and equipment for all the processes and departments should be installed to enable maximum efficiency and smooth flow of fiber processing.

4) The capacity balance among all processes should be planned so as to maintain the most economical unit. Also, subsequent process units should have a larger capacity than former ones.

   The reasons for this are, first, it is crucial for this project to be able to avoid serious detriment due to the periodic fluctuations in the economic condition of the textile industry which often occur. Second, it is important to maintain the ability to regularly procure various kinds of yarns and textiles from the world market in large amounts at any time.

6.1.2 Production Program and Product Mix

The dyeing and finishing department's production plan and product mix, as well as the production plan and product mix for the intermediate products (which include the purchased textiles for the dyeing and finishing department and the purchased yarn for the weaving department) are shown in Table 6-1 and Figure 6-1.

6.1.3 Overall Layout

The overall layout of the integrated mill is shown in Figure 6-2.

Table 6-1 : PRODUCTION PROGRAM AND PRODUCT MIX

Operating Conditions: 350 days/year: 29.17 days/month; 24 hrs/day: 4 Groups 3 Shifts

	Name	Broad	Gaberdine	Poplin	Total
Products	Width	63"	63"	63"	
	Material	Cotton	Cotton	P/C Blended	
	Counts	CM × CM 80/2 × 80/2	CM × CM 60/2 × 60/2	P/C × P/C 45 × 45	
	Density	127 × 73	131 × 60	110 × 76	
Dyeing and Finishing	Bleached	1.620.000	0	11.400.000	13.020.000
	Dyed	1.200.000	3.170.400	7.812.000	12.182.400
	Yarn Dyed	1.497.600	0	3.300.000	4.797.600
	Total M/y	4.317.600	3.170.400	22.512.000	30.000.000
Fabric purchased from outside	Meter/year	0	0	19.365.600 (for Grey)	19.365.600
Weaving	Frames	40	24	32	96
	Grey	2.842.800	3.195.600	0	6.038.400
	Yarn Dyed	1.509.600	0	3.326.400	4.836.000
	Total M/y	4.352.400	3.195.600	3.326.400	10.874.400
Spinning	Frames	52	0	0	52
	LBS/year	2.007.600	0	0	2.007.600
	BLS/year	5.019	0	0	5.019
Yarn purchased from outside		CM 80/2	CM 60/2	P/C 45	
	LBS/year	0	1.868.400	1.311.600	3.180.000
	BLS/year	0	4.671 (for Grey)	3.279 (for Y. Dyed)	7.950

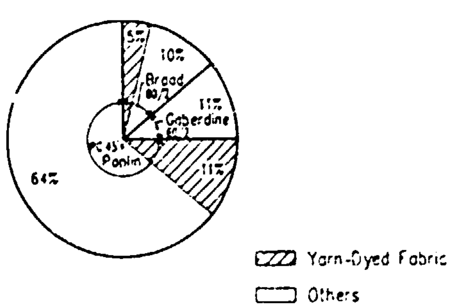
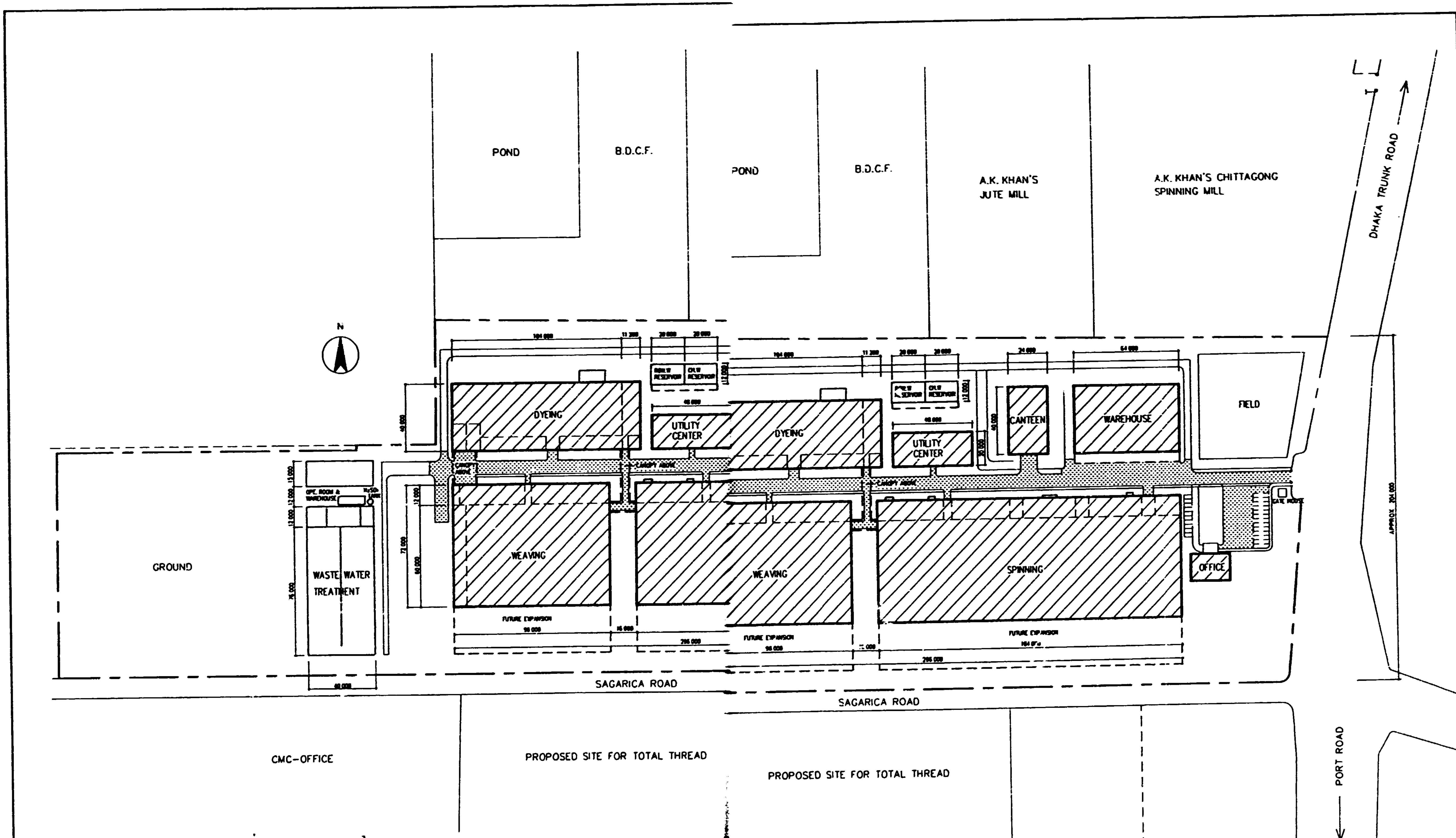


Figure 6-1 : PRODUCTION BALANCE CHART



SECTION 1

SECTION 2

Figure 6–2 : BLOCK PLAN OF PROPOSED MILL

6.2 Spinning

6.2.1 Production Plan

As mentioned in Section 6.1, high-quality cotton combed yarn Ne 80/2 will be manufactured in the spinning department. The production amount at full production is shown in Table 6-2.

Table 6-2 : SPINNING PRODUCTION PLAN (25,000 SP)

Yarn Type	Count	Production		
		per 1-hour	per 1-day(24hrs.)	per 1-year(8,400hrs.)
COTTON COMBED	Ne 80/2	108.4 Kg (239.0 LBS)	2,601 Kg	910,560 Kg

WORKING CONDITIONS

1) 3 shifts per day
2) 8 hours per shift
3) 350 days per year

* 3s x 8h x 350d = 8,400 hours per year

6.2.2 Spinning Machinery and Equipment

In selecting the production equipment, two points, i.e. quality control and minimization of the initial investment amount, were taken into consideration. The former need not be on the highest level, but must be on an international level adequate for RMG export. The latter aims at contributing to increased employment opportunities as well as enhancing cost competitiveness. Therefore, equipment used only for saving labor was eliminated as much as possible.

1) Calculation for Machinery

Table 6-3 is a calculation sheet for the spinning plan based on the aforementioned idea.

2) Flow Chart

It is shown in Figure 6-3.

3) Machinery and Equipment

a) Blow room machinery

High-quality blow room machinery excellent for opening, trash removal and fixability will be selected. A bypass unit has been provided in some units to perform opening and trash removal suitable for the cotton type and the trash content as well as to eliminate damage to the fiber. An automatic cotton feed unit was not adopted because the row cotton which is manually cut into small pieces and sufficiently mixed will be fed into the feed lattice to prevent the mixture of foreign matter and metal. The feed lattice is more advantageous in quality and hazard prevention. Also, a chute feed unit to the carding machine was not adopted. This unit saves labor, but has no bearing on quality.

b) Carding machine

A high-production card was adopted. As the type of product will be fine with a yarn count of cotton combed Ne 80, a super high-production type has been avoided. A 36-inch LP-size coiler was adopted.

c) Lap former

The feed part can supply uniform laps enabling doubling up to 48 threads and is excellent in fiber parallelism at high speed. The automatic lap doffing system was adopted to improve running efficiency.

d) Comber

Uniformity is enhanced by increasing doubling at 8 heads 1 can. An automatic can changer was adopted for high-speed stability and high-efficiency operation. Dropped waste cotton is collected in an intermittent, concentrated cotton collection system.

e) Drawing frame

A high-quality and trouble-free drawing frame easy to operate and maintain was adopted. A pressure bar was adopted in the draft part. Also an automatic can changer was adopted.

f) Simplex fly frame

A high-quality, high-speed, large-package and high-stability model was adopted. A 4-line double-apron and top-arm draft mechanism and a slitless, top-supported flyer were adopted.

g) Ring frame

The ring frame is the last machine in the final yarn forming process which can affect the yarn quality directly. The latest model with proven results and consistently high quality should be selected. To enable high quality and high-speed rotation, a small-package model of a 38-mm ring diameter and a 178-mm lift was adopted. The pneumatic suction unit is a type free from clogging. The traveling cleaner is a blow-and-suction type to prevent dispersion and accumulation of flies to reduce yarn breakage and to improve quality. Neither an automatic doffing unit nor a connection system with a winder was adopted. Also, the spindle speed change gear will be a step-pulley system of a simple structure.

h) Winder

In view of quality, an air splicer and high-performance electric slub catcher are essential. To ensure high efficiency, a 1-drum, 1-splicer type was adopted. Also a yarn length measuring device was adopted.

i) Twister

A two-for-one twister type was adopted to manufacture knot-free, large-package twisted yarn at high efficiency. As the product is cotton, a traveling cleaner will be installed.

4) Specifications of Production Machinery

The specifications and quantities of production machinery are shown in Table 6-4.

5) List of Auxiliary and Laboratory Equipment and Operation Necessities

a) All the auxiliary and laboratory equipment and operation necessities that seem to be necessary have been included.

b) The quantities of plastic bobbins should include proper quantities for changing to different colors, as a precautionary measure for when it may become necessary to classify product lots due to a large change in raw material, etc.

c) The cone cheese truck, to be procured in the loom and yarn dyeing processes, has been excluded.

d) Some twisting machines (8 out of 55 units), for use in yarn dyeing and soft winding, have been excluded since the dyeing bobbins to be used in this type of machine are procured in the yarn dyeing process.

The names and quantities of the auxiliary and laboratory equipment required are shown in Tables 6-5 and 6-6.

6.2.3 Machinery Layout Plan

The production machinery layout plan is shown in Figure 6-4, and is explained below.

1) A 12 meter-wide service area is shown in the lower part of the drawing. Utility equipment; (the air-conditioner, etc.), the maintenance room, toilets, the briefing room, etc. are contained in this area.

2) Blow room machinery is pictured on the left side of the drawing and machinery is laid out in the order of processing approximately from left to right. The twisting machine is placed on the far right and, the yarn manufactured by this machine is carried directly to the weaving and dyeing department without being packaged.

3) Aisles through which the push carts can pass are provided up and down. An aisle is also provided in the center from the spinning frame to the twisting machine.

4) A rather large space has been allocated between the processes to prevent any problems with air current and flies in the other process.

5) In the 2-row layout of the spinning frame and twisting machine, the gear end and the out end (or the motor end) are laid out respectively outside and inside facing one another, and the blow cleaner's cotton collecting duct is installed inside. The doffed products are collected along the inside aisle for convenience of trucking.

6) Product storage space has not been given much consideration, since the cone cheese is carried directly to the next process. In addition, some storage is possible in the aisle and along the wall.

Table 6-3 : CALCULATION TABLE FOR SPINNING SECTION

	Process \ Item	1 Supply thickness (Grain/yard)	2 No. of doubling	3 Draft	4 Produced thickness (Grain/yard)	5 Twist multiplier (α e)	6 Twists per inch (TPI)	7 Waste percent (%)	8 Delivery speed or Revolution (per min)	9 Package size	10 100% Production (LBS) (per hour and unit)	11 Working hour	12 Working efficiency (%)	13 No. of spindles (per machine)	14 Actual Production (per machine) (LBS/hour)	15 Required Production (LBS/hour)	16 Calculated No of machines	17 No of machines
1	Blowing Machinery	–	–	–	(oz/yd) 13.0	–	–	3.0	YDS/M 9.90 (12.0 rpm)	960 mm x 53 mL	482.63	1	88	1	424.71	324.50	0.8	1
2.	Carding Machine	(oz/yd) 13.0	1	109.2	(grn/yd) 300/6	–	–	4.0 + 0.5	51 (16.0 rpm)	36 in x 42 in	21.86		85	1	18.58	309.90	16.7	18
3.	Pre-Drawing Frame	(grn/yd) 300/6	5	5.8	260/6	–	–	0.5	328 (300M/Min)	20 in x 42 in	121.83		80	2	194.93	308.35	1.6	2
4.	Lap Former	260/6	42	2.6	700/1	–	–	0.5	65.6 (60M/Min)	267 W x 420 ϕ	393.60		75	1	295.20	306.81	1.1	2
5.	Combing	700/1	8	93.0	300/6	–	–	17.0 + 1.0	NIP/M 250 x 4.2 mm	20 in x 42 in	45.75		85	1	38.89	251.58	6.5	7
6.	1st-Drawing Frame	300/6	8	8.6	280/6	–	–	0.5	YDS/M 240 (220M/Min)	20 in x 42 in	96.00		80	2	153.60	250.32	1.7	2
7.	2nd-Drawing From	280/6	8	9.3	240/6	–	–	0.5	240 (220M/Min)	6 in x 16 in	82.29		80	2	131.66	249.07	1.9	2
8	Simplex Fly Frame	240/6	1	10.9	110/30	1.00	1.507	1.0	R/M 850	38 mm x 178 mm	0.4924		84	108	44.67	246.58	5.6	6
9	Ring Spinning Frame	110/30	1	35.2	80	3.50	31.305	2.0	13000	6 in x 5' 57"	0.0103		94	480	4.65	241.65	52.0	52
10	Auto Winder	(Ne) 80.0	1	1.0	80	–	–	0.5	YDS/M 983 (900M/Min)	152 mm x Para	0.8777		85	60	44.76	240.44	5.4	6
11	Doubler Winder	80.0	2	1.0	80//2	–	–	0.3	437 (400M/Min)	152 mm x 5' 57"	0.7804		70	120	65.55	239.72	3.7	4
12	Double Twister																	
-1	for Weaving	80//2	1	1.0	80/2	3.50	22.136	0.3	R/M 9000	152 mm x 5' 57"	0.0403		92	120	4.45	208.85	46.9	47
-2	for Yarn Dyeing (Soft Winding)	80//2	1	1.0	80/2	3.50	22.136	0.3	8000	152 mm x 3' 30"	0.0359		92	120	3.96	30.15	7.7	8

Main Machinery		No. of Machines	Chart
			Cotton 80
S-1	Blow Room Machinery	1	
S-2	Carding Machine	18	
S-3	Pre-drawing Frame	2	
S-4	Lap Former	2	
S-5	Comber	7	
S-6	1st Drawing Frame	2	
S-7	2nd Drawing Frame	2	
S-8	Simplex Fly Frame	108 SP x 6	
S-9	Ring Spinning Frame	480 SP x 52	
S-10	Automatic Winder	60 D x 6	
S-11	Doubler Winder	120 D x 4	
S-12	Two-for-one Twister	120 D x 55	
Production (LBS/hour)			Cotton Combed Yarn Ne 80/2 (239.0)

Figure 6-3 : PROCESS FLOW CHART OF SPINNING

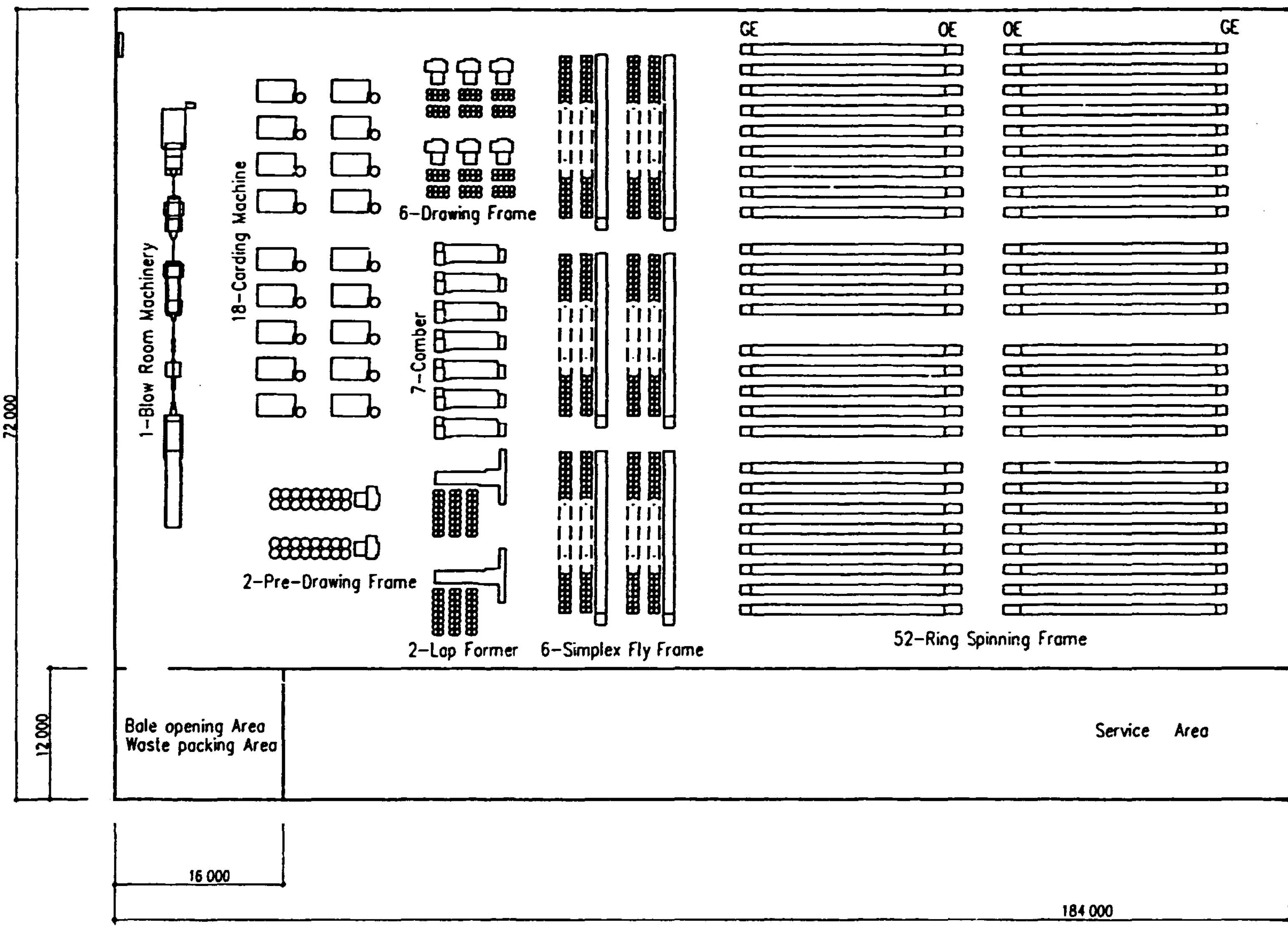
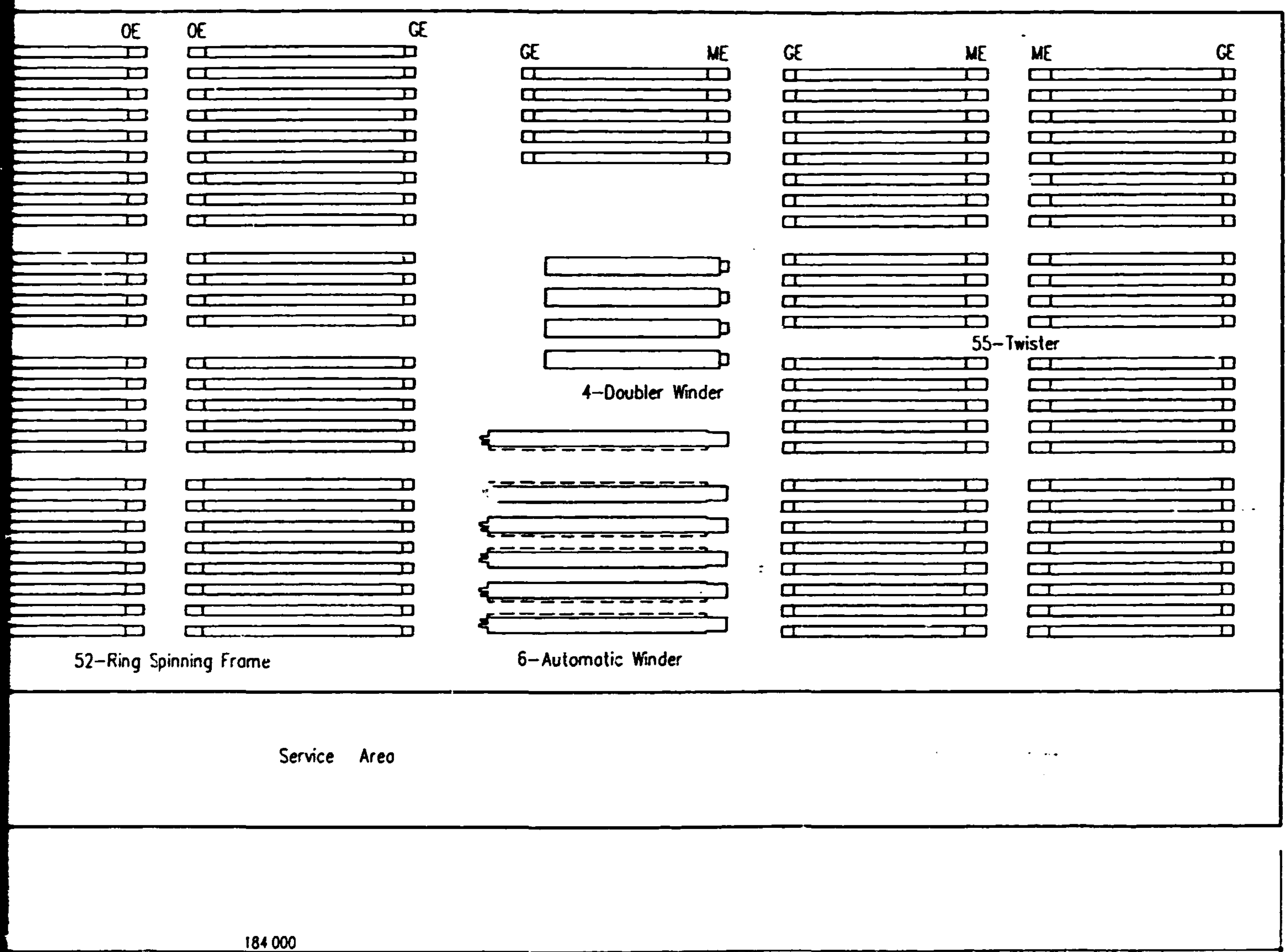


Figure 6-4 : LAYOUT OF PRODUCTION MACHINERY

SECTION 1



AYOUT OF PRODUCTION MACHINERY – SPINNING MILL

SECTION 2

Table 6-4 : SPECIFICATIONS OF MAIN PRODUCTION MACHINERY (SPINNING)

Item No.	Machine/Equipment	Quantity
S-1	Blow room machinery	1 line
	1) Specification	1 scutcher
	Lap forming system	
	Individual waste collecting system	
	Exhaust air and micro dust --- To air conditioning room	
	2) Machine arrangement	
	Super bale opener with 7,000 mm feeding lattice	
	Double magnet	
	Double roller cleaner (with by-pass)	
	Fan condenser	
	Feeding unit	
	Step cleaner	
	D-type opener	
	Fan condenser	
	Pneumatic feeder	
	Scutcher	
	Lap rod inserter	
	Lap scale	
S-2	Carding machine	18 frames
	Lap feed system	
	Working width : 1,016 mm	
	Number of flat bars : 106	
	Roller doffing system	
	Control roller for pre-opening	
	Doffer speed changer	
	Group dust collecting system/flat waste and dust waste	
	Waste conveyor under machine	
	Size of delivery can : 915 mm Dia. x 1,067 mmH	
S-3	Pre-drawing frame	2 frames
	With automatic can changer	
	2 deliveries per frame	
	8 slivers doubling per delivery	
	3 line rollers and pressure bar drafting system with turning roller	
	Main gearing in oil bath with oil pump	
	Air blow cleaning device for bottom rollers and pressure bar	
	Size of feed can : 914 mm Dia. x 1,067 mmH	
	Size of delivery can : 508 mm Dia. x 1,067 mmH	

Item No.	Machine/Equipment	Quantity
S-4	Lap former	2 frames
	3 Heads 1 delivery per frame, and 16 feed cans per head	
	Produced lap : 267 mm width x 600 mm Dia.	
	Automatic lap changing device	
	Size of feed can : 508 mm Dia. x 1,067 mmH	
S-5	Comber	7 frames
	8 Heads 1 delivery per frame	
	Size of feed lap : 267 mm width x 600 mm Dia. (Max.)	
	Automatic can changer	
	Nips per minute : Max. 360 (mechanical)	
	Centralized waste collecting device	
	Head stock gearing in oil bath with pump	
	Size of delivery can : 508 mm Dia. x 1,067 mmH	
S-6/	Drawing frame	2 sets
S-7		4 frames
	With automatic can changer	
	2 deliveries per frame	
	2 passages per set	
	8 slivers doubling per delivery	
	3 line rollers and pressure bar drafting system with turning roller	
	Main gearing in oil bath with oil pump	
	Air blow cleaning device for bottom rollers and pressure bar	
	Size of feed can : 508 mm Dia. x 1,067 mmH	
	Size of delivery can : 508 mm Dia. x 1,067 mmH	
S-8	Simplex fly frame	6 frames
	108 spindles per frame, 520 mm staff, 406 mm lift	
	Full bobbin dia. : 150 mm(Max.)	
	4 lines double apron drafting by SKF PK 1500 weighting arm	
	Light alloy metal flyer (slitless)	
	Size of feed can : 508 mm Dia. x 1,067 mmH	
S-9	Ring spinning frame	52 frames
	480 spindles per frame, 75 mm spindle gauge, and 178 mm lift	
	3 lines double apron drafting by SKF PK 225	
	N type single flanged ring 38 mm inside dia.	
	Spindle with SKF HF-21 roller bearing insert	
	Automatic speed regulating device by 2-step pulley	
	Automatic ring rail down & stop by auto-counter	

Item No.	Machine Equipment	Quantity
	Roller stand provided with pneumatic suction pipe	
	Travelling cleaner	
S-10	Automatic winder	6 frames
	60 drums per frame	
	Individual knotter, air splicer	
	To wind from ring bobbin onto 152 mm (6") traverse 5° 57' cone	
	Yarn length control device	
	Electric slub catcher	
	Travelling cleaner	
S-11	Doubler winder	4 frames
	120 drums per frame	
	Doubling mechanism for two ends	
	Rotary traverse type	
	To wind from cone/cheese onto 152 mm(6") traverse parallel cheese	
	Each side to be driven separately	
	Blow cleaner	
	Yarn length control device	
S-12	Twister	55 frames
	Two-for-one twister type	
	120 drums per frame	
	To twist spun yarn from 152 mm(6") traverse cheese onto 152 mm traverse 3° 30" ~ 5° 57" cone	
	Endless belt driving system	
	S & Z twisting switchable	
	Travelling cleaner	
	** 47 frames --- for weaving section, 5° 57" cone	
	8 frames --- for yarn dyeing section, 3° 30" soft winded cone	

Table 6-5 : AUXILIARY EQUIPMENT AND ACCESSORIES (SPINNING)

Item No.	Equipment Accessories	Quantity
SA-1	Blowing Section	
1-1	Cart for lap transport	3
-2	Sheet for lap	50
-3	Carrier for waste and reusable fiber	5
-4	Double beam platform scale with standard weight (500Kg)	1
-5	Fork-lift (forks and cramps, 1,000Kg)	1
-6	Hand lift truck	2
-7	Trolley for raw material fiber	1
-8	Roving waste opener	1
SA-2	Carding Section	
2-1	Traverse hose roller grinder for MCC	2
-2	Traverse hose roller grinder for TOP	2
-3	Stripping roller	2
-4	Burnishing roller	2
-5	Movable motor device for stripping and burnishing roller	1
-6	Truck for flat bar	2
-7	914mm (36") Can with spring and caster	100
-8	Dressing apparatus for traverse wheel grinder	1
-9	Metallic wire mounting machine complete set	1
-10	Licker in roller mounting machine	1
-11	Flat clipping machine	1
-12	Flat grinding machine	1
-13	Flat tester	1
-14	Chain washing machine	1
-15	Truck for traverse hose roller	1
-16	Side scope	1
SA-3	Combing & Drawing Section	
3-1	Bobbin for ribbon lap machine	130
-2	508mm (20") Can with spring & caster	1,000
SA-4	Roving Section	
4-1	Cart for roving	10
-2	Cart for roving bobbin	7
-3	Bobbin for simplex fly frame	40,000
-4	Polivel picker	8

Item No.	Equipment Accesories	Quantity
SA-5	Spinning Section	
5-1	Cop box with separator	240
-2	Bobbin for ring spinning frame	115,000
-3	Hanger for doffing	15
-4	Cart for cop transportation	6
-5	Spira clean for spindle oil	1
-6	Clearer cleaning machine	1
-7	Blow cleaner for ring spinning frame (BS type)	52
-8	Roller picker with hose (30m)	10
-9	Can containing travellers	360
-10	Traveller magazine	110
-11	Heating press for spindle tape	1
SA-6	Winding Section	
6-1	Cart for cone	15
-2	Scale for auto winder(2 kg)	3
-3	Plastic cone bobbin for winder (5° 57")	6,000
-4	Plastic bobbin for doubler (para)	23,000
-5	Cart for doubler cheese	8
-6	Plastic cone bobbin for DTF (5° 57")	25,000
-7	Cone bobbin for DTF soft cone (3° 37") (To be prepared by dyeing section)	0
-8	Cart for DTF cone (To be prepared by weaving and dyeing section)	0
-9	Blow cleaner for twister(BS type)	55
-10	Other small accessories	1 lot
SA-7	Roller shop & Miscellaneous	
-1	Gum cot grinding machine with attachment	1
-2	Roller outer diameter testing machine	1
-3	Roller center testing machine	1
-4	Heavy type roller assembling machine	1
-5	Automatic ultraviolet rays rubber roller treatment machine	1
-6	E.C. Master	1
-7	Hardness tester for gum cot	1
-8	Top roller box for ring frame	20
-9	Top roller box for simplex	10
-10	Cradle box for spinning & simplex	20
-11	Movable tool box with vice for maintenance	2
-12	Movable tool box for maintenance	5
-13	Handling carrier	6
-14	Portable crane	1
-15	General tools	1 lot

Table 6-6 : LABORATORY EQUIPMENT AND ACCESSORIES (SPINNING)

Item No.	Equipment	Quantity
SL-1	Moisture testing oven	1
-2	Hygro and thermograph	1
-3	Wet and dry thermometer	10
-4	Single yarn strength tester	1
-5	Twist tester	1
-6	Yarn fault classifying installation with 6-drum RT-winder	1
-7	Yarn evenness testing installation including hairiness tester	1
-8	Digital Fibrograph	1
-9	Wrap reel	1
-10	Wrap block	1
-11	Mini evenness tester	1
-12	Lap yard testing machine	1
-13	Auto-sorter	1
-14	Digital electronic balance (62g x 0.001g)	1
-15	Portable micronair	1
-16	Pressley tester	1
-17	Yarn irregularity sample	1 set
-18	Portable moisture tester	1
-19	Digital tachometer	1
-20	Yarn inspector(seriplane) for yarn evenness and cleanness. with 50 blackboards and 100 pitch separators	1 set
-21	Shirley Analyser	1
-22	Sampling box for cop	12
-23	Sampling box for lea	1

6.3 Weaving

6.3.1 Production Plan

The weaving department must supply high-quality yarn-dyed and grey fabrics to enable the dyeing and finishing department to manufacture good products.

As the spinning department can supply only 40 % of the yarn necessary for weaving production, the remaining 60 % is to be purchased. Also, the weaving department can manufacture only 36 % of the dyeing and finishing capacity in production meters. The textile production figures and the yarn consumption are shown in Table 6-7.

6.3.2 Weaving Machinery and Equipment

1) Calculation for Machinery
Table 6-8 is a calculation table for weaving.

2) Flow Chart
The flow chart for the process designed per product type is shown in Figure 6-5.

3) Machinery and Equipment

a) Winder (soft winding)
There are the cheese dyeing and hank dyeing methods for the weft of yarn-dyed fabric. For this project, cheese dyeing should be adopted because it enables quality stabilization through shortening the process and taking advantage of the merits of an integrated mill equipped with a dyeing and finishing department. A unit capable of rewinding yarn by controlling its hardness to cheese suitable for dyeing will be necessary. A yarn cleaning unit will not be necessary.

b) Winder (rewinding)
The dyeing cheese should be rewound to an adequate size and hardness to prevent yarn breakage during high-speed weaving and for enlarging the weft feed lot. A yarn cleaning unit is not necessary. The aforementioned two types of winders should be purchased from the same manufacturer in view of maintenance.

Table 6-7 : WEAVING PRODUCTION PLAN

	Name	Broad	Gaberdine Twill	Poplin	Total
Products	Width	63"	63"	63"	
	Material	Cotton	Cotton	P/C Blended	
	Counts	CM × CM	CM × CM	P/C × P/C	
		80/2 × 80/2	60/2 × 60/2	45 × 45	
	Density	127 × 73	131 × 60	110 × 76	
Weaving	Frames	40	24	32	96
	Grey	236,900	266,300	0	503,200
	Yarn-Dyed	125,800	0	277,200	403,000
	Meter/month	362,700	266,300	277,200	906,200
	Meter/year	4,352,400	3,195,600	3,326,400	10,874,400
	Consumption				
	Dyed (Warp)	38,000	0	64,600	102,600
	Dyed (Weft)	21,100	0	44,700	65,800
	Grey (Warp)	69,500	106,000	0	175,500
	Grey (Weft)	38,600	49,700	0	88,300
	Warp Total	107,500	106,000	64,600	278,100
	Weft Total	59,700	49,700	44,700	154,100
	Total/month (LBS/month)	167,200	155,700	109,300	432,200
	Total/year (Bales/year)	5,020	4,670	3,280	12,970
Yarn procured		CM 80/2	CM 60/2	P/C 45	
	(LBS/month)	0	155,700	109,300	265,000
	(BLS/month)	0	389	273	662
	(BLS/year)	0	4,670	3,280	7,950
			(for Grey)	(for Yarn-dyed)	

c) Warper

When using an air jet loom, the warp preparation process is particularly important in order to take advantage of the loom's high speed. The quality of the warper's beam affects the quality of sizing. Naturally, the machine must be able to manufacture warper's beams of uniform yarn tension with minimal yarn breakage and with the capability to adjust the winding tension of each yarn and beam's winding hardness. A device in which the brake and stopping mechanism operate accurately is required. The creel should have a mechanism convenient for changing the cheese.

d) Warper (soft beaming)

Beam dyeing, which ensures quality stability by shortening the process and taking advantage of the merits of an integrated mill equipped with a dyeing and finishing department, should be adopted. While the machine's functions are exactly the same as those mentioned in 3)-c), a unit capable of adjusting the beam's winding hardness for dyeing is necessary. The winding speed should be a little lower. The aforementioned two types of warpers should also be of the same manufacturer in view of maintenance.

e) Sizer

A loom's weavability is largely affected by the quality of the sizing beam. This is significant in high-speed looms in particular. A machine equipped with a device to automatically control the winding speed, the size squeezing roller pressure, the size tank temperature and the drying room temperature comprehensively and accurately should be adopted. It will enable the mill to manufacture sizing beams of the same hardness while maintaining a constant sizing percentage, yarn tension and degree of drying of the yarn sheet. Naturally, to satisfy these conditions, supplementary parts and mechanisms should be attached ; for example, a warper beam brake, tension adjustment between sections of a long machine and a differential drive gear to react quickly in a wide speed range, are necessary.

f) Sizer (dyed beam)

The machine's functions are as mentioned previously, but a pre-drying section is also necessary since the dyed beam will be delivered while still wet.

g) Tying machine and reaching-in machine

In a high-speed loom, it is particularly important to supply a lease-free weaver's beam in order to assure quality and productivity. A tying machine which will make it easy to do the setting work of yarn arrangement and to make the yarn arrangement density uniform should be adopted. Also, it should be equipped with a yarn tying mechanism that is versatile for yarn counts and easy to adjust. The experience of the operators, however, will play a large part in determing the final results.

h) Loom

The loom is the most important piece of equipment in the weaving department. It must be selected with particular care. The functions and design of the air jet loom have been improving in recent years. In view of this, a model with proven degree of trustworthiness and capability should be adopted to manufacture high-quality textiles. A mixing insertion type for weft and a sufficient mechanism to ensure good weft insertion must be provided. Also a cam shedding motion unit should be adopted to improve the feeling of the fabric. The machine must stop accurately at the fixed position in the yarn breakage stop motion. A computer which will comprehensively control all the aforementioned required functions (for example, the signal lamp to indicate the cause of machine stoppage, and the display panel to examine, record and display operational data and machine conditions) is essential to allow even workers with little experience to operate with pushbuttons easily and safely and to improve the working efficiency. Also, the most economical loom should be selected by comparing and examining loom prices and production capacities. While the rotational speed on the catalog is also important, the loom's actual production capacity determined by the maximum rotational speed and efficiency available when settings are changed to accommodate various products should be regarded as important.

i) Inspecting machine and folding machine

This is an important process to feed back the inspection results to the previous process. Also, it will be the last chance to check the quality of the product. To facilitate inspection of the textiles, a machine having a fluorescent lamp, and an accurate length meter should be adopted. A device to adjust inspection speed according to the product should be included.

j) Auxiliary equipment

A high-pressure cooker with an automatic controller capable of turning starch completely into size and capable of cooking to a stable viscosity in a short time should be adopted for the size in the preparation process. It is necessary to attach a temperature control together with a tank to swell starch and mix the size material evenly and a tank to supply the cooked size to the sizing machine at a stable viscosity. A powerful exclusive loom cleaner is absolutely necessary to improve and keep the quality of the product, the loom's efficiency and the working environment. Smooth operation and easy-to-work units should be taken into consideration. The automation of conveyance between machines and processes, in particular, has progressed in industrialiged countries. However, the cheap labor force in Bangladesh can be utilized effectively in this project. To avoid errors and danger, on the other hand, it is necessary to automate scales to save labor and achieve safety in the conveyance and transportation of heavy objects.

4) Specifications of Production Machinery

The specifications of production machinery are shown in Table 6-9.

5) List of Auxiliary Equipment and Operation Necessities

The auxiliary equipment and operation necessities are shown in Table 6-10.

6.3.3 Machinery Layout Plan

In production, workers must be able to work rationally and efficiently along the manufacturing process. While the product moving distance must be shortened as much as possible, it is necessary to secure a sufficient space so as not to affect supply/demand even if the production plan or raw material should change. In designing layout of machinery, the conveyance to/from the spinning and dyeing and finishing departments, stocking of purchased yarn, unpacking, etc. should be taken into account. The machine layout is shown in Figure 6-6.

Table 6-8 : CALCULATION TABLE FOR WEAVING SECTION

	1	2	3	4	5	6	7	8	9
Item / Machine	Kind of Cloth	Delivery Speed or Revolution (per minute)	100 % Production (per Hour and Unit)	Working Efficiency (%)	Actual Production (per Hour and Machine)	Required Total Production (per Day)	Calculated NO. of Machines	Installed NO. of Machines	Working Hours (per Day)
		m	m		lbs	lbs		(Rewind)	
Winder	Broad	600	36,000	80	0.937	730	32.5	(72 Drum)	24
	P/C Poplin	600	36,000	80	0.833	1,540	77.0	2	24
	(Yarn-Dyed)							(Soft Wind)	
	P/C Poplin	600	36,000	80	0.833	1,540	77.0	(84 Drum)	24
								1	
		m	m		m	m			
Warper	Broad	700	42,000	40	16,800	126,800	0.34		22.5
	Gaberdine	700	42,000	40	16,800	111,500	0.29	1	22.5
	(Yarn-Dyed)								
	Broad	400	24,000	30	7,200	72,200	0.45		22.5
	P/C Poplin	400	24,000	30	7,200	137,300	0.85	2	22.5
		m	m		m	m			
Sizer	Broad	45	2,700	65	1,755	8,970	0.21		24
	Gaberdine	45	2,700	65	1,755	10,040	0.24	1	24
	(Yarn-Dyed)								
	Broad	45	2,700	40	1,080	4,770	0.18		24
	P/C Poplin	45	2,700	40	1,080	10,460	0.40	1	24
		knots	knots		knots	knots			
Tying Machine	Broad	200	12,000	25	3,000	22,260	0.31		24
	Gaberdine	200	12,000	25	3,000	20,600	0.29	1	24
		warps	warps		warps	warps			
Reaching-in Machine	Broad	8	480	95	456	6,170	0.60		22.5
	Gaberdine	8	480	95	456	5,730	0.56		22.5
	(Yarn-Dyed)								
	Broad	8	480	95	456	11,060	1.08		22.5
	P/C Poplin	8	480	95	456	18,750	1.83	5	22.5
		rpm	m		m	m			
Air Jet Loom	Broad	750	15.66	83	13.00	8,123	26.04		24
	Gaberdine	750	19.05	85	16.19	9,132	23.50		24
	(Yarn-Dyed)								
	Broad	750	15.66	82	12.84	4,315	14.00		24
	P/C Poplin	750	15.04	82	12.33	9,508	32.12	96	24
		m	m		m	m			
Inspecting Machine	Broad	35	2,100	35	735	8,120	0.49		22.5
	Gaberdine	35	2,100	35	735	9,130	0.55		22.5
	(Yarn-Dyed)								
	Broad	35	2,100	35	735	4,320	0.26		22.5
	P/C Poplin	35	2,100	35	735	9,510	0.58	2	22.5
		m	m		m	m			
Folding Machine		50	3,000	50	1,500	31,080	0.92	1	22.5

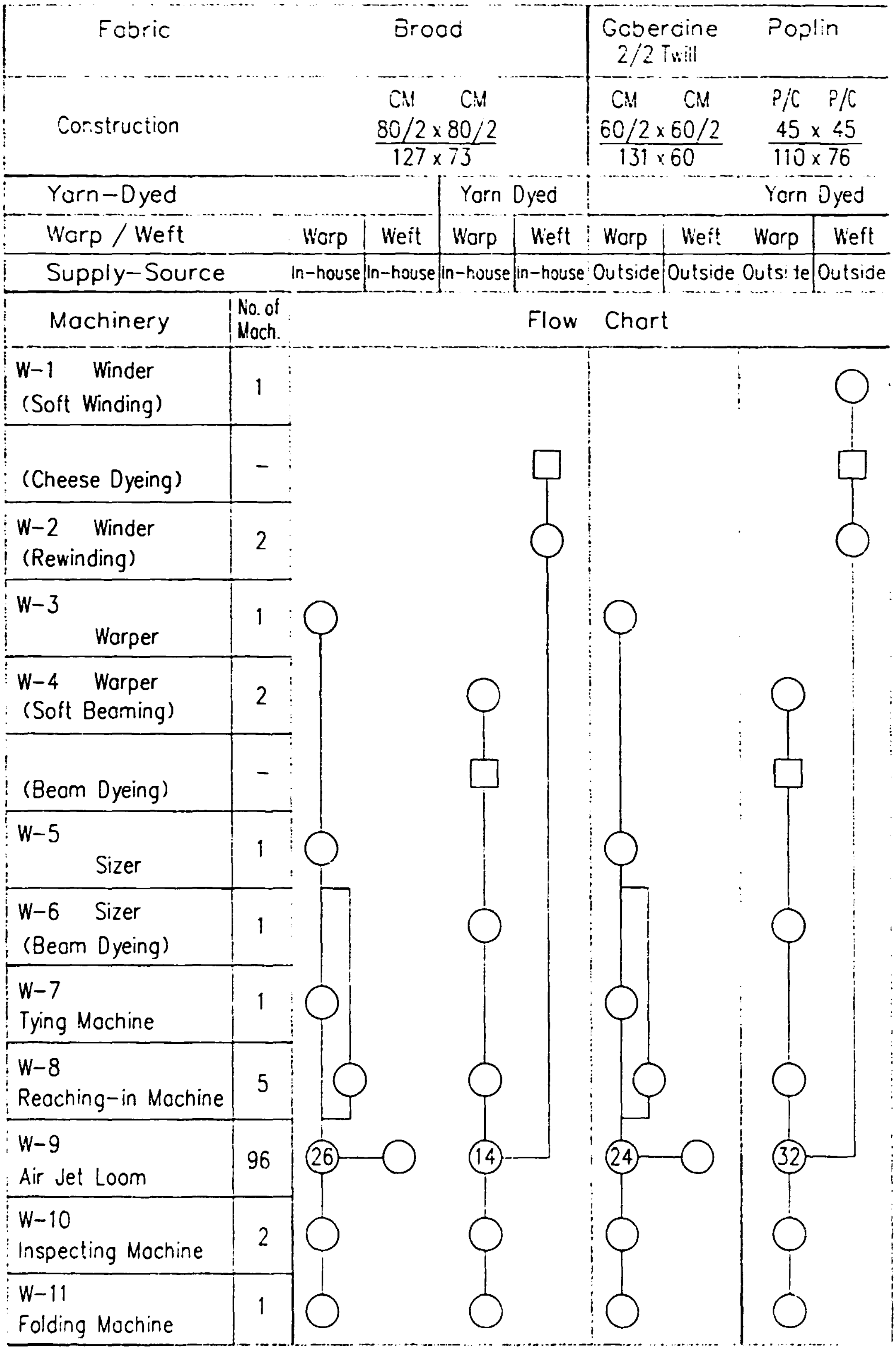


Figure 6-5 : PROCESS FLOW CHART OF WEAVING

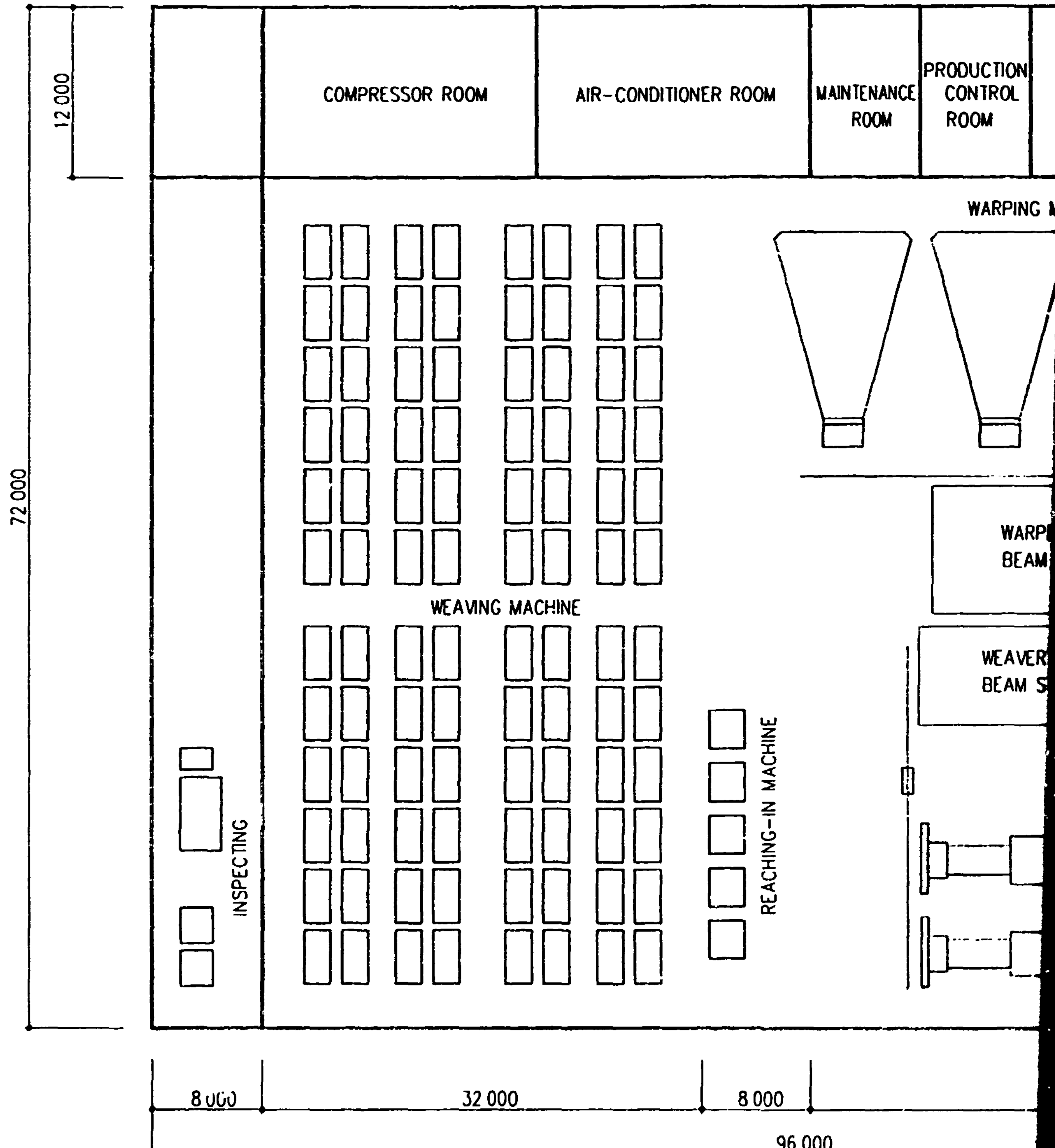
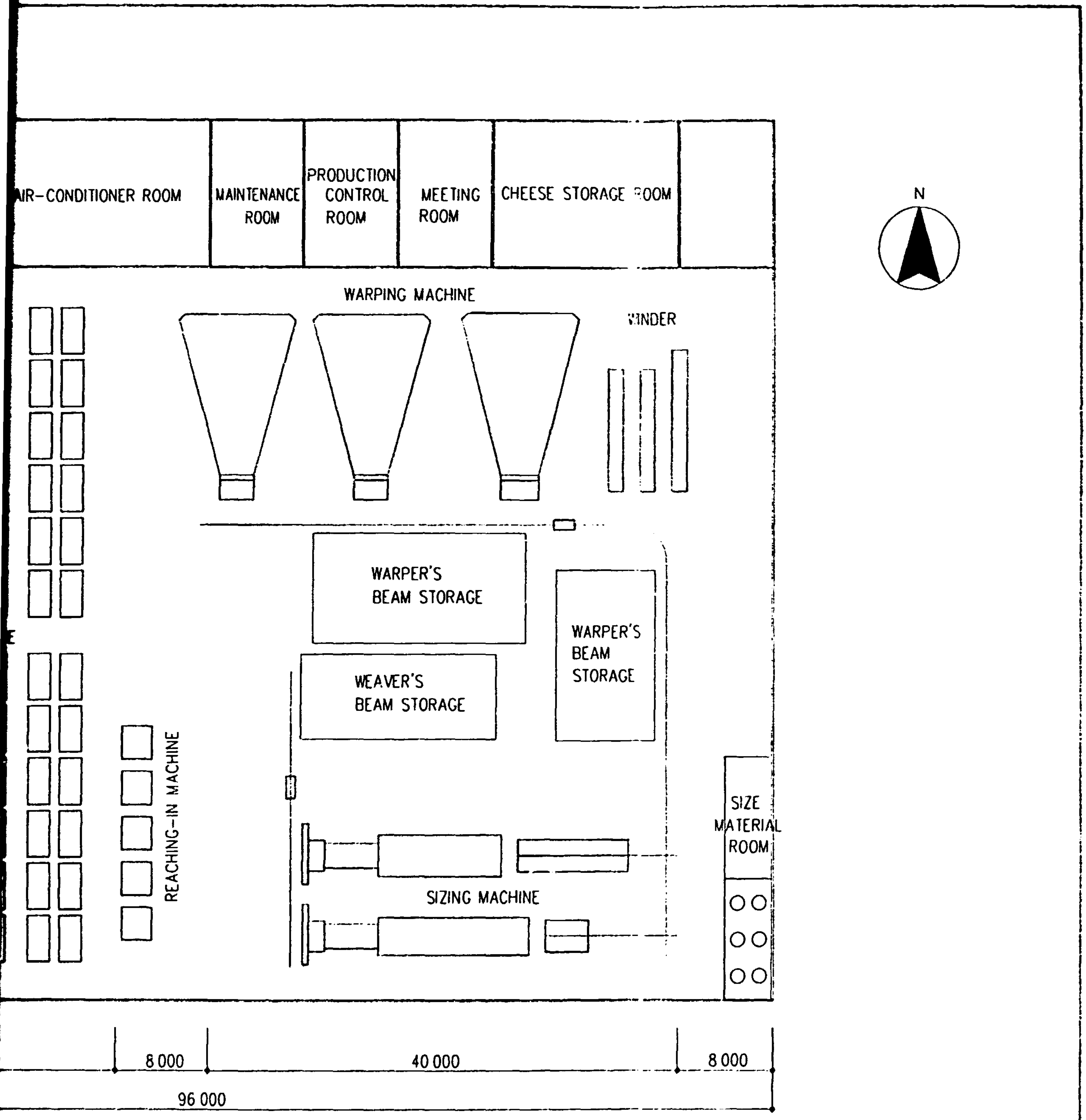


Figure 6-6 : LAYOUT OF PRODUCTION MACHINERY –

SECTION 1



YOUT OF PRODUCTION MACHINERY – WEAVING MILL

SECTION 2

Table 6-9 : SPECIFICATIONS OF MAIN PRODUCTION MACHINERY (WEAVING)

Item No.	Machine/Equipment		Quantity
W-1	Winder (Soft Winding)		1 set
	1) Type of machine	: Counter weight type	
	2) No. of spindles	: 84 SP	
	3) Length of traverse	: 152 mm	
	4) Package shape	: 3°30'	
	5) R.P.M	: 600 m/min.	
	6) Length meter	: 6 SP	
W-2	Winder (Rewinding)		2 sets
	1) Type of machine	: Normal type	
	2) No. of spindles	: 72 SP x 2	
	3) Length of traverse	: 152 mm	
	4) Package shape	: 5°57'	
	5) R.P.M	: 600 m/min.	
W-3	Warper		1 set
	Beaming Head		
	1) Type	: Direct beam driving	
	2) Beaming speed	: Max. 1000 y/min	
	3) Width between beam flange	: 1689 mm(66"1/2)	
	4) Maximum dia. of beam flange	: 900 mm	
	5) Driving device		
	Bobbin Creel		
	1) Type	: V creel	
	2) Number of pegs	: 608 pegs	
	3) Tension control	: Tension rod control system	
	4) Stop motion	: Photoelectric sensing type	
	Special Device		
	1) Blowing-up device for comb		
	2) Cutting device for V-creel		
	3) Comb traverse device		
W-4	Warper (Soft Beaming)		2 sets
	Beaming Head		
	1) Type	: Direct beam driving	
	2) Beaming speed	: Max. 1000 y/min	
	3) Width between beam flange	: 1370 mm(54")	
	4) Maximum dia. of beam flange	: 320 mm	
	5) Driving device	: VS Motor driving	

Item No.	Machine Equipment		Quantity
	Bobbin Creel		
	1) Type	: V creel	
	2) Number of pegs	: 608 pegs	
	3) Tension control	: Tension rod control system	
	4) Stop motion	: Photoelectric sensing type	
	Special Device		
	1) Blowing-up device for comb		
	2) Cutting device for V-creel		
	3) Comb traverse device		
W-5	Sizer		1 set
	Beaming Section		
	1) Type	: Traverse beam carriage type	
	2) Loom beam capacity	: RS 170 cm	
	3) Maximum dia. of beam flange	: 1000 mm	
	4) Beaming device	: PIV Automatic tension control	
	5) Main driving device	: VS Motor driving	
	Drying Section		
	1) Drying system	: 12 cylinder 4 separate drying type	
	Sizing Section		
	1) Size box	: Double size box	
	2) Squeezing	: Double sqeeze 2 ton for second roller linear control system	
	3) Working width of squeezing rollor	: 1830 mm (72")	
	4) Automatic temperature controller		
	5) Pneumatic squeezing roller device		
	6) Level controller		
	7) Wet dividing device		
	Draft Controller	: 2 sets	
	1) Type	: Differential gear type	
	Beam Creel		
	1) No. of units	: 16 Warper's beams	
	2) Braking system	: Pneumatic control type air cylinder for each beam	

Special Device
1) Auto-taping device
2) After-waxing device
3) Stretch monitor
4) Moisture controller
5) Exhaust fan for drying and sizing section

W-6 Sizer — 1 set

Beaming Section

1) Type	: Traverse beam carriage type	
2) Loom beam capacity	: RS 170 cm	
3) Maximum dia. of beam flange	: 1000 m	
4) Beaming device	: PIV Automatic tension control	
5) Main driving device	: VS Motor driving	

Drying Section

1) Drying system	: 12 cylinders 2 separate drying type

Sizing Section

1) Size box	: Double size box
2) Squeezing	: Double squeeze 1.5 ton for second roller linear control system
3) Working width of squeezing roller	: 1524 mm(60")
4) Automatic temperature controller	
5) Pneumatic squeezing roller device	
6) Level controller	
7) Wet dividing device	

Draft Controller	: 2 sets
1) Type	: Differential gear type

Beam Creel

1) No of unit	: 14 Warper's beams
2) Braking system	: Pneumatic control type air cylinder for each beam
Pre-Drying Section	: 3 cylinders

Special Device
1) Auto-taping device
2) After-waxing device
3) Stretch monitor
4) Moisture controller
5) Exhaust fan for drying and sizing section

Item No.	Machine Equipment		Quantity
W-7	Tying Machine		1 set
	1) Working width	: RS 1780 mm(70")	
	2) Tying speed	: Max. 600 knot min	
W-8	Reaching-in Machine		5 sets
	1) Working width	: RS 1780 mm(70")	
	2) Automatic sorting mechanism		
W-9	Air Jet Loom		96 sets
	1) Read Space	: 170 cm	
	2) R.P.M	: 1000 rpm/min	
	3) Weft density	: 25-130 pitch/inch	
	4) Weft color	: 2 color mixing type	
	5) Shedding motion	: Cam motion	
	6) Beating motion	: Multiple slay swords system	
	7) Let-off motion	: Fully automatic positive electric let-off system	
	8) Stop motion	: Photo-electronic type	
	9) Filling insert motion	: Main & sub nozzel with profile reed system	
	10) Automatic pick finder		
	11) Lubrication	: Oil bath for main driving central lubrication system	
	12) Multiple microprocessor control system		
W-10	Inspecting Machine		2 sets
	1) See-through device with fluorescent lamp		
	2) Working width	: 1800 mm(71")	
	3) Inspecting speed varied from 15 m/min to 40 m/min steplessly		
	4) Length measurement	: 6 figures	
W-11	Folding Machine		1 set
	1) Working width	: 1800mm(71")	
	2) Folding speed	: Max. 120 m/min	

Table 6-10 : AUXILIARY EQUIPMENT AND ACCESSORIES

Item No.	Equipment Accessories	Quantity
PREPARATION		
WA- 1	Warper's beam	40 pcs
WA- 2	Cheese carrier	35 sets
WA- 3	Torocon with weighing scale	2 sets
WA- 4	Weighing scale for size stuff	1 set
WA- 5	Mixing tank	1 set
WA- 6	High pressure cooker	1 set
WA- 7	Feed tank	3 sets
WA- 8	Control panel	1 set
WA- 9	Piping materials	1 set
WA-10	Size delivery pump	3 sets
WA-11	Over rail with hoist	2 sets
WA-12	Cone bobbin	8,000 pcs.
WA-13	Bobbin box	20 pcs.
WA-14	Rubber sheet	12 pcs.
WA-15	Rubber block guide	300 m
LOOM		
WA-16	Beam carrier	1 set
WA-17	Beam carrier with heald support	1 set
WA-18	Empty beam carrier	1 set
WA-19	Cloth roll doffer carrier	1 set
WA-20	Reed cleaning machine	1 set
WA-21	Weaver's beam	48 pcs.
WA-22	Cloth roll	48 pcs.
WA-23	Dropper bar	120 pcs.
WA-24	Motor pulley	96 pcs.
WA-25	Leno bobbin	196 pcs.
WA-26	Change gear	192 pcs.
WA-27	Heald frame	550 pcs.
WA-28	Flat heald	960,000 pcs.
WA-29	Dropper	960,000 pcs.
WA-30	Profile reed	144 pcs.
WA-31	Leno bobbin winder	1 set
WA-32	Ring temple	10 sets
WA-33	Blow cleaner for AJL	8 sets
FINISH		
WA-34	U-type carrier	10 sets
WA-35	L-type carrier	5 sets
WA-36	Hand pallet truck	1 set
WA-37	Fork lift	1 set
OTHERS		
WA-38	Technical tool	1 lot
WA-39	Miscellaneous accessories	1 lot

6.4 Dyeing and Finishing

6.4.1 Production Plan

As a result of the market survey, the product mix was planned mainly for fabrics for dress shirts and to supply high-quality fabrics to the garment industry for garment export, which has developed remarkably in recent years.

The production plan calls for 75 % of the total grey cloth for dress shirts (mainly P/C Ne 45) to be imported from Asian countries. In addition, Ne 80/2 fabric was planned for high-grade dress shirts.

For dress shirts of P/C Ne 45 and Cotton Ne 80/2, bleaching, dyeing and yarn dyeing were planned. For gaberdine using Ne 60/2 for coats, jackets and trousers, only dyeing was planned in this project.

The production plan and the product mix shown in Table 6-11 were created from the aforementioned information as a result of considering stable operation and profit.

6.4.2 Dyeing and Finishing Machinery and Equipment

The dyeing mill consists of the yarn dyeing department and the textile dyeing and finishing department.

Machinery was selected to enable stable operation at high efficiency. The ability to manufacture high-quality products consistently was also taken into consideration.

1) Flow Chart

The flow chart for manufacturing seven kinds of products from three kinds of fabrics is shown in Figure 6-7.

2) Caluculation for Machinery

The production amount required in each process was calculated according to the flow chart. To select machinery capable of treating such production amounts, machinery capacity was calculated according to the calculation table shown in Tables 6-12, 6-13, 6-14. For the yarn dyeing machine, considerations were taken to manufacture diversified textiles based on three kinds of designs. For dyeing and finishing textiles, a continuous type with proven results has been adopted.

Table 6-11 : DYEING AND FINISHING PRODUCTION PLAN

1. Production Plan

		Cotton Broad	Cotton Gaberdine	P C Poplin
Materials		Cotton : 100%	Cotton : 100%	Polyester : 65% Cotton : 35% Blended
Yarn Count (Warp x Weft)		CM CM 80/2 x 80/2	CM CM 60/2 x 60/2	P/C P/C 45 x 45
Construction (End x Pick/inch)		127 x 73	131 x 60	110 x 76
WIDTH	Grey cm(inch)	160(63)	160(63)	160(63)
	Finish cm(inch)	152(60)	152(60)	152(60)
Grey cloth weight				
per meter		200 g	217 g	167.6 g
per square meter		125 g	135 g	105 g

2. Product Mix Unit : m/month

Products Materials	Bleached	Dyed	Yarn-Dyed	Total
Cotton Broad	135,000	100,000	124,800	359,800
P/C Poplin	950,000	651,000	275,000	1,876,000
Cotton Gaberdine	-	264,200	-	264,200
Total	1,085,000	1,015,200	399,800	2,500,000

3) Machinery and Equipment

a) Yarn dyeing machine

For the warp dyeing machine, a beam dyeing system with easy yarn handling was adopted. It also allows the dryer to be omitted. The beam, beamed softly in the weaving process, is dyed by the beam dyeing machine and dewatered (residual moisture ratio: 60 - 65%) using high-pressure (20 kg/cm^2) compressed air. It is then sized in the weaving department. For weft yarn, soft cheese is bleached, dewatered and dried and delivered to the weaving process.

b) Inspecting machine for grey cloth

For P/C Ne 45 poplin, grey cloth will be purchased. The same machine with a see-through lamp, used for product inspection, was adopted for the purpose of conducting acceptance inspections of cloth, allowing only those products which pass inspection to continue on to the mill.

c) Gas singeing and desizing machine

Gas singeing will be performed using Bangladesh's abundant natural gas. A water-cooled roll will be provided so as not to damage the texture of the polyester/cotton blended cloth. Also, a mechanism capable of adjusting the degree of singeing by changing the burner angle was adopted. Safety devices for automatic gas shutoff in the case of emergency stoppage, backfire detection, etc. have been provided. To remove the sizing agent applied in the weaving process after gas singeing, the cloth is immersed in a solution of desizing agent in batches and left turning undisturbed for 6 - 8 hours to proceed with desizing. Yarn-dyed textiles will be treated continuously by connecting gas singeing and the subsequent scouring and bleaching range to prevent color transfer.

d) Scouring and bleaching range

After the cloth is washed sufficiently in water after the desizing treatment, it is impregnated with an alkali scouring solution, treated in the reaction chamber for 45 - 60 minutes and rinsed sufficiently in water. Then it is impregnated with a peroxide bleaching solution, treated in the reaction chamber for 40 - 50 minutes, rinsed sufficiently in water again and dried. The pre-treatment process is an important process which affects the quality of the next process and 70 % of the finished product's quality is decided at this point, so machinery and equipment were selected with care.

e) Mercerizing machine

The clip chain type was adopted in view of size stability and glossing of 100 % cotton textiles. In Europe, the chainless type is popular. This is excellent in maintenance, operability, etc. and presents no problem in polyester/cotton blended cloth. The chain type is necessary in view of quality, however, for the high-grade cotton cloth to be manufactured at this mill in particular. The control of the caustic soda solution is important. Auxiliary equipment is arranged to circulate a controlled solution with a unit to control concentration and temperature being provided. As caustic soda will be used in large amounts, a caustic soda recovery unit was adopted to recycle chemicals and to alleviate the burden of waste water treatment. The large amount of cooling water for the caustic soda solution cooler and recovery unit will be recycled by a cooling tower.

f) Heat setter

A pin-type stenter will perform heat treatment (200 - 220 ℃) for enhancing the size stability of the polyester/cotton blended cloth to account for 75 % of the total production amount. An over feed unit will be provided to improve size stability. Thermo-fluid will be used as the heat source and natural gas is used for its heating unit.

g) Hot flue dyeing machine

The hot flue dyeing machine is composed of the three sections: the padding mangle, the pre-dryer and the hot air dryer. First, the cloth is immersed in the dye solution and squeezed evenly. Therefore, a system to pressurize the mangle by air pressure between the rolls and by oil pressure inside one roll was adopted. Then the cloth is pre-dried with a drying ratio of about 30 % by the pre-dryer using an infrared lamp with little migration of the dye within the cloth and is dried completely with a hot blast dryer. The cloth will be sent to a fixing machine since the dye will just be made to adhere uniformly and dried in this process.

h) Thermofixing machine

The thermofixing machine performs high-temperature hot blast treatment in order to fix the reactive dye to the cotton fiber and the disperse dye to the polyester fiber. Thermo-fluid will be used as the heat source just as in the heat setter.

i) Pad-steamer

The pad-steamer fixes the vat dye to the cotton fiber and washes the reactive dye and disperse dye using steam. It is composed of the padding mangle, the steamer, the airing arrangement and the water-washing dryer.

A steamer of the triangular roof system not using the heater was adopted in order to avoid over-drying by steam. In the dyeing process, reactive dye is used in about 90 % of the cotton and vat dye is used in about 10 %. For polyester, disperse dye is used. For the polyester/cotton blended cloth dyeing method, the one-bath method was adopted for light and medium colors and the two-bath method was adopted for very deep colors.

j) Finishing stenter

The finishing stenter finishes all the product kinds. It is composed of a 10-ton mangle, a hot flue type pre-dryer and the pin-type stenter. It was selected in view of performing such finishing as resin finishing, soft finishing, etc. A weft straightener will also be provided for yarn dyeing. Because thermo-fluid will be used as the heat source, high-temperature treatment will also be possible.

k) Baking machine

The baking machine fixes resin as mainly light resin and ordinary resin finishing was chosen as the main approach in the design. Thermo-fluid is used as the heat source.

l) Compressive shrinking machine

The compressive shrinking machine is used for pre-shrinking cotton textiles and adjusting the feeling of the fabric, e.g. flexibility, for polyester/cotton blended cloth. It is composed of the damping unit, the rubber shrinking unit and the blanket palmer.

m) Inspecting machine

The inspecting machine feeds back the results of product inspections to maintain and improve quality. It will be equipped with a see-through lamp to facilitate inspection for defects. It will be also equipped with a counter to measure length while inspecting cloth.

n) Cloth winding machine

The finished product will be shipped wound on a round paper tube (diameter 50 mm) which will be supplied to the sewing mill. An easy-working indirect winding-up system was adopted. A machine which can supply and change the paper tubes easily was selected.

4) Specifications of Production Machinery

The specifications of production machinery are shown in Tables 6-15 and 6-16.

5) List of Auxiliary Equipment and Accessories

The auxiliary equipment and accessories were selected as shown in Table 6-17. Major equipment is explained and their features are described.

a) NaOH recovery unit (FA-1)

To recycle the large amount of caustic soda (NaOH) used in the mercerizing machine, a recovery unit will be provided. Also, as 25 ton/hr of water is required for cooling, a cooling tower is provided for recirculation.

b) Electric vacuum cleaner (FA-12)

The filters attached to such hot blast circulating machines as the hot flue dryer, the stenter, etc. need be cleaned from time to time so an electric vacuum cleaner will be provided. The electric vacuum cleaner may also be used for cleaning the machine room of cotton dust.

c) Jet cleaner (FA-13)

A jet cleaner was adopted to clean the machines (the water-washing machine, etc.) by blowing off the yarn dust and other dust stuck to its corners with high-pressure water.

d) Homogenizer (FA-14)

While recent dye has been pulverized to increase solubility, a special mixer is necessary for complete solution.

e) Strapping machine with roller conveyer (FA-16)

The product is finished ultimately as wound round. For shipment, six tubes are put in a carton box. A strapping machine with a roller conveyer was adopted to band the carton box. The roller conveyer will be arranged in the machine's strapping part to introduce the carton box into the machine.

f) Weft straightener (FA-29)

In finishing yarn-dyed textiles in particular, the grade of the product is affected if the cloth is distorted. The weft straightener, laid out at the inlet of the stenter, automatically detects and corrects distortion.

g) Maintenance tools (FA-30)

For machine tools, a workshop is provided for the whole mill. So tools for minor repairs in the dyeing and finishing department have been prepared. They are required also for the installation of machinery and equipment.

6) Testing Machines, Equipment and Tools for the Laboratory

The dyeing and finishing department's laboratory must be a leader in dyeing and finishing technology and the center for clarification of quality problems. Therefore, high quality testing equipment for conducting performance tests using samples and tools for measuring the finishing conditions, etc. are necessary.

The following three groups of equipment and tools have been prepared as shown in Table 6-18 :

(a) Testing machines and equipment
(b) Model machines for testing
(c) Measuring tools

6.4.3 Machinery Layout Plan

The major product flow in the mill has been designed to be U-shaped so that the product is input and output on the same side of the mill. The flow of the individual product type is not completely U-shaped, however, since all the product types do not pass through the same processes. To simplify product conveyance, considerations have been taken to reduce the conveyance of product kinds of large quantities. The yarn dyeing mill exchanges yarn with the spinning and weaving departments totally irrespective of the textile flow. The mill height differs between the yarn dyeing and textile finishing mills. An effective height of 8 m is required for the yarn dyeing mill and 6 m is required for the textile finishing mill. A space large enough for stocking about 2 days' equivalent of grey cloth and products has been allocated in the warehouse in the mill for preparation and assorting. Small rooms such as the office, the maintenance room, etc. have been arranged on the main road side. The NaOH recovery unit, the NaOH dissolving unit, the cooling tower and the chemical stock tank have been planned outside the mill on the opposite side of the main road.

The dyeing and finishing department layout is shown in Figure 6-8.

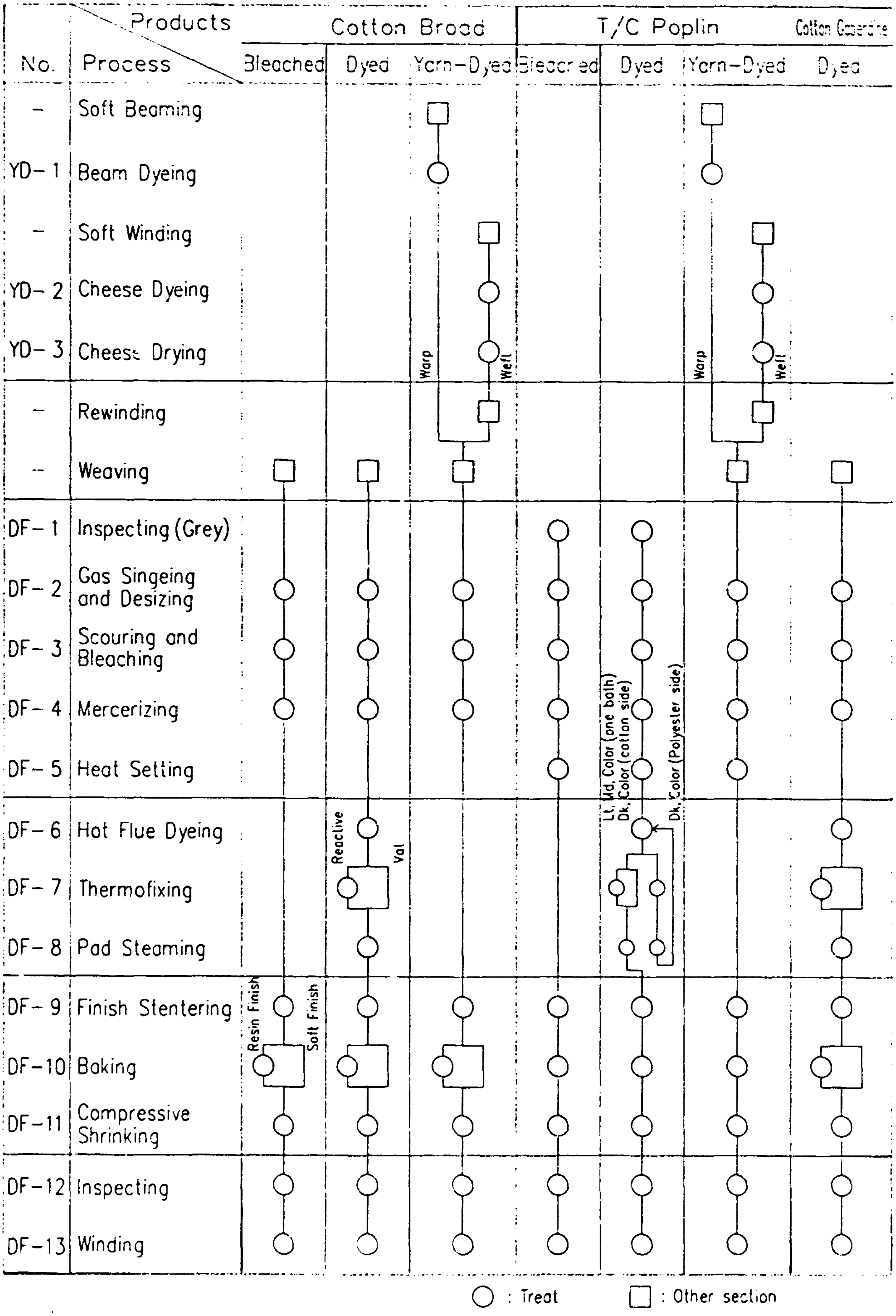


Figure 6-7 : PROCESS FLOW CHART OF DYEING AND FINISHING

Working hours:
24 hr/day
350 days/year
700.08 hr/month by 3 shifts

Table 6-12 : CALCULATION TABLE FOR DYEING AND FINISHING PROCESS

No.	Process	Fiber/Fabric	Delivery Speed m/min.	100 % Production per Machine m/hour	Production Factor %	Actual Production per Machine m/hour	Shift (no.)	Required Production m/month	Required Production m/hour	Calculated No. of Machines	Total Calculated No. of Machines	Note
DF- 1	Inspecting (grey)	P/C Poplin	40	2,400	50	1,200	3	1,613,810	2,306		1.92	2 sets
DF- 2	Gas singeing and Desizing	P/C Poplin	90	5,400	85	4,590		1,891,010	2,702	0.59		
		C. Broad	80	4,800	85	4,080	3	362,680	519	0.13	0.82	
		C. Gaberdine	80	4,800	85	4,080		266,315	380	0.10		
DF- 3	Scouring and Bleaching	P/C Poplin	80	4,800	90	4,320		1,891,010	2,702	0.63		
		C. Broad	60	3,600	90	3,240	3	362,680	519	0.16	0.92	
		C. Gaberdine	55	3,300	90	2,970		266,315	380	0.13		
DF- 4	Mercerizing	P/C Poplin	75	4,500	90	4,050		1,891,010	2,702	0.67		
		C. Broad	65	3,900	90	3,510	3	362,680	519	0.15	0.93	
		C. Gaberdine	65	3,900	90	3,510		266,315	380	0.11		
DF- 5	Heat setting	P/C Poplin	55	3,300	85	2,805	3	1,891,010	2,702		0.97	
DF- 6	Hot flue Dyeing	P/C Poplin	50	3,000	60	1,800		718,282	1,026	0.57		
		C. Broad	45	2,700	60	1,620	3	100,800	144	0.09	0.93	
		C. Gaberdine	40	2,400	60	1,440		266,315	380	0.27		
DF- 7	Thermofixing	all kinds	30	1,800	85	1,530	3	985,013	1,407		0.92	
DF- 8	Pad Steaming	P/C Poplin	45	2,700	75	2,025		718,282	1,026	0.51		
		C. Broad	40	2,400	75	1,800	3	100,800	144	0.08	0.84	
		C. Gaberdine	35	2,100	75	1,575		266,315	380	0.25		
DF- 9	Finish Stenter	P/C Poplin	80	4,800	85	4,080		1,891,010	2,702	0.67		
		C. Broad	65	3,900	85	3,315	3	362,680	519	0.16	0.96	
		C. Gaberdine	60	3,600	85	3,060		266,315	380	0.13		
DF-10	Baking	P/C Poplin	40	2,400	85	2,040		1,891,010	2,702	1.33		
		C. Broad	30	1,800	85	1,530	3	171,520	245	0.16	1.61	2 sets
		C. Gaberdine	30	1,800	85	1,530		126,015	180	0.12		
DF-11	Compressive Shrinking	P/C Poplin	75	4,500	90	4,050		1,891,010	2,702	0.67		
		C. Broad	60	3,600	90	3,240	3	362,680	519	0.16	0.96	
		C. Gaberdine	55	3,300	90	2,970		266,315	380	0.13		
DF-12	Inspecting	all fabrics	40	2,400	55	1,320	3	2,520,005	3,600		2.73	3 sets
DF-13	Winding	all fabrics	50	3,000	70	2,100	3	2,520,005	3,600		1.72	2 sets

Table 6-13 : CALCULATION TABLE FOR WARP YARN ON BEAM DYEING

No.	Item	Lot x Colour x Design	Warp yarn length per Beam	Color % Whi't	Color % Col	Beam lot per Colour	Yarn weight per Beam lbs	Yarn weight per Beam Kg	Kier Capacity	Dyeing Cycle per Days	Calculated No. of Days	Total No. of days on each kier 30 kg	90 Kg	150 K	200 K
A- 1	CM80/2 x CM80/2	2,750m x 1 x 15	3,402m	85.2		W=12(568)	62.9	28.5	200 x 2	6	5.0				5.0
	127 x 73		(3720.5y)		14.8	C= 2(592)	65.6	29.8	90	3	5.0		5.0		
	(41,250)m					PB=2(592)			90	9	1.7		1.7		
A- 2	CM80/2 x CM80/2	2,750m x 1 x 15	3,402m	50.0		W= 7(572)	63.4	28.8	200	6	2.5				2.5
	127 x 73		(3720.5y)		50.0	C= 7(572)	63.4	28.8	200	3	5.0				5.0
	(41,250)m					PB=7(572)			200	9	1.7				1.7
A- 3	CM80/2 x CM80/2	2,640m x 2 x 16	3,266m	66.0		W= 9(587)	62.4	28.3	150 x 2	6	5.4			5.4	
	127 x 73		(3571.8y)		30.3	C-1=5(485)	51.6	23.4	150	3	5.3			5.3	
	(42,240)m				3.7	C-2=1(296)	31.5	14.3	30	3	5.3	5.3			
						PB= 6			200	9	1.8				1.8
B- 1	P/C 45 x P/C 45	3,080m x 1 x 30	3,870m	85.2		W=10(591)	66.2	30.0	150 x 2	6	10.0			10.0	
	110 x 76		(4232.3y)		14.8	C= 2(513)	57.5	26.1	90	3	10.0		10.0		
	(92,400)m					PB=2			90	9	3.4		3.4		
B- 2	P/C 45 x P/C 45	3,080m x 1 x 30	3,870m	50.0		W= 6(578)	64.7	29.4	200	6	5.0				5.0
	110 x 76		(4232.3y)		50.0	C= 6(578)	64.7	29.4	200	3	10.0				10.0
	(92,400)m					PB=6(578)			200	9	3.0				3.0
B -3	P/C 45 x P/C 45	3,190m x 2 x 29	4,008m	66.0		W= 8(572)	66.4	30.1	150 x 2	6	9.7			9.7	
	110 x 76		(4383.2y)		30.3	C-1=4(525)	60.9	27.6	150	3	9.7			9.7	
	(92,510)m				3.7	C-2=1(257)	29.8	13.6	30	3	9.7	9.7			
						PB=5			150	9	3.2			3.2	
										Total days		15.0	20.1	43.3	34.0
										No. of Kiers		0.514	0.689	1.485	1.166

Table 6-14 CALCULATION TABLE FOR WEFT YARN ON CHEESE DYEING

No.	Item	Lot x Color x Design	Production per month lbs	Production per month Kg	Color % White	Color % Col.	Lot size per Color	Total weight of White	Total weight of Pre-bleach	Weight per color	Kier Capacity	Cycles per day	Calculated days	Total No. of days on each kier 25 kg	50 Kg	100 K	200 K
A- 1	CM80/2 x CM80/2		20,325	9,220	100			9,220 Kg			200	6	7.7				7.7
- 2	127 x 73																
- 3																	
B- 1	P/C 45 x P/C 45		42,749	19,391	100			19,391 Kg			200	6	16.2				16.2
- 2	110 x 76											Total days					23.9
- 3												No. of Kiers					0.82

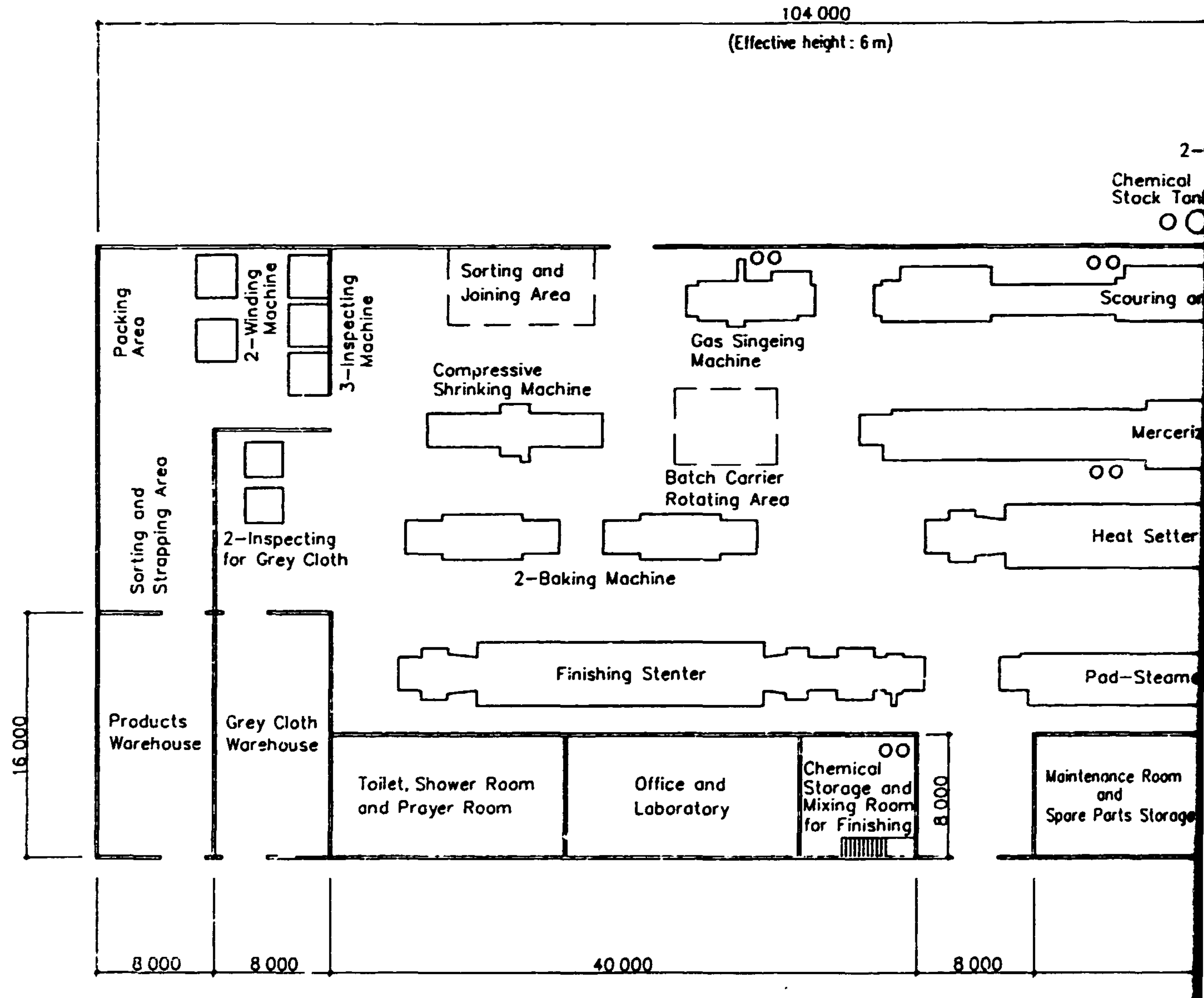
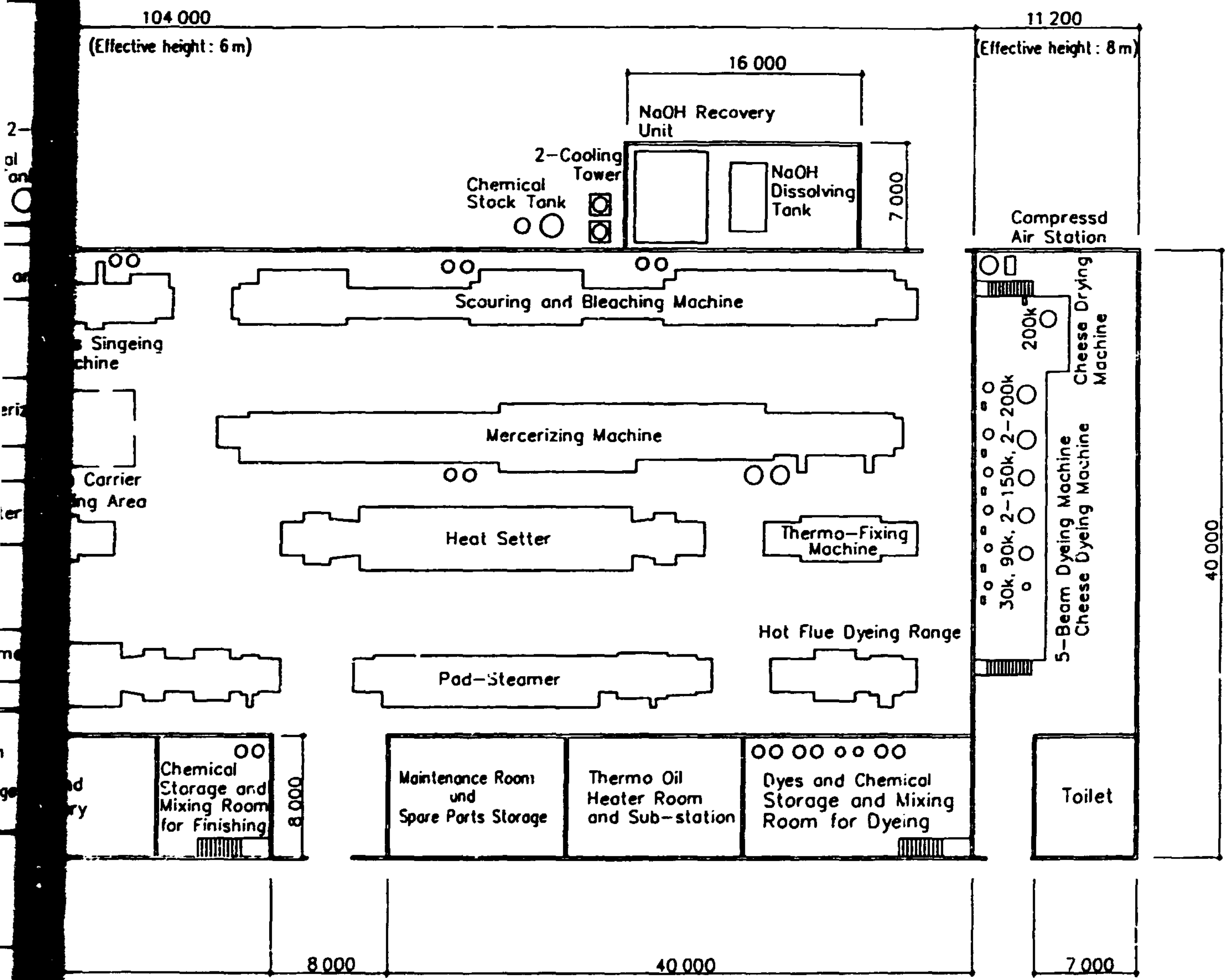


Figure 6–8 : LAYOUT OF PRODUCTION MACHINERY –

SECTION 1



T OF PRODUCTION MACHINERY – DYEING AND FINISHING MILL

SECTION 2

Table 6-15 : SPECIFICATIONS OF MAIN PRODUCTION MACHINERY (YARN DYEING)

Item No.	Machine/Equipment	Quantity
YD-1	Beam Dyeing Machine 1) Loading capacity : 200 Kg x 1 sets 150 Kg x 2 sets 90 Kg x 1 set 30 Kg x 1 set 2) Auxiliary equipment and systems for each machine Control panel Service tank High pressure extract system High temperature drainage system Automatic operation system Automatic dosing system 3 sets of beam carrier 3) Max. temperature and pressure 140 ℃ and 4 Kg/cm^2	5 sets
YD-2	Cheese Dyeing Machine 1) Loading capacity : 200 Kg x 1 set 2) Auxiliary equipment and systems Control panel Service tank High pressure extract system High temperature drainage system Automatic operation system Automatic dosing system of service tank 3 sets of cheese carrier 3) Max. temperature and pressure 140 ℃ and 4 Kg/cm^2	1 set
YD-3	Cheese Dryer 1) Loading capacity : 100 Kg x 1 set 2) Max. temperature and pressure 120 ℃ using 5 Kg/cm^2 of steam 3) Auxiliary equipment Air station	1 set

Table 6-16 : SPECIFICATIONS OF MAIN PRODUCTION MACHINERY (FINISHING)

Item No.	Machine/Equipment	Quantity
DF-1	Inspecting Machine (for grey cloth) (Roller width : 1,800mm)	2 sets
	1) Machine speed : Max. 60 m/min.	
	2) Machine arrangement	
	Inspecting board with see-through device and cloth length counter	
	Plaiting down device	
DF-2	Gas Singeing Machine (Roller width : 1,800mm)	1 set
	1) Machine speed : Max. 120 m/min	
	2) Machine arrangement	
	4 brushes brushing unit	
	2 burners gas singeing unit	
	Energy source : Natural gas	
	1 washing unit (3 tons)	
	1 saturator unit for desizing (1 ton)	
	Batch up device : Max. 1,800 mm in diameter	
	Cyclone type dust collector	
	Chemicals feeding unit (500 ℓ x 2 tanks with mixer)	
DF-3	Scouring and Bleaching Range (Roller width : 1,800mm)	1 line
	1) Machine speed : Max. 100 m/min.	
	2) Machine arrangement	
	1 open washer (1 ton)	
	2 horizontal running type washers (3 tons)	
	1 saturator for scouring (1 ton)	
	No.1 reaction chamber (4,000m at 120g/m^2 of cloth)	
	1 open washer (1 ton)	
	1 horizontal running type washer (3 tons)	
	Saturator for bleaching (H_2O_2, 1 ton)	
	No.2 reaction chamber (4,000m at 120g/m^2 of cloth)	
	1 open washer (1 ton)	
	2 horizontal running type washers (3, 5 tons)	
	24 cylinders drying unit (2 cylinders for water cooling)	
	Cloth delivery : Large batch (Max. diameter : 1,800 mm)	
	2 units of chemicals feeding unit (500 ℓ x 2 tanks with mixer/unit)	
	Counter flow system for water	
DF-4	Mercerizing Machine (Roller width : 1,800mm)	1 line
	1) Machine speed : Max. 80 m/min	

Item No.	Machine/Equipment	Quantity
	2) Machine arrangement	
	No.1 padder(10 tons)	
	Tension cylinders	
	No.2 padder(15 tons)	
	Stentering machine with shower and suction device	
	Mangle unit (3 tons)	
	2 enclosed type washing machines (1 ton. 3 tons)	
	1 horizontal running type washer	
	2 open washer for neutralization (1 ton)	
	1 horizontal running type washer (5 tons)	
	24 cylinders drying unit(2 cylinders for water cooling)	
	Cloth entering and delivery : Large batch and plaiting down	
	NaOH solution feeding and circulation unit with concentration and temperature control unit	
	Chemical feeding unit : 500 ℓ x 2 tanks with mixer for neutralizing	
	Counter flow system for water	
DF-5	Heat Setter (Roller width : 1,800mm)	1 set
	1) Machine speed : Max. 60 m/min.	
	2) Machine arrangement	
	Stenter : 6 chambers(Max. temperature: 230℃)	
	Energy source : Thermal fluid (without boiler)	
	Water cooling cylinder : 2 cylinders	
	Cloth entering and delivery : Cloth carrier and plaiting down	
DF-6	Hot Flue Dyeing Range (Roller width : 1,800mm)	1 line
	1) Machine speed : Max. 90m/min.	
	2) Machine arrangement	
	Padding mangle (Uniform squeezing type)	
	Predryer unit (Electric)	
	Hot flue dryer	
	Air blow type cooling unit	
	Cloth entering and delivery : Cloth carrier and plaiting down	
	Chemicals feeding tank(500 ℓ x 2 with mixer)	
DF-7	Thermofixing Machine (Roller width : 1,800mm)	1 set
	1) Machine arrangement	
	2) Preheating cylinders	
	Cloth capacity : 80 m	
	2 water cooling cylinders	
	Energy source : Thermal fluid(Max. temp. 230℃)	
	Cloth entering and delivery : Cloth carrier and plaiting down	

Item No.	Machine/Equipment	Quantity
DF-8	Pad Steamer (Roller width : 1,800mm)	1 set
	1) Machine speed : Max. 80m/min.	
	2) Machine arrangement	
	Padding mangle (3 tons)	
	Steamer (40 m capacity)	
	1 open washer	
	Airing unit (30 m capacity)	
	7 open washer	
	24 cylinders drying unit	
	Cloth entering and delivery : Cloth carrier and plaiting down	
	3 units of chemicals feeding tank(500 ℓ x 2 with mixer/unit)	
DF-9	Finishing Stenter (Roller width : 1,800mm)	1 set
	1) Machine speed : Max. 80 m/min.	
	2) Machine arrangement	
	2 rolls padding unit (10 tons)	
	Predryer : Hot flue type	
	Weft streightener	
	Stenter : Pin type, 6 chambers(Max. temperature 160℃)	
	Heat source : Thermal fluid	
	2 water cooling cylinders	
	Chemical feeding device (500 ℓ x 2 tanks with mixer)	
	Cloth entering amd delivery : Cloth carrier and plaiting down	
DF-10	Baking Machine (Roller width : 1,800mm)	2 sets
	1) Machine arrangement	
	2 preheating cylinders	
	Cloth capacity : 80 m	
	2 water cooling cylinders	
	Energy source : Thermal fluid (Max. Temp. 160℃)	
	Cloth entering and delivery : Cloth carrier and plaiting down	
DF-11	Compressive Shrinking Machine (Roller width : 1,800mm)	1 set
	1) Machine speed : Max. 80 m/min.	
	2) Machine arrangement	
	Cloth entering and feeding device	
	Spray damping unit	
	Rubber belt compressive shrinking unit	
	Felt blanket drying unit	
	2 cooling cylinders	
	Plaiting down delivery device	
	Shrinkage test equipment	
	Washer, dehydrator, flat press and marker(50 cm)	

Item No.	Machine/Equipment	Quantity
DF-12	Inspecting Machine (Roller width : 1,800mm) 1) Machine speed : Max. 60 m/min. 2) Machine arrangement Inspecting board with see-through device and cloth length counter Plaiting down device	3 sets
DF-13	Cloth Winding Machine (Roller width : 1,800mm) 1) Machine speed : 50 m/min. 2) Machine arrangement Cloth winding machine on paper tube with cut mark-detector and cloth length counter	2 sets

Table 6-17 : AUXILIARY EQUIPMENT AND ACCESSORIES
(DYEING FINISHING)

No.	Name of Equipment	Quantity
FA-1	NaOH recovery unit	1 Unit
	5° Be ~ 32° Be, 2,000 Kg/hr	
FA-2	NaOH stock and service tank	1 lot
FA-3	Sewing machine with stand	14 sets
	Overlock stitch 8 sets	
	Chainstitch 4 sets	
	Double chainstitch 2 sets	
FA-4	Fork-lift truck(1.5 tons, gasoline)	2 sets
FA-5	Hand lift truck(1.5 tons)	4 sets
FA-6	Batch carrier(A-type large batcher)	20 sets
FA-7	Batch carrier truck	2 sets
FA-8	Cloth carrier	240 sets
FA-9	Chemicals and parts carrier	20 sets
FA-10	Pallet(plastic)	100 pcs.
FA-11	Balance(200 gr, 1 Kg, 10 Kg, 100 Kg)	13 sets
FA-12	Electric vacuum cleaner(for industry)	2 sets
FA-13	Jet cleaner(50 Kg/cm^2)	2 sets
FA-14	Homogenizer(for 2 , 20 , 50)	9 sets
FA-15	Mixing tank and tools	1 lot
FA-16	Strapping machine with roller conveyer	1 set
FA-17	2-ton double rail crane	1 set
FA-18	Dyeing beam	120 sets
FA-19	Blind beam	8 sets
FA-20	Beam stand(8 beams/stand)	15 sets
FA-21	Dyeing bobbin	3,000 pcs.
FA-22	Spacer	700 pcs.
FA-23	Blind bobbin	30 pcs.
FA-24	Blind tube	5 pcs.
FA-25	Cheese truck	20 sets
FA-26	Parts box(Plastic)	20 pcs.
FA-27	Pinking scissors	5 pcs.
FA-28	Other scissors	20 pcs.
FA-29	Weft straightener for finishing stenter	1 set
FA-30	Maintenance tools	1 lot

Table 6-18 : LABORATORY EQUIPMENT AND TOOLS

No.	Name of Equipment	Quantity
1. Testing Machines and Equipment		
FL-1	Computer color matching system with on-line system to FL-2	1 lot
FL-2	Automatic color despensing system	1 lot
FL-3	Tensile strength tester (Instron type)	1 set
FL-4	Tearing tester (Elemendorf type)	1 set
FL-5	Fadeometer (Xenone lamp type)	1 set
FL-6	Launder tester(8 beakers)	1 set
FL-7	Rubbing tester	1 set
FL-8	Hot press(Iron tester : 1 head type)	1 set
FL-9	Pilling tester(ICI type, 3 boxes)	1 set
FL-10	Perspiration tester	2 sets
FL-11	Grey scales, blue scale and standard adjacent fabrics	1 lot
FL-12	Water distiller(2 /hr)	1 set
FL-13	Electric water bath(8 beakers)	1 set
FL-14	pH meter(pH 0 ~ 14)	1 set
FL-15	Homogenizer(0.3 ~ 2)	1 set
FL-16	Digital balance(200 g)	1 set
FL-17	Balance(200 g, 1 Kg)	3 sets
FL-18	Glassware, plastics & testing tools	1 lot
FL-19	Standard reagents for analysis	1 lot
FL-20	Testing table with sink	1 set
2. Model Machines for Testing		
FL-21	Padding mangle(4 tons)	1 set
FL-22	Padding mangle(2 tons)	1 set
FL-23	Heat setting and thermofixing machine	2 sets
FL-24	Pad-steamer	1 set
FL-25	Testing oven	1 set
FL-26	Cylinder dryer	1 set
FL-27	12 Color dyeing machine	1 set
3. Measuring Tools		
FL-28	Anemometer	1 set
FL-29	Rubber hardness tester	2 sets
FL-30	Tachometer	2 sets
FL-31	Densimeter	2 sets
FL-32	Light scope(X 30, X 100)	4 sets

6.5 Electrical and Mechanical Engineering Works

6.5.1 Electrical Equipment

1) Electricity Load

The electricity load required for the new project is shown in Table 6-19. There is a large difference in the load of electricity due to some fluctuations in the running condition of the production machinery and large changes in the refrigerator load between summer and winter.

Table 6-19 : ELECTRICITY LOAD

Department		Demand KW	Mean of Load KW
Spinning	Summer	3,843	3,651
	Winter	3,145	2,988
Weaving	Summer	1,453	1,380
	Winter	1,226	1,165
Dyeing	Summer	1,156	1,040
	Winter	1,156	1,040
Total	Summer	6,452	6,071
	Winter	5,527	5,193

2) Load Sharing between Power Reception and Power Generation

The reliability of the Bangladesh Power Development Board is not so high due to frequent power failures. In the weaving and dyeing departments, the production amount and quality are greatly affected by power failures. So a gas engine power generation system, using natural gas, will be installed to supplement power reception from BPDB. The load sharing ratio between power reception from BPDB and in-house power generation is shown in Table 6-20.

Table 6-20 : ALLOTTED ELECTRICITY LOAD

Department	Season	BPDB's Power KW	In-house Generation KW
Spinning	Summer Winter	3,843 3,145	Chiller 660 Production 700
Weaving	Summer Winter	Nil Nil	1,226+230 (Chiller) 1,226
Dyeing	Summer Winter	Nil Nil	1,156 1,156
Total	Summer Winter	3,843 3,145	3,272 3,082

The BPDB power reception system and the power generation system are normally run individually. In view of decreasing the running costs, maximum use of generated power is recommended. When the load is expected to change from one to the other, the two supplies will run in parallel for a very short time when switching over the load. If running in parallel for a short time is impossible due to BPDB's standard, the load will be stopped once and switched over.

3) Outline of Power Reception Equipment

The power is to be received from the nearest BPDB sub-station via a dedicated power distribution line. While this power receiving line equipment is to be installed by BPDB, the expenses required for the equipment are to be borne by this project as work costs.

- Power receiving line voltage and frequency: 3-phase, 11 kV, 50 Hz
- Power reception contract (demand): Category "F", 3800 kW Figure 6-9 shows a skeleton diagram of power reception equipment.

4) Outline of Power Generation Equipment

The power is generated by the gas engine using natural gas as fuel.

Two gas engine generators are to be installed and operated simultaneously, thus, no spare machine is installed. The gas engine needs to be stopped as planned for 2 - 3 hours regularly (about every 3 months) for inspection and maintenance of its plug. Furthermore, planned stoppage for 1 - 2 days is necessary once a year at the time of inspection and maintenance.

It is necessary to conduct overhaul every 4 - 5 years and this will take about 10 days. As there is no spare machine for power generationt, an elaborate maintenance plan and prior securing of parts are necessary.

- Power generation equipment output and number of units: 1,715 kW (2,144 kVA), 2 units
- Power generation equipment voltage and frequency: 11 kV, 3-phase, 50 Hz

The gas engine's emission gas is exhausted after waste heat is recovered by the waste heat boiler.

5) Power Distribution Equipment

Power distribution lines are connected respectively to the 11-kV power distribution board's power reception (R-Bus) and power generation (G-Bus). Adjustment and switching are performed on this power distribution board if the electric power load fluctuates largely from one season to another and at power reception or power generation failure.

6) Sub-station Equipment

The 11-kV primary switch, the transformer, the LT power distribution board and the capacitor pane as shown in Table 6-21 are installed in the spinning, weaving, dyeing and finishing, and utility buildings. Figure 6-9 is a skeleton diagram of the sub-station equipment.

Table 6-21 : CAPACITY AND NUMBER OF TRANSOFORMER FOR SUBSTATION

Department	Peak Load	Voltage	Capacity of Transformer	Number of Transformers
Spinning S/S	3,145KW 3,700KVA	11KV/415V-240V	1,500KVA	3 sets
Weaving S/S	1,226KW 1,442KVA	ditto	1,500KVA	1 set
Dyeing S/S	1,156KW 1,360KVA	ditto	1,500KVA	1 set
Utilities S/S	952KW 1,088KVA	ditto	1,500KVA	1 set

S/S : Sub-station

The capacity of the transformer is selected so that the normal load is within the range 70 % - 80 %, where transformer efficiency is highest.

The indoor type, oil-immersed transformer was adopted.

Abbreviations

MOF	Metering Out Fit	V	Volt Meter
WH	Watt Hour Meter	A	Ammeter
VarH	Var Hour Meter	NYFGbY	XLPE-PVC
DS	Disconnecting Switch	NYY	Polyethylene Insulated PVC Sheathed Power Cable
PT	Potential Transformer	VR	Voltage Relay
LA	Lightning Arrester	OVG	Grand Over Volt Relay
ES	Earth Switch	RP	Reverse Power Relay
VCB	Vacuum Circuit Breaker	OV	Over Voltage Relay
LBS	Load Break Switch	UV	Under Voltage Relay
PF	Power Fuse	MCCB	Molded Case Circuit Breaker
TR	Transformer	OC	Over Current Relay
EF	Earth Fault Relay	W	Watt Meter
EF	Enclosed Fuse	PF	Power Factor Meter
AQR	Reactive Power Relay	DDS	Double through Disconnecting Switch

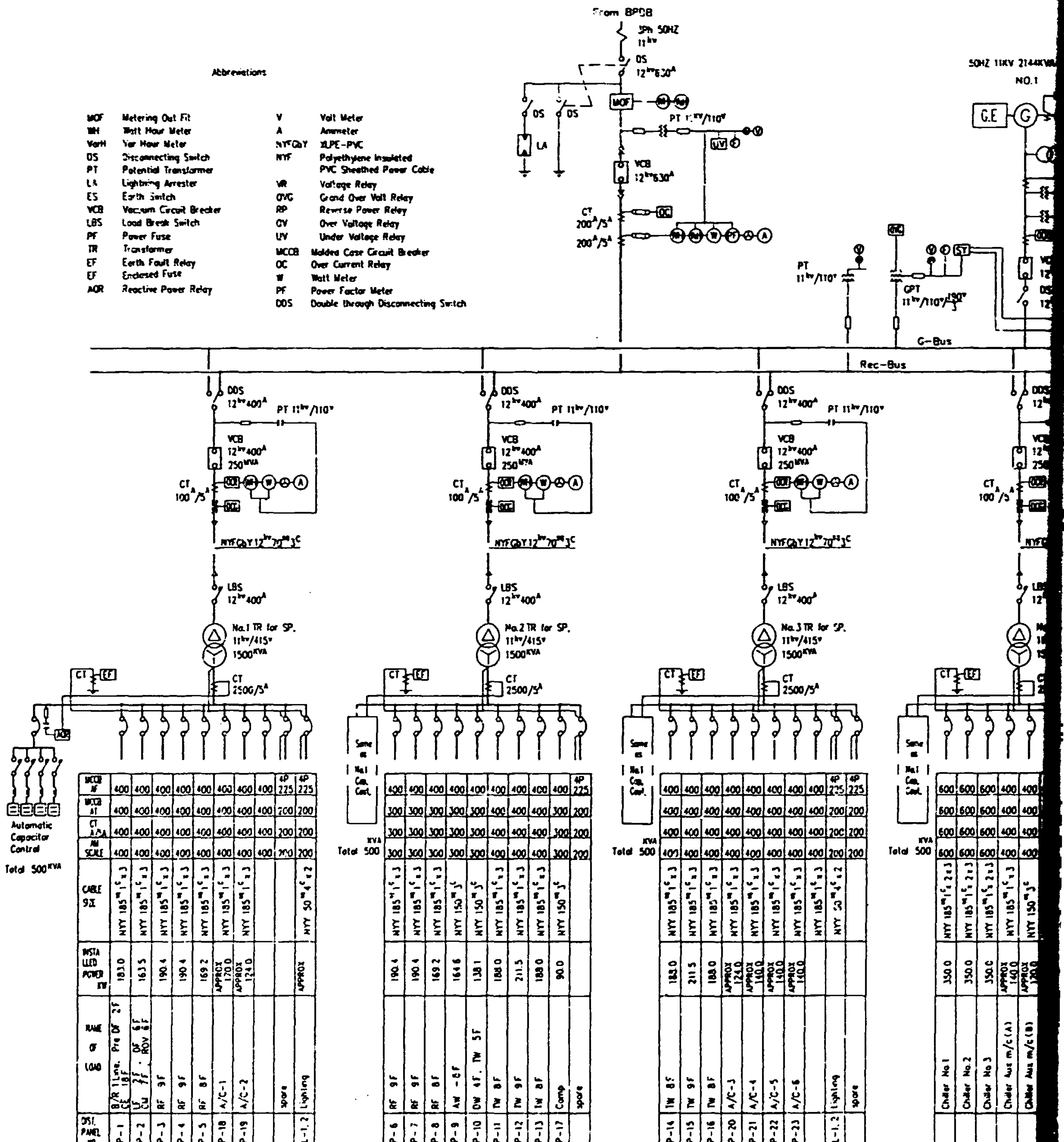
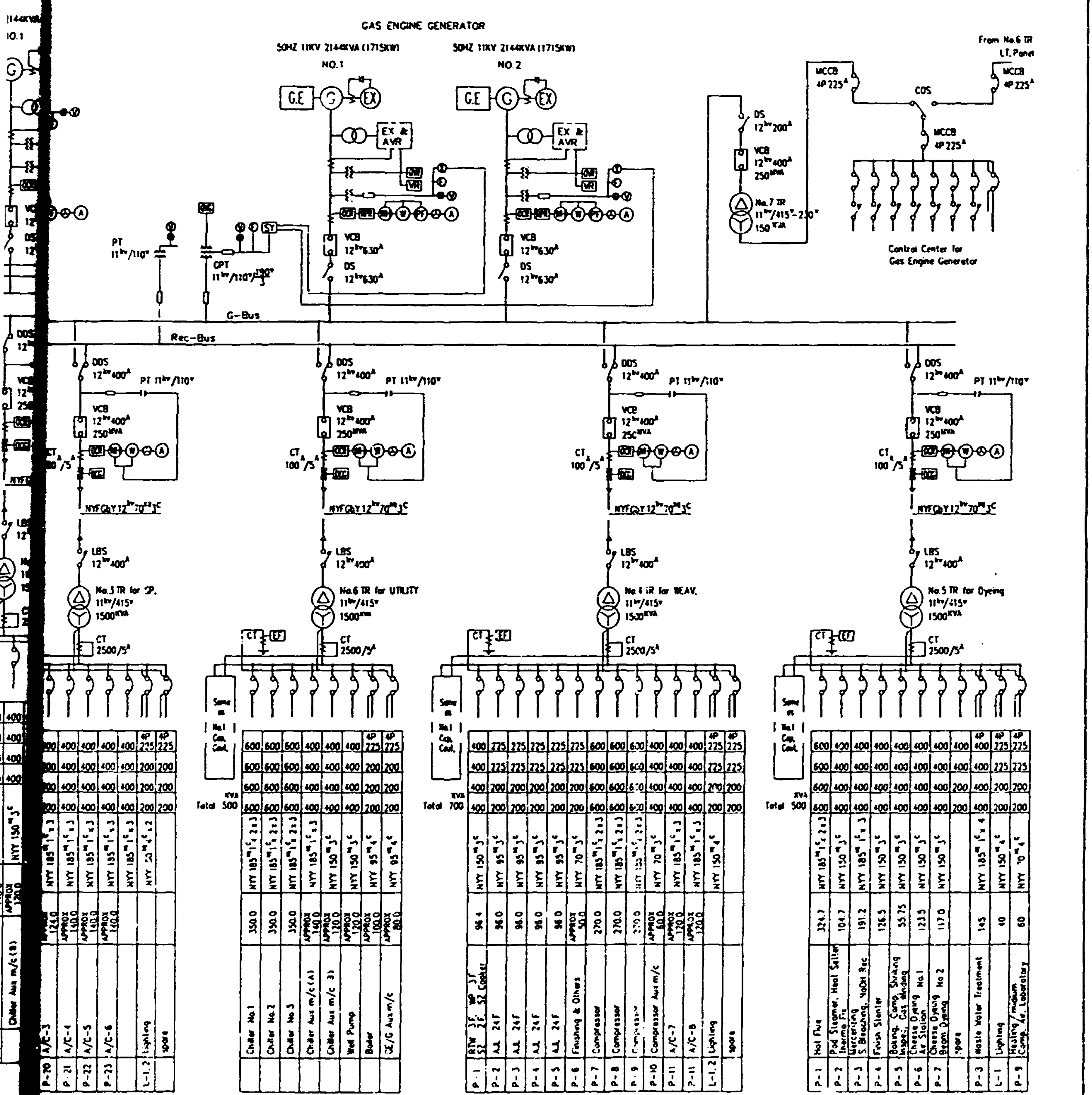


Figure 6-9 : SKELTON DIAGRAM OF EL

SECTION 1



	Chiller Aux m/c (B)	APPROX 120.0	NYY 150㎟ 3C	400	400	400	400
P-20	A/C-3	APPROX 124.0	NYY 185㎟ 1C×3	400	400	400	400
P-21	A/C-4	APPROX 140.0	NYY 185㎟ 1C×3	400	400	400	400
P-22	A/C-5	APPROX 140.0	NYY 185㎟ 1C×3	400	400	400	400
P-23	A/C-6	APPROX 140.0	NYY 135㎟ 1C×3	400	400	400	400
			NYY 185㎟ 1C×3	400	400	400	400
L-1, 2	Lighting		NYY 50㎟ 4C×2	200	200	200	4P 225
	spare			200	200	200	4P 225

Chiller No.1	350.0	NYY 185㎟ 1C×2×3	600	600	600	600
Chiller No.2	350.0	NYY 185㎟ 1C×2×3	600	600	600	600
Chiller No.3	350.0	NYY 185㎟ 1C×2×3	600	600	600	600
Chiller Aux m/c (A)	APPROX 140.0	NYY 185㎟ 1C×3	400	400	400	400
Chiller Aux m/c 3)	APPROX 120.0	NYY 150㎟ 3C	400	400	400	400
Well Pump	APPROX 120.0	NYY 150㎟ 3C	400	400	400	400
Boiler	APPROX 100.0	NYY 95㎟ 4C	200	200	200	4P 225
GE/G Aux m/c	APPROX 80.0	NYY 95㎟ 4C	200	200	200	4P 225

P-1	RTW 3F, WP 3F, SZ 2F, SZ Cooker	96.4	NYY 150㎟ 3C	400	400	400	400
P-2	A.L 24F	96.0	NYY 95㎟ 3C	200	200	225	225
P-3	A.L 24F	96.0	NYY 95㎟ 3C	200	200	225	225
P-4	A.L 24F	96.0	NYY 95㎟ 3C	200	200	225	225
P-5	A.L 24F	96.0	NYY 95㎟ 3C	200	200	225	225
P-6	Finishing & Others	APPROX 50.0	NYY 70㎟ 3C	200	200	225	225
P-7	Compressor	270.0	NYY 185㎟ 1C×2×3	600	600	600	600
P-8	Compressor	270.0	NYY 185㎟ 1C×2×3	600	600	600	600
P-9	Compressor	270.0	NYY 185㎟ 1C×2×3	600	600	600	600
P-10	Compressor Aux m/c	APPROX 60.0	NYY 70㎟ 3C	400	400	400	400
P-11	A/C-7	APPROX 120.0	NYY 185㎟ 1C×3	400	400	400	400
P-11	A/C-8	APPROX 120.0	NYY 185㎟ 1C×3	400	400	400	400
L-1, 2	Lighting		NYY 150㎟ 4C	200	270	225	4P 225
	spare			200	200	225	225

P-1	Hot Flue	324.7	NYY 185㎟ 1C×2×3	600	600	600	600
P-2	Pad Steamer, Heat Setter, Thermo Fix	104.7	NYY 150㎟ 3C	400	400	400	400
P-3	Mercerizing, S Bleaching, NaOH Rec	191.2	NYY 185㎟ 1C×3	400	400	400	400
P-4	Finish Stenter	126.5	NYY 150㎟ 3C	400	400	400	400
P-5	Baking, Comp. Shrinking, Inspec., Cas winding	55.75	NYY 150㎟ 3C	400	400	400	400
P-6	Cheese Dyeing No.1, Air Station	123.5	NYY 150㎟ 3C	400	400	400	400
P-7	Cheese Dyeing No.2, Beam Dyeing	117.0	NYY 150㎟ 3C	400	400	400	400
	spare			200	200	400	400
P-3	Waste Water Treatment	145	NYY 185㎟ 1C×4	400	400	400	4P 400
L-1	Lighting	40	NYY 150㎟ 4C	200	200	225	4P 225
P-9	Heating/medium Comp. Air, Laboratory	60	NYY 70㎟ 4C	200	200	225	4P 225

-9 : SKELTON DIAGRAM OF ELECTRICITY

SECTION 2

The LT and the panel are cubicle switchgear. Each branch switch will be a MCCB (Molded Case Circuit Breaker) with sufficiently protectable short current capacities.

Generally speaking, the motors used in the spinning, weaving, dyeing and finishing, equipment etc. have small power factors. Therefore, a capacitor will be connected to maintain the power factor in the transformer at about 80 % - 90 %. An automatic power-factor regulating capacitor was adopted.

7) Low-Tension Power Wiring

The LT and power wiring to the process line and the utility line in the mill are designed according to the following standards:

- Selection of main cable: Specified in Table 6-22
- Selection of branch cable: Specified in Table 6-23

The main cable will be, in principle, laid in the cable rack in the ceiling and allowed to drop down to the LT and power distribution board per load group from the ceiling.

The branch cable will be, in principle, contained in PVC pipe buried in the floor and will be brought up to each machine and control panel from the floor.

8) Lighting Equipment

a) Target Illumination

The target illumination is shown in Table 6-24.

b) Lighting equipment

For lighting, fluorescent lights with reflectors (40 W x 1 - 2 tubes) will be attached directly to the ceiling where the ceiling height is 4.0 m or less.

A race-way or pipe pendant will be used where the ceiling is significantly high and where there is no ceiling.

For places and locations where local lighting will be particularly required, lighting equipment of a form which appropriately matches the machine has been selected. In principle, the NYM cable (PVC insulated PVC sheathed) will be used in the lighting equipment.

Table 6-22 : CABLE SIZE & MCCB CAPACITY IN LT POWER LINE

(50HZ 400V Induction Motor)

Total ourput of Motors in Circuit		Cable size in buried PVC tube (mm^2)		Maximum Out-put of Direct-start Motor in Circuit(KW)											
				2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
				MCCB Trip Capacity (A)											
(KW)	(A)	NYM 4C	NYY 4C	Direct start			Direct start/ -△ start								
4.5	10.0	2.5	2.5	20	30										
6.0	14.0	2.5	2.5	20	30	40									
7.5	17.0	4.0	2.5	30	30	40	50/30								
11.0	24.0	6.0	4.0	40	40	40	50/40	75/45							
15.0	32.0	10.0	6.0	50	50	50	50	75/50	100/50						
20.0	42.0	16.0	10.0	60	60	60	60	75/60	100/60	125/60					
25.0	52.0	25.0	16.0	75	75	75	75	75	100/75	125/75	125/75				
30.0	62.0	35.0	25.0	100	100	100	100	100	100	125/100	125/100				
35.0	76.0	50.0	35.0	100	100	100	100	100	100	125/100	125/100	125/100			
40.0	86.0	50.0	35.0	125	125	125	125	125	125	125	125	125	125		
50.0	105.0	70.0	50.0	125	125	125	125	125	125	125	125	125	125	150	
60.0	125.0	95.0	50.0	175	175	175	175	175	175	175	175	175	175	75	200/175
75.0	155.00	120.0	70.0	200	200	200	200	200	200	200	200	200	200	200	200

Table 6-23 : SELECTION STANDARDS FOR CABLE SIZE & MCCB CAPACITY

FOR MOTOR IN LT POWER CIRCUIT

(50HZ 400V Induction Motor)

Motor		Cable size in buried PVC tube		Earth wire min. size	MCCB Capacity	
Out-put (KW)	Current (A)	NYM 4C	NYY 4C		Direct start	-△start
2.2	5.5	2.5mm²	2.5mm²	2.5mm²	15	-- A
3.7	8.7	2.5	2.5	2.5	30	--
5.5	13.0	4	2.5	2.5	40	--
7.5	17.0	4	4	4	50	30
11.0	24.0	6	4	4	75	40
15.0	32.0	10	6	6	100	50
18.5	39.0	16	10	6	100	60
22.0	46.0	25	16	10	125	75
30.0	62.0	35	25	10	125	100
37.0	80.0	50	35	10	125	125
45.0	95.0	70	35	16	150	150
55.0	115.0	95	50	16	200	150
75.0	115.0	120	70	25	250	200

FOR LIGHTING & SOCKET-TAP

Branch Breaker	Cable size in 40℃ Air		
	NYA	NYM	NYY
15 A	2.5mm²	2.5mm²	2.5mm²
20	2.5	2.5	2.5
25	4	4	2.5
30	6	6	4

Table 6-24 : ILLUMINATION OF TARGET

Department	Position of Lighting		Illumination of Target
Spinning	Blow Room	Working Surface	100 Lx
	CE,DF, ROV	ditto	120 Lx
	Ring Spinning	ditto	150 Lx
	Winder	ditto	150 Lx
Weaving	Air Jet Loom	Sheet Surface	300 Lx
	Weaving Room	Floor & aisles	50 ~ 100 Lx
	Warper	Sheet Surface	300 Lx
	Warping Room	Around Warper Creel	200 Lx
	Sizing M/C	Sheet Surface	200 ~ 300 Lx
	Inspecting M/C	Sheet Surface	500 Lx
	Folding M/C	Working Surface	150 Lx
	Cloth Repairing Table	Working Surface	300 Lx
Dyeing	General interior of the plant		50 ~ 150 Lx
	Local lighting for plaiting and sheet surface		200 Lx
	Outdoor facilities		50 ~ 100 Lx

9) Other Equipment

Sockets for motor-driven equipment and tools will be installed in the places required in the mill. For safety, the socket circuit will always be connected via the earth leakage breaker in the power distribution board. The ELB (Earth Leakage Breaker) sensitivity used in the socket circuit will be, in principle, a maximum of 30 MA, within 0.1 second.

A motor siren or bell will be provided in the mill for signaling the start of work, meal time, the end of work and emergencies.

6.5.2 Intake of Natural Gas

The energy sources used in this project are electric power from BPDB and natural gas used for power generation, steam generation and as the heat medium. The natural gas is to be supplied from PETRO BANGLA (Bangladesh Oil & Mineral Corporation) as mentioned in Chapter 4.

PETRO BANGLA's natural gas pipe line, at a pressure of 150 psi, is laid under major roads in the city to send natural gas to major places of demand.

The natural gas will be taken in through the branch pipe from the nearest main pipeline and supplied to the gas engine at a pressure of 150 psi via the weighing unit. The pipeline to supply natural gas to the boiler and the heating medium will be connected via the pressure reducing unit.

As to sharing the cost of the intake equipment from PETRO BANGLA, PETRO BANGLA will install the section branching from the main pipe line up to the gas register's weighing unit while the user bears the expenses.

Figure 6-10 is a gas intake system diagram of the site stipulated by this project.

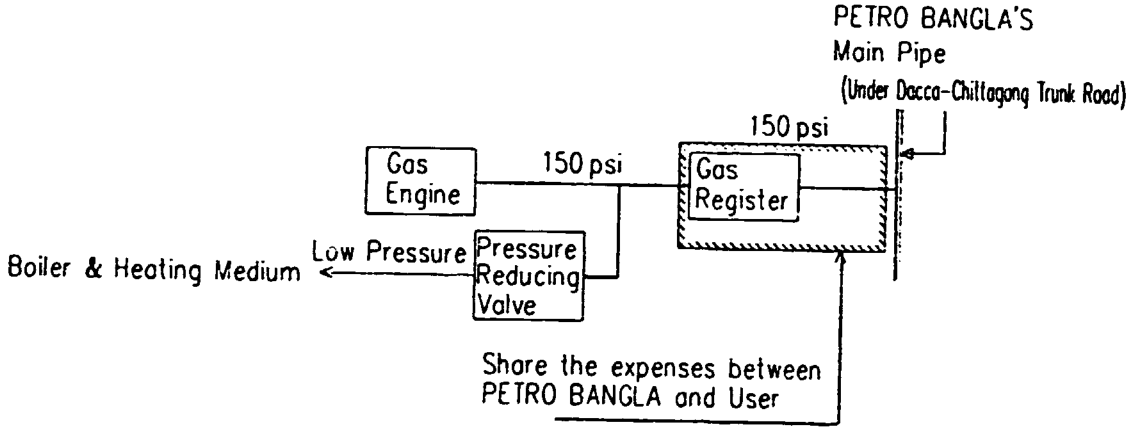


Figure 6-10 : INTAKE OF NATURAL GAS

6.5.3 Water Supply

1) Industrial Water

A large amount of industrial water is required by the dyeing and finishing mill and others. The required water quantity and the required water chlorine level per department are shown in Table 6-25. Also the required quality values of water are shown in Table 6-26.

Table 6-25 : REQUIRED WATER QUANTITY AND QUALITY

Use	Daily Consumption	Maximum Demand	Required Water
For Process of Dyeing	m^3/day 3,076	m^3/hr 150	Cl level < 300ppm
Air-cond. & Chilled Water Equip.	317	18.4	Better
Compressor for Weaving	26	1.1	Ditto
Cooling of Gas Engine	86	4	Ditto
Boiler	96	10	Ditto
Others	25	3	Normal
Total	3,626	186.5	

Table 6-26 : REQUIRED WATER QUALITY FOR INDUSTRIAL WATER

Item / Use	PH	CL-	Electric Conductive	Total Hardness	Silica
Dyeing Other	5.5 ~ 9.0	< 300ppm	< 700 $\mu\Omega$	< 300ppm	-
Water for Chiller Cooling/ Compressor Cooling/ Gas Engine Cooling/ Air-Conditioner/ Boiler	5.5 ~ 8.5	< 50ppm	< 200 $\mu\Omega$	< 50ppm	< 30ppm

There is no problem with either the quality or the quantity of the underground water sampled in Chittagong City as mentioned in Chapter 4. To secure the aforementioned required water quantity, a number of wells are being planned. It is planned to dig about 10 wells, each about 150 m deep with a bore of about 150 mm - 200 mm according to the actual results in Chittagong. An underwater motor pump will be used. The pump depth and the strainer depth will be judged according to the boring test results.

Figure 6-11 is a well water supply system diagram.

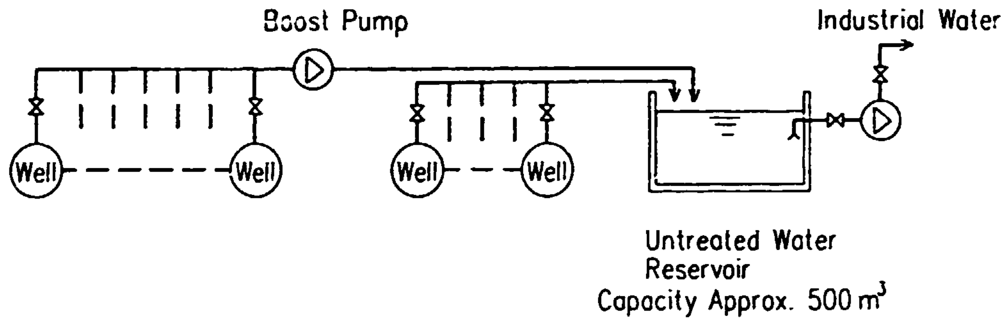


Figure 6-11 : INTAKE SYSTEM OF WELL WATER

2) Potable Water

The employees will be served their meals at the canteen. City water for cooking and office use is supplied directly through piping. The city water is received from Chittagong WASA's main pipeline. About 100 m - 150 m^3/day of city water are required.

6.5.4 Air Conditioning Equipment

For a textile mill, it is very important to adjust the temperature and humidity in the production processes. One of the most important objectives of air conditioning is to maintain a constant relative humidity in the cotton spinning and weaving mills. Improvement in the working environment by air conditioning is another important reason.

In this project, it its also necessary to operate the air conditioning equipment according to the season and the time zone, since the temperature and humidity changes throughout the year from tropical to subtropical.

1) Air Conditioning and Cotton Waste Collecting Equipment of the Spinning Mill

a) Air conditioning equipment

In the spinning mill, the humidity conditions differ slightly from one process to another, so equipment corresponding to each required temperature and humidity is to be installed. The schematic air conditioning system and calculation of the air conditioning load are shown respectively in Figure 6-12 and Table 6-27. The temperature and humidity required in each process are shown below.

- Pre-spinning	Max. 30 ℃	RH 60%
- Ring spinning	Max. 31 ℃	RH 55%
- Winder	Max. 29 ℃	RH 65%

The Air-Conditioner (A/C) of a central air washer system will be adopted. The supply air is diffused from a duct in the ceiling. The A/C in the pre-spinning process is to be combined with the waste collector to be described later.

The air in the room is returned to the A/C through an underground duct as the production machinery's cleaner exhaust or as the return air from the room interior.

The air in the winder room is returned to the A/C via a mesh filter attached to the wall, however. In the A/C room, the chamber is made of concrete and the water tank is made of waterproof concrete. Its equipment comprises the return fan, the damper, the washer spray stand, the eliminator and the supply fan. Dust is removed from the return air with an automatic rotary filter i.e. the wall filter for the winder A/C in the filter chamber. The cold water to be used in the washer spray is chilled by the refrigeration equipment, sent to each A/C and supplied to the washer spray stand by the spray pump.

b) Cotton waste and dust collecting equipment

Air containing cotton dust is discharged by exhaust or suction in some parts of the blow room machine. It is also exhausted from the carding engine's flat strip. Such exhaust is filtered for large cotton waste by the pre-filter and the cotton waste is collected with a fiber separator.

Comber noil is sucked intermittently per machine and is collected by the fiber separator. The air which has passed through each cotton waste collecting unit is returned to the air washer by the return fan via the automatic filter just as the aforementioned return air in the room.

2) Outline of Air Conditioning Equipment of Weaving Mill

In the weaving mill, the humidity conditions differ slightly from one process to another just as in spinning.

The schematic air conditioning system and calculation of the air conditioning load are shown respectively in Figure 6-12 and Table 6-27.

The temperature and humidity required in each process are shown below.

- Warper room	Max. 30 ℃	RH 64%
- Air jet loom	Max. 29 ℃	RH 68%
- Inspecting room	Max. 31 ℃	RH 60%

The A/C of the central air washer system will be adopted just as in spinning.

While the required temperature and humidity conditions differ from one process to another, the air washer will be shared and the supply air volume will be adjusted to meet the specified temperature and humidity requirements.

The air jet loom's return air enters the underground return duct together with the nearby cotton dust on the floor. The A/C structure is the same as in spinning.

3) Chilled Water Equipment

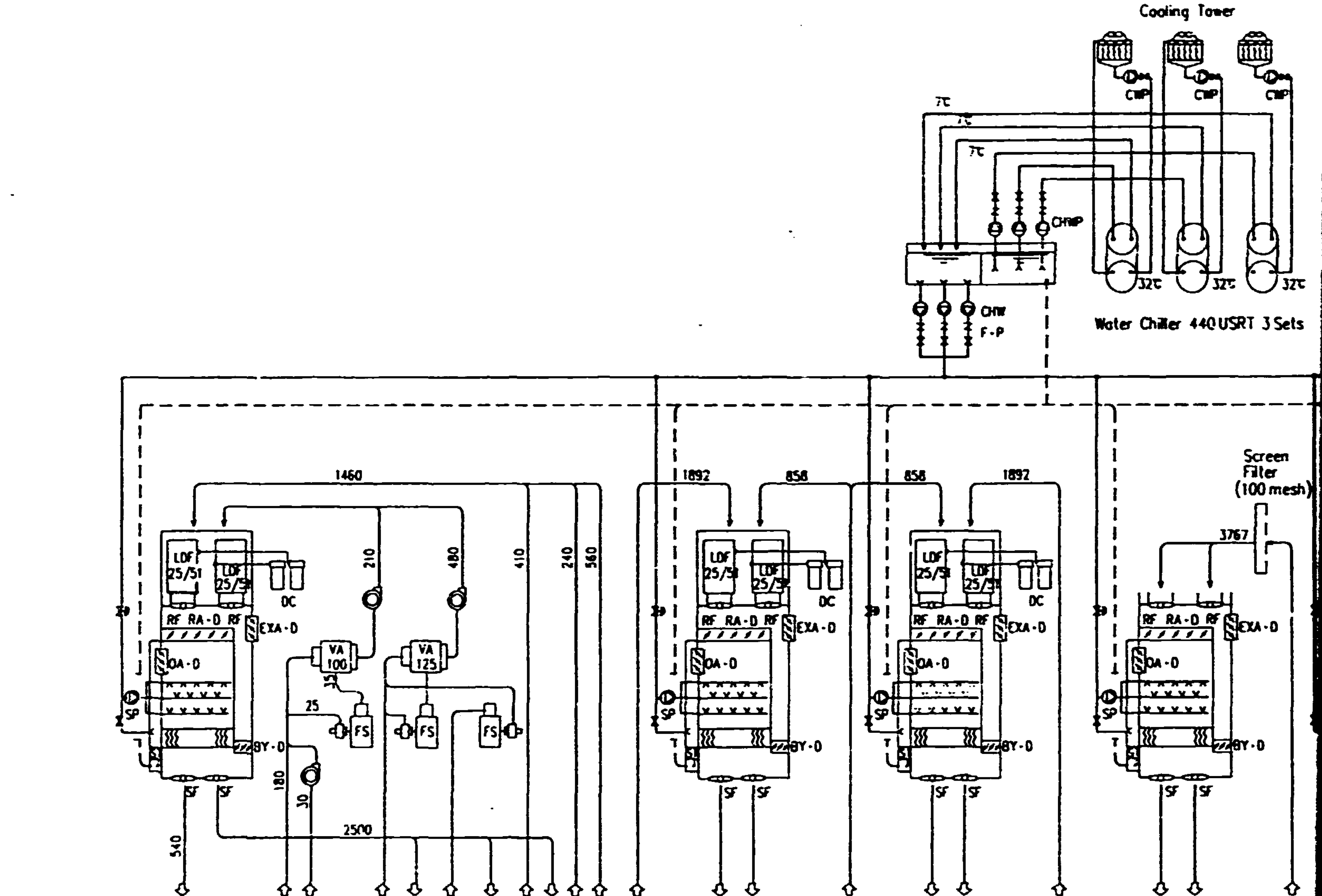
To produce the chilled water to be used in the A/C of the spinning and weaving mills, a refrigerator will be installed. While it is planned to use three turbo-refrigerators (460 USRT), the possible adoption of an absorption refrigerator utilizing the power generation equipment's waste heat in the implementation stage will be studied.

If a turbo chilling unit is to be used, it is planned to adopt the refrigerator in which R-123 type refrigerant is used, since the conventional refrigerant F-11 will be totally abolished by 1995. For the three refrigerators to meet the maximum room cooling load, some of them are to be controlled or stopped at the time of light load and in the off-season to save energy.

There is no stand-by machine employed for the refrigerator, so their maintenance and overhaul must be conducted at the time of light load or in the off-season.

Table 6-27 : CALCULATION OF AIR CONDITIONING LOAD

		Front SP A/C		Ring SP A/C	Winding A/C	Spinning Total	Warping	Air Jet Loom & Insp. Room	Weaving Total	
		Blow Room	CE~ROV							
Air Conditioning Load	Room Area m² (Heat Value) Kcal/hr	600 21,000	2,760 96,600	3,120 109,200	4,560 159,600	11,040 386,400	2,408 84,280	2,598 72,800	4,488 157,080	
	Load of LT Power KW (Heat Value) Kcal/hr	57.5 49,450	197.1 169,506	858 737,880	1,212.4 1,042,664	2,325 1,999,500	38.1 32,766	394.6 337,120	430.1 369,886	
	Load of Lighting KW (Heat Value) Kcal/hr	4.8 4,128	25.4 21,844	37.5 32,250	50 4,300	117.7 101,222	17.0 14,620	28.6	 24,510	
	Number of Workers (Heat Value) Kcal/hr	10 1,000	40 4,000	100 10,000	100 10,000	250 25,000	20 2,000	55 5,500	75 7,500	
	Total (Heat Value) Kcal/hr	75,578	291,950	889,330	1,255,264	2,512,122	133,666	425,310	558,976	
Room condition	Temperature ℃ R.Humidity RH % Enthalpy Kcal/hr	30 62 17.2	30 62 17.2	31 55 17.0	29 65 17.0		30 64 17.5	29 68 17.5		
Supply Air Condition	Temperature ℃ R.Humidity RH % Enthalpy Kcal/hr	22.5 95 15.3		21.7 95 14.7	22.5 95 15.4		23.5 95 % 16.2			
Out Door Air Condition in Summer	Daytime Temperature ℃ R.Humidity % Enthalpy Kca./hr					32.5 85 24.5			32.5 85 24.5	
Required Supply Air	m³/min	570	2,210	5,500	11,300	19,500	1,500	4,750	6,250	G.Total
Required Refrigerating Maximum Load	USRT	25	96	294	415	830	44	140	184	1,014

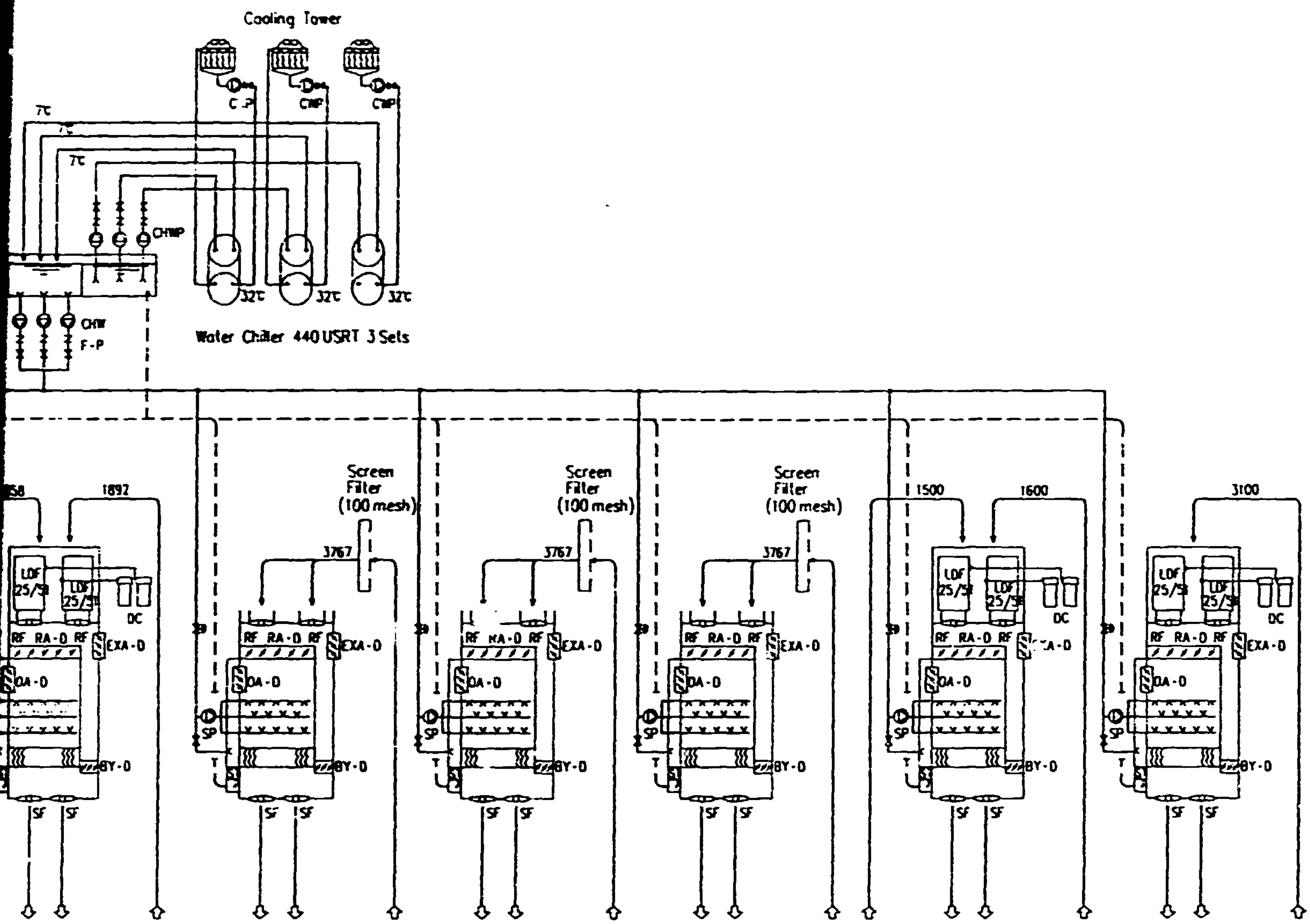


Quantity of Air Flow m^3/min	SA 540 EX·A 180 SU·A 30	EX·A 410 SA 850 SA 850 SA 800 RA 560 N·SU·A 30 EX·A 410 EX·A 240	RA 1892 SA 2750 EX·A 1716 SA 2750 RA 1892	SA 3767 EX·A& 3767
Room Area	600 m^2	2760 m^2	3120 m^2	
Electric Power Consumption (Actual)	Blow Room 50 kw Lighting 4.8 kw Supply Fan 7.5 kw Total 62.3 kw	CE 18F 51.7 kw LF 2F 5.8 kw DF 8F 22.0 kw CM 7F 33.8 kw ROV 6F 46.8 kw Lighting 25.4 kw Supply Fan 37 kw Total 222.5 kw	RF 52F 770 kw Lighting 37.5 kw Supply Fan 88 kw Total 895.5 kw	AW 6F DW 4F TW 55F Total
Air Condition of Room (Summer)	30℃ x 60 %	30℃ x 60 %	31℃ x 55 %	
Process	Blow Room	CE, LF, CM, DF, ROV	RF	

SPINNING

SECTION 1

Figure 6-12 : SCHEMATIC OF AIR-CONDITIONING FOR



SA 2750 RA 1892	SA 3767 EX-A&RA 3767 SA 3767 EX-A&RA 3767 SA 3767 EX-A&RA 3767	RA 1500 SA 1500	SA 1600 RA 1600 SA 3100 RA 3100
	4560 m²	2408 m²	2080 m²
70 kw 37.5 kw 88 kw 95.5 kw	AW 6F 115.2 kw DW 4F 12.4 kw TW 55F 904.8 kw Lighting 50 kw Supply Fan 180 kw Total 1262.4 kw	RTW 18F 2.6 kw WP 2F 13.5 kw Lighting 17.0 kw Supply Fan 22.0 kw Total 55.1 kw	AJL 96F 288 kw B.C 8F 14.0 kw Lighting 11.5 kw Supply Fan 90 kw Total 403.5 kw
%	29℃ x 65 %	30℃ x 64 %	29℃ x 68 %
	WD	WP	AJL Room

G

WEAVING

ATIC OF AIR-CONDITIONING FOR SPINNING & WEAVING

SECTION 2

6.5.5 Compressed Air Equipment

1) Spinning Mill

The compressed air properties and volume required in each process of the spinning mill are shown in Table 6-28.

Table 6-28 : REQUIRED COMPRESSED AIR FOR SPINNING

User	Required Pressure	Required Compressed Air Volume	Remarks
Blow Room	$7.0Kgf/cm^2$	Max 0.5 m^3/min	Oil-free Air
Carding M/C	$6.5Kgf/cm^2$	1.5 m^3/min	ditto
Lapformer	$6.5Kgf/cm^2$	0.068 m^3/min	ditto
Drawing	$6.5Kgf/cm^2$	0.448 m^3/min	ditto
Combing	$6.5Kgf/cm^2$	0.325 m^3/min	ditto
Auto Winder	$7.0Kgf/cm^2$	2.52 m^3/min	ditto
A/C Control	$7.0Kgf/cm^2$	0.03 m^3/min	ditto
General Cleaning	$5.0Kgf/cm^2$	Max 2.5 m^3/min	
Total		7.89 m^3/min(peak)	

The compressed air equipment for spinning is outlined below.

- Oil-free, screw compressor 55 kW : 2 sets
- Receiver tank : 2 sets
- Air dryer : 2 sets
- Air filter : 2 sets

The compressed air for the production line and that for general cleaning are normally run separately. The use of compressed air for general cleaning is limited to running just 1 set during maintenance.

2) Weaving Mill

The compressed air properties and volume required in each process of the weaving mill are shown in Table 6-29.

Table 6-29 : REQUIRED COMPRESSED AIR FOR WEAVING

User	Required Pressure	Required Compressed Air Volume	Remarks
Warper	7.0Kgf/cm^2	Max 0.15 m^3/min	Oil-free Air
Sizer	7.0Kgf/cm^2	0.1 m^3/min	ditto
Size Cooker	7.0Kgf/cm^2	0.02 m^3/min	ditto
Air Jet Loom	7.0Kgf/cm^2	76.24 m^3/min	ditto
A/C Control	7.0Kgf/cm^2	0.01 m^3/min	ditto
General Cleaning	5.0Kgf/cm^2	Max 5.0 m^3/min	
Total		81.52 m^3/min(peak)	

The compressed air equipment for weaving is outlined below :

- Oil-free, screw compressor (8 kgf/cm^2, 42.6 m^3/min) water cooled by cooling tower : 3 sets
- Receiver tank (approx. 10 m^3) : 1 set
- Air dryer (air-cooled) : 3 sets
- Air filter (sub-micron) : 3 sets

Two compressor units will normally be run. The spare unit is for switching runs and maintenance.

The main piping for the air jet loom's compressed air will be laid in an underground duct, branched and brought up to each air jet loom unit.

6.5.6 Steam Generation Equipment

The sizer in the weaving mill and each piece of production equipment in the dyeing and finishing mill require steam. So a steam boiler will be installed. Figure 6-13 shows the steam generation system of the plant.

In the steam generation system, two waste heat boilers which will utilize the waste heat of the power generation equipment's gas engines and one small boiler using natural gas as fuel, for a total three units, will be installed in parallel. Regarding the selection of the boilers, it will be studied whether to adopt the small type boiler or to adopt one flue-tube boiler at the time of implementation.

Such boiler equipment will be installed in the boiler room of the utility center.

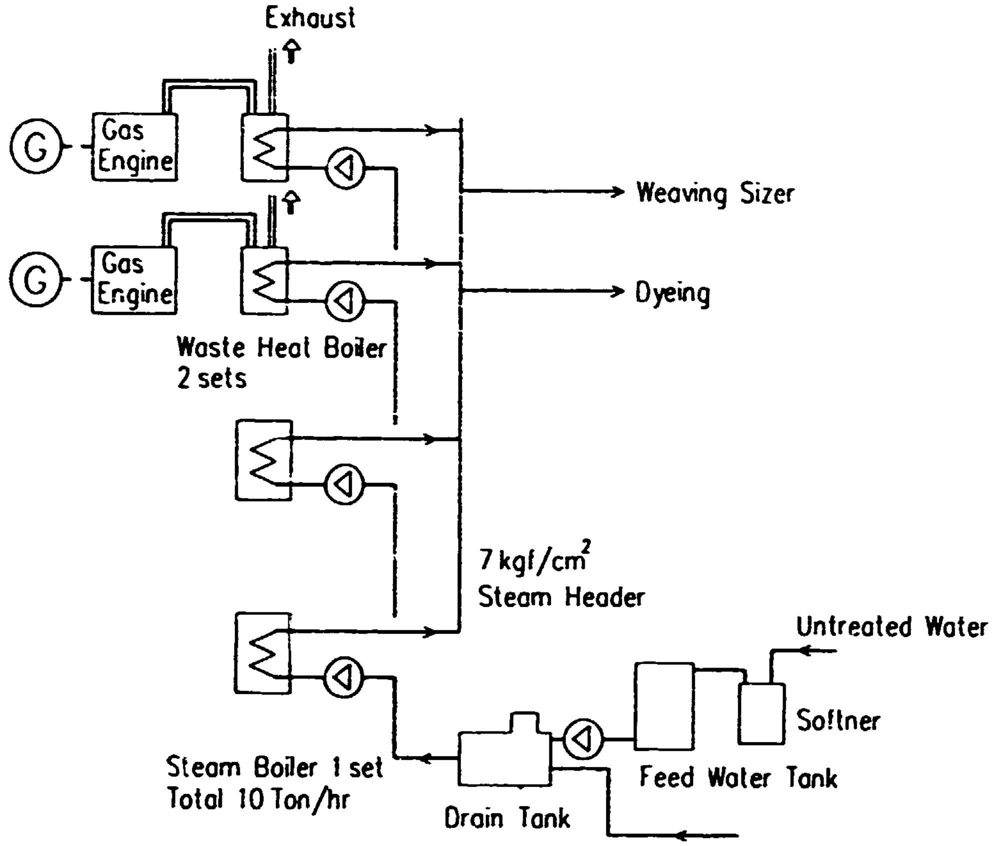


Figure 6-13 : STEAM GENERATION SYSTEM

6.5.7 Heating Medium System

The heating medium system will be installed for the thermofixing M/C of the dyeing and finishing mill and other machines requiring a heating medium. Natural gas will be used as fuel.

Two heaters will be run at the time of the maximum load and one heater will be run at the time of normal or light load.

This system will be installed in the heating medium room of the dyeing and finishing mill. The heating medium system is shown in Figure 6-14.

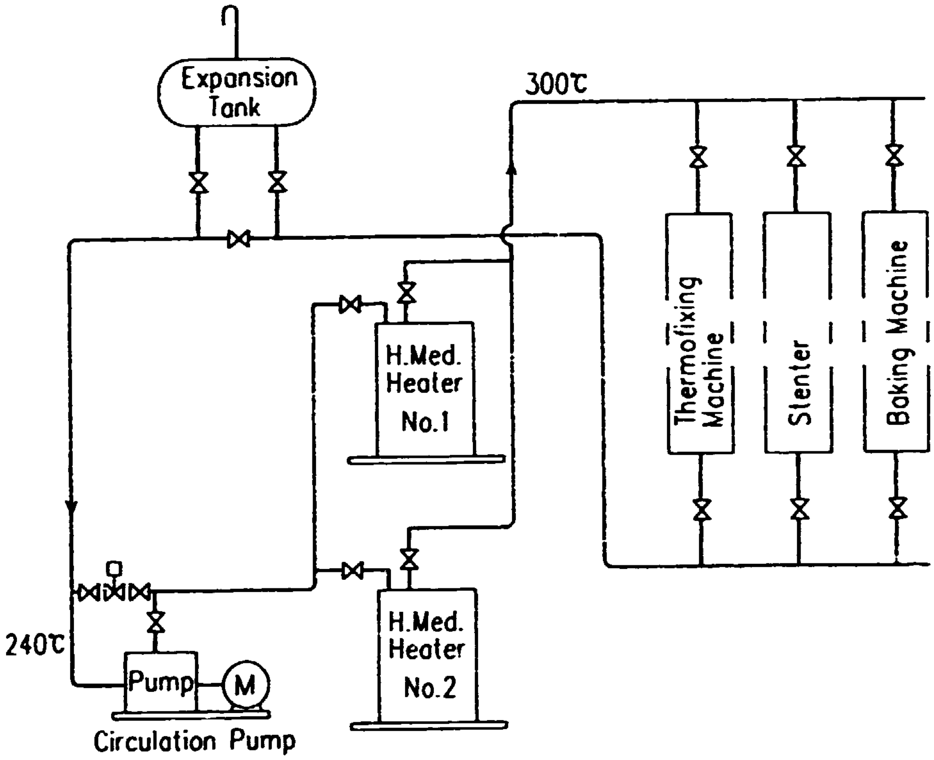


Figure 6-14 : HEATING MEDIUM SYSTEM

6.5.8 Fire Fighting Equipment

The textile mill, which handles large amounts of raw cotton or cotton products, requires fire fighting equipment. The spinning, weaving, dyeing and finishing, and other adjacent buildings are to be equipped with outdoor hydrants, indoor hydrants, fire-extinguishers and water buckets as fire fighting equipment. The fire hydrant system is shown in Figure 6-15.

The fire hydrants have their water source in the untreated water reservoir. The water tank must hold at least 200 m^3 of water. The hydrant pump is driven by a motor and diesel engine. This system will be capable of running even if an electric source may not be available. Fire extinguishers are provided in the places required in the mill for early fire fighting. Water buckets are provided in places where there is much cotton dust in spinning and weaving.

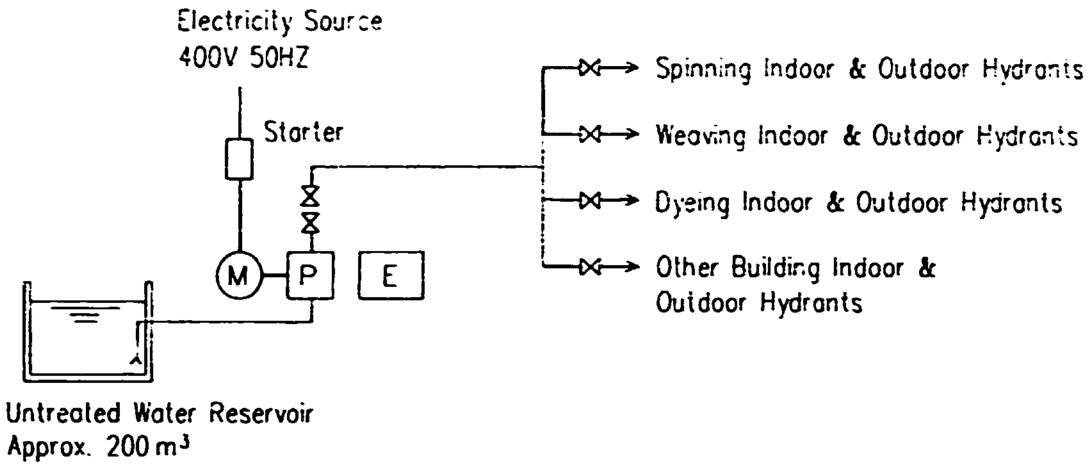


Figure 6–15 : FIRE HYDRANT SYSTEM

To protect the mill, it is important to establish a fire fighting plan and to train personnel in case of emergency. The persons concerned should bear in mind that, at the start of a fire, initial fire fighting by the worker who happens to be nearest the fire is crucial and effective.

6.5.9 Main Specifications of Equipment

Table 6-30 shows a list and specifications of main electrical and mechanical equipment.

6.5.10 Workshop

In running and maintaining the production equipment of the spinning, weaving and dyeing and finishing mills and the utility equipment, maintenance must often be relied upon as well as securing spare parts. It is necessary to own equipment which can fulfill the function of a workshop to enable such lathe work as roller polishing, sizer rubber roller polishing, etc. in the dyeing and finishing mill, welding repair, simple piping work, etc.

What ever cannot be worked on or repaired at the workshop and what ever is too big will be entrusted to subcontractors.

Table 6-30 : SPECIFICATIONS OF MAIN ELECTRICAL AND MECHANICAL EQUIPMENT (ELECTRICITY)

Item No.	Machine Equipment	Quantity
UE-1	Generation equipment	1 lot
	1) Gas engine generator	2 sets
	Engine	
	Engine output : 2,468 PS (1,789 kw)	
	Engine speed : 1,000 rpm	
	Fuel : Natural gas 8,542 kcal/kg	
	Cooling : Water cooled by cooling tower	
	Waste heat boiler	
	Type : Percolation boiler	
	Pressure : 7.0 kgf/cm^2	
	Capacity : Max 1.0 ton/hr	
	Generator	
	Voltage : 11,000 volt	
	Frequency : 50HZ	
	Phase : 3	
	Capacity : 2,144KVA (1,715 kw)	
	Generator panel	
	Disconnecting switch : 12 KV 630A	
	Circuit breaker : VCB 12 KV 630A Draw out type	
	Peak withstand current : 63 KA	
	2) Synchronizing device & protection of grounded panel	1 set
	GPT : 11 kv/110 v/ $\frac{190}{3}$ v 3 ϕ	
	Synchronizing : Semi-automatic system	
UE-2	Incoming circuit breaker panel	1 set
	Disconnecting switch : 12 KV 630A	
	Lightning arrestor and DS	
	Earth Switch	
	PT : 11 kv/110 v 1 ϕ x 2 with primary fuse	
	Vacuum circuit breaker : 12 KV 630A Draw out type	
UE-3	Feeder panel for spinning, weaving, dyeing mills	6 sets
	Double throw D.S : 12 KV 630A	
	Circuit breaker : VCB 12 KV 630A 63KA	
UE-4	C.B. panel and transformer for power station house & chiller	1 set
	Disconnecting switch : 12 KV 630A	
	Circiut breaker : VCB 12 KV 630A	

Item No.	Machine Equipment	Quantity
	Transformer : 3-Phase 4 wire 1,500KVA	
	11 kv/415v-230v	
	LT. busduct & distribution board	
	Control center for power station	
UE-5	Sub-station for spinning	1 lot
	1) Isolated primary for transformer	
	Load breaking switch 12 KV 630A	3 sets
	2) Transformer 11 KV/415v-230v 1500KVA 3ph-4w	3 sets
	3) Low tension distribution board	3 sets
	3-Phase 4 wire	
	Number of branches : 10 line	
	Branch switches : MCCB 3P or 4P 225A or 400A	
	4) Automatic power factor control panel	3 sets
	Capacitor : 3-phase 415 V 200KVA 1 pc.	
	100KVA 3 pcs.	
UE-6	Sub-station for weaving	1 lot
	1) Isolated primary for transformer	1 set
	Load breaking switch 12KV 630A	
	2) Tranformer 11KV/415V-230V 1500KVA 3ph-4w	1 set
	3) Low tension distribution board	1 set
	3-phase 4 wire	
	Number of branches : 14 line	
	Branch switches : MCCB 3P or 4P 225A, 400A, 600A frame	
	4) Automatic power factor control panel	1 set
	Capacitor : 3 ph. 415V 200KVA 2 pcs.	
	100KVA 3 pcs.	
UE-7	Sub-station for dyeing	1 lot
	1) Isolated primary for transformer	1 set
	Load breaking switch 12KV 630A	
	2) Tranformer 11KV/415V-230V 1500KVA 3ph-4w	1 set
	3) Low tension distribution board	1 set
	3-phase 4 wire	
	Number of branches : 11 line	
	Branch swiches : MCCB 3P or 4P 225A, 400A, 600A frame	
	4) Automatic power factor control panel	1 set
	Capacitor : 3 ph. 415V 200KVA 1 pc.	
	100KVA 3 pcs.	

Item No.	Machine Equipment		Quantity

(WELL AND WATER SUPPLY)

Item No.	Machine Equipment		Quantity
UW-1	Deep well		10 sets
	Depth : Approx 150 m		
	Diameter : Approx 150 mm		
	Pump capacity : 18 m^3/hr		
	Total head : Approx 65 m		
	Motor : Submersible motor 50HZ 400V Approx 5.5 kw		
UW-2	Untreated water reservoir		1 lot
	Reinforced concrete made semi-underground tank		
	Capacity : 300 m^3		
UW-3	Industrial water feed pump		2 sets
	Capacity : 3.5 m^3/min		
	Head : 20 mAg		
	Motor : 50HZ 400V 18.5 kw Inverter drive		
UW-4	Pressure water tank		1 set
	Capacity : 3 m^3 3 kgf/cm^2		

(AIR CONDITIONING)

[SPINNING]

Item No.	Machine Equipment		Quantity
UA-1	Air-Conditioner for front spinning		1 set
	Air-washer capacity : 2,950 m^3/min		
	Supply air fan : 1,475 m^3/min	2 pcs.	
	Return air fan : 1,475 m^3/min	2 pcs.	
	Return air filter : Automatic rotary filter	2 pcs.	
	Waste collecting device	3 sets	
UA-2	Air-conditioner for ring spinning		2 sets
	Air-washer capacity : 2,750 m^3/min/set (Total 5,500 m^3/min)		
	Supply air fan : 1,375 m^3/min	2 pcs/set	
	Return air fan : 1,375 m^3/min	2 pcs/set	
	Return air filter : Automatic rotary filter	2 pcs/set	
UA-3	Air-conditioner for winding		3 sets
	Air-washer capacity : 3,767 m^3/min/set (Total 11,300 m^3/min)		
	Supply air fan : 1,883 m^3/min	2 pcs/set	
	Return air fan : 1,883 m^3/min	2 pcs/set	
	Return air filter : Wall mesh type	1 lot	

Item No.	Machine Equipment	Quantity
[WEAVING]		
UA-4	Air-conditioner for weaving	2 sets
	Air-washer capacity : 3,175 m³/min set (Total 6,350 m³/min)	
	Supply air fan : 1,588 m³/min 2 pcs/set	
	Return air fan : 1,588 m³/min 2 pcs/set	
	Return air filter : Automatic rotary filter 2 pcs/set	
[CHILLED WATER EQUIPMENT]		
UA-5	Chiller for spinning	2 sets
	Centrifugal type turbo-chiller : 440 USRT	
	Freon gas : R-123	
	Motor : 50HZ 400V Approx. 350 KW	
	with chilled water pump, cooling water pump & cooling tower	
UA-6	Chiller for weaving	1 set
	Centrifugal type turbo-chiller : 440 USRT	
	Freon gas : R-123	
	Motor : 50HZ 400V Approx. 350 KW	
	with chilled water pump, Cooling water pump & cooling tower	
UA-7	Chilled water reservoir	1 set
	Reinforced concrete made semi-underground tank	
	Capacity : Approx 300 m³	
UA-8	Chilled water feed pump	3 sets
	Centrifugal pump : Approx x 3.4 m³/min 25mAg	
[AIR-CONDITIONER FOR TESTING ROOM OF DYEING]		
UA-9	Room cooler 2.5 KW (2,150 kcal/hr)	1 lot
	with Humidifier	
	(COMPRESSED AIR GENERATION)	
UM-1	Compressed air equipment for spinning	1 lot
	Air-cooled oil-free screw compressor	2 sets
	Capacity : 6.4 m³/min	
	Pressure : 7.0 kgf/cm²	
	Motor : 50HZ 400V 45 KW	
	Refrigerating type air-dryer	2 sets
	Capacity : 8.5 m³/min	
	Pressure : 9.9 kgf/cm²	

Item No.	Machine Equipment	Quantity
	Air filter	2 sets
	Air flow rate : Approx. 7.0 m^3/min	
	Filter : 0.3 micron	
	Air receiver	2 sets
	Capacity : 0.65 m^3	
UM-2	Compressed air equipment for weaving	1 lot
	Oil-free screw compressor	3 sets
	Cooling system : Water cooled by cooling tower	
	Capacity : 42.6 m^3/min	
	Pressure : 8 kgf/cm^2	
	Motor : 50HZ 400V 320 KW	
	with cooling water pump & cooling tower	
	Refrigerating type air-dryer	3 sets
	Cooling : Air-cooled	
	Capacity : 48.5 m^3/min	
	Pressure : 9.9 kgf/cm^2	
	Air filter	3 sets
	Air flow rate : 41.6 m^3/min	
	Filter : 0.3 micron	
	Air receiver	1 set
	Capacity : Approx. 10 m^3	
	Pressure : 9.9 kgf/cm^2	
UM-3	Compressed air equipment for dyeing	1 lot
	Baby compressor	2 sets
	Capacity : 1.2 m^3/min	
	Pressure : 9.5 kgf/cm^2	
	Motor : 50HZ 400V 11 KW	
	Refrigerating type air-dryer	
	Capacity : 3.0 m^3/min	
	Pressure : 9.9 kgf/cm^2	
	Air filter	1 set
	Air flow rate : 3.0 m^3/min	
	Filter : 3 micron	

(STEAM GENERATING AND HEATING MEDIUM SYSTEM)

Item No.	Machine Equipment	Quantity
UM-4	Steam boiler for sizing & dyeing	1 lot
	1) Type : Once-through boiler	3 sets
	Equivalant output : 4 ton/hr	
	(Thermal output : Approx. 2,156 x 103 kcal/hr)	
	Fuel : Natural gas 8,542 kcal/kg	

Item No.	Machine/Equipment	Quantity
	2) Auxiliary machine for steam boiler	1 lot
	Water softener	
	Chemical feeder	
	Feed water tank	
	Drain water tank	
	3) Booster pump for recovery drain	2 sets
UM-5	Heating medium system	1 lot
	1) Heating transfer medium heater	2 sets
	Thermal capacity, output : 1,000 x 10^3 kal/hr	
	Operating temperature : 300 ℃	
	2) Auxiliary machine for H.T. medium heater	1 lot
	Circulation pump	
	Expansion tank	
	Filling & discharging pump	
	Sump for heating medium	
	(FIRE FIGHTING)	
UM-6	Hydrant pump unit	1 lot
	Diesel engine & motor-driven turbine pump	1 set
	: Capacity 750 /min	
	: Head 63 mAq	
UM-7	Spinning	1 lot
	Hydrant box (Indoor)	Approx. 10 pcs.
	Hydrant box (Outdoor)	Approx. 6 pcs.
	Fire extinguisher : Dry chemical 3.5 kg	Approx. 30 pcs.
UM-8	Weaving	1 lot
	Hydrant box (Indoor)	Approx. 6 pcs.
	Hydrant box (Outdoor)	Approx. 4 pcs.
	Fire extinguisher : Dry chemical 3.5 kg	Approx. 20 pcs.
UM-9	Dyeing	1 lot
	Hydrant box (Indoor)	Approx. 6 pcs.
	Hydrant box (Outdoor)	Approx. 4 pcs.
	Fire extinguisher : Dry chemical 3.5 kg	Approx. 20 pcs.
UM-10	Common	1 lot
	Hydrant box (Indoor)	Approx. 3 pcs.
	Hydrant box (Outdoor)	Approx. 3 pcs.
	Fire extinguisher : Dry chemical 3.5 kg	Approx. 10 pcs.

The following are considered necessary for the workshop :

- Precision lathe L = 3000 mm 1 set
- Bench drill press 23 mm[PHI] 1 set
- Bench drill press 13 mm[PHI] 1 set
- Bench grinder 205 mm[PHI] 1 set
- High speed cut-off machine 1 set
- AC arc welder 1 set
- TIG arc welder (using argon gas) 1 set
- Manual type chain hoist 1 set
- Pipe threading machine 1 set
- Electric tools & hand tools, etc. 1 lot

6.5.11 Cooking Equipment for Canteen

The employees of the mill have one meal at the mill's canteen during their working hours.

Number of persons served: Max. 300 person/shift
(number of meals per time)

Fuel used: Natural gas
Therefore, the following kitchen equipment will be installed :
Major cooking appliances:

- Rice washer 1 set
- Gas rice cooker Max. 21 kg 3 sets
- Gas tilting kettle 200 ℓ 1 set
- Convection oven 1 set
- Conveyer food fryer 1,800 pcs/hr 1 set
- Refrigerator freezer 164 ℓ 1 set
- Compartment sink 2 sets

6.6 Civil Engineering Work

6.6.1 Outline of Civil and Building Works

Figure 6-2 in section 6-1 shows the overall site plan for the ITM project. The site assumed for the project is the so-called "STM" site, located south of the existing A.K.Khan Spinning and Jute Mills, facing the Dacca-Chittagong Trunk Road.

The total area required is 100,000 m^2. Since this site has an oblong shape, flexibility of placing structures and buildings is limited. The key points considered in determining the layout are to attain the smoothest semi-products flow and the simplest management system of both personnel and materials. It is, of course, very important to pay due consideration and attention to environmental preservation. Architectural treatment to each building and finishing is an another factor to be taken into account as a modern joint-venture-based industry.

Civil and building work required for the ITM project is itemized into four groups as follows:

1) Site Preparation Work

Prior to the construction of the new buildings, it is necessary to carry out the following work as site preparation and development:

a) Reclamation of the land

Some parts of the land are currently being utilized for cultivation and will have to be reclaimed to the level of the existing road and the surrounding area so as to be free from flood devastation. The estimated area to be reclaimed is approximately 29,000 m^2 at a height of 1.2 meters on the average.

b) Demolition of existing buildings

Existing STM buildings, houses and structures have to be demolished prior to site leveling. The total floor area to be demolished is estimated at 6,500 m^2. Some of the debris shall be utilized for reclamation and the rest will be dumped off the site.

c) Site leveling

Upon demolishing and reclaiming, the entire site area should be leveled and firmly compacted. A storm water drainage system and the locations of underground ducts will need to be examined prior to site leveling.

2) Building Construction Work

The ITM project requires the following buildings:

a)	Spinning Mill	:	13,248 m^2
b)	Weaving Mill	:	6,912 m^2
c)	Dyeing Mill	:	4,608 m^2
d)	Warehouse	:	2,560 m^2

e)	Utility Center	:	960 m^2
f)	Adm. Office	:	400 m^2
g)	Canteen	:	960 m^2
h)	Canopy	:	250 m^2
i)	Others	:	300 m^2
	Total built-up area	:	30,198 m^2

3) Civil Work Relating to Mechanical Work

The following work is considered as civil work to be carried out in connection with mechanical work :

a) Machine plinths in general
b) Reinforced Concrete (RC) chambers for Air-conditioner
   - 6 in spinning
   - 2 in weaving
c) RC underground ductings
d) RC water reservoir (12m x 20m x 2.5m)
e) RC tanks for effluent treatment
f) RC foundations for pumps, compressors, chillers generators, etc.
g) Excavation and backfilling for pipes, cables, etc.

4) External Work

The external work required for the project is as follows:

a) Road work and pavement for parking and bicycle shed
b) External sewage and storm water drainage line
c) Perimeter fencing
d) Planting and gardening

6.6.2 Design Concept of the Building

The "Building Standards Act in Bangladesh" is under preparation and thus no special regulations or laws for civil and building works are in effect so far. In other words, any kind of international standards or building codes, such as BS, ASTM, DIN or JIS will be accepted and utilized in designing. Availability of building materials in Bangladesh is limited, and materials such as reinforcing bars, structural steel, roofing and insulation materials, wall panels, etc. are all dependent on imports from neighboring countries. Even cement is being imported from China and/or Indonesia, since local production is not sufficient to meet national demand. It is the general feeling that only three items, i.e. labor, bricks and water are abundant enough for civil construction. The method of construction is still traditional, and depends on manual labor and the intuition of each contractor, resulting in difficult scheduling and poor workmanship.

Taking the aforementioned into consideration, i.e. the availability of materials the local conditions, and the quality of civil construction, the design concept of the factory buildings adopted for the purpose of the study are as follows:

a) Basic/Detailed Design
   - to be done by the experienced consultants

b) Tendering and Documentation
   - to be done by the consultants and two or three top local contractors and one international contractor to be invited for tendering

c) Standards
   - British Standards (BS), JIS or equivalent to be applied

d) Structure in Principle
   - Foundations : RC footings with connection beams; piling depends on soil test.
   - Column : RC column
   - Main Beam : Steel truss system using locally available steel-angle members
   - Flooring : RC flooring with Terrazzo tile finish, and dust- proof paint finish beneath production machinery and warehouse
   - Roofing : Folded Galvanized Iron (G.I.) sheets with glasswool insulation.

Table 6-31 gives a rough idea of the structures and finishings for each building required for the project.

6.6.3 Construction Work

1) Ordering

After the completion of the basic and detailed design of civil and building works, it will be necessary to invite bids from prospective contractors, evaluate them, negotiate, and finalize a formal contract with one or more contractors. Selection of

Table 6-31 : FINISHING SCHEDULE OF BUILDINGS

Name of Building	Built-up Area(m^2)	Structure	Roofing	Floor	Wall	Ceiling	Remarks
Spinning Bldg. Weaving Bldg.	13,248 6,912	RC Column+ S-truss	G.I.Sheet	Terrazzo Floor (Partially D.P.Floor)	Brickwall w/ Plastering V.P.	Ceiling Board w/ Insulation	Ceiling height : CH = 3.8m (Blow Room Area CH = 5.0m)
Dyeing Bldg.	4,608	RC Column+ S-truss	G.I.Sheet	D.P.Floor	Brickwall w/ Plastering V.P.	Nil	Effective height : EH = 6.0 (Yarn Dye EH = 8.0m)
Warehouse	2,560	RC Column+ S-truss	G.I.Sheet	D.P.Floor	Brickwall w/ Plastering V.P.	Nil	EH = 6.0m
Utility Center Bldg.	960	RC Column+ S-truss	G.I.Sheet	D.P.Floor	Brickwall w/ Plastering V.P.	Nil	EH = 4.0m (Generator Room EH=6.0m w/ Crane Facility)
Admin.office Canteen	400 960	RC	G.I.Sheet	Terrazzo Floor	Brickwall w/ Plastering V.P.	Ceiling Board	Ceiling Height : CH = 3.0m
Others	300	RC Column+ S-truss	G.I.Sheet	Terrazzo Floor	Brickwall w/ Plastering V.P.	Nil	Pump House, Garage, Gatehouse, etc.

Note : RC : Reinforced Concrete V.P.: Vinyl Paint
S : Structural Steel G.I.: Galvanized Iron
D.P.: Dust-proof Painting

superior and reliable contractors is a key to the success of the project implementation, for it generally influences the construction time as well as workmanship. In view of the scale and content of the work, as well as imposing a single responsibility on the contractor, it appears best to entrust the entire work to a single reliable contractor.

2) Temporary Work

Temporary power and water for construction will be readily available from the existing A. K. Khan plant. However, space and area for temporary material yards and offices should be investigated.

3) Site preparation and Development

Reclamation of land (partially) and demolition of existing buildings are needed prior to site leveling as described previously. A prime point in this work is to utilize suitable soil for backfilling so that firm sub-soil compaction is attained.

4) Earthwork

Excavation and backfilling for footings and machine plinths shall be carried out in full compliance with specifications. Since the ground water level is high (approx. GL - 2.0 m), methods of ground water treatment during earthwork must be thoroughly examined prior to digging below two meters in depth.

5) Reinforced Concrete Work

Reinforced concrete work is the most important and costly job in the entire civil work to be executed under the present plan of civil and building works. It is necessary to elucidate the quality standards of reinforcing bars and concrete, test them to confirm that they provide the prescribed strength, and make sure to inspect the formwork and arrangement of reinforcing bars prior to concreting. Waterproofing measures for underground ducts and tanks must be thoroughly considered because of the given high groundwater level.

6) Steelwork

In view of the availability and price of steel members, minimum usage of steel members are to be considered in designing the building. Full scale inspection at the workshop as well as strength and quality tests on steel and bolts, must be carried out prior to erection work at the site. It is particularly important to closely inspect the welded parts and tightness of the bolts after the steel frames are erected. Since the project is located in a rainy and coastal region, it is also important to thoroughly apply rust-proof coating on the surface of steel members to prevent quick oxidation.

7) Brickwork and Plastering

The cheapest way of constructing walls and partitions in Bangladesh is a brick construction with plastering finish. Since the strength of bricks is not sufficient for wide panels, RC pillars and beams must be installed at appropriate spans in the walls. Mortar must be finished into a smooth, even surface by paying attention to its mixing proportion, thickness of application and period of curing. Because faulty mortar finishing is often due to a lack of proper skill on the part of the plasterer, one must be particularly careful in employing competent plasterers. Appropriate joints will be installed at proper intervals to prevent the cracking of the wall.

8) Painting Work

Optimal painting work shall be performed by considering such factors as the type of surface, local availability of painting materials, etc. Surface preparation is essential in achieving good workmanship. Painting shall not be considered as a decoration of the wall or ceiling. It is a surface treatment of building elements for durability. In painting work on plastered surfaces, application for color coordination should always be taken into account to achieve higher efficiency of production.

9) Floor Work

For durability, dustproofing, and beauty of appearance, the concrete floor shall be finished mainly with terrazzo tiles and epoxy or equivalent dust-proof materials around the machine plinths. Possible problems shall be thoroughly investigated in advance by carefully examining the color samples and performing trial finishing of respective materials.

6.6.4 Construction Schedule

Execution of civil work is affected by various factors such as weather conditions, competence of contractor(s), availability of materials, etc. With an understanding that smooth progress of civil work is a key to the success of the overall project implementation, the highest priority in bid evaluation should be set not on construction price but on the contractor's competence. A contractor who is not able to control the implementation of the work scientifically and systematically shall be disqualified. In this regard, responsibilities and deadlines must be clearly specified in the contract. The tentative overall implementation schedule can be seen in Section 9.1, Chapter 9.

6.7 Office Supplies

The project requires a variety of apparatus and supplies in connection with managing and controlling the works such as :

(Vehicles)

a) Saloon car ------ 3 units
b) Mini-bus or wagon car ------ 2 units
c) Bus ------ 2 units

(Office Equipment)

a) Telephone system ------ 1 set
b) Telex and facsimile ------ 1 set each
c) Copy machine ------ 1 unit
d) Personal computers ------ 2 units
e) Word processors ------ 4 units
f) Office utensil ------ 1 lot

(Furniture)

a) Desks and chairs for office ------ 1 lot
b) Tables and chairs for canteen ------ 1 lot
c) Lockers and cabinets ------ 1 lot
d) Others ------ 1 lot

6.8 Cost Estimates

In accordance with the aforementioned design concepts and technological analysis, cost estimates of machinery and equipment are as follows :

6.8.1 Spinning Machinery

The cost estimates of spinning machinery and equipment explained in section 6.2.2 are shown in Table 6-32.

6.8.2 Weaving Machinery

The cost estimates of weaving machinery and equipment explained in section 6.3.2 are shown in Table 6-33.

6.8.3 Dyeing and Finishing Machinery

The cost estimates of dyeing and finishing machinery and equipment explained in section 6.4.2 are shown in Table 6-34.

6.8.4 Mechanical and Electrical Work

The cost estimates of mechanical and electrical work explained in section 6.5 are shown in Table 6-35.

6.8.5 Civil and Building Work

The cost estimates of civil and building work explained in section 6.6.2 are shown in Table 6-36.

6.8.6 Office Equipment

The cost estimates of office equipment explained in section 6.7 are shown in Table 6-37.

Table 6-32 : ESTIMATE OF INVESTMENT COSTS:
PLANT MACHINERY AND EQUIPMENT

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Spinning				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		1.Main Procuction Machinery				
	1	Blow Room Machinery	448.0	448.0		448.0
18		Carding Machine	57.83	1,041.0		1,041.0
2		Pre-Drawing Frame	43.0	86.0		86.0
2		Lap Former	126.5	253.0		253.0
7		Comber	138.29	968.0		968.0
4		Drawing Frame	43.0	172.0		172.0
6		Simplex Fly Frame	148.17	889.0		889.0
52		Ring Spinning Frame	110.81	5,762.0		5,762.0
6		Automatic Winder	249.17	1,495.0		1,495.0
4		Doubler Winder	116.75	467.0		467.0
55		Twister	80.42	4,423.0		4,423.0
	1	Spare Parts	316.0	316.0		316.0
Sub-total				16,320.0		16,320.0
		2.Auxiliary Equipment and Accessories				
	1	Blowing Section	79.3	79.3		79.3
	1	Carding Section	140.3	140.3		140.3
	1	Combing & Drawing Sec.	110.6	110.6		110.6
	1	Roving Section	106.6	106.6		106.6
	1	Spinning Section	479.1	479.1		479.1
	1	Winding Section	301.6	301.6		301.6
	1	Roller Shop & Miscellaneous	164.6	164.6		164.6
Sub-total				1,382.1		1,382.1
		3.Laboratory Equipment				
1		Moisture Testing Oven	24.0	24.0		24.0
1		Single Yarn Strength Tester	12.7	12.7		12.7
1		Yarn Fault Classifying Installation with 6-drum RT-winder	69.3	69.3		69.3
1		Yarn Evenness Testing Installation with Hairiness Tester	145.4	145.4		145.4
1		Digital Fibrograph	52.0	52.0		52.0
	1	Others	129.9	129.9		129.9
Sub-total				433.3		433.3
Total investment costs				18,135		18,135

Table 6-33 : ESTIMATE OF INVESTMENT COSTS:
PLANT MACHINERY AND EQUIPMENT

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Weaving				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		1.Main Production Machinery				
1		Winder (Soft Winding)	52.1	52.1		52.1
2		Winder (Rewinding)	41.15	82.3		82.3
1		Warper	283.3	283.3		283.3
2		Warper (Soft Beaming)	275.55	551.1		551.1
1		Sizer	639.3	639.9		639.9
1		Sizer (Pre-Cylinder)	665.6	665.6		665.6
1		Tying Machine	25.3	25.3		25.3
5		Reaching-in Machine	11.08	55.4		55.4
96		Air Jet Loom	58.35	5,601.6		5,601.6
2		Inspecting Machine	15.2	30.4		30.4
1		Folding Machine	59.2	59.2		59.2
	1	Spare Parts	241.8	241.8		241.8
Sub-total				8,288.0		8,288.0
		2.Auxiliary Equipment and Accessories				
40		Warper's Beam	2.448	97.9		97.9
	2	Torocon with Weighing Scale	48.96	97.9		97.9
	1	Size Cookers and Tank	133.8	133.8		133.8
1		Reed Cleaning Machine	21.2	21.2		21.2
48		Weaver's Beam	1.836	88.1		88.1
550		Heald Frame	0.286	157.3		157.3
	960	Flat Heald	0.171	164.2		164.2
	960	Dropper	0.065	62.4		62.4
144		Profile Reed	0.734	105.7		105.7
	8	Blow Cleaner	11.95	95.6		95.6
	1	Others	476.9	476.9		476.9
Sub-total				1,501.0		1,501.0
Total investment costs				9,789		9,789

Table 6-34 : ESTIMATE OF INVESTMENT COSTS: PLANT MACHINERY AND EQUIPMENT

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Dyeing and Finishing				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		1. Main Production Machinery				
1		Beam Dyeing Machine 200 Kg	220.8	220.8		220.8
2		Beam Dyeing Machine 150 Kg	195.9	391.8		391.8
1		Beam Dyeing Machine 90 Kg	157.3	157.3		157.3
1		Beam Dyeing Machine 30 Kg	113.4	113.4		113.4
1		Cheese Dyeing Machine 200 Kg	256.2	256.2		256.2
1		Cheese Dryer 100 Kg	260.2	260.2		260.2
2		Inspecting Machine for Grey Cloth	17.5	35.0		35.0
1		Gas Singeing Machine	221.3	221.3		221.3
1		Scouring and Bleaching Range	1,605.4	1,605.4		1,605.4
1		Mercerizing Machine	1,321.8	1,321.8		1,321.8
1		Heat Setter	594.9	594.9		594.9
1		Hot Flue Dyeing Range	434.4	434.4		434.4
1		Thermofixing Machine	234.3	234.3		234.3
1		Pad Steamer	624.7	624.7		624.7
1		Finishing Stenter	732.0	732.0		732.0
2		Baking Machine	233.1	466.2		466.2
1		Compressive Shrinking Machine	509.3	509.3		509.3
3		Inspecting Machine	17.5	52.5		52.5
2		Cloth Winding Machine	43.5	87.0		87.0
	1	Spare Parts for 2 years Operation	374.5	374.5		374.5
Sub-total				8,693.0		8,693.0
		2. Auxiliary Equipment and Accessories				
	1	NaOH Recovery Unit	295.0	295.0		295.0
	1	NaOH Stock and Service Tank	16.0	16.0		16.0
	1	Sewing Machine	13.1		13.1	13.1
2		Fork-lift Truck	18.4	36.8		36.8
20		Batch Carrier	1.2	24.0		24.0
2		Batch Carrier Truck	11.0	22.0		22.0
240		Cloth Carrier	0.85	204.0		204.0
2		Electric Vacuum Cleaner	4.5	9.0		9.0
2		Jet Cleaner	6.3	12.6		12.6
	1	Homogenizer	34.5	34.5		34.5
	1	Strapping Machine with Roller Conveyer	16.8	16.8		16.8
	1	2-ton Double Rail Crane	29.2	29.2		29.2
120		Dyeing Beam	0.94	112.8		112.8
30		Cheese Truck	1.05	31.5		31.5
1		Weft Straightener for Finishing Stenter	56.5	56.5		56.5
	1	Maintenance Tools	11.6	11.6		11.6
	1	Others	105.7	105.7		105.7
Sub-total				1,018	13	1,031

ESTIMATE OF INVESTMENT COSTS:
PLANT MACHINERY AND EQUIPMENT

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Dyeing and Finishing				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		3.Laboratory Equipment				
	1	Computer Color Matching System	105.6	105.6		105.6
	1	Automatic Color Dispensing System	89.0	89.0		89.0
1		Tensile Strength Tester(Instron)	44.2	44.2		44.2
1		Fadeometer(Xenone Type)	57.0	57.0		57.0
1		Launder Tester(8 beakers)	11.0	11.0		11.0
1		Padding Mangle(4-ton loading)	25.0	25.0		25.0
1		Padding Mangle(2-ton loading)	12.0	12.0		12.0
2		Head Setting & Thermofixing Machine	32.0	64.0		64.0
1		Pad-steamer	31.0	31.0		31.0
1		Testing Oven	11.3	11.3		11.3
1		12-color Dyeing Machine	36.9	36.9		36.9
	1	Others	64.0	64.0		64.0
Sub-total				551.0		551.0
Total investment costs				10,262	13	10,275

Table 6-35 : ESTIMATE OF INVESTMENT COSTS: PLANT MACHINERY AND EQUIPMENT

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Utility				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		1.Spinning				
3		Transformer Station	94/10	282	29	311
	1	Low tension Power Wiring	195/272	195	272	467
	1	Lighting	98/40	98	40	138
	1	Time Signal System	6/3	6	3	9
	1	Air-Conditioning and waste collecting	2,630/48	2,630	48	2,678
2		Refrigeration Equip.	381/4	762	8	770
	1	Compressed Air Equip.	171/8	171	8	179
	1	Water Piping	31/3	31	3	34
	1	Fire Prevention Equip.	62/2	62	2	64
Sub-total				4,237	413	4,650
		2.Weaving				
1		Transformer Station	107/12	107	12	119
	1	Low tension Power Wiring	74/72	74	72	146
	1	Lighting	60/4	60	4	64
	1	Time Signal System	2/1	2	1	3
	1	Air-Conditioning Equip.	910/17	910	17	927
1		Refrigeration Equip.	253/3	253	3	256
	1	Compressed Air Equip. and Piping	845/3	845	3	848
	1	Steam Generation Equip. and Piping	72/2	72	2	74
	1	Water Equip. and Piping	34/2	34	2	36
	1	Fire Prevention Equip. and Piping	58/1	58	1	59
Sub-total				2,415	117	2,532
		3.Dyeing				
1		Transformer Station	107/12	107	12	119
	1	Low tension Power wiring	66/63	66	63	129
	1	Lighting	26/2	26	2	28
	1	Time Signal System	2/1	2	1	3
	1	Compressed Air Equip. and Piping	36/1	36	1	37
	1	Steam Generation Equip. and Piping	493/3	493	3	496
	1	Heat Transfer Medium Equip. and Piping	410/2	410	2	412
	1	Water Equip. and Piping	64/3	64	3	67
	1	Fire Prevention Equip. and Piping	47/1	47	1	48
	1	Air-conditioning for Laboratory	6/1	6	1	7
Sub-total				1,257	89	1,346

ESTIMATE OF INVESTMENT COSTS:
PLANT MACHINERY AND EQUIPMENT

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Utility				Units : 1,000.-$		
Q'ty	Unit	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		4.Others				
	1	Electricity Incoming Station	99/16	99	16	115
	1	Incoming	163		163	163
2		Generating Station		3,183	14	3,197
	1	Intake Natural Gas Equip.	1,592/6		11	11
	1	10KV Distribution Equip.	90/17	90	17	107
1		Utility Transformer Station	96/5	96	5	101
	1	Utility Low tension Power Wiring	39/44	39	44	83
	1	Lighting of Utility Area	13/2	13	2	15
	1	Well and Water Equip.	218/77	218	77	295
	1	Fire Prevention Equip.	42/1	42	1	43
	1	Workshop and Other devices for Utility	105/1	105	1	106
	1	Cooking appliances for Canteen	57/11	57	11	68
Sub-total				3,942	362	4,304
Total Investment Cost				11,851	981	12,832

Table 6-35 : ESTIMATE OF INVESTMENT COSTS:
CIVIL AND BUILDING

Project : ITM in Bangladesh				Currency :U.S.$		
Department : Civil and Building				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		1.Site Preparation Work (1,000m²)				
34.8		Reclamation of land	1.1		38.3	38.3
6.5		Demolition	40.0		260.0	260.0
100.0		Site levelling	1.0		100.0	100.0
Sub-total					398.3	398.3
		2.Building Construction Work (1,000m²)				
13.2		Spinning Mill	280	1,112.8	2,596.6	3,709.4
6.9		Weaving Mill	280	580.6	1,354.8	1,935.4
4.2		Dyeing Mill (H=6.0m)	250	312.0	728.0	1,040.0
0.4		ditto (H=8.0m)	280	37.6	87.8	125.4
2.6		Warehouse	200	153.6	358.4	512.0
1.0		Utility Center	250	72.0	168.0	240.0
1.4		Admin. Office/Canteen	300		408.0	408.0
0.3		Canopy	150		37.5	37.5
0.3		Others	250		75.0	75.0
Sub-total				2,268.6	5,814.1	8,082.7
		3.Civil Works relating to Mechanical Work				
	1	Machine Plinth in general	125		125.0	125.0
10		RC Chamber for A/C	8		80.0	80.0
	1	RC Ducting (sp/wv)	300		300.0	300.0
	1	RC Water Reservoir	30		30.0	30.0
	1	RC Tanks for Treatment	60		60.0	60.0
	1	RC Foundations for Pumps, Chiller, etc.	60		60.0	60.0
	1	Earthwork for Pipes/Cables	50		50.0	50.0
Sub-total					705.0	705.0
		4.External Work (1,000m²)				
3.5		Road Work (Asphalt)	12		42.0	42.0
	1	External Sewage/Drainage	15		15.0	15.0
0.8		Perimeter Fencing	20		16.0	16.0
	1	Planting and Gardening	10		10.0	10.0
Sub-total					83.0	83.0
	1	5.Provisional Sum	440		440.0	440.0
Total investment costs				2,269	7,440	9,709

Table 6-37 : ESTIMATE OF INVESTMENT COSTS:
OFFICE SUPPLY

Project : ITM in Bangladesh				Currency :U.S.$		
Main plant item or plant unit : Office				Units : 1,000.-$		
Q'ty	Units	Item description	Unit Cost	Cost		
				Foreign	Local	Total
		Vehicles				
3		Saloon Cars	20.0	60.0		60.0
2		Mini-Buses or Station Wagons	25.0	50.0		50.0
2		Buses	80.0	160.0		160.0
		Office Equipment				
	1	Telephone System	20.0		20.0	20.0
	1	Telex and Facsimile	2.0	2.0		2.0
1		Copy Machine	1.0	1.0		1.0
2		Personal Computers	4.0	8.0		8.0
4		Word Processors	1.5	6.0		6.0
	1	Office Supplies	4.0		4.0	4.0
		Furniture				
	1	Desks and Chairs for Office	40.0		40.0	40.0
	1	Tables and Chairs for Canteen	20.0		20.0	20.0
	1	Lockers and Cabinets	10.0		10.0	10.0
	1	Others	10.0		10.0	10.0
Total investment costs				287	104	391

6.8.7 Summary of Cost Estimates for Engineering and Technology

The estimated total cost of this project are summarized in Table 6-38.

Table 6-38 : SUMMARY OF COSTS

Unit: 1,000.US$

Department	Investment Cost			Reference
	Foreign	Local	Total	
Spinning	18,135		18,135	Table 6-32
Weaving	9,789		9,789	Table 6-33
Dyeing and Finishing	10,262	13	10,275	Table 6-34
Utility	11,851	981	12,832	Talbe 6-35
Environmental	355	454	809	Table 5-11
Civil	2,269	7,440	9,709	Table 6-36
Office	287	104	391	Table 6-37
Total	52,948	8,992	61,940	

CHAPTER 7 : ORGANIZATION AND OVERHEAD COSTS

7.1 Organization in General

7.1.1 Basic Concept

In managing a company, clarifying the responsibilities and authority of the personnel is the prime requirement for stimulating its organization.

First of all, it is necessary to breakdown the organization's duties into units of an easy-to-manage size to facilitate supervision. ITM is classified into three departments: Management, Sales and Marketing, and Production. Each department is classified further by duty and work responsibility. The organization should be unified and balanced inside the mill, irrespective of such classification.

Next, to achieve maximum investment return, the equipment should be working at full capacity 24 hours a day, 350 days a year, and the working time should be divided into three types: a) 3 shifts of 4 groups, b) 2 shifts of 2 groups, and c) day shift only.

Consideration has been taken to simplify the chain of command by having the higher-ranked personnel involved as much as possible in lower level management .

While each department and section is given independent authority and responsibility, priority should be placed on mutual communication, according to management guidelines. Foreign staff will be responsible at the outset to effectively transfer management and technology-related knowledge to Bangladeshi workers.

In concrete terms, it is recommended that the following ideas be employed :

(1) Open-door policy: the spirit of working together efficiently in an open-door atmosphere of communication between administration and lower level employees

(2) Two way decision system: decisions should be made not only top-to-bottom but also bottom-to-top. Everybody understands and is in agreement when a top decision maker gives the greenlight

(3) Introduction of a scientific quality control system, e.g. TQC method, in the production department

(4) Maximum use of female workers in spinning and weaving operations

7.1.2 Organization Chart

The new company's organization chart is shown in Figure 7-1.

7.2 Organization Structure

7.2.1 Management

The new company must try to contribute to society while pursuing profits by establishing a new corporate idea under firm management philosophy. The ultimate objective of this project is to become a model case of a textile manufacturer in Bangladesh and for it to contribute to the country's economic and social development.

It is recommend that management be composed of 5 executives, as shown in Figure 7-2.

While the Chairman will be a Bangladeshi national on a non-full-time commitmenting basis, the President, the Director of Production and the Director of Sales/Marketing will be foreign specialists and will be the core of the new company's management. The Administrative Director will be a Bangladeshi national and will mainly be in charge of personnel and labour. Therefore, the new company's CEO will be the President, and he will be responsible for all the management. The management cost is shown in Table 7-1. Thus, management by foreign experts will be employed in the initial stages of running the company.

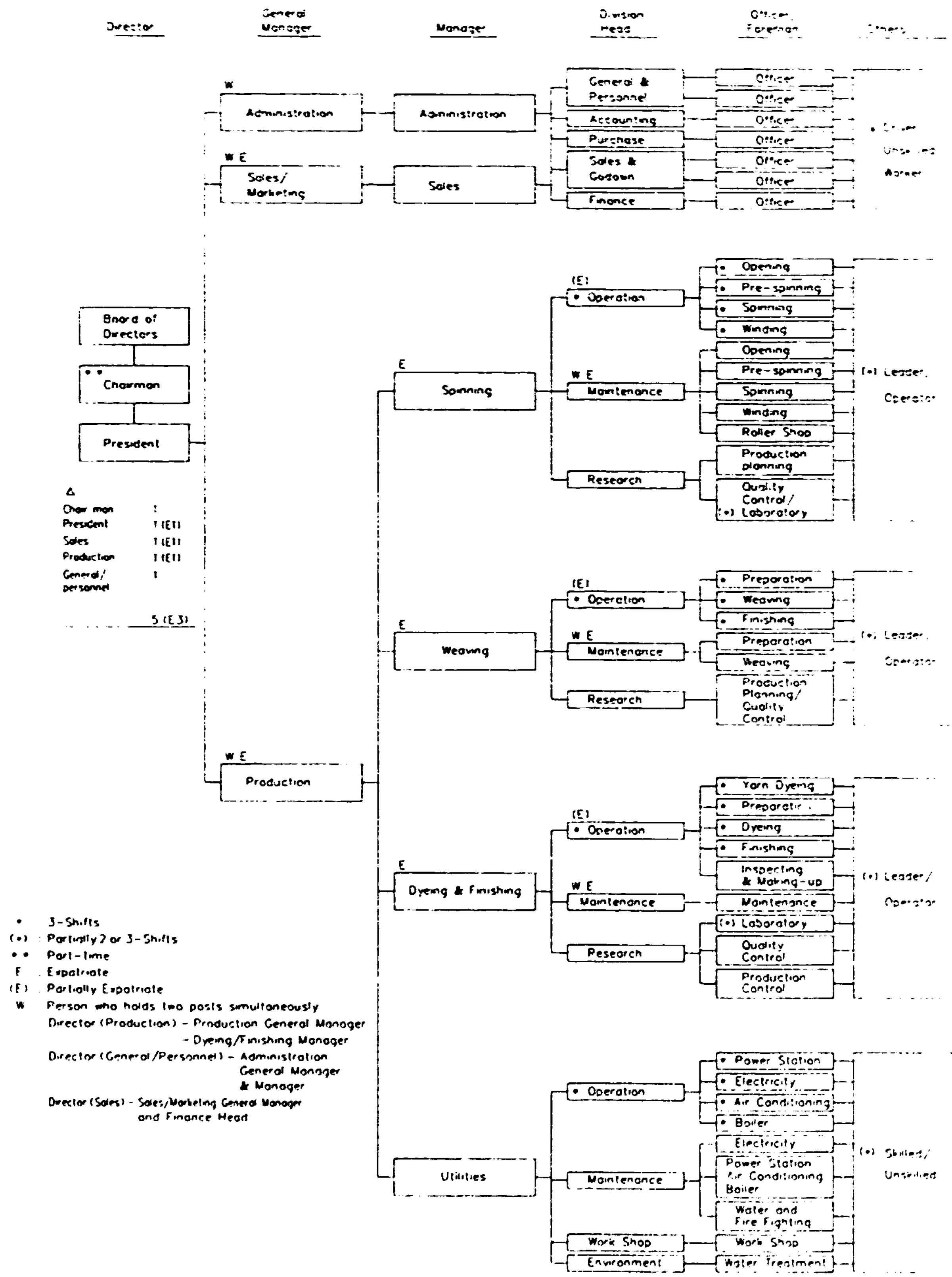


Figure 7-1 : COMPANY ORGANIZATION

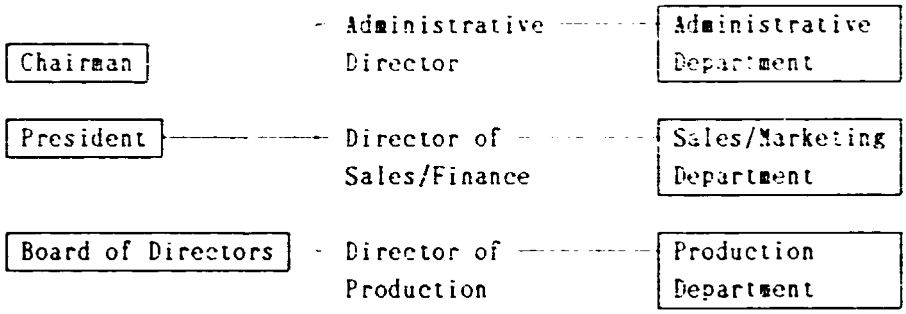


Figure 7-2 : MANAGEMENT STRUCTURE

7.2.2 Administrative department

The organization is classified roughly into the Production and Non-Production Departments as shown in Figure 7-1. The Non-Production Department is divided further into the Sales/Marketing and Administrative Departments to clarify the allotment of responsibilities. The Sales/Marketing Department is in charge of order-receiving, sales of products and purchasing of raw cotton, grey yarn and grey cloth. It is also in charge of the finance/ accounting duties. The Administrative Department is in charge of personnel/labor duties, local material purchasing and accounting as well as other duties related to general affairs.

7.2.3 Production Department

The Production Department is divided into four departments: spinning, weaving, dyeing and finishing, and utilities. Each department should be managed independently while maintaining the harmony of the whole mill, but these departments are still to be under the direction of the mill manager. While the three departments perform production through many kinds of machinery models and processes, effective management is possible by clarifying the allotment of duties and responsibilities by classifying processes into the two duties of operation and maintenance. As long as the world market is being targeted, it is necessary to secure high product quality and a punctual delivery. Thus, systematic management of production planning and its implementation, as well as quality control inspection in the production process, is essential. The research section is in charge of achieving this goal as well as promoting communication among the departments. The utilities department is in charge of all supplementary duties except for direct production duties, i.e. running maintenance of the motor electric equipment, the effluent treatment facility, etc. While classified likewise into operation and maintenance duties, environmental preservation and workshop duties also full under the utilities department's responsibilities.

7.3 Overhead Costs

Overhead costs are generally separated into factory overhead and administrative overhead.

7.3.1 Factory Overhead

The following are considered as factory overhead:

- Wages and salaries of employees not directly involved in production
- Factory supplies
- Utilities (water, power, gas, steam)
- Effluent disposal

The cost implications of these items are mentioned either in Chapter 4 or Chapter 8. As for disposal of waste or effluent generated by the mill, no significant cost will be accrued to the mill.

7.3.2 Administrative Overhead

The following are considered as administrative overhead:

- Management fee for hiring foreign management experts
- Wages and salaries for office employees
- Office supplies
- Utilities for office
- Communication expenses
- Rents, property insurance and property taxes, etc.

These expenses will arise in connection with the running of the mill. The cost implications of these items are shown in Table 7-1.

7.3.3 Cost Estimate (in US dollars x 1.000, but all local portion)

Table 7-1 indicates a summary of administrative overhead. Labor costs not directly related to production can be seen in Tabie 8-6.

Table 7-1 : ADMINISTRATIVE OVERHEAD COSTS
(FIXED COST)

Unit : US $ 1,000

Cost Item	Foreign	Local
[Administrative overhead]		
- Management fee for operation		
3 expatriate directors/5 expatriate managers/2 expatriate division heads	1,008	–
- Administrative labor		
· Office	–	20.0
· Sales/Marketing	–	9.3
Total	1,008	29.3
[Non-labor cost]		
- Administrative		
· Office supplies	–	5
· Utility/Transportation	–	2
· Communication	–	2
· Property insurance	–	2
· Property tax	–	8
- Sales/Marketing	67	49.2
Total	67	68.2

CHAPTER 8 : HUMAN RESOURCES

8.1 Labor Conditions in General

The labor force in Bangladesh in 1989 was appproximately 50.7 million, of which 50.1 million were employed. Table 8-1 shows some data related to the labor conditions in Bangladesh. The unemployment rate shown in the table for 1989 is very small (1.2 %), however, it is a general feeling that the actual number of unemployed workers is much larger than this figure because of what it means to be "employed" in an agricultural economy.

Table 8-1 : INDICATORS OF LABOR AND MANPOWER SECTOR

Characteristics	Census		
	1981	1985-86	1989
1. Total Labor Force (millions)	25.9	30.9	50.7
Male	24.4	27.7	29.7
Female	1.5	3.2	21.0
2. Employed Pop. (millions)	25.3	30.5	50.1
Male	23.9	27.4	29.4
Female	1.4	3.1	20.7
3. Unemployed Population (millions)	0.6	0.4	0.6
4. Unemployment Rate	2.3	1.3	1.2
5. Employment by Broad Sector			
Agriculture (millions)	15.4	17.4	37.0
Non-Agriculture (millions)	9.9	13.0	13.1

(Source : Statistical Pocket Book of Bangladesh 1992)

One of the main objectives of the Fourth Five-Year Plan is poverty alleviation and creation of employment opportunities through human resources development. The major strategies for achieving these objectives are (a) integration of the group-based approach with the sector-based approach, (b) community involvement in the centrally implemented projects and (c) participatory planning in rural areas. It is also necessary to put emphasis on increasing employment opportunities through education and on-the-job training.

The problems of poverty alleviation and employment generation, however, seem to be very serious and difficult to solve. The projected growth of the labor force will be 3.4 % per annum during the Fourth Five-Year Plan. This is greater than the population growth of 2.4 %. This is mainly attributed to female participation in the labour force.

The higher growth rate in female participation is the result of the government's policy toward female employment in the public sector, as well as the introduction of special food-for-work program for women and the high growth rate of the garment industry during the last decade. The garment industry employs mostly female workers.

In regard to wage rates, Bangladesh still has one of the lowest levels in the world. Table 8-2 shows comparative wages among ASEAN countries. From this table, it is understood why Bangladesh is so attractive for labor-intensive industries such as garment industries. This trend will continue for some time since the increase in the labor force will be much greater than that of employment opportunities.

Table 8-2 : WAGES IN ASEAN COUNTRIES

(US$/month)

	Workers		Manager	
	Skilled or Foremen	Unskilled	Top-level	Medium-level
Indonesia	100 ~ 150	50 ~ 70	500 ~ 800	300 ~ 400
Thailand	150 ~ 200	80 ~ 150	1500 ~ 2000	500 ~ 1500
Philippines	150 ~ 200	80 ~ 150	800 ~ 1500	500 ~ 800
Malaysia	100 ~ 200	70 ~ 100	1500 ~ 2000	600 ~ 1500
Sri Lanka	60 ~ 100	40 ~ 60	200 ~ 300	100 ~ 150
Bangladesh	60 ~ 100	40 ~ 60	200 ~ 300	100 ~ 150

(Source : from Japanese firms already invested as of 1992)

Table 8-3 shows some indications of the education system in Bangladesh. In line with government policy, Bangladeshi people are becoming very interested in the education of their children and Bangladesh has achieved more than 94 % participation in primary school Participation in junior and senior high schools and college is still very low, probably due to poverty. The national literacy rate is still low (24.8 %), but the Chittagong division is a little higher at 33.8 %.

Table 8-3 : KEY INDICATORS OF EDUCATION IN BANGLADESH

Items	1989	1990	1991
Participation Rate (%)			
- Primary (ages 5-9)	85.9	89.9	94.6
- Secondary (ages 10-14)	26.1	26.6	27.6
- Higher (ages 15-24)	3.4	3.4	4.2
Number of Colleges			
- College (general)	872	893	997
- Medical college	10	10	10
- Engineering college	4	4	4
- University	7	7	9
Literacy rate (%)	Bangladesh average		24.8%
	Chittagong		33.8%

(Source : Statistical Pocket Book of Bangladesh 1992)

In view of the project under consideration, which will require more than 1,100 workers, recruitment of the necessary number of workers, including the managerial level, seems to be no problem. Their quality or qualifications must be carefully investigated. According to the preliminary survey of this matter through foreign investors in Chittagong, the workers are generally very diligent and hardworking, provided they have received appropriate training. In this sense, the proper training of employed workers up to the managerial levels is considered crucial for systematic and efficient operation of the mill.

8.2 Manpower Requirements

The personnel required (at full operation) by duty/job and by department, according to the company's scale and organization, are shown in Table 8-4. The assignment of foreign experts is also included in this table. Such personnel are assigned/employed while being given training according to the establishment of the company, construction of the mill, installation of machinery, test run and operation. The personnel employment plan from the establishment of the company to full operation is shown in Table 8-5. The total number of personnel required at full production is estimated to be 1,105, of which 8 are foreign experts (3 directors, 3 managers and 2 division heads). Employment of workers starts at the outset of the project, and at the end of construction period, the number of employees will be 349. Nine months after commencing operation, 100 percent recruitment is to be completed.

8.3 Training Scheme

The objective of setting up this new company is to create a model for Bangladesh's textile industry by introducing new management philosophy. In this regard it is recommended that new personnel be unexperienced. The education and training referred to here includes not only operating technology using the latest machine models but also quality control, maintenance, mill management, technology and peripheral knowledge. The construction period for the new mill is most suitable for conducting education and training through actual machine installation and test runs. The principle of education and training is to acquire necessary technology by fully understanding the machinery and equipment through hands-on experience at one's own mill. In other words, original on-the-job training should be implemented. The aforementioned training scheme is effective only if it is implemented concurrently with the construction of the mill, installation of machinery and equipment, and guidance on operation by thoroughly experienced trainers. It may also be a good idea to learn advanced technology abroad, but this is not economical. The training should therefore, be conducted in Bangladesh by foreign trainers under the engineering and training contract.

Training on maintenance will be conducted during the installation of production machinery and the method of operation and quality control will be taught for 1 - 2 years, after operation start-up, during which time technical transfer will be possible. The work controller under the engineering contract will also have the role of trainer. An approximate dispatching schedule is shown in Figure 8-1.

Table 8-4 : NUMBER OF STAFF AND WORKERS

Director	No.	E	General Manager	No.	E	Manager	No.	E	Division Head	No.	E	Officer/ Foreman No.	Leader/ Skilled No.	Operator/ Unskilled No.	Total No.	Total E
			Administration			Administration	1		General &	1		1	1	6	9	0
									Personnel			1	1	1	3	0
									Accounting	1		1	1	0	3	0
									Purchase	1		1	0	0	2	0
			Total	0	0		1	0		3	0	4	3	7	18	0
Chairman	1															
			Sales/ Marketing			Sales	1		Sales &	1		1	1	1	4	0
President	1	1							Godown			1	1	0	2	0
									Finance	1		1	1	0	3	0
Sales/ Marketing/ Finance	1	1	Total	0	0		1	0		2	0	3	3	1	10	0
			Total	0	0		2	0		5	0	7	6	8	28	0
Technical	1	1	Mill Production			Spinning	1	1	Operation	4	1	16	28	276	324	1
									Maintenance			5	5	27	37	0
General/ Personnel	1								Research	1		2	0	13	16	0
						Sub-Total	1	1		5	1	23	33	316	378	2
						Weaving	1	1	Operation	4	1	12	20	218	254	1
									Maintenance			2	4	5	11	0
									Research	1		0	2	0	3	0
						Sub-Total	1	1		5	1	14	26	223	269	2
						Dyeing & Finishing	1	1	Operation	5		20	33	260	318	0
									Maintenance			2	2	4	8	0
									Research	2		4	6	16	28	0
						Sub-Total	1	1		7	0	26	41	280	355	1
						Utilities	1		Operation	4		4	24	0	32	0
									Maintenance	3		3	12	7	25	0
									Work Shop	1		1	2	3	7	0
									Environment	1		1	1	2	5	0
						Sub-Total	1	0		9	0	9	39	12	70	0
			Total	0	0		4	3		26	2	72	139	831	1,072	5
Grand Total	5	3		0	0		6	3		31	2	79	145	839	1,105	3

Note : No. : Number of Persons
E : Number of Expatriates included in No.
Operation : 4 Groups, 3 Shifts (including 2 and 1 Shift)
Research : 1 and 2 Shifts

Table 8-5 : PERSONNEL REQUIREMENT SCHEDULE

Depart-ment	Year	1994											1995												1996				
	Month	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
	NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		← Pre-Operation																		Operation →									
Board of Directors	Incorporation																												
	Chairman																	1	1	1	1	1	1	1	1	1	1	1	"
	President (E)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Technical (E)													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Sales (E)																1	1	1	1	1	1	1	1	1	1	1	1	"
	General	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Total	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	4	5	5	5	5	5	5	5	5	5	5	5	"
Office	Requirement																												
	General Man.	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	"
	Manager	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	"
	Div. Head	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	"
	Foreman	2	2	2	2	2	2	2	2	2	4	4	4	5	5	5	7	7	7	7	7	7	7	7	7	7	7	7	"
	Others	4	4	4	4	4	4	6	6	6	6	6	6	6	6	10	10	10	14	14	14	14	14	14	14	14	14	14	"
	Total	10	10	10	10	10	10	12	12	12	14	14	14	16	16	20	24	24	28	28	28	28	28	28	28	28	28	28	"
Spinning	Requirement																												
	Manager (E)															1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Div. Head															2	2	2	2	2	3	3	3	3	5	5	5	5	"
	Foreman																3	4	5	5	11	11	11	11	19	19	23	23	"
	Others																35	38	48	73	73	108	135	162	211	260	336	349	"
	Total															3	41	45	56	81	88	123	150	177	236	285	365	378	"
Weaving	Requirement																												
	Manager (E)															1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Div. Head															4	4	4	4	4	5	5	5	5	5	5	5	5	"
	Foreman															2	8	8	8	14	14	14	14	14	14	14	14	14	"
	Others																20	26	58	87	108	149	180	211	249	249	249	249	"
	Total															7	33	39	71	106	128	169	200	231	269	269	269	269	"
Dyeing Finishing	Requirement																												
	Manager (E)													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Div. Head													7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	"
	Foreman														14	26	26	26	26	26	26	26	26	26	26	26	26	26	"
	Others															17	44	85	85	85	179	179	179	321	321	321	321	321	"
	Total													8	22	51	78	119	119	119	213	213	213	355	355	355	355	355	"
Utilities	Requirement																												
	Manager										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	"
	Div. Head										9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	"
	Foreman										8	8	9	9	[illegible]	9	9	9	9	9	9	9	9	9	9	9	9	9	"
	Others										17	17	17	17	17	25	25	51	51	51	51	51	51	51	51	51	51	51	"
	Total										35	35	36	36	36	44	44	70	70	70	70	70	70	70	70	70	70	70	"
Grand Total	Requirement																												
	Director	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	4	5	5	5	5	5	5	5	5	5	5	5	"
	General Man.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	"
	Manager	2	2	2	2	2	2	2	2	2	3	3	3	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	"
	Div. Head	2	2	2	2	2	2	2	2	2	11	11	11	19	19	25	27	27	27	27	29	29	29	29	31	31	31	31	"
	Foreman	2	2	2	2	2	2	2	2	2	12	12	13	14	28	42	53	54	55	61	67	67	67	67	75	75	[illegible]	[illegible]	"
	Others	4	4	4	4	4	4	6	6	6	23	23	23	23	23	52	134	210	256	310	425	501	559	759	816	895	971	984	"
	Total	12	12	12	12	12	12	14	14	14	51	51	52	63	77	128	224	302	349	469	532	608	666	866	963	1012	1012	1105	"

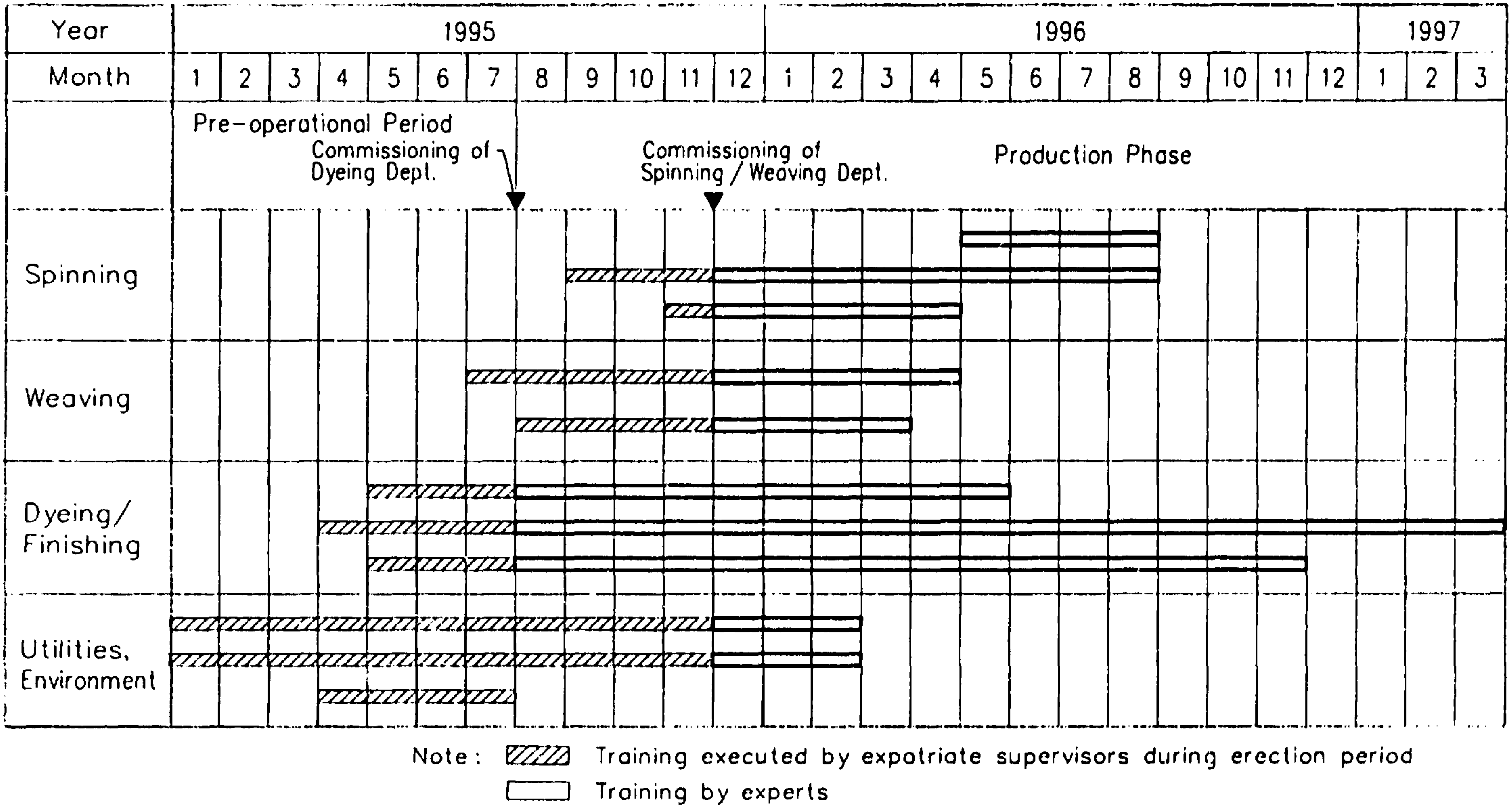


Figure 8-1 : TRAINER'S DISPATCH SCHEDULE

8.4 Cost Estimates

Cost estimates related to human resources can be seen in the following tables:

- Table 8-6 : Estimates of direct and indirect labor costs
- Table 8-7 : Estimates of training fees

Table 8-7 : TRAINING FEE

Unit : 1,000$

Year	Cost item	Local costs	
		Variable	Fixed
1st year	Spinning trainer	–	216
	Weaving trainer	–	108
	Dyeing trainer	–	408
	Utilities trainer	–	72
	1st Year Total	–	804
2nd year	Spinning trainer	–	24
	Weaving trainer	–	–
	Dyeing trainer	–	144
	Utilities trainer	–	–
	2nd Year Total	–	168

Note : This fee is included in the administrative overhead of 1996 and 1997 in the table 10-4.

Table 8-6 : SUMMARY OF LOCAL LABOR COSTS

Unit : US$

		Number	Variable cost	Fixed cost
DIRECT LABOR	Spinning			
	Division head	4	4,800	
	Foreman	23	20,700	
	Skilled worker	33	23,760	
	Unskilled worker	316	170,640	
	Total	376	219,900	
	Weaving			
	Division head	4	4,800	
	Foreman	14	12,600	
	Skilled worker	26	18,720	
	Unskilled worker	223	120,420	
	Total	267	156,540	
	Dyeing/Finishing			
	Division head	7	8,400	
	Foreman	26	23,400	
	Skilled worker	41	29,520	
	Unskilled worker	280	151,200	
	Total	354	212,520	
INDIRECT LABOR	Utilities/Electricity			
	Manager	1		1,500
	Division head	9		10,800
	Foreman	9		8,100
	Skilled worker	39		28,080
	Unskilled worker	12		6,480
	Total	70		54,960
ADMINISTRATIVE LABOR	Office			
	Chairman	1		3,000
	Director	1		2,400
	Manager	1		1,500
	Division head	3		3,600
	Foreman	4		3,600
	Skilled worker	3		2,160
	Unskilled worker	7		3,780
	Total	20		20,040
	Sales/Marketing			
	Manager	1		1,500
	Division head	2		2,400
	Foreman	3		2,700
	Skilled worker	3		2,160
	Unskilled worker	1		540
	Total	10		9,300
	Grand Total	1,097	588,960	84,300

CHAPTER 9 : IMPLEMENTATION SCHEDULE

9.1 Project Implementation

The project under contemplation is a brand new, large textile project to be established in the form of a joint venture which contains a great deal of overlapping and simultaneous activities in the course of project implementation. Therefore, appropriate implementation scheduling together with stage-wise analysis is essential to the timely completion of the project. An overall view of the project implementation can be seen in Figure 9-1, which was prepared on the basis of the following assumptions:

1) Basic agreement as a new company is to be concluded by the end of 1993.

2) BEPZA or BOI's approval is to be obtained within a month of application for the establishment of a new company.

3) Site acquisition will be completed by the end of April, 1994 which will enable the contractor to start mobilization scheduled for the beginning of June, 1994.

4) There will be no such abnormal weather as may adversely affect the smooth progress of the civil work.

Project implementation is categorized into three groups as follows:

- Stage 1 : Company Formation and Initial Project Management
- Stage 2 : Construction Period at Site
- Stage 3 : Official Operation Period

9.2 Stage of Project Implementation

9.2.1 Company Formation and Initial Project Management : Stage 1

Figure 9-2 indicates the breakdown of main activities during the period of Stage 1, i.e. Company Formation and Initial Project Management. This stage begins with official approval by the Government of Bangladesh for the establishement of a new company, scheduled for mid-January, 1994 and ends at the time of completing the awarding of the contract to the main machinery supplier(s). Stage 1 is estimated to take about 6.5 months.

As soon as the new company is officially formed, a unit for dealing with managerial work in respect to project implementation will be formed within the organization of the company. This unit is called "PIU", and will be headed by the president of the company. It will be responsible for all matters related to the implementation of the new project, such as various applications and formalities, the appointment of the engineering firm and contractors, machine suppliers, issuing Letters of Credit and certificates for payment, accepting machinery and equipment, etc. As described in the previous chapter, appointing an experienced consulting firm for design and supervision, and selecting competent contractor(s) for civil, mechanical, and electrical work is vital to attaining successful and timely implementation of the project. Full acquisition of the land by the end of May, 1994 will also be very important in commencing site work on time.

The engineering firm to be appointed by the new company is responsible for the following s:

(1) basic and detailed design and engineering of the project

(2) documentation and evaluation of the bids

(3) supervision of the site work

(4) guidance of the test-run and commissioning

(5) pre-operational training and technical guidance after start-up

9.2.2 Construction Period at Site : Stage 2

Stage 2 is the period for actual construction at the site. It will begin from the time the contact is awarded to the civil contractor and continue up to the time of issuing the certificate of completion to the contractor. In other words, Stage 2 will continue until the commencement of official operation of the mill.

PIU, assisted by the consulting team under the engineering contract, will be responsible for implementation in this period.

The phasing of the work during Stage 2 is shown in Figure 9-3. The main points noted for this period are as follws:

(1) Site preparation work includes demolishing existing structures, reclaiming the low area and site levelling.

(2) The order of building construction shall be dyeing and finishing, first, followed by spinning and weaving, since installation of dyeing and finishing machinery will take place first.

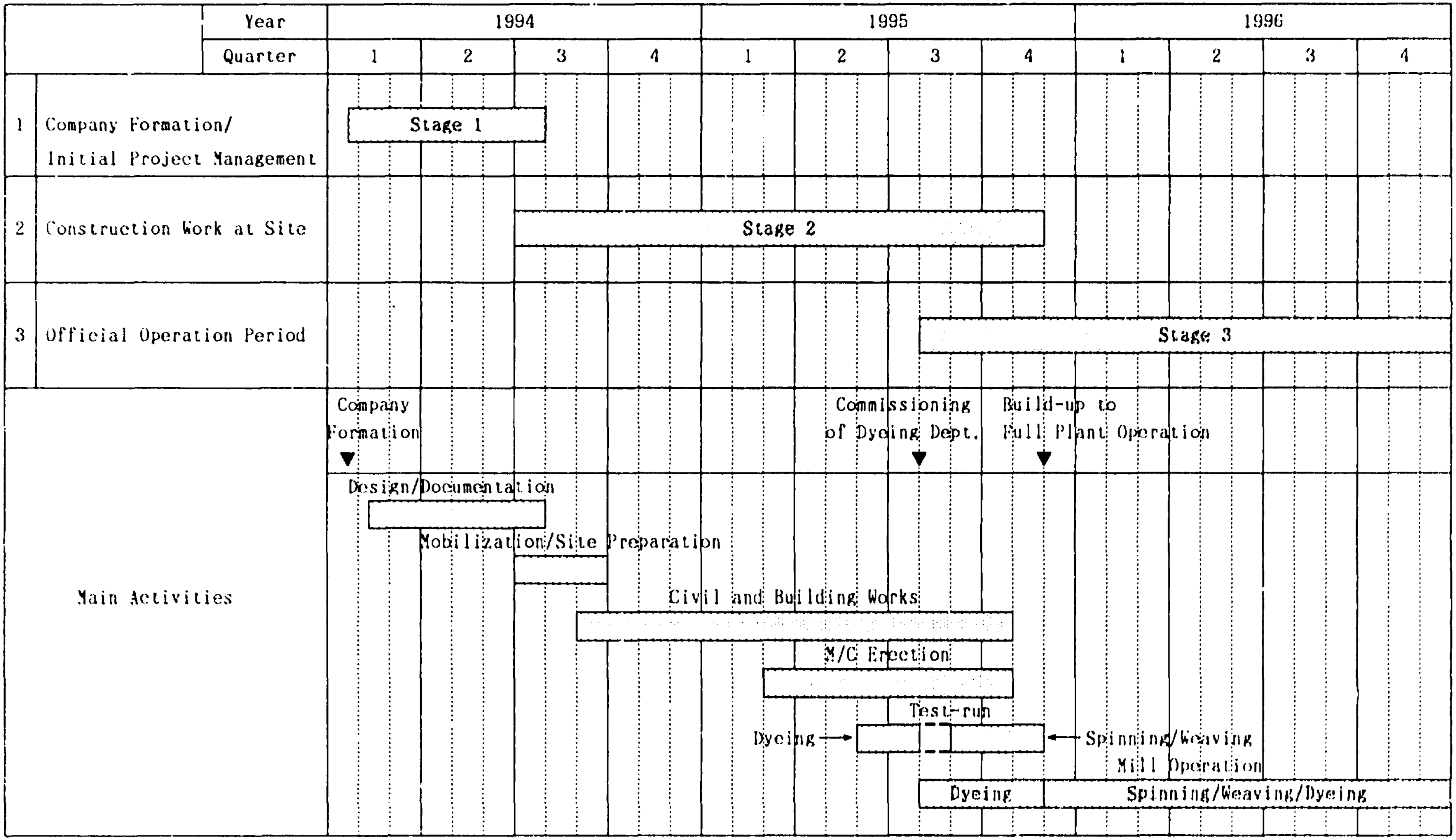


Figure 9-1 : OVERALL VIEW OF PROJECT IMPLEMENTATION SCHEDULE

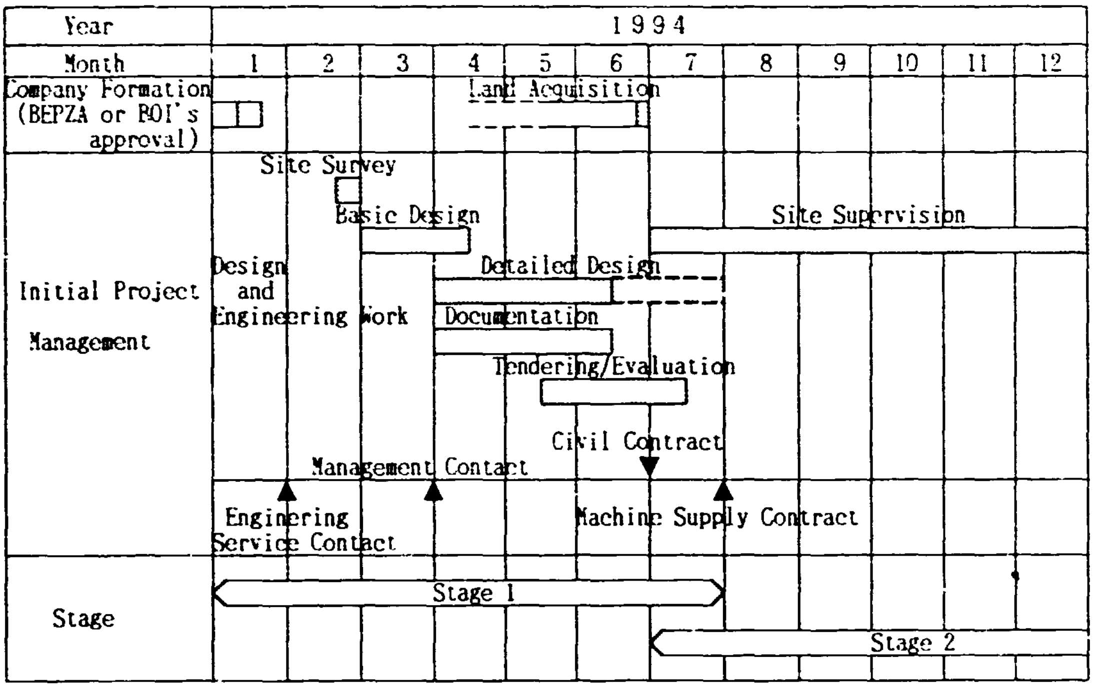


Figure 9-2 : 1ST STAGE PROJECT IMPLEMENTATION SCHEDULE

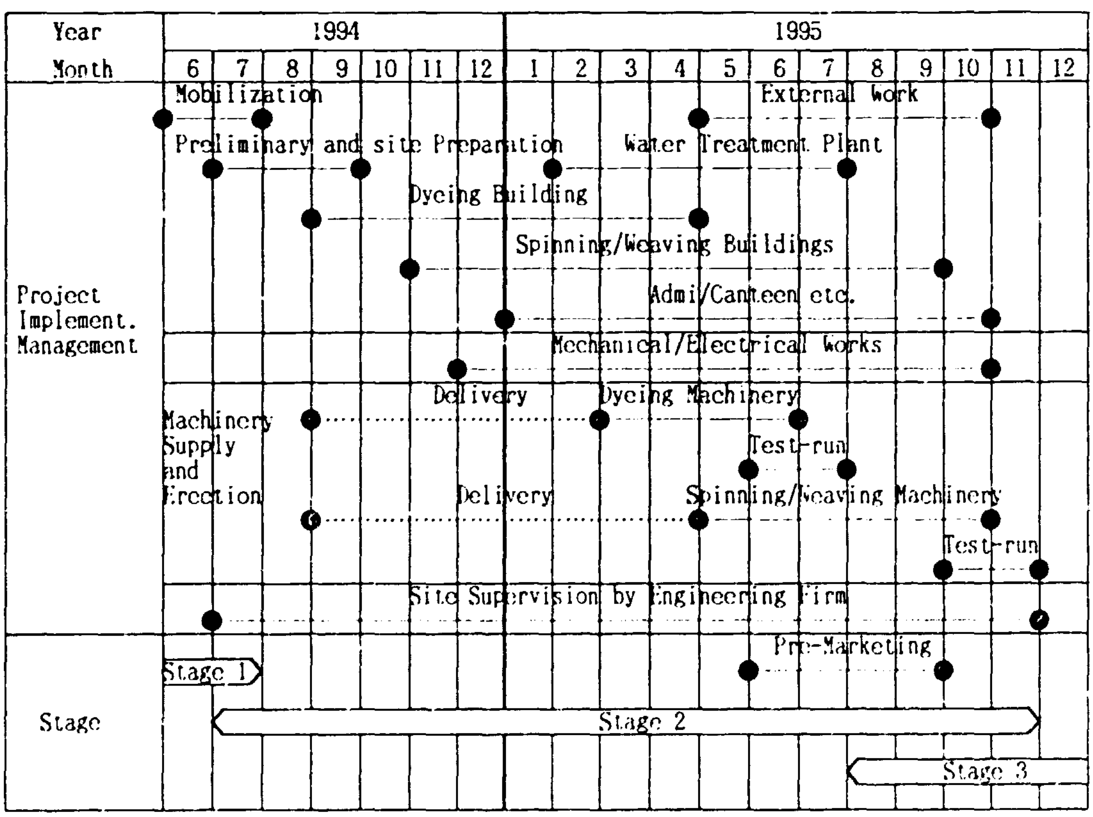


Figure 9-3 : 2ND STAGE PROJECT IMPLEMENTATION SCHEDULE

(3) Erection of spinning, weaving and dyeing and finishing machinery shall be done in a systematic manner. Its schedule is shown in Figure 9-4, 9-5 and 9-6.

Table 9-1 shows the estimated man-days for erection supervisors and workers. These workers will receive on-the-job training by the suppliers' supervisors during the course of erection and test-run, and thereafter will be basically employed by the new company.

Table 9-1 : ERECTION MAN-DAYS

Department	Supplier SV	Worker SV	Worker	Total
Spinning	840	675	6,843	8,358
Weaving	582	1,075	3,002	4,659
Dyeing/Finishing	404	1,000	2,474	3,878
Utility	415	1,675	5,975	8,065
Total	2,241	4,425	18,294	24,960

(4) Commissioning of the dyeing and finishing department should be done four months before overall mill operation begins, by utilizing grey fabrics purchased from outside. The operation ratio after start-up is shown in Table 9-2.

Table 9-2 : OPERATION RATIO

Department	1st Year	2nd Year	3rd Year
Spinning	33 %	91 %	100 %
Weaving	35 %	98 %	100 %
Dyeing/Finishing	65 %	99 %	100 %

(5) Preliminary marketing for fabrics newly introduced to RMG industries should be done during this stage.

9.2.3 Official Operation Period : Stage 3

This period starts when the company commences commercial operation, i.e. at the time of starting production of finished fabrics which will take place four months before full production of the mill. It means Stage 3 will overlap Stage 2 for four months.

9.3 Project Implementation Budgeting

Table 9-3 shows the summary of estimated costs which will arise in the course of project implementation.

	Machine	No. of Machine	Month 1	2	3	4	5	6	7
1	Blowing	1 L x 1 S				8 persons x 25 days			
2	Carding	18 sets			6 x 95				
3	Drawing	6 sets				2 x 18			
4	Lap Former	2 sets				3 x 11			
5	Comber	7 sets				4 x 35			
6	Roving	6 sets				6 x 54			
7	Ring	52 sets			32 x 130				
8	Winder	6 sets				6 x 54			
9	Doubler	4 sets					4 x 12		
10	Twister	55 sets				8 x 83			
11	Blow Cleaner	52+55				6 x 54			
	Laboratory	1 lot				1 x 10			
	Roller Shop	1 lot					1 x 10		
	Test-run								

Figure 9-4 : ERECTION SCHEDULE FOR SPINNING

	Machine	No. of Machine	Month						
			1	2	3	4	5	6	7
1	Winder	3 sets	6 persons x 60 days						
2	Warper	3 sets	6 x 20		6 x 20			6 x 20	
3	Sizer	2 sets		8 x 40		8 x 40			
4	Size Cooker	1 lot		4 x 25					
5	Tying Machine	1 set		4 x 5					
6	Reaching in Machine	5 sets		4 x 5					
7	Air Jet Loom	96 sets					12 x 102		
8	Loom Cleaner	8 sets			6 x 25				
9	Inspecting Machine	2 sets				4 x 6			
10	Folding Machine	1 set				4 x 6			
11	Torocon	2 lots	4 x 20						
Test-run									

Figure 9-5 : ERECTION SCHEDULE FOR WEAVING

	Machine	No. of Machine	Month					
			1	2	3	4	5	6
1	Beam Dyeing, Cheese Dyeing, Cheese Dryer, NaOH Recovery	8 sets				14 persons x 25 days		
2	Gas Singeing, Scouring and Bleaching, Mercerizing	3 sets	14 x 43					
3	Heat Setter, Hot Flue Dryer, Thermofixing, Baking, Stenter	6 sets		16 x 53				
4	Pad-steamer, Compressive Shrinking	2 sets			14 x 24			
5	Inspecting Cloth Winding	7 sets			4 x 17			
6	Auxiliary Equipment and Accessories, Laboratory	1 lot				10 x 27		
	Test-run							

Figure 9-6 : ERECTION SCHEDULE FOR DYEING AND FINISHING

Table 9-3 : COST ESTIMATES DURING IMPLEMENTATION

Unit : 1,000$

	Cost Items	1994*		1995*	
		Foreign	Local	Foreign	Local
1	Management Fee and Administrative Expenses during pre-operation				
	- Directors : 27m/m	97.2	–	291.6	–
	- Expatriate Staff : 10m/m	60.0	–	60.0	–
	- Salaries and Wages	–	12.0		25.0
	Sub-Total	157.2	12.0	351.6	25.0
2	Pre-study Cost ¥15,000,000	120.0	–	–	–
3	Consulting and Engineering Fee				
	- Design and Engineering Fee	1,240.0	–	–	–
	- Grand Supervision Fee	438.0	19.5	438.0	26.8
	- Others(Communication, Travelling, etc.)	40.0	–	40.0	–
	Sub-Total	1,718.0	19.5	478.0	26.8
4	Cost for erection of Machinery/Equip.				
	- Expatriate Supervisors Fee : 75m/m	450.0	–	450.0	–
	- Erection (Local Workers)	–	–	–	125.5
	Sub-Total	450.0	–	450.0	125.5
5	Raw Materials for Commissioning/Test-run				
	- Raw Cotton : 51 tons	–	–	106.8	–
	- yarn : CM60/2 ······ 15 bales	–	–	22.3	–
	P/C 45 ······ 12.5 bales	–	–	11.0	–
	- Grey Cloth : P/C Grey Cloth ·· 0.16mil. m	–	–	104.3	–
	- Other materials (chemicals, etc.)	–	–	50.0	–
	Sub-Total	–	–	294.4	–
6	Other Pre-operational Expenses				
	- Rents/lease etc.	–	25.0	–	25.0
	- Miscellaneous Expenses for Company Formation, Communication, Travel, etc	–	15.0	–	10.0
	Sub-Total	–	40.0	–	35.0
	Total	2,445.2	71.5	1,574.0	212.3
		2,516.7		1,786.3	
7	Interest during Construction	217.7		3,080.64	
	Pre-production Cost Total	2,734.7		4,866.64	
8	Working Capital			5,945.06	
	Grand Total	13,546.4			

CHAPTER 10 : FINANCIAL EVALUATION

10.1 General

This chapter covers the financial evaluation of the project on the basis of financial calculations carried out utilizing UNIDO's "Computer Model For Feasibility Analysis And Reporting (COMFAR)", and the following general premises and assumptions were used as the basic conditions for said financial calculations.

a) Currency
U.S. dollar, exchange rate US $ 1.0 = J.Yen 125 = Bangladesh Taka 40.0

b) Construction start : 1994

c) Operation start : 1996

d) Project life : 15 years

e) Loaning conditions

(1) Foreign Loan
- Interest : 10 % per annum
- Grace Period : 2 years
- Repayment : yearly

(2) Local loan
- Interest : 12 % per annum
- Grace Period : 0 year
- Repayment : yearly

f) Depreciation

(1) Land : not depreciated
(2) Civil and Building : straight-line method, 20 years
(3) Machinery and Equipment : straight-line method, 10 years
(4) Other Fixed Assets : straight-line method, 10 years

g) Dividends
Dividends will be deferred until the time the accummulated net cashflow figures show a surplus, that is in the fifth year after the start-up of operation. The rate is 20 % per annum of net profit.

h) Tax and Duties
It was guaranteed by the government of Bangladesh that the project can enjoy a tax holiday for 10 years, even if its site is outside the EPZ.

10.2 Financial Evaluation

The summary of the financial evaluation of the base case appears on the summary sheet of the COMFAR calculations. The details of the various analyses are as follows (the related output table number appears in the parentheses):

10.2.1 Initial Investment (Table 10-2)

The total investment amounts to US$ 78.57 million. Machinery and equipment share about 66% of the total initial investment costs. The remaining portion goes for factory and office building construction costs. The initial investment accrueing in the first year of construction amounts US$ 18.13 million, including fixed investment cost, pre-production expenditures and working capital for financing interests during the construction period. It will be US$ 60.44 million for the second year of the construction period, including working capital for inventory and materials.

10.2.2 Source of Financing (Table 10-3)

The above initial investment costs will be financed by the integral portion of loan and equity with the debt/equity ratio being 70/30.

1st year US $ 18.13 million
2nd year US $ 60.44 million

In the first year of operation (1996), overdraft amounting to US$ 0.426 million will accrue (see details in 10.2.7).

Repayment of foreign loans will be disbursed during the construction period starting from the third year of operation after the two-year grace period ends. Repayments of local loans start from the first year of operation.

10.2.3 Production Costs (Table 10-4, Figure 10-1)

As is shown in the schedule of total production costs, the raw material cost is the major production cost component, accounting for 55.41 % of total production costs. Depreciation costs and financial charges follow the raw material costs, accounting for 14.34 % and 9.64 % respectively. Labor costs are the lowest. This reflects the lower level of wages in Bangladesh (lower than in Indonesia and nearly equal to Vietnam). Energy and utility costs which amount to 6.80 % of the total costs seem almost the same or slightly costlier than those in Indonesia.

10.2.4 Break-Even Point (Figure 10-2)

The break-even ratio is obtained by dividing the fixed cost by the marginal profit as follows:

Break-even ratio including financial cost				60.2 %
annual sale	US$	53.725	million	
fixed costs	"	13.029	"	
total costs	"	45.124	"	
Break-even ratio excluding financial cost				40.1 %
annual sale	US$	53.725	million	
fixed costs	"	8.679	"	
total costs	"	40.774	"	

This project is judged as very safe economically from this figure, since a firm whose break-even ratio is less than 60 % is generally recognized as an excellent one.

10.2.5 Debt-Service Ratio (Figure 10-3)

The repayment ability of the project is evaluated as sound, judging from the debt-service ratio which ranges from around 2 to 3. The ratio deteriorates slightly and temporarily in the third year when the foreign loan repayments start and in the 11th year when the tax holiday ends. No debt remains from the 13th year onward.

Debt Service Ratio, by year
(net cashflow/debt service)

1	0.94	9	2.56
2	2.68	10	2.77
3	1.76	11	2.23
4	1.86	12	2.39
5	1.96	13	-
6	2.09	14	-
7	2.22	15	-
8	2.38		

10.2.6 Working Capital Requirement (Table 10-5)

The project requires approximately US$ 8.7 million of working capital which accounts for about 19 % of the total production costs in the 5th year of operation (2000). The working capital for raw materials and chemicals/dyestuffs is capitalized in 1995, the year before start-up, due to their possibility of acquisition difficulties. The working capital for the remaining items is included in the operating year.

10.2.7 Cashflow Analysis (Table 10-6)

In the first year of operation (1996), a bank overdraft of US$ 0.426 million will accrue. It is broken down as follows:

Sales revenue	29.672	(US$ in million)
Accounts payable	1.632	
Accounts receivable & other assets	-3.476	
Operating cost excld. depreciation cost	-21.566	
Principal repayment	-0.962	
Financial cost	-5.726	
Total	-0.426	

This amount of bank overdraft, resulting in a cash balance deficit for the first year of operation, should be financed by an additional equity or through short-term borrowing. The cumulated net cashflow becomes positive in the fifth year of operation. This indicates that the simple pay-back period is over six years after the initial investment.

10.2.8 Internal Rate of Return (Table 10-1)

The IRR is computed to be 19.15 %. This rate is higher than the average interest rate for project loans. This value of IRR is regarded as acceptable for an industrial project in developing countries.

10.2.9 Net Income Statement (Table 10-7)

The contribution margin is computed as 40.3 % from 1998 onward. The net profit ratio out of total sales exceeds 10 % from the 2nd year (1997) and improves in line with the project life. This ratio is identical with the gross profit ratio during the ten years after the start-up, as the corporate tax is exempted due to the tax holiday. The profit situation of this project is evaluated as normal and sound.

10.3 Sensitivity Analysis of IRR (Table 10-9, Figure 10-4)

- 6 % increase in sales price : IRR 22.84 %
  6 % decrease : IRR 15.14 %
  Sales prices envisaged in the study are retained low, reflecting the actual slump in the textile market. They are likely to be raised in the future, as the market recovers and product quality increases.

- 6 % decrease in operating cost : IRR 21.58 %
  6 % increase : IRR 16.60 %
  It is necessary to curtail operating costs as much as possible in order to survive the severe competition in the textile market. It is possible to achieve this target through the rationalization of management under corporate efforts.

- 6 % decrease in initial investment : IRR 20.47 %
  6 % increase : IRR 17.95 %
  As cutting down of investment more or less affects the quality of products, this case is not recommended.

The analysis shows that reduction in initial investment does not imply significant improvement of the IRR. Therefore, attention should be paid to the sales price and production cost as the variators of IRR.

10.4 Conclusion of Financial Evaluation

Viewing from the aforementioned evaluation, the project can be judged financially sound.

Table 10-1

COMFAR 2.1 - TOYOBO ENGINEERING CO., LTD, JAPAN

ITM in Bangladesh
22 June 1993
base case

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: thousand US dollar

Total initial investment during construction phase

fixed assets:	72630.34	81.818 % foreign
current assets:	5945.06	100.000 % foreign
total assets:	78575.41	83.193 % foreign

Source of funds during construction phase

equity & grants:	23241.41	88.206 % foreign
foreign loans .	45710.00	
local loans :	9624.00	
total funds :	78575.41	84.264 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	21566.42	34329.41	34305.50
depreciation :	6468.68	6468.68	6468.68
interest :	5725.88	5610.39	5494.90
production costs	33760.98	46408.49	46269.09
thereof foreign	86.55 %	86.28 %	86.47 %
total sales :	29672.09	52909.80	53725.05
gross income :	-4088.89	6501.31	7455.96
net income :	-4088.89	6501.31	7455.96
cash balance :	-426.55	11073.21	8369.16
net cashflow :	6261.73	17646.00	19397.46

Net Present Value at: 10.00 % = 44923.20
Internal Rate of Return: 19.15 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

Table 10-2

Total Initial Investment in thousand US dollar

Year	1994	1995
Fixed investment costs		
Land, site preparation, development	3169.000	318.000
Buildings and civil works	1862.000	7449.000
Auxiliary and service facilities	2728.000	10913.000
Incorporated fixed assets	0.000	391.000
Plant machinery and equipment	7637.000	30562.000
Total fixed investment costs	15396.000	49633.000
Pre-production capital expenditures	2734.700	4866.640
Net working capital	0.000	5945.063
Total initial investment costs	18130.700	60444.700
Of it foreign, in %	72.049	86.536

ITM in Bangladesh --- 22 June 1993

Source of Finance, construction in thousand US dollar

Year	1994	1995
Equity, ordinary ..	14215.700	9025.708
Equity, preference.	0.000	0.000
Subsidies, grants .	0.000	0.000
Loan A, foreign .	1720.000	43990.000
Loan B, foreign..	0.000	0.000
Loan C, foreign .	0.000	0.000
Loan A, local....	2195.000	7429.000
Loan B, local....	0.000	0.000
Loan C, local....	0.000	0.000
Total loan	3915.000	51419.000
Current liabilities	0.000	0.000
Bank overdraft	0.000	0.000
Total funds	18130.700	60444.710

Source of Finance, production in thousand US dollar

Year	1996	1997	1998	1999-2005	2006- 7
Equity, ordinary ..	0.000	0.000	0.000	0.000	0.000
Equity, preference.	0.000	0.000	0.000	0.000	0.000
Subsidies, grants .	0.000	0.000	0.000	0.000	0.000
Loan A, foreign .	0.000	0.000	-4571.000	-4571.000	-4571.000
Loan B, foreign..	0.000	0.000	0.000	0.000	0.000
Loan C, foreign .	0.000	0.000	0.000	0.000	0.000
Loan A, local....	-962.400	-962.400	-962.400	-962.400	0.000
Loan B, local....	0.000	0.000	0.000	0.000	0.000
Loan C, local....	0.000	0.000	0.000	0.000	0.000
Total loan	-962.400	-962.400	-5533.400	-5533.400	-4571.000
Current liabilities	1632.493	1116.583	12.008	0.000	0.000
Bank overdraft	426.547	-426.547	0.000	0.000	0.000
Total funds	1096.640	-272.364	-5521.392	-5533.400	-4571.000

Table 10-4

Total Production Costs in thousand US dollar

Year	1996	1997	1998	1999	2000
% of nom. capacity (single product).	0.000	0.000	0.000	0.000	0.000
Raw material 1	15182.000	25096.920	25005.000	25005.000	25005.000
Other raw materials	1819.000	3391.996	3432.000	3432.000	3432.000
Utilities	101.997	155.003	157.000	157.000	157.000
Energy	1502.004	2911.989	2912.000	2912.000	2912.000
Labour, direct	388.917	588.999	589.000	589.000	589.000
Repair, maintenance	177.000	231.000	233.000	233.000	233.000
Spares	364.000	558.000	750.000	750.000	750.000
Factory overheads	55.000	55.000	55.000	55.000	55.000
Factory costs	19589.920	32988.910	33133.000	33133.000	33133.000
Administrative overheads	1851.000	1215.000	1047.000	1047.000	1047.000
Indir. costs, sales and distribution	125.500	125.500	125.500	125.500	125.500
Direct costs, sales and distribution	0.000	0.000	0.000	0.000	0.000
Depreciation	6468.684	6468.684	6468.684	6468.684	6468.684
Financial costs	5725.880	5610.392	5494.904	4922.316	4349.728
Total production costs	33760.980	46408.480	46269.090	45696.500	45123.910
Costs per unit (single product)	0.000	0.000	0.000	0.000	0.000
Of it foreign, %	86.547	86.284	86.468	86.551	86.637
Of it variable,%	62.772	69.480	69.366	70.235	71.[illegible]26
Total labour	2230.217	1794.299	1626.300	1626.300	1626.300

Total Production Costs in thousand US dollar

Year	2001	2002	2003	2004	2005
% of nom. capacity (single product).	0.000	0.000	0.000	0.000	0.000
Raw material 1	25005.000	25005.000	25005.000	25005.000	25005.000
Other raw materials	3432.000	3432.000	3432.000	3432.000	3432.000
Utilities	157.000	157.000	157.000	157.000	157.000
Energy	2912.000	2912.000	2912.000	2912.000	2912.000
Labour, direct	589.000	589.000	589.000	589.000	589.000
Repair, maintenance	233.000	233.000	233.000	233.000	233.000
Spares	750.000	750.000	750.000	750.000	750.000
Factory overheads	55.000	55.000	55.000	55.000	55.000
Factory costs	33133.000	33133.000	33133.000	33133.000	33133.000
Administrative overheads	1047.000	1047.000	1047.000	1047.000	1047.000
Indir. costs, sales and distribution	125.500	125.500	125.500	125.500	125.500
Direct costs, sales and distribution	0.000	0.000	0.000	0.000	0.000
Depreciation	6468.684	6468.684	6468.684	6468.684	6468.688
Financial costs	3777.140	3204.552	2631.964	2059.376	1486.788
Total production costs	44551.320	43978.730	43406.150	42833.560	42260.980
Costs per unit (single product)	0.000	0.000	0.000	0.000	0.000
Of it foreign, %	86.724	86.814	86.906	87.000	87.098
Of it variable,%	72.041	72.978	73.941	74.930	75.945
Total labour	1626.300	1626.300	1626.300	1626.300	1626.300

Total Production Costs in thousand US dollar

Year	2006	2007	2008-10
% of nom. capacity (single product).	0.000	0.000	0.000
Raw material 1	25005.000	25005.000	25005.000
Other raw materials	3432.000	3432.000	3432.000
Utilities	157.000	157.000	157.000
Energy	2912.000	2912.000	2912.000
Labour, direct	589.000	589.000	589.000
Repair, maintenance	233.000	233.000	233.000
Spares	750.000	750.000	750.000
Factory overheads	55.000	55.000	55.000
Factory costs	33133.000	33133.000	33133.000
Administrative overheads	1047.000	1047.000	1047.000
Indir. costs, sales and distribution	125.500	125.500	125.500
Direct costs, sales and distribution	0.000	0.000	0.000
Depreciation	485.450	485.450	485.450
Financial costs	914.200	457.100	-0.000
Total production costs	35705.150	35248.050	34790.950
Costs per unit (single product)	0.000	0.000	0.000
Of it foreign, %	85.802	85.618	85.429
Of it variable,%	89.889	91.055	92.251
Total labour	1626.300	1626.300	1626.300

Table 10-5

Net Working Capital in thousand US dollar

Year	mdc	coto	1996	1997	1998	1999-2010
Coverage	mdc	coto				
Current assets &						
Accounts receivable	30	12.0	1797.202	2860.784	2858.792	2858.792
Inventory and materials	1	360.0	5945.346	5945.494	5945.499	5945.499
Energy	15	24.0	62.583	121.333	121.333	121.333
Spares	60	6.0	60.667	93.000	125.000	125.000
Work in progress	10	36.0	544.164	916.359	920.361	920.361
Finished products	15	24.0	893.372	1425.163	1424.167	1424.167
Cash in hand	15	24.0	118.163	110.333	111.417	111.417
Total current assets			9421.497	11472.460	11506.570	11506.570
Current liabilities and						
Accounts payable	30	12.0	1632.493	2749.076	2761.083	2761.083
Net working capital			7789.004	8723.389	8745.484	8745.484
Increase in working capital			1843.941	934.385	22.095	0.000
Net working capital, local			284.135	488.277	489.131	489.131
Net working capital, foreign			7504.869	8235.112	8256.354	8256.354

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Table 10-6

Cashflow Tables, construction in thousand US dollar

Year	1994	1995
Total cash inflow	18130.700	60444.710
Financial resources	18130.700	60444.710
Sales, net of tax	0.000	0.000
Total cash outflow	18130.700	60444.700
Total assets	17913.000	57364.060
Operating costs	0.000	0.000
Cost of finance	217.700	3080.640
Repayment	0.000	0.000
Corporate tax	0.000	0.000
Dividends paid	0.000	0.000
Surplus (deficit)	0.000	0.004
Cumulated cash balance	0.000	0.004
Inflow, local	4936.000	7429.000
Outflow, local	5067.700	8138.140
Surplus (deficit)	-131.700	-709.140
Inflow, foreign	13194.700	53015.710
Outflow, foreign	13063.000	52306.560
Surplus (deficit)	131.698	709.145
Net cashflow	-17913.000	-57364.060
Cumulated net cashflow	-17913.000	-75277.060

Cashflow tables, production in thousand US dollar

Year	1996	1997	1998	1999	2000	2001
Total cash inflow	31304.590	54026.380	53737.060	53725.050	53725.050	53725.050
Financial resources	1632.493	1116.583	12.008	0.000	0.000	0.000
Sales, net of tax	29672.090	52909.800	53725.050	53725.050	53725.050	53725.050
Total cash outflow	31731.130	42953.170	45367.900	44761.210	48836.930	48264.340
Total assets	3476.434	2050.968	34.103	0.000	0.000	0.000
Operating costs	21566.420	34329.410	34305.500	34305.500	34305.500	34305.500
Cost of finance	5725.880	5610.392	5494.904	4922.316	4349.728	3777.140
Repayment	962.400	962.400	5533.400	5533.400	5533.400	5533.400
Corporate tax	0.000	0.000	0.000	0.000	0.000	0.000
Dividends paid	0.000	0.000	0.000	0.000	4648.300	4648.300
Surplus (deficit)	-426.545	11073.210	8369.156	8963.836	4888.125	5460.711
Cumulated cash balance	-426.541	10646.670	19015.830	27979.660	32867.790	38328.500
Inflow, local	258.656	266.110	115.967	115.050	115.050	115.050
Outflow, local	5369.655	7054.018	6585.576	6468.317	6901.029	6785.541
Surplus (deficit)	-5110.999	-6787.908	-6469.609	-6353.267	-6785.979	-6670.491
Inflow, foreign	31045.930	53760.270	53621.090	53610.000	53610.000	53610.000
Outflow, foreign	26361.480	35899.160	38782.330	38292.900	41935.900	41478.800
Surplus (deficit)	4684.453	17861.110	14838.760	15317.100	11674.100	12131.200
Net cashflow	6261.733	17646.000	19397.460	19419.550	19419.550	19419.550
Cumulated net cashflow	-69015.330	-51369.330	-31971.870	-12552.320	6867.230	26286.780

Cashflow tables, production in thousand US dollar

Year	2002	2003	2004	2005	2006	2007
Total cash inflow . .	53725.050	53725.050	53725.050	53725.050	53725.050	53725.050
Financial resources .	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax . .	53725.050	53725.050	53725.050	53725.050	53725.050	53725.050
Total cash outflow . .	47691.750	47119.160	46546.570	45973.990	51646.960	51372.700
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs . . .	34305.500	34305.500	34305.500	34305.500	34305.500	34305.500
Cost of finance . . .	3204.552	2631.964	2059.376	1486.788	914.200	457.100
Repayment	5533.400	5533.400	5533.400	5533.400	4571.000	4571.000
Corporate tax . . .	0.000	0.000	0.000	0.000	7207.961	7390.801
Dividends paid . . .	4648.300	4648.300	4648.300	4648.300	4648.300	4648.300
Surplus (deficit) .	6033.301	6605.887	7178.477	7751.063	2078.090	2352.348
Cumulated cash balance	44361.800	50967.690	58146.160	65897.230	67975.310	70327.660
Inflow, local	115.050	115.050	115.050	115.050	115.050	115.050
Outflow, local	6670.053	6554.565	6439.077	6323.590	12453.660	12636.500
Surplus (deficit) .	-6555.003	-6439.516	-6324.027	-6208.540	-12338.610	-12521.450
Inflow, foreign . . .	53610.000	53610.000	53610.000	53610.000	53610.000	53610.000
Outflow, foreign . . .	41021.700	40564.600	40107.500	39650.400	39193.300	38736.200
Surplus (deficit) .	12588.300	13045.400	13502.500	13959.600	14416.700	14873.800
Net cashflow	19419.550	19419.550	19419.550	19419.550	12211.590	12028.750
Cumulated net cashflow	45706.330	65125.880	84545.440	103965.000	116176.600	128205.300

Cashflow tables, production in thousand US dollar

Year	2008	2009	2010
Total cash inflow . .	53725.050	53725.050	53725.050
Financial resources .	0.000	0.000	0.000
Sales, net of tax . .	53725.050	53725.050	53725.050
Total cash outflow . .	46527.440	46527.440	46527.440
Total assets	0.000	0.000	0.000
Operating costs . . .	34305.500	34305.500	34305.500
Cost of finance . . .	-0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax . . .	7573.641	7573.641	7573.641
Dividends paid . . .	4648.300	4648.300	4648.300
Surplus (deficit) .	7197.609	7197.609	7197.609
Cumulated cash balance	77525.270	84722.880	91920.480
Inflow, local	115.050	115.050	115.050
Outflow, local	12819.340	12819.340	12819.340
Surplus (deficit) .	-12704.290	-12704.290	-12704.290
Inflow, foreign . . .	53610.000	53610.000	53610.000
Outflow, foreign . . .	33708.100	33708.100	33708.100
Surplus (deficit) .	19901.900	19901.900	19901.900
Net cashflow	11845.910	11845.910	11845.910
Cumulated net cashflow	140051.200	151897.100	163743.000

COMFAR 2.1 - TOYOBO ENGINEERING CO., LTD, JAPAN

Net Income Statement in thousand US dollar

Year	1996	1997	1998	1999	2000
Total sales, incl. sales tax	29672.090	52909.800	53725.050	53725.050	53725.050
Less: variable costs, incl. sales tax.	21192.330	32244.780	32095.000	32095.000	32095.000
Variable margin	8479.762	20665.020	21630.050	21630.050	21630.050
As % of total sales	28.578	39.057	40.261	40.261	40.261
Non-variable costs, incl. depreciation	6842.774	8553.316	8679.182	8679.184	8679.186
Operational margin	1635.987	12111.700	12950.870	12950.870	12950.870
As % of total sales	5.517	22.891	24.106	24.106	24.106
Cost of finance	5725.880	5610.392	5494.904	4922.316	4349.728
Gross profit	-4088.893	6501.309	7455.965	8028.551	8601.137
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	-4088.893	6501.309	7455.965	8028.551	8601.137
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	-4088.893	6501.309	7455.965	8028.551	8601.137
Dividends paid	0.000	0.000	0.000	0.000	4648.300
Undistributed profit	-4088.893	6501.309	7455.965	8028.551	3952.836
Accumulated undistributed profit	-4088.893	2412.416	9868.381	17896.930	21849.770
Gross profit, % of total sales	-13.780	12.288	13.878	14.944	16.010
Net profit, % of total sales	-13.780	12.288	13.878	14.944	16.010
ROE, Net profit, % of equity	-17.593	27.973	32.081	34.544	37.008
ROI, Net profit+interest, % of invest.	2.123	15.517	16.587	16.587	16.587

ITM in Bangladesh --- 22 June 1993

Net Income Statement in thousand US dollar

Year	2001	2002	2003	2004	2005
Total sales, incl. sales tax	53725.050	53725.050	53725.050	53725.050	53725.050
Less: variable costs, incl. sales tax.	32095.000	32095.000	32095.000	32095.000	32095.000
Variable margin	21630.050	21630.050	21630.050	21630.050	21630.050
As % of total sales	40.261	40.261	40.261	40.261	40.261
Non-variable costs, incl. depreciation	8679.185	8679.186	8679.185	8679.183	8679.188
Operational margin	12950.870	12950.870	12950.870	12950.870	12950.860
As % of total sales	24.106	24.106	24.106	24.106	24.106
Cost of finance	3777.140	3204.552	2631.964	2059.376	1486.788
Gross profit	9173.727	9746.313	10318.900	10891.490	11464.070
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	9173.727	9746.313	10318.900	10891.490	11464.070
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	9173.727	9746.313	10318.900	10891.490	11464.070
Dividends paid	4648.300	4648.300	4648.300	4648.300	4648.300
Undistributed profit	4525.426	5098.012	5670.602	6243.192	6815.774
Accumulated undistributed profit	26375.190	31473.210	37143.810	43387.000	50202.770
Gross profit, % of total sales	17.075	18.141	19.207	20.273	21.338
Net profit, % of total sales	17.075	18.141	19.207	20.273	21.338
ROE, Net profit, % of equity	39.471	41.935	44.399	46.862	49.326
ROI, Net profit+interest, % of invest.	16.587	16.587	16.587	16.587	16.587

Net Income Statement in thousand US dollar

Year	2006	2007	2008	2009	2010
Total sales, incl. sales tax	53725.050	53725.050	53725.050	53725.050	53725.050
Less: variable costs, incl. sales tax.	32095.000	32095.000	32095.000	32095.000	32095.000
Variable margin	21630.050	21630.050	21630.050	21630.050	21630.050
As % of total sales	40.261	40.261	40.261	40.261	40.261
Non-variable costs, incl. depreciation	2695.948	2695.947	2695.949	2695.949	2695.949
Operational margin	18934.100	18934.100	18934.100	18934.100	18934.100
As % of total sales	35.243	35.243	35.243	35.243	35.243
Cost of finance	914.200	457.100	-0.000	0.000	0.000
Gross profit	18019.900	18477.000	18934.100	18934.100	18934.100
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	18019.900	18477.000	18934.100	18934.100	18934.100
Tax	7207.961	7390.801	7573.641	7573.641	7573.641
Net profit	10811.940	11086.200	11360.460	11360.460	11360.460
Dividends paid	4648.300	4648.300	4648.300	4648.300	4648.300
Undistributed profit	6163.641	6437.903	6712.161	6712.161	6712.161
Accumulated undistributed profit	56366.410	62804.320	69516.480	76228.640	82940.800
Gross profit, % of total sales	33.541	34.392	35.243	35.243	35.243
Net profit, % of total sales	20.125	20.635	21.146	21.146	21.146
ROE, Net profit, % of equity	46.520	47.700	48.880	48.880	48.880
ROI, Net profit+interest, % of invest.	15.019	14.784	14.550	14.550	14.550

Table 10-8

Projected Balance Sheets, construction in thousand US dollar

Year	1994	1995
Total assets	18130.700	78575.410
Fixed assets, net of depreciation	0.000	18130.700
Construction in progress	18130.700	54499.640
Current assets	0.000	5945.063
Cash, bank	0.000	0.000
Cash surplus, finance available .	0.000	0.000
Loss carried forward	0.000	0.000
Loss	0.000	0.000
Total liabilities	18130.700	78575.410
Equity capital	14215.700	23241.410
Reserves, retained profit	0.000	0.000
Profit	0.000	0.000
Long and medium term debt	3915.000	55334.000
Current liabilities	0.000	0.000
Bank overdraft, finance required.	0.000	0.000
Total debt	3915.000	55334.000
Equity, % of liabilities	78.407	29.578

ITM in Bangladesh --- 22 June 1993

Projected Balance Sheets, Production in thousand US dollar

Year	1996	1997	1998	1999	2000
Total assets	79672.050	85900.990	83746.680	86241.820	89309.550
Fixed assets, net of depreciation	66161.660	59692.970	53224.290	46755.610	40286.920
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	9303.334	11362.130	11395.150	11395.150	11395.150
Cash, bank	118.163	110.333	111.417	111.417	111.417
Cash surplus, finance available	0.000	10646.660	19015.820	27979.640	37516.060
Loss carried forward	0.000	4088.893	0.000	0.000	0.000
Loss	4088.893	0.000	0.000	0.000	0.000
Total liabilities	79672.050	85900.990	83746.680	86241.820	89309.550
Equity capital	23241.410	23241.410	23241.410	23241.410	23241.410
Reserves, retained profit	0.000	0.000	2412.416	9868.381	17896.930
Profit	0.000	6501.309	7455.965	8028.551	8601.137
Long and medium term debt	54371.600	53409.200	47875.800	42342.400	36809.000
Current liabilities	1632.493	2749.076	2761.083	2761.083	2761.083
Bank overdraft, finance required.	426.547	0.000	0.000	0.000	0.000
Total debt	56430.640	56158.270	50636.880	45103.480	39570.080
Equity, % of liabilities	29.171	27.056	27.752	26.949	26.023

Projected Balance Sheets, Production in thousand US dollar

Year	2001	2002	2003	2004	2005
Total assets	88301.590	87866.200	88003.400	88713.190	89995.560
Fixed assets, net of depreciation	33818.240	27349.550	20880.870	14412.190	7943.500
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	11395.150	11395.150	11395.150	11395.150	11395.150
Cash, bank	111.417	111.417	111.417	111.417	111.417
Cash surplus, finance available	42976.780	49010.070	55615.960	62794.430	70545.500
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	88301.590	87866.200	88003.400	88713.190	89995.570
Equity capital	23241.410	23241.410	23241.410	23241.410	23241.410
Reserves, retained profit	21849.770	26375.190	31473.210	37143.610	43397.000
Profit	9173.727	9746.313	10318.900	10891.490	11464.070
Long and medium term debt	31275.600	25742.200	20208.800	14675.400	9142.000
Current liabilities	2761.083	2761.083	2761.083	2761.083	2761.083
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	34036.680	28503.280	22969.880	17436.480	11903.080
Equity, % of liabilities	26.320	26.451	26.410	26.198	25.825

Projected Balance Sheets, Production in thousand US dollar

Year	2006	2007	2008	2009	2010
Total assets	91588.210	93455.110	100167.300	106879.400	113591.600
Fixed assets, net of depreciation	7458.049	6972.599	6487.149	6001.699	5516.250
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	11395.150	11395.150	11395.150	11395.150	11395.150
Cash, bank	111.417	111.417	111.417	111.417	111.417
Cash surplus, finance available	72623.590	74975.950	82173.550	89371.170	96568.780
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	91588.210	93455.110	100167.300	106879.400	113591.600
Equity capital	23241.410	23241.410	23241.410	23241.410	23241.410
Reserves, retained profit	50202.770	56366.410	62804.320	69516.480	76228.650
Profit	10811.940	11086.200	11360.460	11360.460	11360.460
Long and medium term debt	4571.000	-0.000	-0.000	-0.000	-0.000
Current liabilities	2761.083	2761.083	2761.083	2761.083	2761.083
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	7332.083	2761.083	2761.083	2761.083	2761.083
Equity, % of liabilities	25.376	24.869	23.203	21.745	20.460

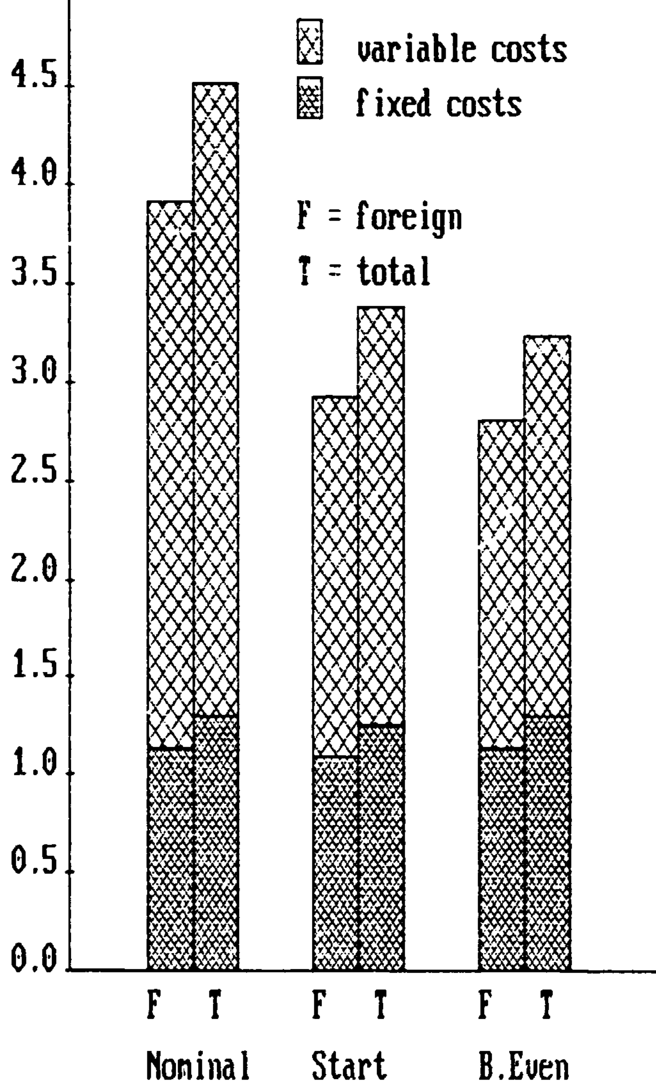
ITM in Bangladesh --- 22 June 1993

Figure 10-1

Structure of Production Costs

10^4 thousand US dollar

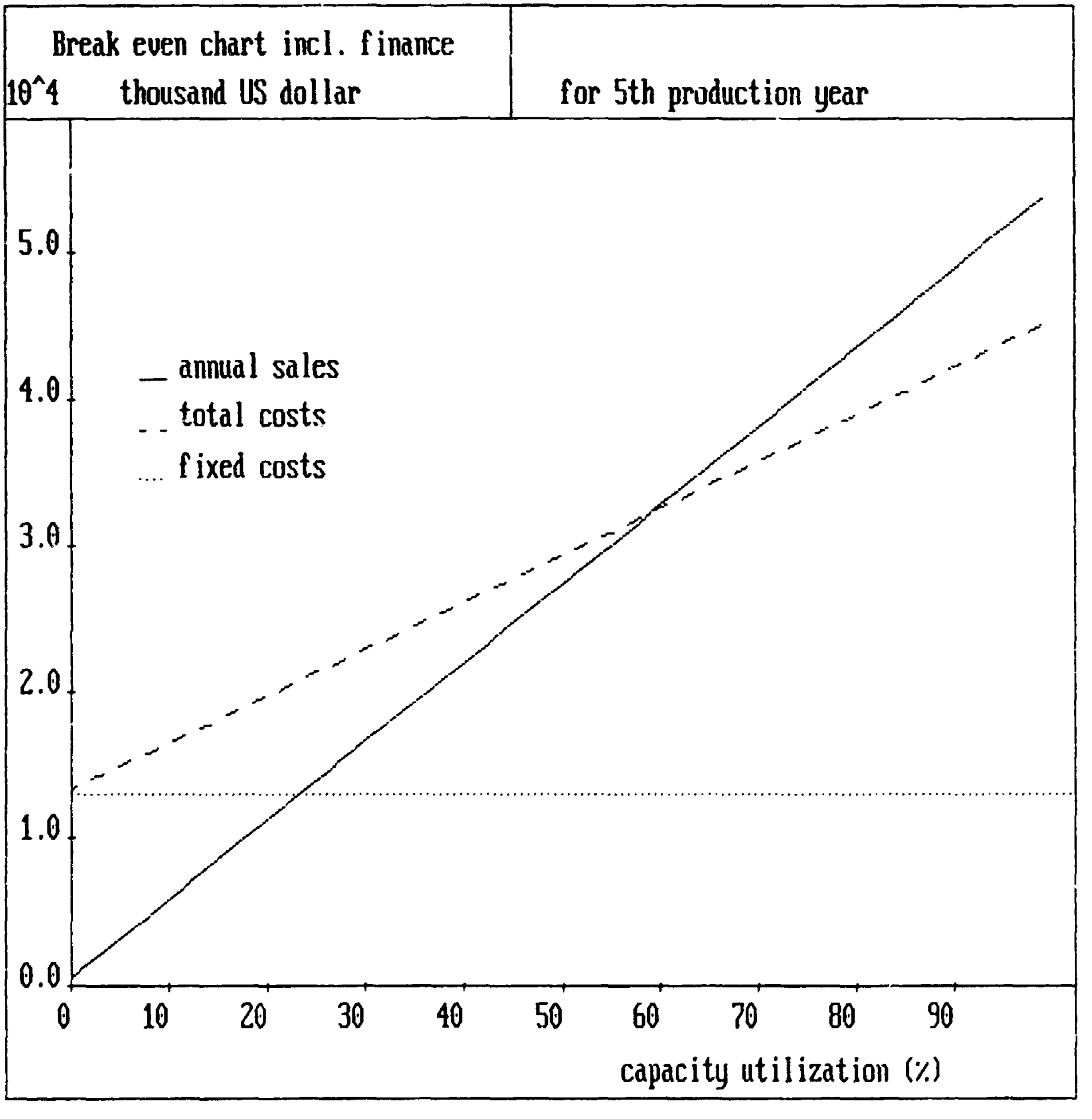
for 5th production year



Nominal	Start up	
55.41	44.97	raw material
7.61	5.39	other RM
0.35	0.30	utilities
6.45	4.45	energy
1.31	1.15	labour
0.52	0.52	maintenance
1.66	1.08	spares
2.72	6.02	overheads
14.34	19.16	depreciation
9.64	16.96	interest
100.00	100.00	Total Prod C.

production level

Figure 10-2


Break even chart incl. finance
10^4 thousand US dollar
for 5th production year
5.0
4.0
3.0
2.0
1.0
0.0
annual sales
total costs
fixed costs
0
10
20
30
40
50
60
70
80
90
capacity utilization (%)

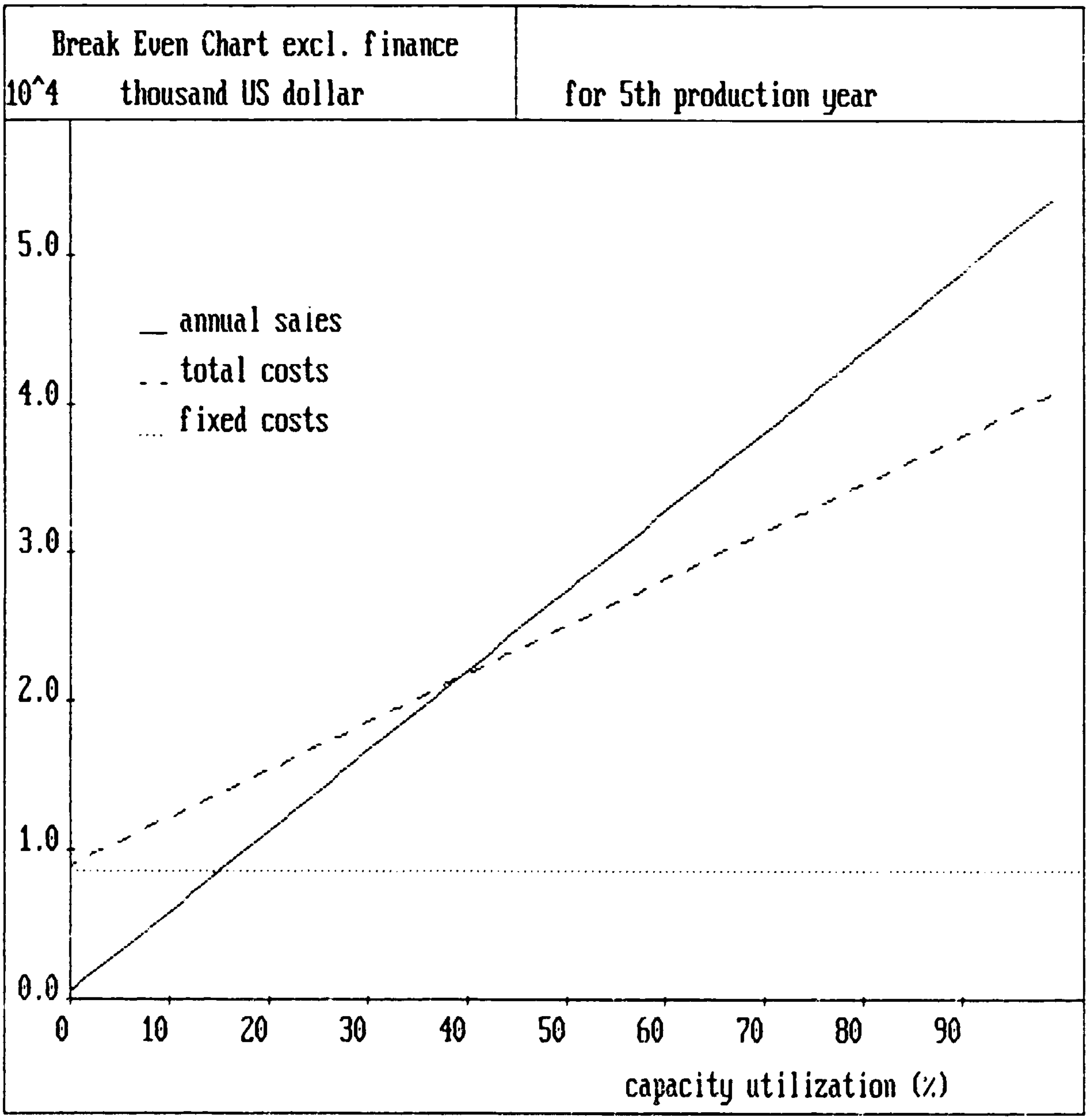

Break Even Chart excl. finance
10^4 thousand US dollar
for 5th production year
5.0
4.0
3.0
2.0
1.0
0.0
annual saies
total costs
fixed costs
0
10
20
30
40
50
60
70
80
90
capacity utilization (%)

Figure 10-3

--- COMFAR 2.1 - TOYOBO ENGINEERING CO., LTD, JAPAN -----

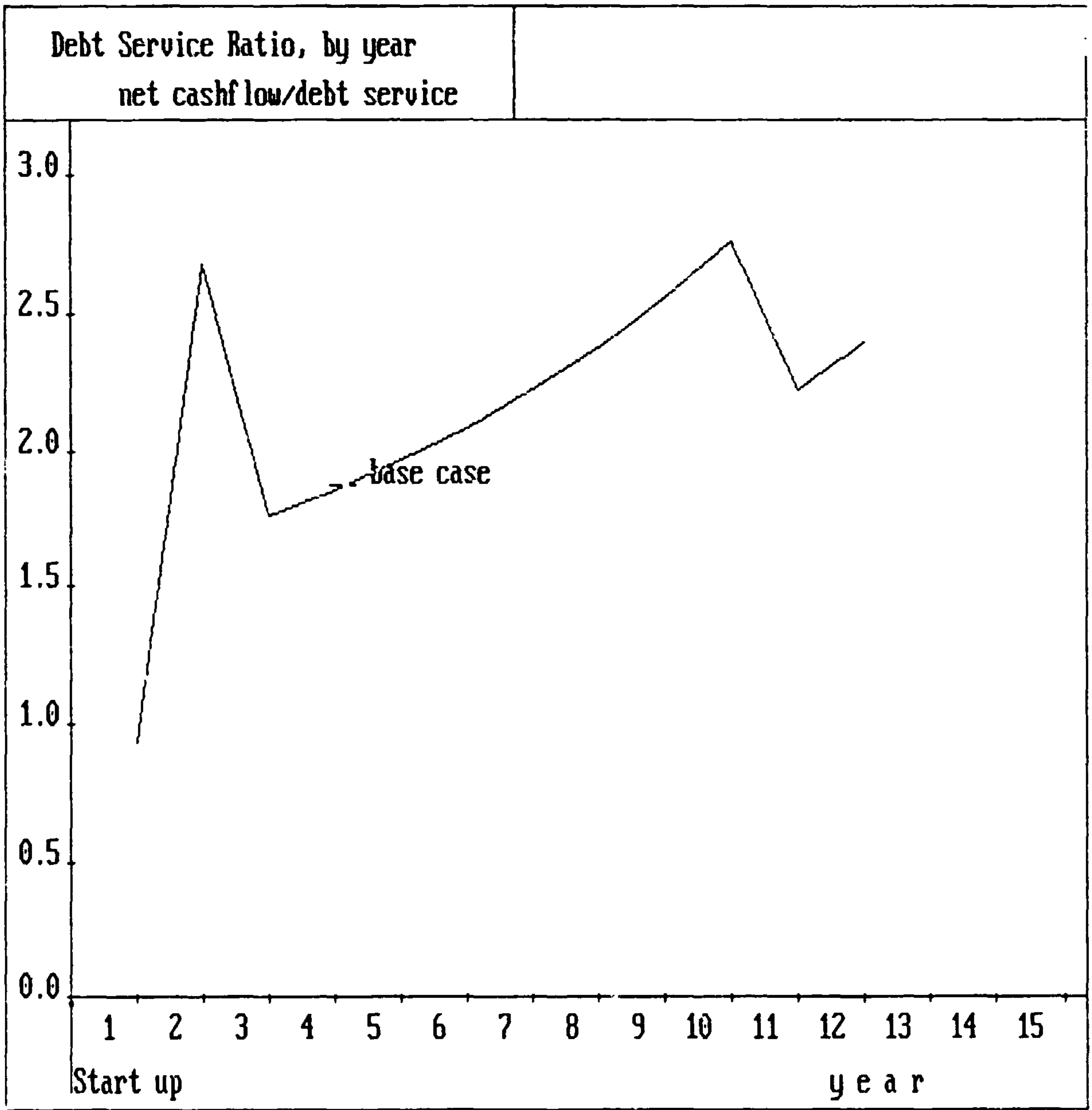


Figure 10-4

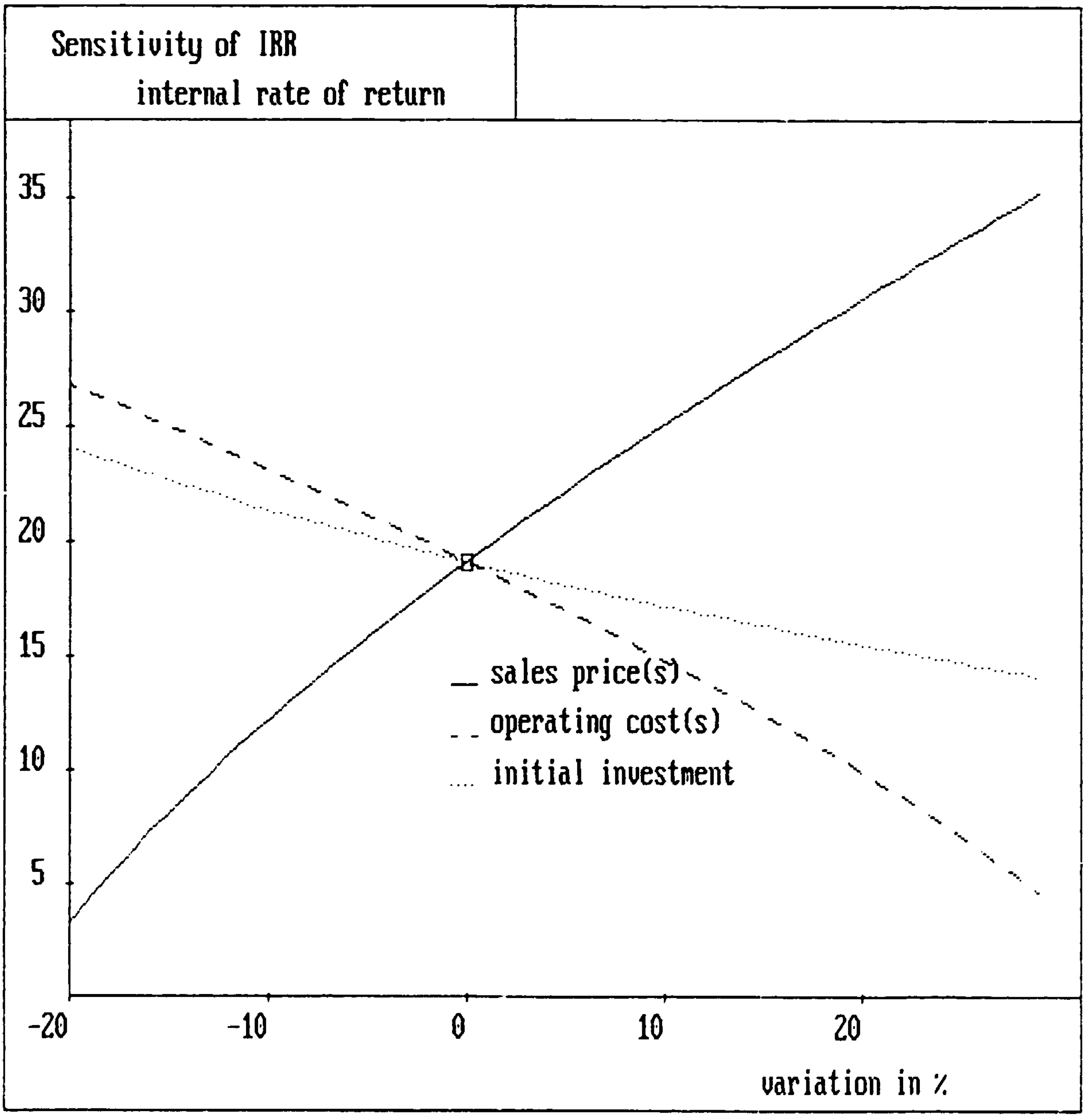

Sensitivity of IRR
internal rate of return
35
30
25
20
15
10
5
-20
-10
0
10
20
variation in %
sales price(s)
operating cost(s)
initial investment

Table 10-9

VALUES chart description [STANDARD]

Sensitivity of IRR
internal rate of return

	sales price	operating c	initial inv	
-20.0	3.28	26.87	24.13	19.15
-19.0	4.33	26.51	23.84	
-18.0	5.34	26.14	23.55	
-17.0	6.31	25.78	23.27	
-16.0	7.23	25.41	22.99	
-15.0	8.13	25.03	22.72	
-14.0	9.00	24.66	22.45	
-13.0	9.83	24.28	22.19	
-12.0	10.65	23.90	21.93	
-11.0	11.44	23.52	21.68	
-10.0	12.22	23.14	21.43	
-9.0	12.97	22.75	21.18	
-8.0	13.71	22.36	20.94	
-7.0	14.43	21.97	20.71	
-6.0	15.14	21.58	20.47	
-4.0	16.52	20.78	20.02	
-3.0	17.20	20.38	19.80	
-2.0	17.86	19.97	19.58	
-1.0	18.51	19.57	19.36	
0.0	19.15	19.15	19.15	
1.0	19.79	18.74	18.94	
2.0	20.41	18.32	18.74	
3.0	21.03	17.89	18.54	
4.0	21.64	17.47	18.34	
5.0	22.24	17.03	18.14	
6.0	22.84	16.60	17.95	
7.0	23.43	16.16	17.76	
8.0	24.01	15.71	17.57	
9.0	24.59	15.26	17.39	
10.0	25.16	14.81	17.20	
12.0	26.29	13.88	16.85	
13.0	26.85	13.41	16.67	
14.0	27.40	12.93	16.50	
15.0	27.95	12.44	16.33	
16.0	28.49	11.95	16.16	
17.0	29.03	11.45	16.00	
18.0	29.57	10.94	15.83	
19.0	30.10	10.43	15.67	
20.0	30.63	9.90	15.51	
21.0	31.15	9.37	15.35	
22.0	31.67	8.82	15.20	
23.0	32.19	8.27	15.04	
24.0	32.70	7.70	14.89	
25.0	33.22	7.12	14.74	
26.0	33.72	6.53	14.59	
28.0	34.73	5.30	14.30	
29.0	35.23	4.66	14.16	

-- variation in %

APPENDIX 1

A BRIEF STUDY ON CASE 3 : SPINNING MILL

Contents

1. GENERAL AND BASIC CONDITIONS
   - 1.1 General
   - 1.2 Basic Conditions
2. THE PROJECT : SPINNING PLAN
   - 2.1 Consumption of Raw Materials
   - 2.2 Production Plan
   - 2.3 Process Flow Chart
   - 2.4 List and Basic Specifications of Main Production Machinery
   - 2.5 Layout of Production Machinery
3. THE PROJECT : CIVIL, MECHANICAL AND ELECTRICAL WORKS
   - 3.1 Civil Works
   - 3.2 Mechanical Equipment and Works
   - 3.3 Electrical Equipment and Works
4. IMPLEMENTATION SCHEDULE AND MILL ORGANIZATION
5. INVESTMENT COST
6. FINANCIAL PLAN AND EVALUATION
   - 6.1 Fundamental Conditions for Calculation
   - 6.2 Sales Revenue
   - 6.3 Production Cost
   - 6.4 Financial Evaluation

1. GENERAL AND BASIC CONDITIONS

1.1 General

In Bangladesh, there are approx. 1,400,000 spindles installed, of which 50 % are owned by the private sector and the remaining 50 % by the public sector (i.e. Bangladesh Textiles Mills Corporation: BTMC). However, due to obsolete machinery and a lack of spare parts, only 85 % of this machinery is considered under operation now, producing roughly 75,000 tons of yarn annually. Along with the increase in population, yarn demand in Bangladesh in recent years has been growing, and there was a shortage of as much as 40,000 tons of yarn last year. This fact was substantiated by the study team during their field survey which took place at the end of November 1992. Consequently, regardless of the quality level of the yarn and poor productivity, all spinning mills in Bangladesh are operating at full capacity.

On the other hand, current yarn prices on the international market are unfavorable for the spinners as a result of worldwide over-production.

Although the project on the drawing board is based on a composite textile mill, aiming at producing high quality fabrics to meet the requirement of the RMG industry, it is considered worthwhile to check on the feasibility of the spinning mill only, taking into account the phase-wise implementation of the project. This is also in line with the agreement reached during the meeting of prospective sponsors held in early September 1992.

This case study is hereafter called "CASE 3."

1.2 Basic Conditions

In order to proceed with the feasibility study for the above-mentioned Case 3, basic conditions have been set out in advance as follows:

1) The Project

The principles of the project are the same as those in Case 1 and Case 2, based on the joint-venture, to be designed by Japanese consultants and managed by Japanese experts.

Although A.K. Khan's land has been assumed as the project site, incentives applied are the same as those available in the EPZ.

2) The Site

The site for this spinning project has been coined the "STM" site, south of existing "Chittagong Spinning Mill" and "Jute Mill," both owned by the A.K. Khan Group. The total land required for the site area is estimated to be 41,000 m^2. One third of the area shall be reclaimed with suitable soil (averaging 1.0 m in depth), and existing buildings are to be demolished. A block plan of the mill can be seen in Figure A-1.

3) Production Capacity and Product-mix

Cotton carded yarn (Ne 30/Ne 40) and cotton combed yarn (Ne 80/Ne 100) are being considered for production with the same number of spindles, totaling 24,960. This product-mix was decided in consideration of the following:

- Ne 30 and Ne 40 are conventional types of yarn and are widely utilized in the weaving industry in Bangladesh, so no marketing problem in the domestic market is anticipated.
- Ne 80 and Ne 100 are a finer count of yarn to be utilized for high quality national dresses and shirtings, presently imported from India and other ASEAN countries. High quality and finer yarns are also expected to be exported to specialized areas of the international market.

4) Operating Conditions

The same idea applied in Case 1 and Case 2 is to be employed :

- 3 shifts with 4 groups
- 8 hours per shift
- 350 days per year

5) Water Supply

Two deep wells will be dug and a water supply of 15 m^3/hour per well is estimated.

6) Power Supply

A natural gas generator is to be used for production and power from the BPDB and will be utilized only for administration and emergency purposes.

7) Environmental Impact Assessment

Since the spinning mill has no harmful emissions, environmental assessment is deemed unnecessary.

2. THE PROJECT : SPINNING PLAN

2.1 Consumption of Raw Materials

All necessary raw cotton shall be imported, and its consumption schedule is shown in Table A-1.

Table A-1 : CONSUMPTION OF RAW COTTON

YARN COUNT	TYPE OF FIBER	STAPLE LENGTH	MICRONAIR	DEMAND	
				Kg(lbs)/h	Kg(lbs)/year
30s 40s	US. GRADE "SM" and/or Equivalents	1-3/32" ~ 1-1/8"	4.3 ~4.8	186.7 (411.7)	1,568,280 (3,457,430)
80s 100s	EGYPT. G70 and/or Equivalents	1-7/16"	3.8 ~4.3	61.6 (135.9)	517,440 (1,140,748)

- At Blow Room Line : 3.5 % for all counts
- At Carding : 3.5 % for Ne 30/N 40 and 4.0% at for Ne 80/100
- At Combing : 17 % for Ne 80/100
- At Winder : 0.5 % for all counts

2.2 Production Plan

Production plan at full capcity is shown in Table A-2. The first year is considered to be 80 % of the full production.

Table A-2 : PRODUCTION PLAN

Yarn Kind	Count	Production		
		per 1-hour	per 1-day(24hrs.)	per 1-year(8400hrs.)
COTTON CARDED	Ne 30s	101.7 Kg (224.3 lbs)	2,440 Kg (5,379 lbs)	854,280 Kg (1,883,345 lbs)
	Ne 40s	71.7 Kg (158.0 lbs)	1,720 Kg (3,792 lbs)	602,280 Kg (1,327,786 lbs)
COTTON COMBED	Ne 80s	27.2 Kg (60.1 lbs)	652 Kg (1,437 lbs)	228,480 Kg (503,707 lbs)
	Ne100s	19.5 Kg (43.0 lbs)	468 Kg (1,032 lbs)	163,800 Kg (361,113 lbs)
			(5,280 Kg) (11,640 lbs) (29.1 Bales)	(1,848,840 Kg) (4,075,953 lbs) (10,189 Bales)

2.3 Process Flow Chart

The process flow chart can be seen in Figure A-2.

2.4 Basic Specifications of Spinning Machinery

A list and basic specifications can be seen in Table A-3.

2.5 Layout of Spinning Machinery

Figure A-3 shows a layout plan of the spinning machinery.

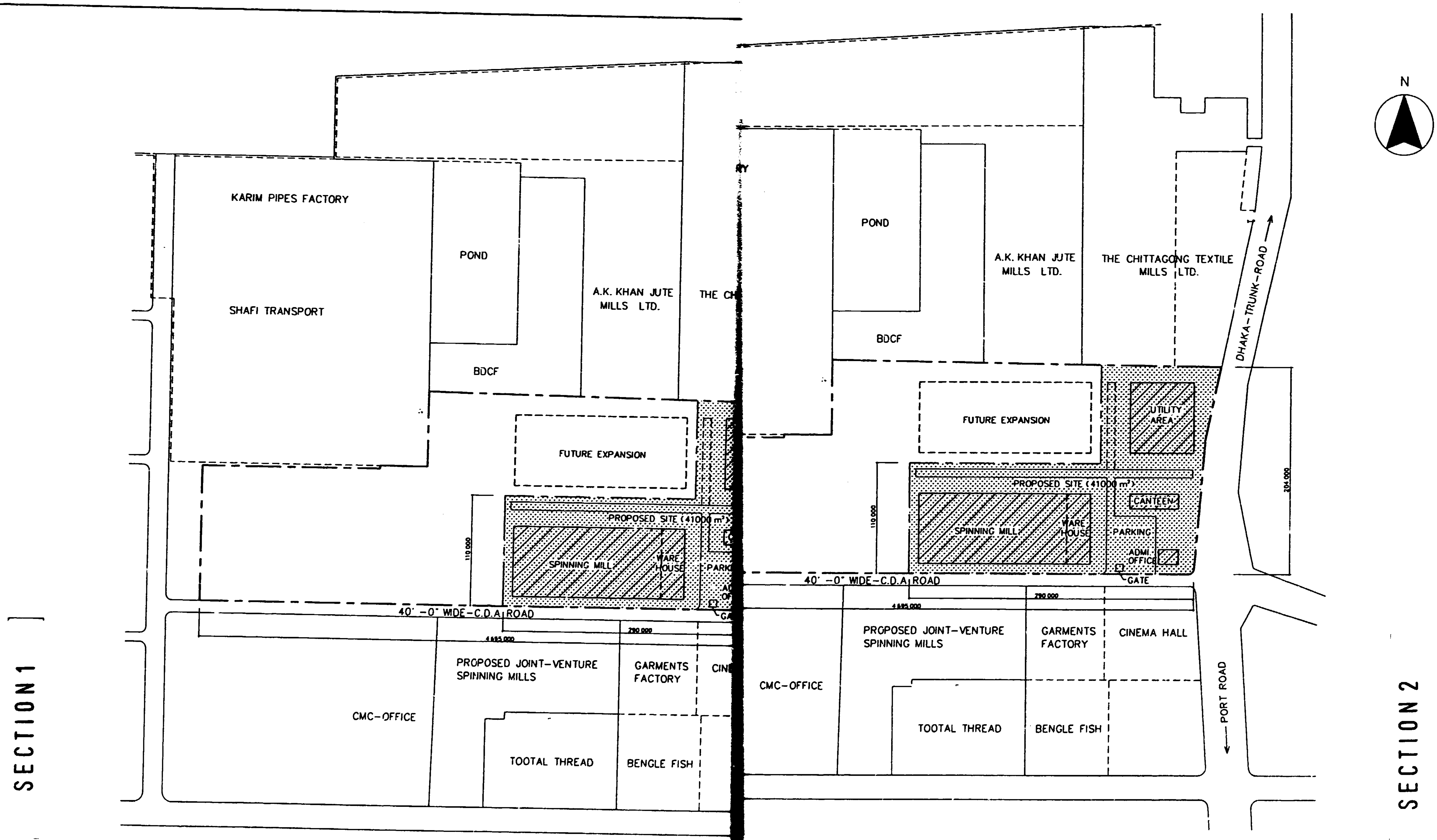


Figure A-1 : BLOCK PLAN (CASE 3) AT A.K. KHAN SITE FOR PROPOSED SPINNING MILL IN BANGLADESH

Main Machinery		No. of Machines	Chart			
			Cotton 30 · 40		Cotton 80 · 100	
S-1	Blow Room Machinery	2	1		1	
S-2	Carding Machine	21	13		8	
S-3	Pre-drawing Frame	1			1	
S-4	Lap Former	1			1	
S-5	Comber	4			4	
S-6	1st-Drawing Frame	3	2		1	
S-7	2nd-Drawing Frame	3	2		1	
S-8	Simplex Fly Frame	120 SP x 7	4		3	
S-9	Ring Spinning Frame	480 SP x 52	13	13	13	13
S-10	Automatic Winder	60 D x 7	2	2	1.5	1.5
Production LBS/hour			Carded Yarn		Combed Yarn	
			Ne 30	Ne 40	Ne 80	Ne 100
			(224.3)	(158.0)	(60.1)	(43.0)

Figure A-2 : PROCESS FLOW CHART

Table A-3 : LIST OF MAIN PRODUCTION MACHINERY

ITEM No.	Machine / Equipment	Quantity
S-1	Blow room machinery ··	2 Lines
	1) Specification	2 Scutchers
	Lap forming system	
	Individual waste collecting system	
	Exhaust air and microdust --- To air-condition room	
	2) Machine arrangement	
	Super bale opener with 7000mm feeding lattice	
	Double magnet	
	Double roller cleaner (with by-pass)	
	Fan condenser	
	Feeding unit	
	Step cleaner	
	D-type opener	
	Fan condenser	
	Pneumatic feeder	
	Scutcher	
	Lap rod inserter	
	Lap scale	
S-2	Carding machine ··	21 Frames
	Lap feed system	
	Working width : 1016 mm	
	Number of flat bars : 106	
	Roller doffing system	
	Control roller for pre-opening	
	Doffer speed changer	
	Group dust collecting system/flat waste and dust waste	
	Waste conveyor under machine	
	Size of delivery can : 915mm dia. x 1067mm H	
S-3	Pre-drawing frame ··	1 Frame
	With automatic can changer	
	2 deliveries per frame	
	8 slivers doubling per delivery	
	3 line rollers and pressure bar drafting system with turning roller	
	Main gearing in oil bath with oil pump	

Air blow cleaning device for bottom rollers and pressure bar
Size of feed can : 914mm dia. x 1067mm H
Size of delivery can : 508mm dia. x 1067mm H

S-4 Lap former ·· 1 Frame
3 heads 1 delivery per frame, and 16 feed cans per head
Produced lap : 267mm width x 600mm dia.
Automatic lap changing device
Size of feed can : 508mm dia.x 1067mm H

S-5 Comber ·· 4 Frames
8 heads 1 delivery per frame
Size of feed lap : 267mm width x 600mm dia.(Max.)
Automatic can changer
Nips per minute : Max.360 (mechanical)
Centralized waste collecting device
Head stock gearing in oil bath with pump
Size of delivery can : 508mm dia.x 1067mm H

S-6/S-7 Drawing frame ·· 3 sets
With automatic can changer 6 Frames
2 deliveries per frame
2 passages per set
8 slivers doubling per delivery
3 line rollers and pressure bar drafting system with turning roller
Main gearing in oil bath with oil pump
Air blow cleaning device for bottom rollers and pressure bar
Size of feed can : 508mm dia. x 1067mm H
Size of delivery can : 508mm dia. x 1067mm H

S-8 Simplex fly frame ·· 7 Frames
120 spindles per frame, 520mm staff, 406mm lift
Full bobbin dia. : 150mm (max.)
4 lines double apron drafting by SKF PK 1500 weighting arm
Light alloy metal flyer (slitless)
Size of feed can : 508mm dia. x 1067mm H

S-9 Ring spinning frame ·· 52 Frames

480 spindles per frame, 75mm spindle gauge, and 178mm lift

3 lines double apron drafting by SKF PK 225

N-type single flanged ring 41mm, 38mm inside dia.

Spindle with SKF HF-21 roller bearing insert

Automatic speed regulating device by 2-step pulley

Automatic ring rail down & stop by auto counter

Roller stand provided with pneumatic suction pipe

Travelling cleaner

S-10 Automatic winder ·· 7 Frames

60 drums per frame

Individual knotter, air splicer

To wind from ring bobbins onto 152mm (6") traverse 5°57′ cones

Yarn length control device

Electric slub catcher

Travelling cleaner

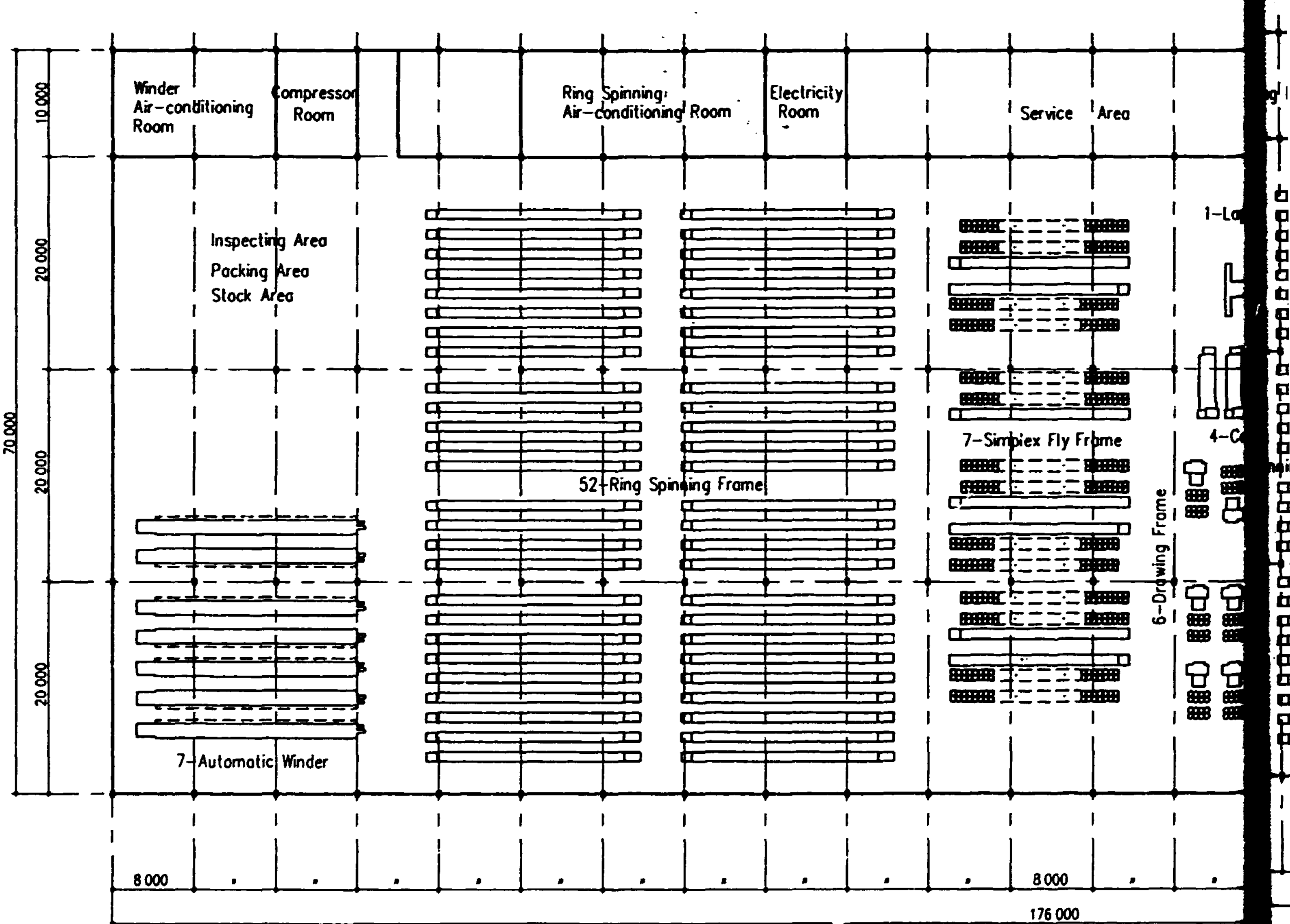
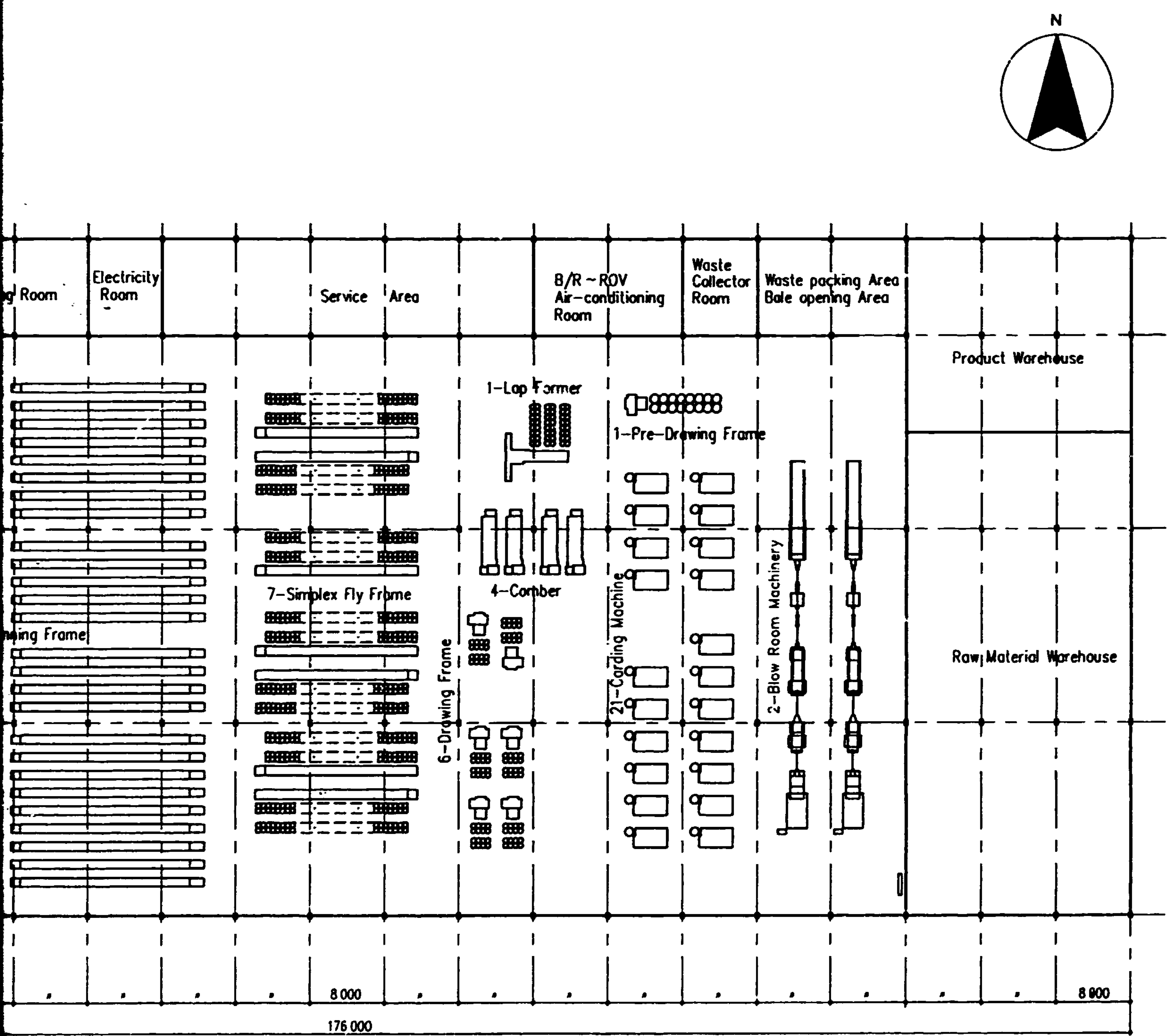


Figure A-3 : LAYOUT OF PRODUCTION MACHINERY: SPINNING MI

SECTION 1



YOUT OF PRODUCTION MACHINERY : SPINNING MILL (Case-3) -1

SECTION 2

3. THE PROJECT : CIVIL, MECHANICAL AND ELECTRICAL WORKS

3.1 Civil Works

1) Site Area : 41,000 m^2

2) Building Area : 13,570 m^2
   - Factory Building : 10,640 m^2
   - Warehouse : 1,680 m^2
   - Utility Warehouse : 200 m^2
   - Admin. Office and Canteen : 1,050 m^2

3) Site Preparation
   - Demolishing of existing structures
   - Reclamation of the land will average 1.0 m in depth in an area of 15,000 m^2.

4) External Works
   - Road work
   - Fencing
   - Underground water tanks, etc.

5) Specifications of Civil Works
   As per Chapter 6 of this report

3.2 Mechanical Works

1) Air Conditioning Equipment
   Design and specifications for air conditioning systems and equipment are basically as per Chapter 6 of this report, summarized below:
   - Central air conditioning system
   - Underground ducts for return air
   - Turbo type chiller
   - Inside temperature and humidity to be maintained shall be the same as the figures described in Chapter 6.

2) Water supply
   a) Water Consumption
      - For air conditioning ....500 m^3/day
      - For potable water ....25 m^3/day

b) Source of Water

- For air conditioning ....deep well (150 mm dia. and 150 m deep)
- For potable water ....from city water

3) Compressed Air and Fire Fighting Equipment

Basic idea is as per Case 1 and Case 2.

3.3 Electrical Equipment

1) Power Generation

a) Power Consumption

- Installed capacity 3,124 KW or 4,396 KVA
- Max. consumption 2,191 KW

b) Generator

- Natural gas generator, producing 415V, 50 Hz and 3 Ph-4W Gas consuption to be 452,000 m^3/month

2) LT Wiring, Lighting, Lightning Equipment, etc.

As per Case 1 and Case 2

4. IMPLEMENTATION SCHEDULE AND MILL ORGANIZATION

4.1 Implementation Schedule

A tentative implementation schedule (see Figure A-4) was prepared on the basis of the following assumptions :

- Civil works shall be awarded to those contractors who are competent in general and who have enough experience in similar types of construction work.
- No abnormal weather which will adversely affect the execution of civil works is expected in the course of project implementation.
- Required construction materials (local or imported) will be delivered on time.

4.2 Mill Organization

The proposed mill organization is shown in Figure A-5.

10 January 1993

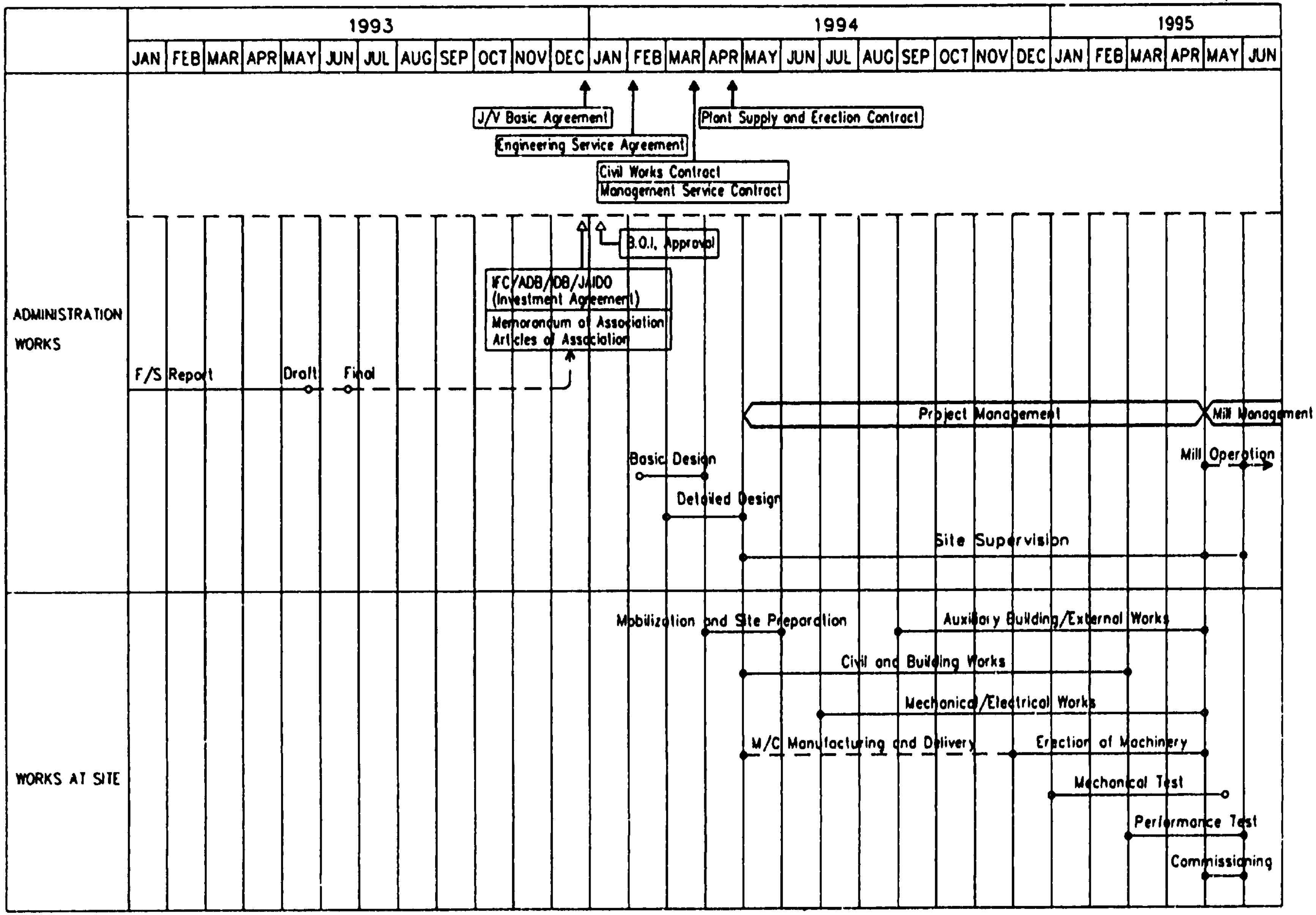
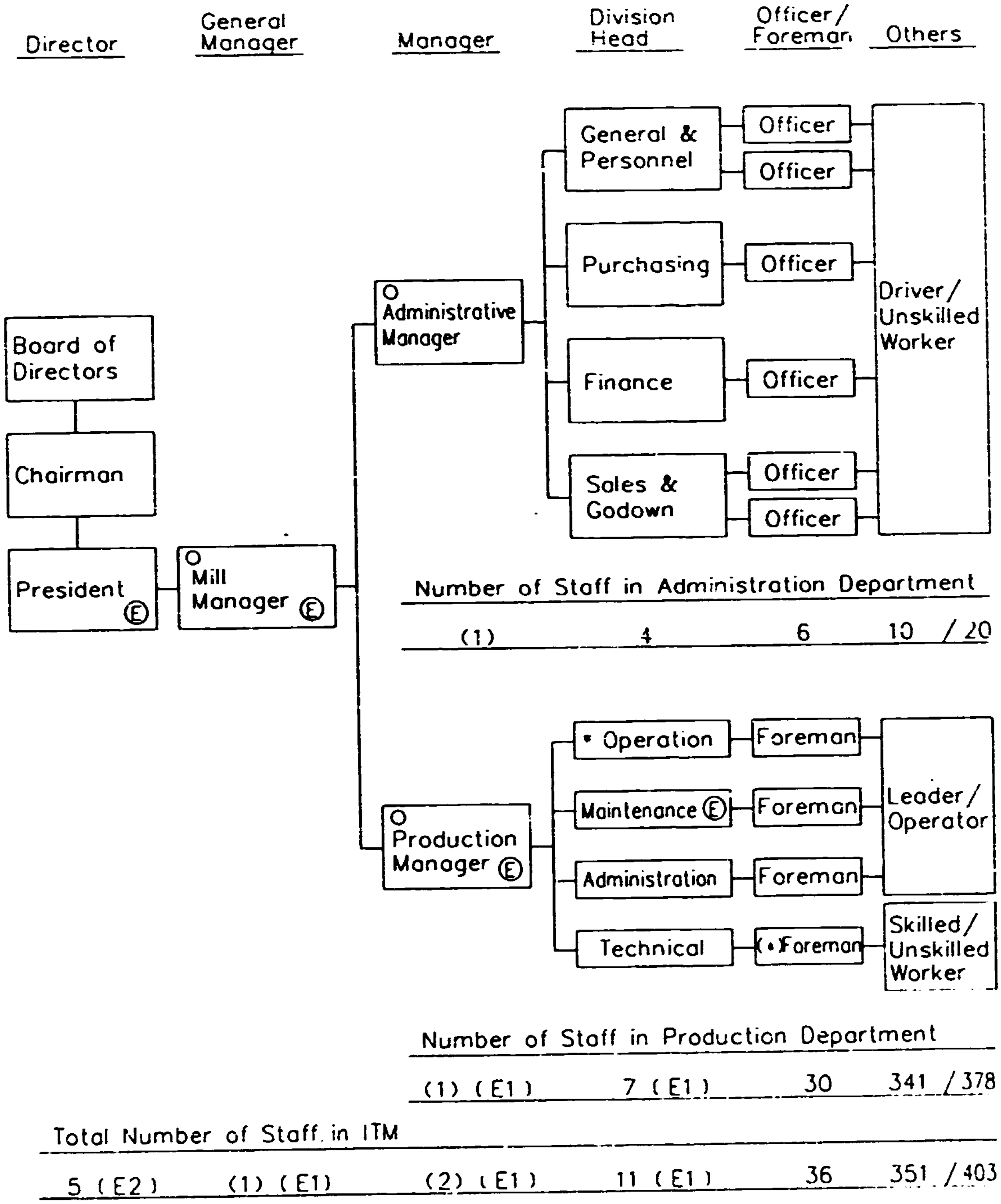


Figure A-4 : TENTATIVE IMPLEMENTATION SCHEDULE : SPINNING MILL PROJECT IN BANGLADESH



E : Expatriate
• : 3 Shifts
(•) : Partially 3 Shifts
O : Director (Production) holds an additional post of Mill Manager
Director (General) holds an additional post of Administrative Manager
Mill Manager holds an additional post of Production Manager

Figure A-5 : MILL ORGANIZATION AND NUMBER OF STAFF

5. INVESTMENT COST

The investment cost is tabulated in Table A-4.

Table A-4 Investment Cost

Unit: US $ x 1000

Items	Local	Foreign	Total
1. Spinning Machinery			
- Main Machinery	-	11,735	11,735
- Aux. Lab. Equipment	-	1,877	1,877
Sub-total		13,612	13,612
2. Civil Works			
2.1 Land (41,000 m²)	1,267	-	1,267
2.2 Site Preparation			
1) Demolition and disposal	80	-	80
2) Reclamation and compaction	27	-	27
2.3 Buildings			
1) Spinning Mill	2,558	634	3,192
2) Warehouse/Utility	352	88	440
3) Admi. Buildings	294	74	368
4) External Works	328	-	328
Sub-total	4,906	796	5,702
3. Mechanical and Electrical Works			
1) Mechanical Equip./Works	270	2,331	2,601
2) Electrical Equip./Works	273	2,614	2,887
Sub-total	543	4,945	5,488
4. Pre-operational Expenses			
1) Port Clearance	40	-	40
2) Inland Transportation	80	-	80
3) F/S and Engineering Fee	205	945	1,150
4) Erection of Machinery	270	-	270
5) Personnel Expenses	100	18	118
6) Vehicles/Office Equipment	15	240	255

	Local	Foreign	Total
7) Test-run and commissioning	120	-	120
8) Miscellaneous Costs	100	-	100
Sub-total	930	1,203	2,133
PROJECT BASE COST	6,379	20,556	26,935
6. Interest During Construction	0	0	909
7. Working Capital 5 months for raw materials and 1 month for accounts receivable. (1st Year = 1,092 and 2nd Year = 225)		Total	1,317
TOTAL INVESTMENT COST			29,161

6. FINANCIAL PLAN AND EVALUATION

6.1 Fundamental Conditions for Calculation

1) Exchange Rate
U.S.$ 1 = Tk. 40.- = ¥ 125

2) Fund Raising Plan
- Loan ----- 80% of the Project Base Cost
- Equity --- 20% of the above as well as Interest during construction and necessary working capital (= 30% of Investment)

3) Loan Conditions
- Local Portion

a) Interest : 16 % per annum
b) Amortization : 10 years without a grace period
c) Repayment : annual installments

- Foreign Portion

a) Interest : 6 % per annum
b) Amortization : 10 years with a grace of 2 years
c) Repayment : annual installment

4) Capacity Utilization

80 % for the first year and 100 % for the 2nd year onward

5) Depreciation

Straight line method is employed.

- Land --------------------------------not depreciated
- Building ---------------------------- 20 years
- Machinery, equipment, etc.------10 years

6) VAT

No consideration on VAT is taking into account.

6.2 Sales Revenue

1) 1st Year		: 80 % of the 2nd year		
2) 2nd Year onward		:		
a) Ne 30 Carded Yarn	:	1,883,000 lbs	@US$1.44	
b) Ne 40 Carded Yarn	:	1,328,000 lbs	@US$1.56	
c) Ne 80 Combed Yarn	:	504,000 lbs	@US$4.80	
d) Ne 100 Combed Yarn	:	361,000 lbs	@US$7.20	
Total		4,076,000 lbs	@US$2.30	$ 9,374,800.-
e) Sales of waste		160,000 kg	@US$0.40	$ 64,000.-
Total				$ 9,438,800.-

The unit price $2.30/lb is a weighted average value.

6.3 Production Cost

1) Cost of Raw Materials

- 1st Year : 80 % of the 2nd year
- 2nd year onward :

(a) Raw cotton for Ne 30 and Ne 40

3,457,430 x $ 0.60 = $ 2,129,000.-

(b) Raw cotton for Ne 80 and Ne 100

1,140,748 x $ 0.80 = $ 913,000.-

Total = $ 3,042,000.-

2) Cost of Packing Materials

- 1st Year : 80 % of the 2nd year
- 2nd Year onward :

  Cost of packing materials per bale= Tk 620

  10,189 x 620 /40 = $ 157,000.-

3) Cost of Power and Utility

- 1st Year : 80 % of the 2nd year
- 2nd Year onward :

  Cost for BPDB --------- $ 15,000.-

  Cost for Gas ------------ $ 446,000.-

  Cost of Water ---------- $ 1,000.-

  Cost of Maintenance -- $ 60,000.- Total = $ 522,000.-

4) Cost of Maintenance

- 1st Year : 50 % of 3rd year(CIF)
- 2nd Year : 70 % of 2nd year(CIF)
- 3rd Year onward :

  $ 7/spindle/month ; i.e. 25,000 x 7 x 12 = $ 210,000.-

5) Management Expenses

- 1st Year : 3 expatriates for mill management

  $ 15,000 x 12 x 3 = $ 540,000.-
- 2nd Year onward : 2 expatriates = $ 360,000.-

6) Labour Expenses

- 1st Year : 80 % of the 2nd year
- 2nd Year onward :

  Directors : 5 x $ 600/M, Head 11 x $ 300/M

  Foremen : 36 x 150/M Worker 351 x 60/M = $ 392,000.-

7) Overhead Costs (Sales Expenses, etc.)

- 1st Year : 80 % of 2nd year
- 2nd Year : 1 % of the sales revenue, i.e.

  9,865,000 x 0.01 = $ 987,000.-

8) Summary of Production Costs (Unit: $ x1000)

	1st Year	2nd Year	3rd Year
- Cost of Raw Materials	2,434	3,042	3,042
- Cost of Packing Materials	126	157	157
- Cost of Power/Utilities	418	522	522
- Cost of Maintenance	105	147	210
- Management Expenses	540	360	360
- Labour Expenses	314	392	392
- Overhead Costs	790	987	987
- Depreciation	2,436	2,436	2,436
Total	7,163	8,043	8,106

6.4 Financial Evaluation

1) Break-even point (Figure A-6)
   - break-even ratio including financing cost : 99.0 %
     break-even ratio excluding financing cost : 75.3 %
   - The investment cannot be regarded as safe from this figure.

2) Debt service ratio

1 year	0.75	5 year	1.10	9 year	1.39
2 year	1.62	6 year	1.16	10 year	1.49
3 year	0.99	7 year	1.23	11 year	1.32
4 year	1.04	8 year	1.30	12 year	1.37

The repayment ability of the project is not evaluated as sound.

3) Internal rate of return (IRR)
   - 8.96 %
   - not acceptable for a new project

4) Sensitivity analysis of IRR (Figure A-7)
   - 6% increase in sales 11.56 %
   - 6% decrease in operating costs 10.54 %
   - 6% decrease in initial investment 9.98 %

5) Conclusion

Based upon the aforementioned evaluation, the project cannot be judged as financially sound. The outcome of the sensitivity analysis of the IRR should be taken into account in order to restudy the viability of the project.

Schedules of the financial statements of this case are attached at the end of this Appendix.

Figure A-6 (1)

COMFAR 2.1 - TOYOBO ENGINEERING CO., LTD, JAPAN

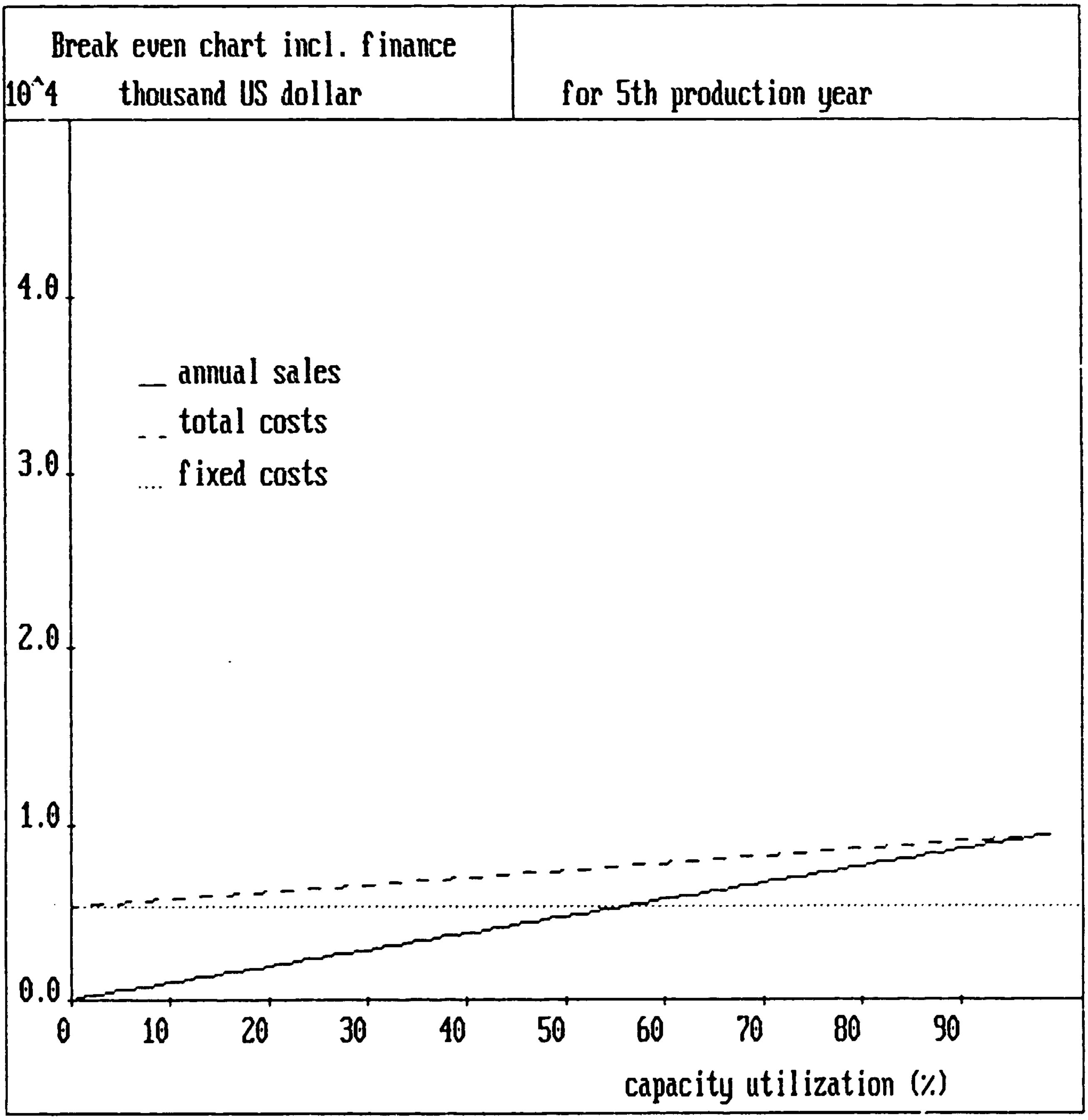
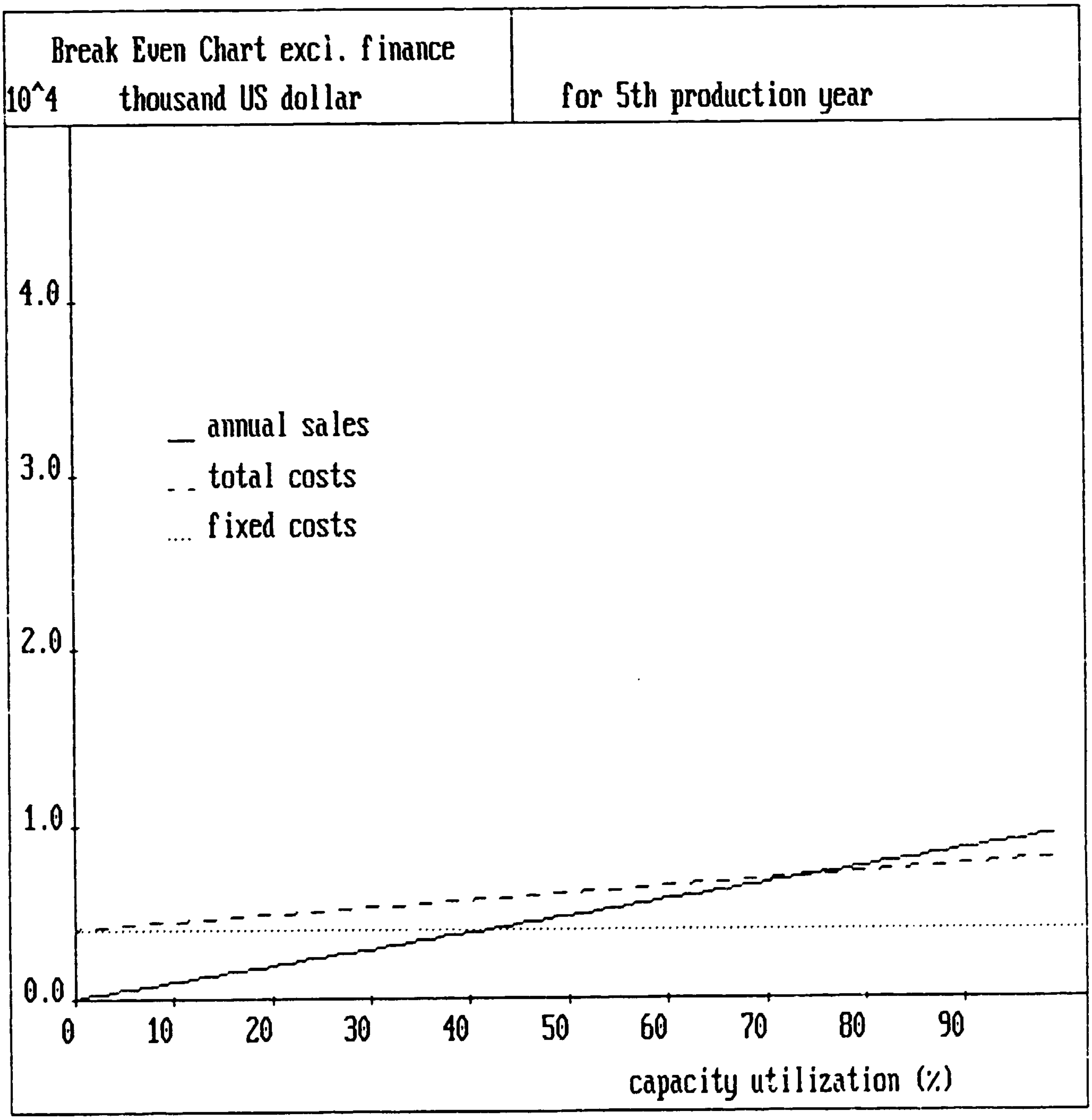
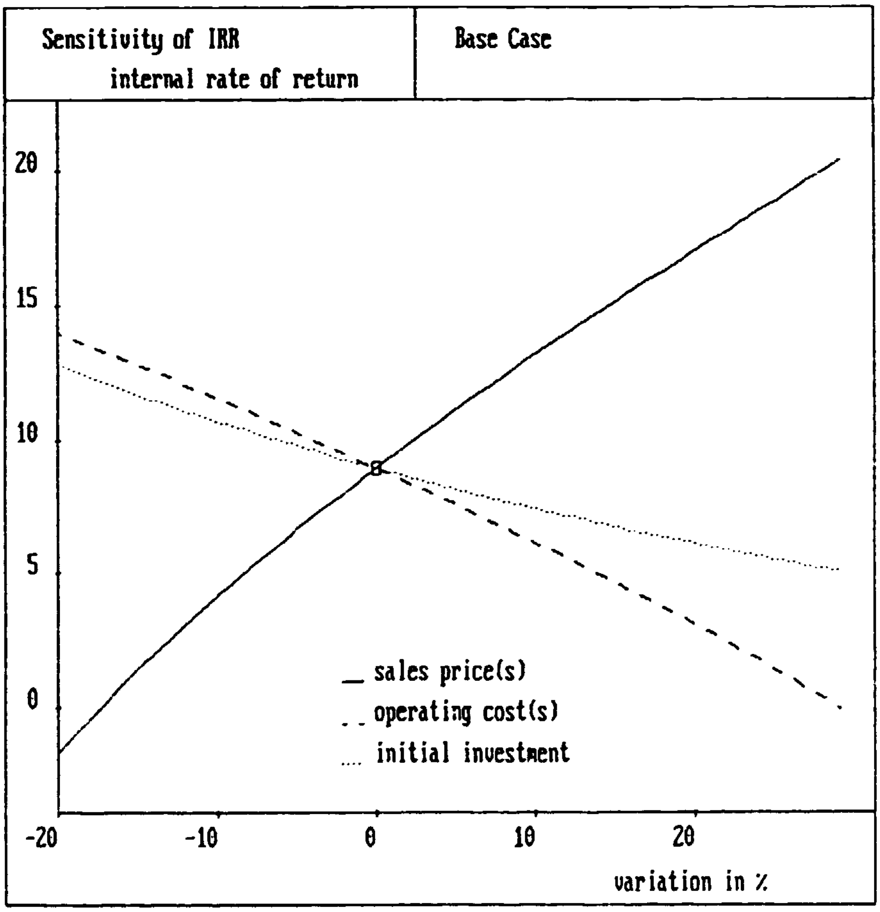


Figure A-6 (2)


Break Even Chart excl. finance
10^4 thousand US dollar
for 5th production year
4.0
3.0
2.0
1.0
0.0
_ annual sales
_ _ total costs
.... fixed costs
0
10
20
30
40
50
60
70
80
90
capacity utilization (%)



	sales price	operating c	initial inv
-20.0	-1.77	14.02	12.82
-19.0	-1.11	13.78	12.59
-18.0	-0.46	13.54	12.37
-17.0	0.16	13.30	12.15
-16.0	0.77	13.06	11.93
-15.0	1.37	12.81	11.72
-14.0	1.94	12.56	11.52
-13.0	2.51	12.32	11.31
-12.0	3.06	12.07	11.11
-11.0	3.60	11.82	10.92
-10.0	4.13	11.57	10.72
-9.0	4.65	11.31	10.53
-8.0	5.16	11.06	10.35
-7.0	5.66	10.80	10.16
-6.0	6.16	10.54	9.98
-4.0	7.12	10.02	9.63
-3.0	7.59	9.76	9.46
-2.0	8.05	9.50	9.29
-1.0	8.51	9.23	9.12
0.0	8.96	8.96	8.96
1.0	9.40	8.69	8.80
2.0	9.85	8.42	8.64
3.0	10.28	8.14	8.48
4.0	10.71	7.86	8.33
5.0	11.14	7.58	8.17
6.0	11.56	7.30	8.02
7.0	11.97	7.02	7.88
8.0	12.39	6.73	7.73
9.0	12.79	6.44	7.59
10.0	13.20	6.15	7.44
12.0	14.00	5.55	7.17
13.0	14.39	5.25	7.03
14.0	14.79	4.94	6.90
15.0	15.17	4.64	6.76
16.0	15.56	4.32	6.63
17.0	15.94	4.01	6.50
18.0	16.32	3.69	6.38
19.0	16.70	3.37	6.25
20.0	17.08	3.04	6.12
21.0	17.45	2.71	6.00
22.0	17.82	2.37	5.88
23.0	18.19	2.03	5.76
24.0	18.55	1.69	5.64
25.0	18.92	1.34	5.52
26.0	19.28	0.98	5.41
28.0	20.00	0.26	5.18
29.0	20.36	-0.11	5.07

'' variation in %

Spinning Mill Project in Bangladesh
7 May 1993
case 3

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: thousand US dollar

Total initial investment during construction phase

fixed assets:	27844.43	75.596 % foreign
current assets:	0.00	0.000 % foreign
total assets:	27844.43	75.596 % foreign

Source of funds during construction phase

equity & grants:	5387.00	76.313 % foreign
foreign loans :	16445.00	
local loans :	5103.00	
total funds :	26935.00	76.317 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	4725.21	5607.00	5670.00
depreciation :	2435.99	2435.99	2435.99
interest :	1803.18	1721.53	1639.88
production costs	8964.38	9764.53	9745.88
thereof foreign	68.84 %	68.10 %	68.75 %
total sales :	7549.20	9438.80	9438.80
gross income :	-1415.18	-325.73	-307.08
net income :	-1415.18	-325.73	-307.08
cash balance :	-581.07	1375.34	-42.30
net cashflow :	1732.41	3607.17	3752.38

Net Present Value at: 10.00 % = -1500.38
Internal Rate of Return: 8.96 %
Return on equity1: 5.10 %
Return on equity2: 10.74 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

Total Initial Investment in thousand US dollar

Year	1994	1995
Fixed investment costs		
Land, site preparation, development	1374.000	0.000
Buildings and civil works	0.000	4328.000
Auxiliary and service facilities	0.000	0.000
Incorporated fixed assets	0.000	0.000
Plant machinery and equipment	0.000	19100.000
Total fixed investment costs	1374.000	23428.000
Pre-production capital expenditures.	203.000	2839.430
Net working capital	0.000	0.000
Total initial investment costs	1577.000	26267.430
Of it foreign, in %	12.873	79.362

Source of Finance, construction in thousand US dollar

Year	1994	1995
Equity, ordinary ..	1479.000	3908.000
Equity, preference.	0.000	0.000
Subsidies, grants .	0.000	0.000
Loan A, foreign .	0.000	16445.000
Loan B, foreign..	0.000	0.000
Loan C, foreign .	0.000	0.000
Loan A, local....	98.000	5005.000
Loan B, local....	0.000	0.000
Loan C, local....	0.000	0.000
Total loan	98.000	21450.000
Current liabilities	0.000	0.000
Bank overdraft	0.000	909.430
Total funds	1577.000	26267.430

Source of Finance, production in thousand US dollar

Year	1996	1997	1998	1999	2000	2001- 5
Equity, ordinary ..	0.000	0.000	0.000	0.000	0.000	0.000
Equity, preference.	0.000	0.000	0.000	0.000	0.000	0.000
Subsidies, grants .	0.000	0.000	0.000	0.000	0.000	0.000
Loan A, foreign .	0.000	0.000	-1644.500	-1644.500	-1644.500	-1644.500
Loan B, foreign..	0.000	0.000	0.000	0.000	0.000	0.000
Loan C, foreign .	0.000	0.000	0.000	0.000	0.000	0.000
Loan A, local....	-510.300	-510.300	-510.300	-510.300	-510.300	-510.300
Loan B, local....	0.000	0.000	0.000	0.000	0.000	0.000
Loan C, local....	0.000	0.000	0.000	0.000	0.000	0.000
Total loan	-510.300	-510.300	-2154.800	-2154.800	-2154.800	-2154.800
Current liabilities	343.517	87.233	5.250	0.000	0.000	0.000
Bank overdraft	581.068	-1375.338	42.301	-154.434	-3.027	0.000
Total funds	414.286	-1798.405	-2107.249	-2309.234	-2157.827	-2154.800

Source of Finance, production in thousand US dollar

Year	2006- 7
Equity, ordinary ..	0.000
Equity, preference.	0.000
Subsidies, grants .	0.000
Loan A, foreign .	-1644.500
Loan B, foreign..	0.000
Loan C, foreign .	0.000
Loan A, local....	0.000
Loan B, local....	0.000
Loan C, local....	0.000
Total loan	-1644.500
Current liabilities	0.000
Bank overdraft	0.000
Total funds	-1644.500

Cashflow Tables, construction in thousand US dollar

Year	1994	1995
Total cash inflow	1577.000	25358.000
Financial resources	1577.000	25358.000
Sales, net of tax	0.000	0.000
Total cash outflow	1577.000	26267.430
Total assets	1577.000	25358.000
Operating costs	0.000	0.000
Cost of finance	0.000	909.430
Repayment	0.000	0.000
Corporate tax	0.000	0.000
Dividends paid	0.000	0.000
Surplus (deficit)	0.000	-909.430
Cumulated cash balance	0.000	-909.430
Inflow, local	1374.000	5005.000
Outflow, local	1374.000	5421.080
Surplus (deficit)	0.000	-416.080
Inflow, foreign	203.000	20353.000
Outflow, foreign	203.000	20846.350
Surplus (deficit)	0.000	-493.350
Net cashflow	-1577.000	-25358.000
Cumulated net cashflow	-1577.000	-26935.000

Cashflow tables, production in thousand US dollar

Year	1996	1997	1998	1999	2000	2001
Total cash inflow . .	7892.718	9526.032	9444.050	9438.800	9438.800	9438.800
Financial resources .	343.517	87.233	5.250	0.000	0.000	0.000
Sales, net of tax . .	7549.200	9438.800	9438.800	9438.800	9438.800	9438.800
Total cash outflow . .	8473.784	8150.693	9486.351	9284.366	9104.048	8923.729
Total assets	1435.097	311.862	21.667	0.000	0.000	0.000
Operating costs . . .	4725.208	5607.000	5670.000	5670.000	5670.000	5670.000
Cost of finance . . .	1803.180	1721.532	1639.884	1459.566	1279.248	1098.930
Repayment	510.300	510.300	2154.800	2154.800	2154.800	2154.800
Corporate tax . . .	0.000	0.000	0.000	0.000	0.000	0.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	-581.066	1375.339	-42.301	154.434	334.752	515.070
Cumulated cash balance	-1490.496	-115.157	-157.458	-3.024	331.728	846.798
Inflow, local	179.768	96.348	65.083	64.000	64.000	64.000
Outflow, local	3247.476	3333.437	3189.095	3103.836	3022.188	2940.540
Surplus (deficit) .	-3067.708	-3237.088	-3124.012	-3039.836	-2958.188	-2876.540
Inflow, foreign . . .	7712.949	9429.685	9378.967	9374.800	9374.800	9374.800
Outflow, foreign . . .	5226.309	4817.256	6297.256	6180.530	6081.860	5983.190
Surplus (deficit) .	2486.640	4612.428	3081.711	3194.270	3292.940	3391.610
Net cashflow	1732.413	3607.171	3752.383	3768.800	3768.800	3768.800
Cumulated net cashflow	-25202.590	-21595.420	-17843.030	-14074.230	-10305.430	-6536.634

Spinning Mill Project in Bangladesh --- 7 May 1993

Cashflow tables, production in thousand US dollar

Year	2002	2003	2004	2005	2006	2007
Total cash inflow	9438.800	9438.800	9438.800	9438.800	9438.800	9438.800
Financial resources	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax	9438.800	9438.800	9438.800	9438.800	9438.800	9438.800
Total cash outflow	8743.412	8563.094	9459.776	9279.458	9928.724	9869.521
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs	5670.000	5670.000	5670.000	5670.000	5670.000	5670.000
Cost of finance	918.612	738.294	557.976	377.658	197.340	98.670
Repayment	2154.800	2154.800	2154.800	2154.800	1644.500	1644.500
Corporate tax	0.000	0.000	0.000	0.000	1339.884	1379.352
Dividends paid	0.000	0.000	1077.000	1077.000	1077.000	1077.000
Surplus (deficit)	695.388	875.706	-20.977	159.342	-489.924	-430.722
Cumulated cash balance	1542.186	2417.892	2396.915	2556.257	2066.333	1635.611
Inflow, local	64.000	64.000	64.000	64.000	64.000	64.000
Outflow, local	2858.892	2777.244	2950.596	2868.948	3616.884	3656.352
Surplus (deficit)	-2794.892	-2713.244	-2886.596	-2804.948	-3552.884	-3592.352
Inflow, foreign	9374.800	9374.800	9374.800	9374.800	9374.800	9374.800
Outflow, foreign	5884.520	5785.850	6509.180	6410.510	6311.840	6213.170
Surplus (deficit)	3490.280	3588.950	2865.620	2964.290	3062.960	3161.630
Net cashflow	3768.800	3768.800	3768.800	3768.800	2428.916	2389.448
Cumulated net cashflow	-2767.834	1000.966	4769.766	8538.565	10967.480	13356.930

Cashflow tables, production in thousand US dollar

Year	2008	2009	2010
Total cash inflow	9438.800	9438.800	9438.800
Financial resources	0.000	0.000	0.000
Sales, net of tax	9438.800	9438.800	9438.800
Total cash outflow	8165.820	8165.820	8165.820
Total assets	0.000	0.000	0.000
Operating costs	5670.000	5670.000	5670.000
Cost of finance	0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax	1418.820	1418.820	1418.820
Dividends paid	1077.000	1077.000	1077.000
Surplus (deficit)	1272.980	1272.980	1272.979
Cumulated cash balance	2908.591	4181.571	5454.551
Inflow, local	64.000	64.000	64.000
Outflow, local	3695.820	3695.820	3695.820
Surplus (deficit)	-3631.820	-3631.820	-3631.820
Inflow, foreign	9374.800	9374.800	9374.800
Outflow, foreign	4470.000	4470.000	4470.000
Surplus (deficit)	4904.800	4904.800	4904.800
Net cashflow	2349.980	2349.980	2349.979
Cumulated net cashflow	15706.910	18056.890	20406.870

Net Income Statement in thousand US dollar

Year	1996	1997	1998	1999	2000
Total sales, incl. sales tax	7549.200	9438.800	9438.800	9438.800	9438.800
Less: variable costs, incl. sales tax.	3227.208	4035.000	4035.000	4035.000	4035.000
Variable margin	4321.992	5403.800	5403.800	5403.800	5403.800
As % of total sales	57.251	57.251	57.251	57.251	57.251
Non-variable costs, incl. depreciation	3933.993	4007.993	4070.993	4070.993	4070.992
Operational margin	387.999	1395.806	1332.807	1332.807	1332.808
As % of total sales	5.140	14.788	14.121	14.121	14.121
Cost of finance	1803.180	1721.532	1639.884	1459.566	1279.248
Gross profit	-1415.181	-325.726	-307.077	-126.759	53.560
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	-1415.181	-325.726	-307.077	-126.759	53.560
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	-1415.181	-325.726	-307.077	-126.759	53.560
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	-1415.181	-325.726	-307.077	-126.759	53.560
Accumulated undistributed profit	-1415.181	-1740.906	-2047.983	-2174.742	-2121.183
Gross profit, % of total sales	-18.746	-3.451	-3.253	-1.343	0.567
Net profit, % of total sales	-18.746	-3.451	-3.253	-1.343	0.567
ROE, Net profit, % of equity	-26.270	-6.047	-5.700	-2.353	0.994
ROI, Net profit+interest, % of invest.	1.384	4.941	4.715	4.715	4.715

Net Income Statement in thousand US dollar

Year	2001	2002	2003	2004	2005
Total sales, incl. sales tax	9438.800	9438.800	9438.800	9438.800	9438.800
Less: variable costs, incl. sales tax.	4035.000	4035.000	4035.000	4035.000	4035.000
Variable margin	5403.800	5403.800	5403.800	5403.800	5403.800
As % of total sales	57.251	57.251	57.251	57.251	57.251
Non-variable costs, incl. depreciation	4070.993	4070.992	4070.993	4070.993	4070.992
Operational margin	1332.807	1332.807	1332.807	1332.807	1332.808
As % of total sales	14.121	14.121	14.121	14.121	14.121
Cost of finance	1098.930	918.612	738.294	557.976	377.658
Gross profit	233.877	414.195	594.513	774.831	955.149
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	233.877	414.195	594.513	774.831	955.149
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	233.877	414.195	594.513	774.831	955.149
Dividends paid	0.000	0.000	0.000	1077.000	1077.000
Undistributed profit	233.877	414.195	594.513	-302.169	-121.851
Accumulated undistributed profit	-1887.306	-1473.110	-878.598	-1180.767	-1302.617
Gross profit, % of total sales	2.478	4.388	6.299	8.209	10.119
Net profit, % of total sales	2.478	4.388	6.299	8.209	10.119
ROE, Net profit, % of equity	4.342	7.689	11.036	14.383	17.731
ROI, Net profit+interest, % of invest.	4.715	4.715	4.715	4.715	4.715

Spinning Mill Project in Bangladesh --- 7 May 1993

Net Income Statement in thousand US dollar

Year	2006	2007	2008	2009	2010
Total sales, incl. sales tax	9438.800	9438.800	9438.800	9438.800	9438.800
Less: variable costs, incl. sales tax.	4035.000	4035.000	4035.000	4035.000	4035.000
Variable margin	5403.800	5403.800	5403.800	5403.800	5403.800
As % of total sales	57.251	57.251	57.251	57.251	57.251
Non-variable costs, incl. depreciation	1856.750	1856.750	1856.750	1856.750	1856.749
Operational margin	3547.050	3547.050	3547.050	3547.050	3547.051
As % of total sales	37.579	37.579	37.579	37.579	37.579
Cost of finance	197.340	98.670	0.000	0.000	0.000
Gross profit	3349.710	3448.380	3547.050	3547.050	3547.051
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	3349.710	3448.380	3547.050	3547.050	3547.051
Tax	1339.884	1379.352	1418.820	1418.820	1418.820
Net profit	2009.826	2069.028	2128.230	2128.230	2128.230
Dividends paid	1077.000	1077.000	1077.000	1077.000	1077.000
Undistributed profit	932.826	992.028	1051.230	1051.230	1051.230
Accumulated undistributed profit	-369.791	622.237	1673.467	2724.697	3775.927
Gross profit, % of total sales	35.489	36.534	37.579	37.579	37.579
Net profit, % of total sales	21.293	21.920	22.548	22.548	22.548
ROE, Net profit, % of equity	37.303	38.408	39.507	39.507	39.507
ROI, Net profit+interest, % of invest.	7.808	7.668	7.529	7.529	7.529

APPENDIX 2

A BRIEF STUDY ON CASE 2 : INTEGRATED MILL

Contents

1. GENERAL AND BASIC CONDITIONS
   - 1.1 General
   - 1.2 Basic Conditions
2. THE PROJECT
   - 2.1 Consumption of Raw Materials
   - 2.2 Production Plan
   - 2.3 Basic Specifications of Main Production Machinery
   - 2.4 Civil, Mechanical and Electrical Works
3. INVESTMENT COST
4. FINANCIAL EVALUATION

1. GENERAL AND BASIC CONDITIONS

1.1 General

This is a brief study report on Case 2 which was carried out in accordance with the provision under Chapter 2 aforementioned. In Case 2, the mill is also assumed to be an integrated textile mill (the same as in Case 1) which will produce high quality fabrics such as cotton and T/C poplin and cotton twill fabric, all of which are universally utilized in the present market in Bangladesh. In order for easy comparison with Case 1, the production machinery installed in Case 2 was considered to be the same as in Case 1. However, the doubling machines from Case 1 were no longer required, and thus were deleted in Case 2.

1.2 Basic Conditions

The principles of the project are exactly the same as those in Case 1, based on the joint-venture corporation to be designed by Japanese consultants and managed by Japanese experts.

2. THE PROJECT

2.1 Consumption of Raw Materials

- raw cotton (for 40's)
  1,305 tons x @US$1,430 = US$ 1,866,150.-
- yarn (P/C 45's)
  1,993 bales x @US$880 = US$ 1,753,840.-
- grey cloth (P/C 45, 110 x 76)
  16,952,000m x @US$0.656 = US$11,120,512.-

2.2 Production Plan

The production plan at full capcity is shown in Table A-5.

2.3 Basic Specifications of Production Machinery

This is also the same as in Case 1. Except for spinning machinery, the layout plan is the same as in Case 1. The layout plan of spinning machinery can be seen in Figure A-8.

Table A-5 CASE 2 PRODUCTION PROGRAM AND PRODUCT MIX

Operating Conditions 350 days/year: 29.17 days/month

24 hrs/day: 4 Groups 3 Shifts

Garments	Name	Poplin	Twill 3/1 Twill	Poplin	Total
	Width	63"	63"	63"	
	Material	Cotton	Cotton	P/C Blended	
	Counts	CD × CD 40 × 40	CM × CM 40/2 × 40/2	P/C × P/C 45 × 45	
	Density	133 × 72	108 × 58	110 × 76	
Dyeing and Finishing	Bleached	2.286.000	0	10.824.000	13.110.000
	Dyed	1.524.000	2.790.000	7.200.000	11.514.000
	Yarn Dyed	2.118.000	0	2.130.000	4.248.000
	Meters/year	5.928.000	2.790.000	20.154.000	28.872.000
Fabric procured	Meters/year	0	0	16.952.400 (for Grey)	16.952.400
Weaving	Frames	56	20	20	96
	Grey	3.809.850	2.791.440	0	6.601.290
	Yarn Dyed	2.116.660	0	2.129.850	4.246.510
	Meters/year	5.926.510	2.791.440	2.129.850	10.847.800
Spinning	Frames	32	20	0	52
	LBS/year	3.276.000	2.209.200	0	5.485.200
	BLS/year	8.190	5.523	0	13.713
Yarn procured	LBS/year	0	0	797.140	797.140
	BLS/year	0	0	1.993 (for Y.Dyed)	1.993
Yarn Sold	LBS/year	496.000	83.120	0	579.120
	BLS/year	1.240	208	0	1.448

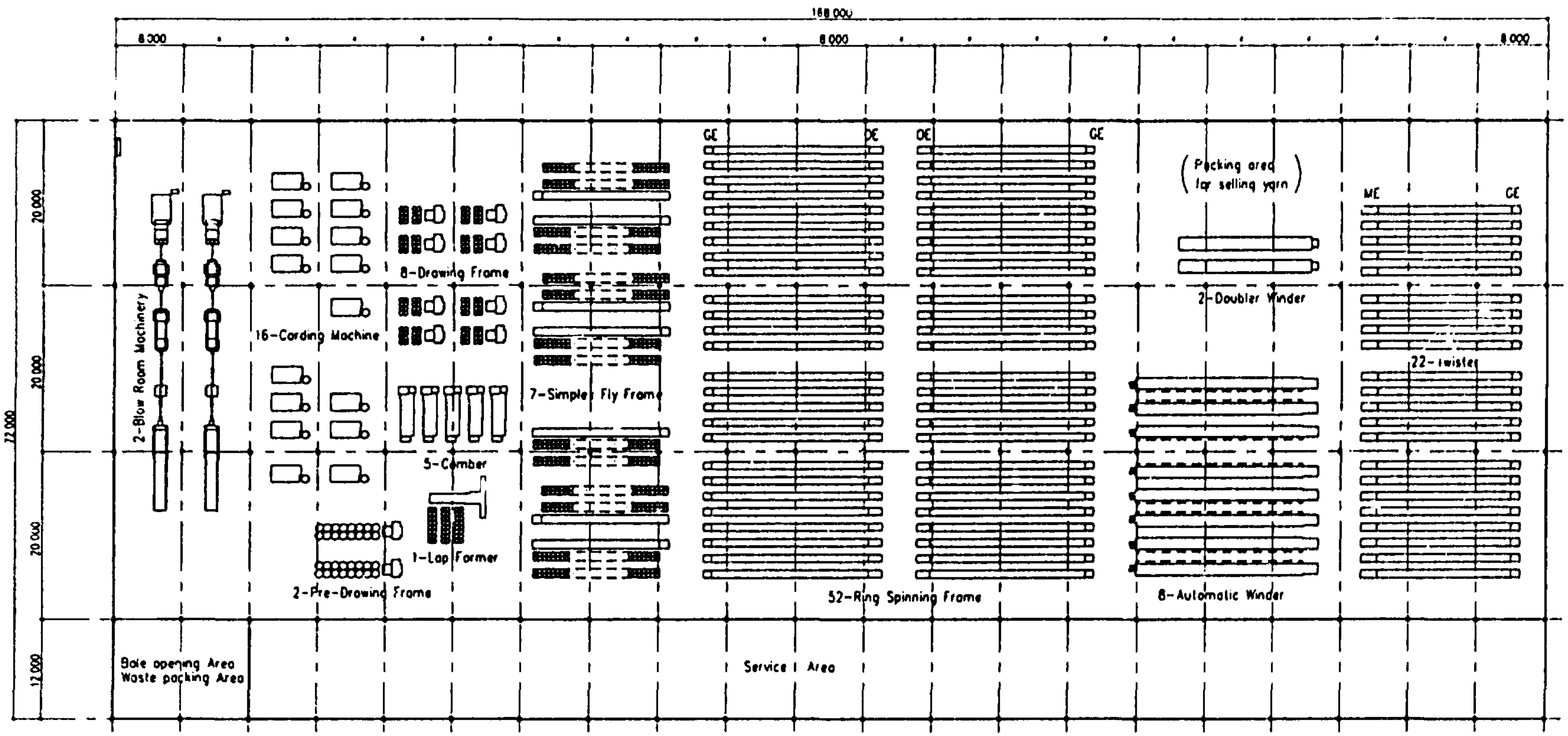


Figure A-8 LAYOUT OF PRODUCTION MACHINERY: SPINNING MILL (Case-2) -1

2.4 Civil, Mechanical and Electrical Works

The civil, mechanical and electrical works necessary for the project are also the same as in Case 1, except for the building area of the spinning mill, which is reduced by 1,152 m^2 due to the fact that there are no doubling machines in Case 2.

3. INVESTMENT COST

	1994	1995	total
CASE 1	US$ 17,320,840	US$ 53,756,700	US$ 71,077,540
CASE 2	16,483,000	51,127,500	67,610,500
reduction	837,840	2,629,200	3,467,040

In Case 2, the initial investment amount is reduced due to:

- elimination of doubler-winders contemplated in Case 1
- reduction of construction and air-conditioning costs due to reduced building area

4. FINANCIAL EVALUATION

4.1 Sales Revenue at Normal Operation Year

cotton poplin	(CD40, 133x72)	5,928,000 m		
cotton twil	(CM40/2, 108x58)	2,790,000 m		
P/C poplin	(P/C45, 110x76)	20,154,000 m		
sub-total		28,872,000 m	@1.148	US$33,145,050
cotton waste				127,000
total sales revenue				US$ 33,272,050

4.2 Financial Evaluation (Table A-6)

1) Break-even Point

break-even point including financing costs : 97.5%

break-even point excluding financing costs : 71.4%

The investment cannot be regarded as safe from these figures.

2) Internal Rate of Return (IRR)

- 7.91%
- not acceptable for a new project

3) Sensitivity Analysis of IRR

- 6% increase in sales 11.28%
- 6% decrease in operating costs 10.39%
- 6% decrease in initial investment 8.81%

4) Conclusion

Based upon the aforementioned evaluation, the project cannot be judged as financially sound. The outcome of the sensitivity analysis of the IRR should be taken into account in order to restudy the viability of the project.

Table A-6

COMFAR 2.1 UNIDO

ITM in Bangladesh
16 May 1993
case2

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: thousand US dollar

Total initial investment during construction phase

fixed assets:	67610.50	80.769 % foreign
current assets:	0.00	0.000 % foreign
total assets:	67610.50	80.769 % foreign

Source of funds during construction phase

equity & grants:	13071.00	80.002 % foreign
foreign loans :	42832.00	
local loans :	9451.00	
total funds :	65354.00	81.539 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	16790.80	24050.00	24040.00
depreciation :	5984.00	5984.00	5984.00
interest :	4082.08	3930.86	3779.65
production costs	26856.88	33964.86	33803.65
thereof foreign	80.28 %	80.25 %	80.60 %
total sales :	21588.52	33272.05	33272.05
gross income :	-5268.37	-692.81	-531.59
net income :	-5268.37	-692.81	-531.59
cash balance :	-4516.04	2329.21	208.38
net cashflow :	511.14	7205.17	9216.33

Net Present Value at: 10.00 % = -8053.91
Internal Rate of Return: 7.91 %
Return on equity1: 4.54 %
Return on equity2: 8.68 %

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Total initial investment
Total investment during production
Total production costs
Working Capital requirements
Cashflow Tables
Projected Balance
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Source of finance

APPENDIX 3

Survey on Fabric Requirements of
Export-Oriented Ready-Made Garment (RMG)
Industry in Bangladesh

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3. Scope and Limitation of the Study

4. Methodology

5. The Findings of the Study
   - 5.1 Profile of the RMG Units
   - 5.2 Products and Markets
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6. Export-Oriented Ready-Made Garments (RMG) Industry in Bangladesh
   - 6.1 Background
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7. Existing Textile Manufacturing Capacity
   - 7.1 Recent Developments
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   - 7.3 Fabric Manufacturers Supplying to the RMG Industry
   - 7.4 Problems
   - 7.5 Prospects for Growth in Backward Linkage
   - 7.6 Existing Backward Linkage

1. INTRODUCTION AND ABSTRACT

This study on the fabric the requirements of the export-oriented Ready-Made Garments (RMG) industry in Bangladesh was carried out by Prof. G.M. Chowdhury, Institute of Business Administration, Dhaka University, in accordance with the Terms of Reference (TOR) prepared by UNIDO's study team.

The Bangladesh RMG industry is estimated to be an importer of over 900 million SME (Square Meter Equivalent) fabrics in fiscal year 1992-1993. A major portion of this fabric consists of light shirting fabrics since Bangladesh is now one of the leading shirt makers of the world. Based on past trends and Bangladesh's very low and stable export prices, further rapid growth is expected in all categories of garments to all the markets of the world. While current exports are concentrating on the cheaper low-end products, it is expected that, with a growing reputation for quality, Bangladesh will soon capture the high-value, higher-end segments of the market.

The domestic textiles industry has not been able to capitalize on this huge opportunity for a number of reasons, not the least of which has been inadequate government planning, policy and support. Other factors are a lack of technical expertise and the tunavailability of capital or financing to set up modern, integrated textile mills. Also, after years of complete protection and government intervention, the textile industry is antiquated and in disarray, and it does not even meet local consumer demand. It will, therefore, take some time for the industry to come up to international standards. Meanwhile, the Government has recognized the importance of the textile sector, especially to feed the burgeoning RMG industry, and it has designated it as a "thrust sector", with appropriate supportive policies expected to be in place shortly. This coincides with a general opening up of the economy to achieve free market efficiency as well as a marked export orientation.

There are important advantages to the RMG industry in being able to buy fabric from a local manufacturer. These are as follows:

a) A local manufacturer of fabrics would generate a whole new range of business for the RMG industry, which is currently hampered by the 30 % minimum value addition requirement imposed by the Government.

b) Much shorter lead times or delivery periods, which would also further strengthen existing RMG business, as well as generate new business which is currently being placed elsewhere.

c) Reduction in the risk and uncertainty of foreign supplies.

d) Reduction in banking/financial costs involved in fabric procurement from abroad.

e) Avoidance of the considerable problems associated with Bangladesh customs procedures.

f) GSP benefit of 15% on exports to Europe.

g) Free quotas to U.S./Canada markets are provided by the Government to RMG units utilizing locally produced fabrics.

The prices that the industry is willing to pay are at least 15-20 % higher than international market prices for similar products. As far as competition on the supply side is concerned (local Bangladesh manufacturers), this is virtually non-existent today with no new competition on the horizon. A manufacturer setting up now would enjoy considerable monopoly benefits for some time with excellent growth prospects. A similar situation has been observed with the Tootal thread project, whose perfomance and growth has far exceeded initial expectations and projections.

2. PURPOSE OF THE STUDY

The survey was mainly designed with the following objectives in mind :

a) To identify the major types of fabrics used by RMG units in the country, including identification of major sources of supply and their prices.

b) To make an estimate of the total quantity of fabrics consumed by the RMG units in order to make a demand forecast for each type of fabric.

c) To gather RMG manufacturers' views on existing and potential supplies of high quality local fabrics.

d) To identify major problems faced by leading local manufacturers of fabrics in order to cater to the needs of the export-oriented RMG industry.

3. SCOPE AND LIMITATION OF THE STUDY

The scope of the study is defined in the TOR supplied by the study team (UNIDO'S consultants).

Key areas encompassed within the scope of the study were:

a) Profile of the RMG units in Bangladesh including:
   - production capacity
   - number of employees
   - year of the establishment
   - annual turnover, and
   - equity structure, including the level of foreign participation

b) Products and market information including:
   - major product categories and prices
   - major sources of orders and mode of operation

c) Demand for fabric consumption including:
   - total demand with projection of future demand
   - major fabrics categories

d) Local fabric manufacturing capacity in the country which is capable of supplying the export-oriented RMG units including:
   - major manufacturing units operating in the area at present
   - major problems and prospects in this area, and
   - future trends

The study was limited to investigating the fabric requirements for the export-oriented garments industry only. Local fabric requirements and the fabrics exported directly were not a part of this study. For the primary survey of the RMG units, factories producing knitwear only were excluded from the study.

Also, in calculating the total demand for fabrics, terry towels and shop towels were excluded, as these were not within the scope of the study.

4. METHODOLOGY

Primary data were collected by interviewing the key personnel of 100 RMG units in the country. The units were selected to ensure that both large and medium - size companies were included. Special emphasis was given to incorporate units using better quality raw materials. This was because the proposed textile project is designed to produce high quality fabrics. In reality, however, it was not possible to maintain such selectiveness for the desired length of time.

Interestingly, manufacutrers located in Chittagong were generally more cooperative than those in Dhaka. Altogether 100 units were interviewed, 57 from Dhaka and 43 from Chittagong.

Although commercial manager's of the respective RMG units provided most of the information, generally the investigators had to retrieve information from various departments/personnel within the company including production mangers, general managers or the managing directors. In many cases, prior appointments were made by the consultant over the telephone to ensure that the field research personnel were provided with the desired information.

5. THE FINDINGS OF THE STUDY

The findings reported in this section are based on both the primary field survey of 100 RMG units and secondary data collection from various sources, including local fabric manufacturers.

5.1 Profile of the RMG units

1) Experience in Production:

According to BGMEA sources, about 1400 export-oriented RMG industries have been registered. However, the actual number of operating units could not be identified from BFMEA, EPB, the Department of Textiles or any other known sources. The best estimates suggest that there are about 1100 units currently in operation. It should be noted that not all the factories are direct exporters themselves. Knowledgeable sources indicate that as many as 300 factories are working as sub-contractors for exporting manufacturers.

It was found that as many as 60 percent of the factories studied have been in operation between 5-10 years and 27 percent have been in production for less than 5 years (see Table-1). Also, it was remarkable that 12 percent of the total factories studied have been in operation between 10-15 years. This shows that the RMG industry as a whole has reached a state of maturity. It should now be in a position to cater to the higher quality segment in the international market requiring adequate experience and workmanship. Higher quality would automatically mean better quality (and naturally more expensive) fabrics.

Table - 1
Years in Production

Range	No. of responses	Percentage
Less than 5 years	27	27.00%
5 to 10 years	60	60.00%
10 to 15 years	12	12.00%
More than 15 years	1	1.00%
	100	100.00%

2) Size of the production units:
The production units varied in terms of the number of employees, the number of sewing machines, and annual turnover. All of these reflect the size of the operations studied.

a) Number of Employees (Table-2)
The majority (58 %) of the factories seem to have between 200 and 400 employees. There were none with less than 100 employees and only 6 factories out of a total of 100 reported having between 100 and 200 employees.

Table -2
Total Number of Employees

Range	No. of responses	Percentage
Less than 100	0	0.00%
100 to 200	6	6.00%
200 to 300	28	28.00%
300 to 400	30	30.00%
400 to 500	11	11.00%
500 to 700	13	13.00%
700 to 1000	6	6.00%
More than 1000	6	6.00%
	100	100.00%

On the other hand, 24 factories reported having between 400 and 700 employees, and 12 reported having more than 700 employees.

b) Number of basic sewing machines

Most factories (46) seem to have between 100 and 200 sewing machines. This suggests (see Table-3) that most factories studied were of medium size. Also, 16 factories reported having between 200 and 300 machines.

Table -3

Total Number of Sewing Machines

Range	No. of responses	Percentage
Less than 100	27	27.00%
100 to 200	46	46.00%
200 to 300	16	16.00%
300 to 400	9	9.00%
More than 400	2	2.00%
	100	100.00%

c) Annual Turnover

Table-4 that about half of the RMG units interviewed fell under the category of less than USD 3 million per year. There were 24 factories that were in the USD 3-10 million category and 4 factories reported having annual turnover in excess of USD 10 million per year.

Table -4

Annual Turnover

Range	No. of responses	Percentage
Less than mn. USD	20	24.69%
1 to 2 mn. USD	19	23.46%
2 to 3 mn. USD	14	17.28%
3 to 4 mn. USD	10	12.35%
4 to 5 mn. USD	5	6.17%
5 to 10mn. USD	9	11.11%
Above 10 mn. USD	4	4.94%
	81	100.00%

In this context it should be noted that some of the units responding as a single unit here may consist of more than one factory. However, for all practical purposes (management, procurement of raw materials, exports, marketing, etc.) they are managed as a single unit.

It was expected that with the maturity of entrepreneurship as a whole, the proportion of factories with a higher turnover is likely to increase further.

5.2 Products and Markets

1) Major products categories and prices:

It was found that (see Table-5) most factories produce a combination of products (e.g. men's shirts, boy's shirts, ladies' shirts, etc.).

Table - 5

Products and Price Information

PRODUCT	Production			Price		
	No. of responses	Percent (%)	Dozens/ day Capacity	No. of responses	Percent (%)	Avg. FOB Price/doz
Men's shirts	78	78.00	17,408	70	89.74	39.70
Boy's shirts	57	57.00	11,633	51	89.47	33.44
Ladies' shirts/blouses	65	65.00	14,963	57	87.69	38.46
Men's trousers/shorts	56	56.00	10,400	51	91.07	54.25
Ladies' trousers/shorts	40	40.00	6,355	38	95.00	51.58
Jackets(all)	24	24.00	4,490	22	91.67	105.86
Jogging wear/tracksuits	7	7.00	405	3	42.86	95.00
Sleeping wear	7	7.00	1,345	7	100.00	53.21
Others(caps)	1	1.00	275	1	100.00	20.00

Note : The percentage of production cases has been computed based on a total sample of 100. The percentage of average FOB price cases has been computed on the basis of production.

Usually one or two items at a time are being produced in the production lines. Men's shirts appeared to be the most widely (78 %) manufactured item, followed by ladies' shirts/blouses (65 %) and boy's shirts (57.89 %). The table also shows the corresponding capacity of production per day.

In regard to pricing, only average FOB prices are quoted. It should be noted that not all factories agreed to provide price information. Hence, the calculation of average prices is based on the factories who supplied such information. Jackets were found to be the most expensive (USD 105.86/dz) item. followed by jogging wear/track suits (USD 95.00/dz). although, only a few units produced the latter item. The most popular items, like men's shirts, boy's shirts, ladies shirts/blouses, reported having an average FOB price of USD 39.70, USD 33.44, and USD 38.46 respectively.

2) Sources of orders and mode of operation:
It was found that 16 % of the orders were placed by foreign retailers themselves and 25 % by foreign importers, whereas the bulk of the orders (58 %) was placed by local buying agents. It is noteworthy that a large number of buying houses are now operating in Dhaka. Quite a few larger groups are also operating as buying houses and thus placing orders in their own factories, as well as in other factories on behalf of their overseas principal. However, few Bangladesh firms have so far been able to set up their operation abroad.

3) Equity Participation:
The extent of foreign participation in the RMG sector is negligible except for 5 units currently operating in Chittagong Export Processing Zones (CEPZ). There were about 5 units having some sort of foreign equity participation outside the CEPZ. Some of these units were approached by the researcher, but only one successful interview resulted.

5.3 Fabric Requirements

1) Estimate of Demand and Price of Fabrics:
The extraordinary growth in RMG manufacturing units and the corresponding growth in sales turnover resulted in an huge increase in fabric consumption. Actual demand for the fabrics was estimated using two different methods.

a) Method-1:

(1) Estimate of Demand
This was based on the primary data obtained from the field survey of 100 RMG units. Data for export was collected for the last 12 months. It was found that (Annex 1.a) T/C, P/C fabrics (printed, solid-dyed, yarn-dyed) were the most common (21.45 %) type of fabric being used by the RMG units. The fine count fabrics (Ne 50 and above) were still quite limited. Twill (7.6 %) and Flannel

(13.62 %) also appeared to be quite popular fabric items. Only major items using a particular construction of fabric were recorded. The quantity (in dozens) of garments exported was then converted to SME by multiplying it using a conversion factor. The conversion factor used was derived by averaging various conversion factors for different categories of garments using the same construction of fabric. The total fabric consumption arrived at for 1991-1992 was approx. 863 mn. SME.

(2) Estimate of Fabric Prices:

As previously mentioned, the most widely used fabrics were identified to be T/C, P/C, Twill, and Denim. Prices are estimated on the basis of the response from the sample RMG units. (However, not all RMG units studied provided information on price.) Average prices quoted were based on fabrics with a width of 43" (on average, unless otherwise mentioned) per linear yard. These were converted to 63" width per linear meter prices since the proposed project is designed to produce fabric of said measure. It shows that almost all the fabrics (Annex 1.b) were above USD 1.50 per meter. Considering the GSP benefit entitlement, the actual cost to the exporter of RMG will be even less, which will make local production of fabrics even more competitive.

b) Method-2:

This method was based on secondary data collected from various sources including BGMEA, EPB, the Department of Textiles and the US Department of Commerce. In most cases, considerble analysis had to be undertaken to translate data obtained into meaningful information. Both EPB and BGMEA need to be fairly organized to be an effective service center (as they were supposed to be) to the entrepreneurs, or researchers.

In this method the calculation was based on the actual quantity exported (in dozens) to USA (Annex 2.a & 2.b) and Canada (Annx 2.c) for different quota categories. The quantity exported was then converted to SME by using corresponding conversion factors to get the total SME exported for quota items in these countries. Finally, total world-wide exports (1987-88 to 1991-92) were calculated (Annex 2.d) by adding all the quota exports (e.g. approx. 230 mn. SME for 1991-92) and calculating the figure for total exports by using the year-wise quota : non-quota ratio (35:65 for 1991-92). In this way estimated non-quota supply to the world (both quota and non-quota countries) were approx.

428 million SME for 1991-92. Accordingly, total fabric requirements for RMG exports to the world for corresponding years were obtained. For 1991-92 this figure was approx. 658 millon SME.

2) Estimate of future demand of fabrics

Future demand is predicted on the basis of the data obtained from secondary sources. This was because it was felt that secondary sources which used original export figures obtained from EPB/BGMEA were more dependable than the export figures obtained from the primary field survey.

The forecast for 1993-1995 shows (see Annex 2.e) that, by 1995, fabric requirements will exceed 1 billion SME. The corresponding requirements for 1993 and 1994 are 0.736 and 0.88 billion respectively. It should be noted that the import figures for fabrics should be at least 5-10 % higher than the export figure due to waste and inefficiency during the cutting of the fabric.

6. EXPORT-ORIENTED READY-MADE GARMENTS (RMG) INDUSTRY IN BANGLADESH

6.1 Background

The Ready-Made Garments (RMG) industry is one of the success stories of Bangladesh. The Industry achieved phenomenal growth over a short span of time. The number of units has increased from 9 units in 1977/78 to 754 units in 1988/89, nearly 60 % growth per year. By the latter half of the 1980s, the industry reached a different peak. In 1983/84, the number of enterprises rose by 242 % over the preceding year, but due to US quota restrictions and the Bangladesh government's control in 1984 on the expansion of capacity by adding new units, the growth was somewhat slowed down. However, there was still a growth rate of 40 % in 1989.

The US quota restriction led to the exploration of new opportunities in terms of new markets in Western Europe and non-quota items for US market. Export growth was again as high as 133 % in the 1987/88 fiscal year. In fiscal years 1987/88, 1988/89, 1989/90, the growth rate was 48 %, 11 %, and 33 % respectively.

Currently, there are about 1400 garment manufacturers registered with the BGMEA. However, the actual number of operating units could not be established from any of the relevant sources, i.e. BGMEA, EPB, the Department of Textiles, etc. The best estimates suggest that there are about 1100 units presently in operation. It should be noted that not all the manufacturers are direct exporters themselves. A substantial number (200-300) are operating on a sub-contracting basis (wholly or partly).

The sector is employing as many as 600,000 workers, most of whom are female (80 %). In the last ten years, the value of exports from the sector has increased form Taka 0.14 billion in 1981/82 to Taka 45.021 billion in 1991/92 - a 320 - fold increase, making it the most important export industry, with well over 50 % of the gross national export value (see Table-6).

Bangladesh has emerged as a major supplier to two very important markets (Annex 5.b). On a quantity basis, Bangladesh is the 8th largest exporter to the US (1991) and the 10th largest exporter to the EEC (1990).

Overall, garment exports account for almost 60 % of all Bangladesh exports, and it is the only sector with any significant growth. In 1990-91, the second largest sector, jute goods exports, and the fourth largest, leather exports declined. The third largest, frozen food, increased only marginally. Growth in traditional exports and other items was insignificant.

Table - 6

Bangladesh Garments Export (1981-92)

Year	Exports in Million Tk.	Growth Rate in Tk.	Exchange Rate	Exports in Million US$	Growth Rate in US$
81-82	140.00		22.80		6.14
82-83	255.00	82.14	24.94	10.22	66.51
83-84	775.00	203.82	25.96	29.85	191.98
84-85	3004.00	287.61	29.89	100.50	236.65
85-86	3902.00	29.89	30.24	129.03	28.39
86-87	9007.00	130.83	31.24	288.32	123.44
87-88	13421.00	49.01	31.87	421.12	46.06
88-89	14943.00	11.34	32.63	457.95	8.75
89-90	20385.00	36.42	35.23	578.63	26.35
90-91	30504.00	49.64	36.50	835.73	44.43
91-92	45021.00	47.59	38.00	1184.76	41.78

Note : Compounded Annual Growth Rate = 61.35%

6.2 Related Economic Activities

The extraordinary growth of the sector has resulted in a host of other activities of economic benefit to the country. Some of these are highlighted below:

a) The garment sector has opened up a big opportunity for the establishment of backward linkage industries. In the early days of the industry, all the required raw materials were imported. Today, a number of industries have come up, e.g. production of cartons, thread, labels, polybags, gum tape, shirtboards, neckboards, etc. The sector currently imports about 700 million square metres of fabric. This provides the local textile producers with an opportunity to meet at least a part of this growing demand for fabrics. This aspect has been further dicussed in Chapter 7.

b) More than half of the foreign exchange business of Bangladesh banks is related to the garment sector.

c) This sector accounts for a substantial part of the marine business of the insurance companies of Bangladesh.

d) The shipping business in Bangladesh increased significantly because of this sector. As a result, the export authorities had to set up a vast container yard and expand their port facilities to handle the garment sector's large containers.

e) An inland container yard was established in Dhaka by the Bangladesh Railway mainly to cater to the needs of the garment sector. Special container carrying trains have been introduced by Bangladesh Railway to cope with the need of the RMG units in Dhaka.

f) The large expansion of the handling and storage facilities at the Dhaka International Airport to handle business created by the garment industry was carried out.

g) With the increased shipping business, the C&F agencies and stevedoring businesses have also prospered.

h) The industry has created intensive economic activity in the land cargo transport business between Dhaka, Chittagong and Benapole.

i) More than 120 buyers have opened up their offices in Dhaka and Chittagong. They are bringing in foreign exchange to support their expatriate staff. In addition, a large employment opportunity has been created for local support staff for these offices.

j) The garment buyers now visiting Bangladesh are providing major business to the hotels of Dhaka and Chittagong.

6.3 Product and Market Segment Trends

1) US Market

The US share of Bangladesh garment exports was over 80 % in fiscal year 1986-87. This declined to 51 % by fiscal year 1990-91. This decline in market share was due to increased trade with the EC whose market share in 1990-91 stood at 40 %. In absolute terms, exports to the US increased during this time but at a slower rate.

a) Pangladesh is a major exporter of the following products to the United States (1991):

(1)	Woven shirts, blouses and other woven products	:	36.72 mn pcs
(2)	Knit shirts and other knit products	:	15.80 mn pcs
(3)	Trousers	:	30.20 mn pcs

b) There are 84 categories of US garment products. Bangladesh is subjected to quotas on 28 products. There are 56 products where trade is now developing.

The major exports of Bangladesh both to the US (Annex 6.a & 6.b) and the EC (Annex 6.c to 6.f) consist of shirts and T-shirts. Medium and light-weight cotton and blended fabrics are the main materials for these shirts.

2) EC Market

The EC market share increased from 14 % in fiscal year 1986-87 to 40 % in 1990-91.

Exports to the EC have increased dramatically over the last two years.

a) In 1989, Bangladesh exported over 50 million garments to the EC. This increased by 138 % in 1990 to over 118 million pieces. Exports were projected to increase to 166 million pieces in 1991.

b) Exports to these countries also increased substantially in 1990 compared to the previous years. Significant growth in trade was achieved with Belgium, the Netherlands, Germany, Spain and the United Kingdom in 1990.

Export trends in the first six months of 1991 showed that exports to Germany, the United Kingdom, Italy and Spain would register substantial growth by year end.

Bangladesh exports to the EC consist mainly of woven shirts and T-shirts (Annex 5.c to 5.e). In 1991, exports of woven shirts and T-shirts accounted for 82 % of the exports to the EC.

a) Additional products being developed are:
   - Trousers
   - Blouses
   - Anoraks
   - Track suits

b) Woven shirt exports increased by 83.2 % from 1990 to 1989 and were projected to increase by 16.2 % in 1991.

c) T-shirts exports increased by 354.2 % from 1990 to 1989 and were projcted to increase by 68 % in 1991.

d) Bangladesh exports still enjoy quota-free status in the European markets.

Other important markets for export of garments from Bangladesh are Norway, Sweden, Finland and Russia.

6.4 Recent Changes in Industry Structure

One of the important aspects of the structural change in the RMG industry was the change in the ownership patterns. Clearly the smaller units were not economically viable and those who could not master the means to expand, sold their factories to their competitors. Thus, we see that today there are groups who own multiple factories of smaller sizes. If these mergers are considered as single production facilities, the number of units in the 0-50 machine group will be almost negligible.

In the initial days of the industry, product specialization was not very prevalent. Factories used to accept orders of any item they came across. Also, lot sizes were relatively small. Now, most factories have developed skills in the production of particular types of garments. Today, it is difficult to find a shirt factory that is willing to accept a lower price if the lot size per style is greater. Experience taught them that productivity increases with larger lot orders, thereby reducing the unit cost of production.

Over the years, production facilities have also improved, especially in the finishing department. Introduction of steam irons fed directly from steam boilers, use of vacuum tables, washing facilities, etc, improved the finishing quality substantially. The US market share declined until 1986, but recovered thereafter, while the EC market share increased steadily. The market share of developing countries in the world textile export industry rose from 28 % in 1982 to 33 % in 1990.

Traditionally, world exports of textiles had been more important than clothing. In 1974, the first year of MFA, world exports of textiles (at USD 28 billion) was almost twice as large as world exports of clothing. Since then, world exports of clothing have persistently risen more rapidly than those of textiles. In 1990, for the first time, world exports of clothing (at an estimted USD 104 billion) equaled world exports of textiles.

In developed nations, textile exports remained more important than clothing exports. In the case of developing countries, however, in 1990 clothing represented more than 60 % of their total exports of textiles and clothing.

The export of clothing from developing countries has been the most rapid, expanding trade flow in the world in the 1980's. It increased from 15.5 billion dollars in 1982 to 54.0 billion dollars in 1990. One important feature of this expanded trade flow was that it has not often led to a corresponding increase in the domestic value addition in the exporting countries, because a sizeable part of this trade was based on imports of yarn, fabric and clothing from the developed countries. In many cases, the value added domestically by the developing countries has not exceeded 20-25 % of the gross value of their exports. Over the years, with the establishment of backward linkage industries, Bangladesh has now attained a value addition of over 30 % aggregate.

7. EXISTING TEXTILE MANUFACTURING CAPACITY

7.1 Recent Developments

Because of an enduring gap between local yarn demand and manufacturing, the spinning sub-sector has been reliably profitable, so that the recent major investment in the textiles industry has tended to be in spinning. Also, the rapid growth of hosiery garment exports (knitwear) and hosiery production capacity (knitting and finishing factories) has created an additional demand for quality cotton yarn. Prior to this wave of investment in spinning capacity, there was substantial investment in modern dyeing/printing/finishing capacity mainly geared torward domestic fabric requirements. There has been virtually no investment in any modern integrated textile mills or modern weaving capacity, despite government policy support, to create composite mills to meet the RMG industry's requirements.

7.2 The Bangladesh Textile Sector

There are some unique features in the structure of the Bangladesh textile industry.

1) Domestic Market

First, there is an effectively segregated and highly protected domestic market, whose demand is estimated (by UNIDO) at 1.25 billion square meters. Of this, 970 million meters comes from local manufacturing, while 280 million meters reaches the market through illegal imports (including "leakages" from the RMG industry). 88% of the local supply of textile fabric comes from the handloom and powerloom sectors, while only 12 % (approx. 116 million m.) is manufactured by the large mill sector. (The latter dates back primarily to the 50's and 60's with outdated machinery and outdated technical expertise). Because of complete protection from external competition, the local yarn prices have been a function of domestic supply and demand conditions. The high capital cost of setting up spinning capacity, in a country where the accumulation of capital in private hands is limited, has restricted the growth of spinning mills despite an enduring supply gap and prices well above international levels. It should be mentioned here that local raw cotton supplies are under 10 % of the total requirement, so the balance of 90 % has to be imported from various sources, mainly Pakistan. Pakistan imposes a substantial export tax on its raw cotton, while the other major textile manufacturers, India and China, are self-sufficient in raw cotton. Consequently. Bangladesh suffers a cost disadvantage in this regard, leading to higher yarn prices.

The large, disorganized handloom and powerloom sectors convert the yarn into fabrics more cheaply than the mill sector because of lower labour, power and capital costs. Since the bulk of demand is for lower-priced fabrics (due to the very low average purchasing power), mill quality fabric demand at the higher prices is limited, and the growth of modern weaving capacity in the mill sector remains small. Modern dyeing/finishing/printing mills have come to cater to the entire weaving sub-sector because of increased consumer demand for better printed products and the promise of "backward linkage" with the RMG industry. But with the quality of the woven fabrics being low, the dyeing/finishing/printing mills have not had the projected breakthrough into the RMG market, they were hoping for with the result being that further hardware and software investment is required in these mills to make them truly export-capable companies. The government has been trying to ratify the situation by allowing yarn and grey fabric imports to be duty-free if re-exported, in an attempt to integrate the domestic and export textile markets, but this has met with only limited success because of the bureaucracy involved and the inherent weaknesses of the weaving and dyeing/finishing/printing sub-sectors as noted above.

2) Export Market

Second, the RMG industry has been built around a completely free access to international fabric sourcing. With its geographical as well as business proximity to Hong Kong, China, India, Pakistan, Korea, Taiwan, and Thailand, the Bangladesh RMG industry has grown into one of the most dynamic textile producers in the world, offering the most competitive prices for the range of fabrics required by the RMG industry. This situation, coupled with an overvalued Taka, has made it difficult for local textile producers to break into the RMG market, despite the major advantages accruing from close proximity and a GSP of 15 % (Europe) and quota (US/Canada) benefits. The considerable technical input required to produce international standard quality fabric is also not readily available in Bangladesh, so that all these factors put together have restricted the supply to under 3 % of the RMG demand. With no substantial investment in modern capacity geared specifically to the RMG market, the possibility of rapid growth in the near future is remote. In other words, the export and domestic textile markets remain effectively segregated, to the detriment of both, with rampant smuggling of fabrics into Bangladesh and "leakages" from the RMG industry. This makes it impossible to realize the potential of local fabric manufacturing in the RMG industry.

3) Structural overview

Third, the textile industry is composed of all kinds of units, from private individuals operating handlooms to the state-owned Bangladesh Textile Mills Corporation, comprised of 42 large mills. There are old mills (over 30 years old) with spinning, weaving and some finishing capability, old spinning mills, handlooms, powerlooms (small weaving projects), mills with weaving and dyeing/finishing/printing capabilities, hand printing units, finishing units, dyeing/printing units, new spinning mills, fully-integrated mills, modern dyeing/printing/finishing units, knitting mills, composite knitting mills with dyeing/finishing capabilities, and so on. There are legal imports of textile-products from India, Pakistan, and other countries, smuggled textiles from India, "leakages" from the RMG industry, smuggling into India, and of course legal exports out of the country. The apparently haphazard structure of the industry is due in large part to confused governmental policy (both general and specific) with regard to the sector.

7.3 Fabric Manufacturers Supplying to the RMG Industry

Our survey relied on in-depth interviews with concerned people at the leading fabric manufacturers, some of whom were also leading suppliers to the RMG industry.
The following companies were surveyed :

1. Siddique Textiles/Sidtex.
2. Arkay Fabrics
3. Rahim Textiles
4. Quasem Group
5. Phoenix Group
6. Bangladesh Textile Mills Corporation
7. All-tex Industries
8. A.K.Khan Group
9. Pahartali Textile
10. Dhaka Dyeing
11. Chittagong Dyeing
12. Saiham Textiles

13. Syntex
14. GMG Industrial Corporation

Some of these mills are weaving only grey cloth, some are spinning and weaving only grey cloth, some are weaving and finishing, some are only dyeing/finishing/ printing, while some handle the entire process. As noted earlier, the main products involved are Ne 20 and Ne 30 cotton sheeting and cotton twill fabrics.

7.4 Problems

The reasons identified for the very poor penetration into the RMG market were as follows:

1) Prices are low and unattractive compared to costs, especially since domestic yarn prices and raw cotton costs are on the high side. Excessive payroll, low productivity, and old machinery are largely responsible for the high costs.

2) Quality requirements of the RMG industry are difficult to meet because of inadequate equipment, lack of technicl know-how, generally low standard and lack of a genuinely international export orientation.

3) Governmental policy in the textiles sector is unstable and unpredictable. Import tariff structures, incentive structures, and duty drawback facilities are out and are poorly implemented.

4) An overvalued currency compared to competing countries like India, China, and Pakistan leads to export competitiveness difficult.

5) The inability to invest in modern plants and machinery because of insufficient capital accumulation and unavailability from other sources (such as bank loans and the stock market) has hindered growth.

7.5 Prospects for Growth in Backward Linkage

1) Despite the past history, it was generally felt that the tremendous opportunity offered by the RMG industry would give the textiles industry a boost, provided that the government policy is supportive.

2) It was expected that the Government would either devalue the currency shortly or make it fully convertible on trade accounts (which would likely have the same

effect, that is, the Taka would depreciate). This would raise the price of imported fabrics and make local production more competitive.

3) Since a major share of the recent growth in exports was coming from Europe, which offers a GSP (Generalised System of Preferences) tax benefit of 15 % to RMG imports from Bangladesh (provided the fabric is Bangladeshi), there are possibilities for increasing local fabric supply even at 15-20 % higher prices.

4) The Government has reserved U.S. and Canadian quotas for garment exporters utilizing local fabrics. Judging by the steadily increasing quota premiums, it is now quite attractive for the RMG industry to procure fabric locally, even at much higher prices, to make use of these free quotas (provided suitable quality fabrics can be supplied).

5) As confirmed by the experience of the textile manufacturers currently selling cotton sheeting and twills to the RMG industry, there are substantial delivery advantages and other advantages (such as reduction of risk, uncertain delivery, banking costs, avoidance of customs formalities and costs, etc.) which will enable the RMG industry to procure locally at higher prices. The premium being realised on this account alone is estimated to be at least 5 %. However, this does not quantify the potentially large boost to RMG exports from shorter lead time, which is one of the major advantages of local fabric procurement for the RMG industry.

6) Easier access to intermediate textile products from international markets, such as yarn or grey fabric, and the reduction of import duties to zero on raw cotton and other basic raw materials, would facilitate the growth of quality fabric manufacturing. While government implementation is quite slow, it was felt that the policies were moving in the right direction.

7) For all practical purposes, it is virtually impossible to mobilize locally the US $ 50 million or so needed to set up a modern integrated textile mill. Three such projects, approved by the main industrial finance bank, BSB, about 5 years ago, were eventually cancelled. The Government is apparently not yet ready to commit bank loans of this magnitude to private investors, nor is the stock market developed enough to enable this financing. This situation presents an ideal opportunity for the "first one in."

8) The technical know-how needed to produce international quality fabric is just not available locally with no foreseable improvement of the situation in the near future. Foreign technicians have to be hired or, joint-venture projects undertaken. to achieve the desired standards. Again, the first project would enjoy the benefits of overcoming these considerable entry barriers.

9) The government has imposed a minimum local value addition of 30 % (for woven garments), and RMG manufacturers can import materials whose value does not exceed 70 % of its export value, which is often insufficient for garments made of expensive materials. The RMG industry is, therefore, having to pass up the higher value, higher-end products which are more lucrative. A local fabric manufacturer could thus remove this problem and open up new and better opportunities for the RMG industry.

10) There is a substantial demand for quality fabric in the local market which is currently being met by smuggled goods and "leakages" from the RMG industry. Also there is a potential for Bangladesh to become a fabric exporting country as well. These are no less interesting for a modern integrated mill than the RMG demand, but it goes beyond the scope of this study.

7.6 Existing Backward Linkage

As noted earlier, local supplies are restricted to 100 % cotton sheeting (with Ne 20 and Ne 30 yarn counts) and heavier 100 % twills (40/2x40/2, 108x58), with well under 3 % of the total RMG fabric demand. The quality of these fabrics is thought to be poor and barely acceptable by international standards. Nevertheless, the RMG industry is paying at least 15-20 % higher prices than for imports, due to the many advantages of local procurement. The fabrics are ordered and procured directly from the local manufacturers by the RMG units through letters of credit (L/C's).

Annex : 1 (a)

Demand of Fabric for RMG Units (April 1992 to March 1993) estimated from Field Survey Data

Average width 45" unless otherwise stated.

Type of Fabric	Dozon Exported	Type of Apperal	Conversion factor (for Square Meter Equivalent per Dz.)	Usage of Fabric by the Sample of 100 RMG Units in SME (In '000') (Fig in '000)	Ratio of Usage of Fabric by the Sample of 100 In SME (In '000')	Usage of Fabric by the Population of 800 in SME (Fig in '000')
	(a)		(b)	(c)=(axb/1000)	(d)	(e)=(c)/100x800
T/C,P/C (printed, solid dyed), 45x45/110x76	932,792	S & B	14.00	13,059.09	12.11%	104,472.70
T/C,P/C (yarn dyed), 45x45/110x76	719,679	S & B	14.00	10,075.51	9.34%	80,604.05
Poplin, 40x40/133x72 or 40x40/140/72	417,543	S & B	14.00	5,845.60	5.42%	46,764.82
Poplin 40x40/120x64	279,800	S & B	14.00	3,917.20	3.63%	31,337.60
Twill (3/1), 40/2x40/2 / 108x58	546,685	Tr	15.00	8,200.28	7.60%	65,602.20
All Flannel (printed)	644,925	S & B	14.00	9,028.95	8.37%	72,231.60
All Flannel (yarn died)	404,815	S & B	14.00	5,667.41	5.25%	45,339.28
Denim, 13.75 to 14.50 Oz. (59" to 60")	309,753	Tr	15.00	4,646.30	4.31%	37,170.36
Denim, 6.00 to 6.50 Oz. (59" to 60")	360,840	S & B	14.00	5,051.76	4.68%	40,414.08
100% Cotton Sheeting	219,550	S & B	14.00	3,073.70	2.85%	24,589.60
Taffeta	23,250	Tr	15.00	348.75	0.32%	2,790.00
Others	1,557,406	Jkt	25.00	38,935.15	36.10%	311,481.20
Total Dz Exported by Sample:	6,417,038.00					
Total Fabric Used by the Sample RMG Manufacturers				107,849.69	100.00%	862,797.49

- Width of farbric imported has been found to be 42" to 44".
- The data of this table is from the Field Survey.
- Dozon Exported is from the responses of the sample RMG Manufacturers.
- The Conversion factor of SME per Dz is from the estimates given by the Sample RMG factories and cross checked against the Conversion Factors gathered form the EPB/BGMA.
- Best estimate of the population size is 1100, however, it is also a fact that approximately 300 or more RMG manufacturers are solely working on sub-contracts, hence actual population of interest of the study may be considered 800.

Key

S & B : Shirts & Blouses
Tr : Trousers
Jkt : Jactets, Paysuits etc.

Data Source : EPB/BGMEA
Prepared by : IBA Consultants

Annex : 1 (b)

Current Prices of Major Fabrics

Average width 43" unless otherwise stated.

Type of Fabric	Average C&F Price per Yard in USD	Conversion Factor for 1 Meter x 63"	Converted Per Meter Price of Fabric with width of 63" in USD
T/C,P/C (printed, solid dyed), 45x45/110x76	0.92	1.61	1.48
T/C,P/C (yarn dyed), 45x45/110x76	1.10	1.61	1.77
Poplin, 40x40/133x72 or 40x40/140/72	1.10	1.61	1.77
Poplin 40x40/120x64	1.19	1.61	1.91
Twill (3/1), 40/2x40/2 / 108x58	1.36	1.61	2.18
All Flannel (printed)	0.69	1.61	1.11
All Flannel (yarn died)	0.90	1.61	1.44
Denim, 13.75 to 14.50 Oz. (59" to 60")	2.32	1.14	2.65
Denim, 6.00 to 6.50 Oz. (59" to 60")	1.58	1.14	1.81
100% Cotton Sheeting	0.96	1.61	1.54
Taffeta	1.03	1.61	1.65
Others	—	—	—

Data source: Direct Field Survey
Prepared by IBA Consultant.

Source : EPB/BGMEA
Prepared by : IBA Consultants

Annex : 2 (a)

Export Against Quota to USA

Figs in Dz.

Quota Type		Conversion Factor SME/Dz	1987-1988	1988-89	1989-90	1990-91	1991-92
237	Playsuits	37.90	0.00	0.00	0.00	0.00	245,449.00
331	Gloves	1.50	379,085.00	436,855.00	692,818.00	661,610.00	622,022.00
334	Coats,non-suit,M&B	34.50	52,625.00	75,686.00	79,671.00	77,334.00	109,618.00
335	Coats,W&G	34.50	99,530.00	119,074.00	121,457.00	102,945.00	146,913.00
336/636	Dresses	37.90	38,983.00	70,596.00	100,433.00	235,625.00	217,753.00
338/339	Knit Shirts & Blouses	6.00	200,612.00	507,002.00	790,453.00	728,721.00	977,085.00
340/640	Shirtsnon-knit,W&G	20.10	1,282,600.00	1,594,065.00	1,771,264.00	1,676,375.00	2,443,317.00
341	Shirts & Blouses, non-knit,W&G	12.10	1,235,960.00	1,121,893.00	1,177,660.00	1,033,510.00	1,797,372.00
342/642	Skirts	14.90	122,430.00	222,473.00	177,483.00	250,206.00	178,161.00
347/348	Trousers	14.90	1,112,364.00	1,259,100.00	1,249,852.00	1,249,852.00	1,648,250.00
351/651	Nightwear	43.50	0.00	0.00	0.00	360,319.00	502,789.00
634	Coats, non-suit, M&B	34.50	0.00	0.00	0.00	0.00	345,316.00
635	Coats, W&G	34.50	45,408.00	61,817.00	97,984.00	146,506.00	258,298.00
638/639	Knit Shirts & Blouses	12.96	370,602.00	905,269.00	602,657.00	036,014.00	1,293,950.00
641	Shirts & Blouses, non-knit, W&G	12.10	160,035.00	155,311.00	442,900.00	747,761.00	497,901.00
645/646	Sweaters	14.90	167,209.00	140,437.00	139,844.00	158,990.00	188,770.00
647/648	Trousers	14.90	807,720.00	556,000.00	897,307.00	951,146.00	980,718.00
847	Trousers, Slacks, Shorts	14.90	0.00	0.00	0.00	353,709.00	523,737.00

t Data Source EPB, US Department of Commerce, Prepared by IBA Consultants.

o Quota items of terry towel and shop towel excluded since they do not fall under interest group.

Source : EPB/BGMEA
Prepared by:IBA Consultants

Annex : 2 (b)

Export Against Quota to USA

Fig.s in SME

Quota Type		1987-1988	1988-89	1989-90	1990-91	1991-92
237	Playsuits	0.00	0.00	0.00	0.00	9,302,517.10
331	Gloves	568,627.50	655,282.50	1,039,227.00	992,415.00	933,033.00
334	Coats,non-suit,M&B	1,815,562.50	2,611,167.00	2,748,649.50	2,668,023.00	3,781,821.00
335	Coats,W&G	3,433,785.00	4,108,053.00	4,190,266.50	3,551,602.50	5,068,498.50
336/636	Dresses	1,477,455.70	2,675,588.40	3,806,410.70	8,930,187.50	8,252,838.70
338/339	Knit Shirts & Blouses	1,203,672.00	3,042,012.00	4,742,718.00	4,372,326.00	5,862,510.00
340/640	Shirtsnon-knit,W&G	25,780,260.00	32,040,706.50	35,602,406.40	33,695,137.50	49,110,671.70
341	Shirts & Blouses, non-knit,W&G	14,955,116.00	13,574,905.30	14,249,686.00	12,505,471.00	21,748,201.20
342/642	Skirts	1,824,207.00	3,314,847.70	2,644,496.70	3,728,069.40	2,654,598.90
347/348	Trousers	16,574,223.60	18,760,590.00	18,622,794.80	18,622,794.80	24,558,925.00
351/651	Nightwear	0.00	0.00	0.00	15,673,876.50	21,871,321.50
634	Coats, non-suit, M&B	0.00	0.00	0.00	0.00	11,913,402.00
635	Coats, W&G	1,566,576.00	2,132,686.50	3,380,448.00	5,054,457.00	8,911,201.00
638/639	Knit Shirts & Blouses	4,906,681.92	11,732,286.24	7,810,434.72	10,834,741.44	16,769,592.00
641	Shirts & Blouses, non-knit, W&G	1,936,423.50	1,879,263.10	5,359,090.00	9,047,908.10	6,024,602.10
645/646	Sweaters	2,491,414.10	2,092,511.30	2,083,675.60	2,368,951.00	2,812,673.00
647/648	Trousers	12,035,028.00	8,284,400.00	13,369,874.30	14,172,075.40	14,612,698.20
847	Trousers, Slacks, Shorts	0.00	0.00	0.00	5,270,264.10	7,803,681.30
	Total SME exported against US Quota	90,569,032.82	106,904,299.54	119,650,178.22	151,488,300.24	221,992,866.20

* Data Source EPB, US Department of Commerce, Prepared by IBA Consultants.

o Quota items of terry towel and shop towel excluded since they do not fall under interest group.

Source: EPB/BGMEA
Prepared by: IBA Consultants

Annex : 2 (c)

Export Against Quota in Pieces to Canada

Quota Type	Conversion Factor SME/pc. *	1987-1988	1988-89	1989-90	1990-91	1991-92
6 Tailored Collar Shirts, Blouses	1.80	65,445.92	1,224,875.00	1,441,200.00	1,363,026.00	Not available
1a Jackets	2.90	185,441.00	438,932.00	559,631.00	598,067.00	Not available
2 Winter Apperals	3.50	78,614.00	167,321.00	277,792.00	169,403.00	Not available
7,8a,8b Shirts, Blouses	1.70	161,875.00	227,515.00	[illegible]9,310.00	245,510.00	Not available
3,4a,4b Coordinated Sets	3.40	416,678.00	72,101.00	2[illegible]6,407.00	419,426.00	Not available

Export Against Quota in SME to Canada

Quota Type	1987-1988	1988-89	1989-90	1990-91	1991-92
6 Tailored Collar Shirts, Blouses	117,802.65	2,204,775.00	2,594,160.00	2,453,446.80	Not available
1a Jackets	537,778.90	1,272,902.80	1,622,929.90	1,734,394.30	Not available
2 Winter Apperals	275,149.00	585,623.50	972,972.00	592,910.50	Not available
7,8a,8b Shirts, Blouses	275,187.50	386,775.50	219,827.00	417,367.00	Not available
3,4a,4b Coordinated Sets	1,416,705.20	245,143.40	905,783.80	1,426,048.40	Not available
Total supplied to Canada	2,622,623.25	4,695,220.20	6,315,672.70	6,624,167.00	8,470,691.72 *

* 1992 Export has been estiaaded through applying St. Line Regression Method.

Source : EPB/BGMEA
Prepared by: IBA Consultants

Annex : 2 (d)

Total Export of RMG (SME) from Bangladesh

	1987-1988	1988-89	1989-90	1990-91	1991-92
USA	90,569,032.82	106,904,299.54	119,650,178.22	151,488,300.24	221,992,866.20
Canada	2,622,623.25	4,695,220.20	6,315,672.70	6,624,167.00	8,470,691.72 *
Total SME Supply Against Quota:	93,191,656.07	111,599,519.74	125,965,850.92	158,112,467.24	230,463,557.92
Ratio of Quota/Non-Quota in USD:					
Quota	Not available	53.00%	46.00%	44.00%	35.00%
Non-quota	Not available **	47.00%	45.00%	56.00%	65.00%
Estimated SME supplied against Non-Quota:	Not availavle	98,965,611.84	123,227,462.86	201,234,049.21	428,003,750.43
Est. Total SME Exported Quota/Non-quota:	93,191,656.07	210,565,131.58	249,193,313.78	359,346,516.45	658,467,308.36

* 1992 Export to Canada has been estimaded through applying St. Line Regression Method.
** 1978-88 Data of Quota and Non-quota Export could not be retrieved from EPB, or any other source.

Source: EPB/BGMEA
Prepared by: IBA Consultants

Annex : 2 (e)

Past and Forecasted Trend of SME Export from Bangladesh:

		In Billion
1989	210,565,131.58	0.21
1990	249,193,313.78	0.25
1991	359,346,516.45	0.36
1992	658,467,308.36	0.66
1993	732,858,000.79	0.73
1994	878,243,974.09	0.88
1995	1,023,629,947.39	1.02

The forecast has been made using Linear Regression Method.

Annex : 3 (a)

Country-wise Export Value of Ready Made Garments

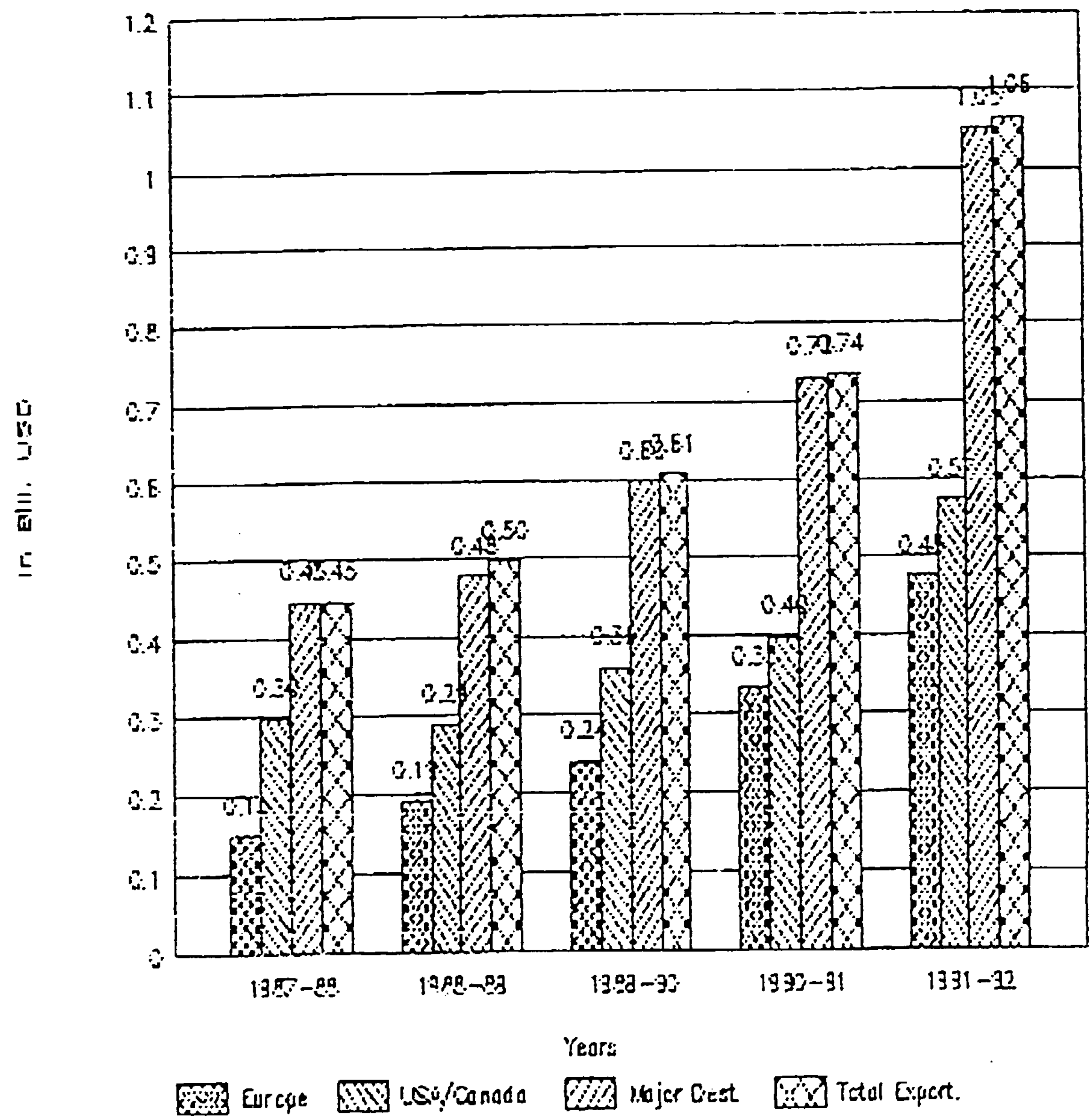
Name of Country	Export Volume in 1987-88 USD	% of Total	1988-89 USD	% of Total	1989-90 USD	% of Total	1990-91 USD	% of Total	1991-72 USD	% of Total
ANZ-AUSTRALIA	209.27	0.05	1,154.57	0.23	641.86	0.11	1,094.70	0.15	916.26	0.09
ANZ-NEWZEALAND	0.00	0.00	605.77	0.12	0.00	0.00	0.00	0.00	269.40	0.03
TOTAL AUS/NZ	209.27	0.05	1,760.33	0.35	641.86	0.11	1,094.70	0.15	1,185.66	0.11
GERMANY	45,393.50	10.15	45,438.70	9.13	57,282.77	9.40	96,730.26	13.15	123,791.78	11.63
FRANCE	18,269.73	4.08	28,770.70	5.78	46,480.43	7.63	52,965.54	7.20	90,623.84	8.54
ITALY	22,460.77	5.02	30,378.17	6.10	27,274.93	4.48	50,199.34	6.82	89,883.94	8.45
UK	18,967.87	4.24	31,550.70	6.34	43,838.09	7.19	59,431.08	8.08	63,211.03	5.94
NETHERLANDS	13,762.80	3.08	18,211.67	3.66	25,642.31	4.21	30,746.86	4.18	47,486.58	4.46
BELGIUM	2,567.03	0.57	6,750.07	1.36	8,836.50	1.45	8,422.86	1.14	15,276.48	1.44
SWEDEN	15,396.10	3.44	12,679.13	2.55	17,056.58	2.80	15,891.60	2.16	12,322.35	1.16
SPAIN	411.33	0.09	2,698.77	0.54	2,315.13	0.38	4,960.44	0.67	10,142.18	0.95
NORWAY	3,068.93	0.69	4,174.33	0.84	4,760.66	0.78	6,503.52	0.88	9,341.94	0.88
DENMARK	1,768.23	0.40	3,589.60	0.72	4,261.51	0.70	3,042.26	0.41	6,033.88	0.57
SWITZERLAND	3,851.43	0.86	1,376.93	0.28	646.55	0.11	2,585.42	0.35	2,906.43	0.27
IRELAND	0.00	0.00	30.03	0.01	159.44	0.03	944.47	0.13	1,523.22	0.14
AUSTRIA	0.00	0.00	31.87	0.01	9.99	0.00	1,019.37	0.14	1,462.78	0.14
FINLAND	1,843.60	0.41	4,466.97	0.90	337.20	0.06	802.38	0.11	1,030.71	0.10
GREECE	0.00	0.00	0.00	0.00	6.25	0.00	0.00	0.00	130.50	0.01
CZECHOSLOVAKIA	0.00	0.00	36.00	0.01	60.23	0.01	9.81	0.00	129.97	0.01
POLAND	0.00	0.00	0.00	0.00	0.00	0.00	42.68	0.01	110.03	0.01
PORTUGAL	0.00	0.00	0.00	0.00	865.78	0.14	0.00	0.00	62.83	0.01
RUMANIA	0.00	0.00	0.00	0.00	34.51	0.01	0.00	0.00	3.70	0.00
GDR	0.00	0.00	33.47	0.01	123.46	0.02	0.00	0.00	0.00	0.00
BULGARIA	0.00	0.00	162.10	0.04	92.44	0.02	0.00	0.00	0.00	0.00
TOTAL EUROPE	147,751.33	33.03	190,399.60	38.24	240,084.76	39.40	334,297.91	45.44	475,674.18	44.71
USA	282,301.13	63.11	277,705.10	55.77	342,450.42	56.20	373,960.24	50.84	553,060.44	51.98
CANADA	15,904.03	3.56	10,763.70	2.16	17,753.76	2.91	23,104.56	3.14	21,850.08	2.05
TOTAL USA/CANADA	298,205.17	66.67	288,468.80	57.93	360,204.18	59.12	397,064.81	53.98	574,910.52	54.03
MAJOR DESTN.	446,165.77	99.75	480,628.73	96.53	600,930.79	98.62	732,457.42	99.57	1,051,770.36	98.85
OUT OF TOTAL	447,287.50	100.00	497,928.80	100.00	609,323.00	100.00	735,621.00	100.00	1,064,004.00	100.00

Source : EPB

Annex : 3 (a) Contd.

Name of Country	Export Volume in 1967-88 USD	% of Total	Major Destn.-wise Export Value of Ready Made Garments 1988-89 USD	% of Total	1989-90 USD	% of Total	1990-91 USD	% of Total	1991-92 USD	% of Total
EUROPE	147,751.33	33.03	190,399.60	38.24	240,084.76	39.40	334,297.91	45.44	475,674.16	44.71
USA/CANADA	298,205.17	66.67	288,468.80	57.93	360,204.16	59.12	397,064.81	53.98	574,910.52	54.03
MAJOR DESTN.	445,165.77	99.70	480,628.73	96.17	600,288.94	98.52	731,362.72	99.42	1,050,584.70	98.74
OUT OF TOTAL	447,287.50	100.00	497,928.80	100.00	609,323.00	100.00	735,621.00	100.00	1,064,004.00	100.00

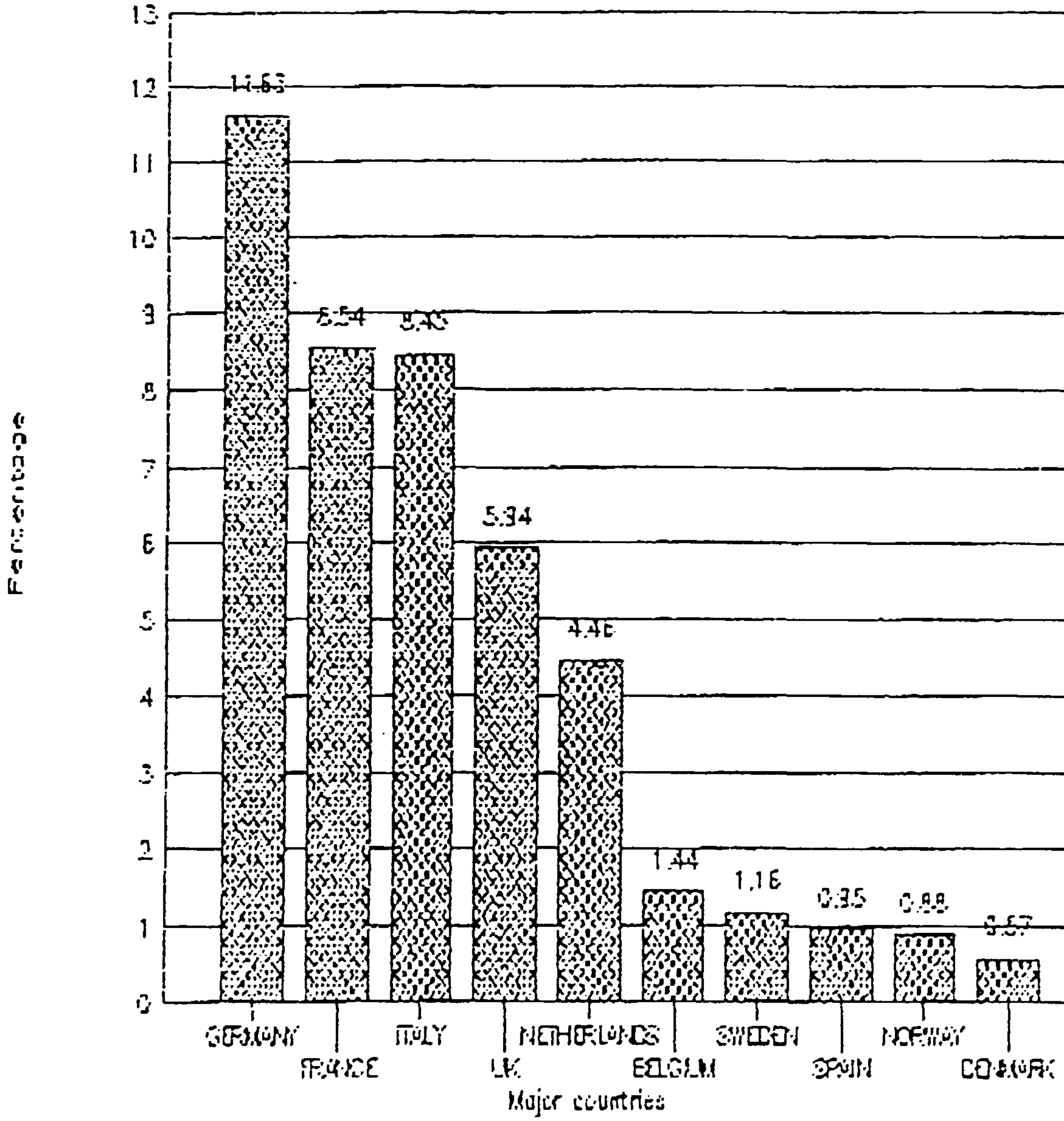
Export to Major Destinations



Source:EPB/BGMEA
Prepared by: IBA consultants

Annex : 3 (c)

% Exp. to major Destn in Europe in 1992



Data Source : EPB BGMEA
Prepared by : IBA Consultants

Annex : 3 (d)

BANGLADESH GARMENT EXPORTS
MAJOR MARKETS

- The U.S. had over 80% share of Bangladesh garment exports in fiscal year 1986 - 1987. This declined to 50.8% in fiscal year 1990-1991. This decline in market share was due to increased trade to the EEC. Exports to the U.S. increased during this time in value terms.

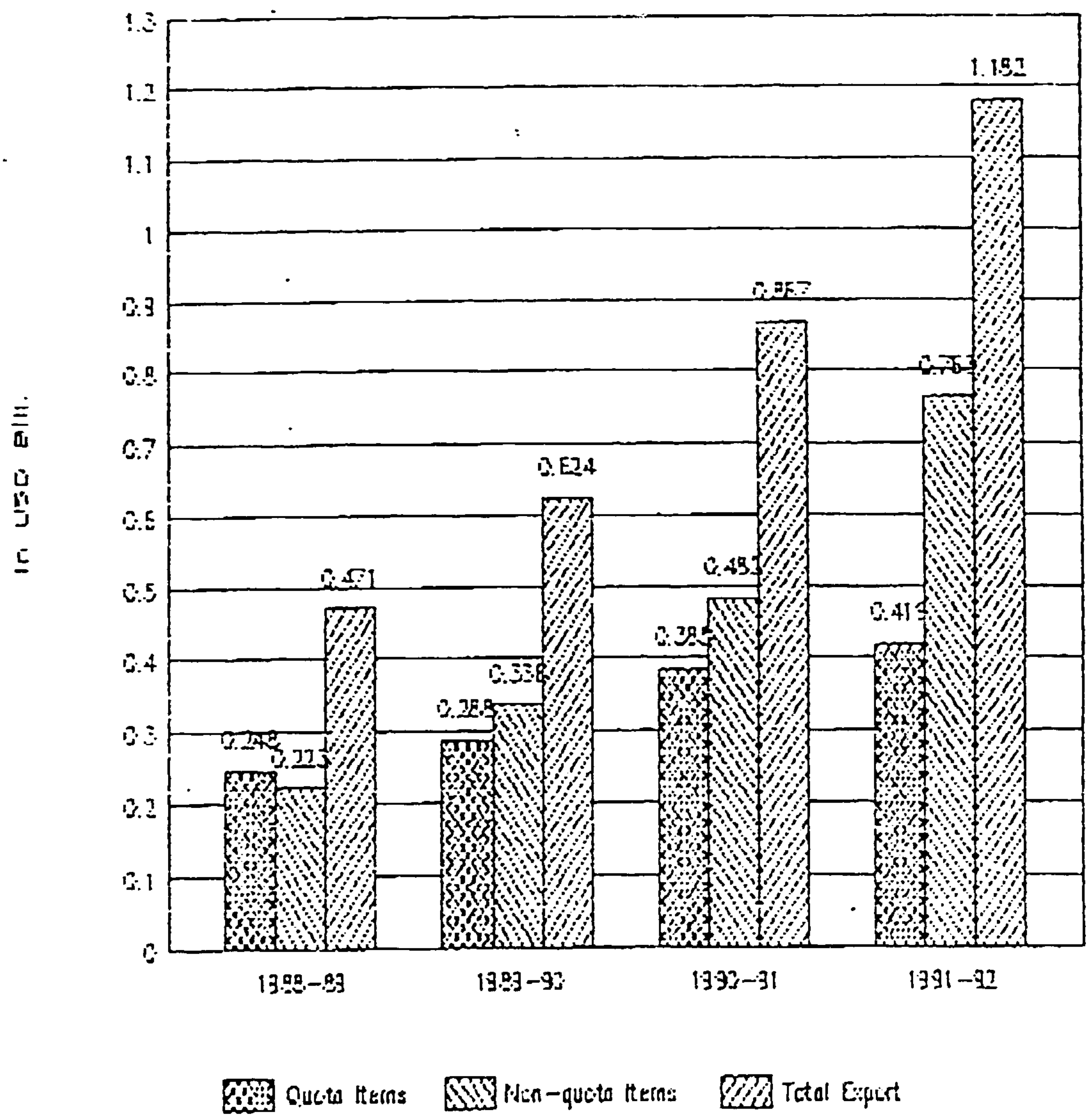
- The EEC market share increased from 14% in the 1986-1987 fiscal year to 42% in the fiscal year 1990-1991.

- The Canadian share of Bangladesh garment trade has remained close to 3.14% in 1990-1991.

- Other important markets include Norway and Sweden.

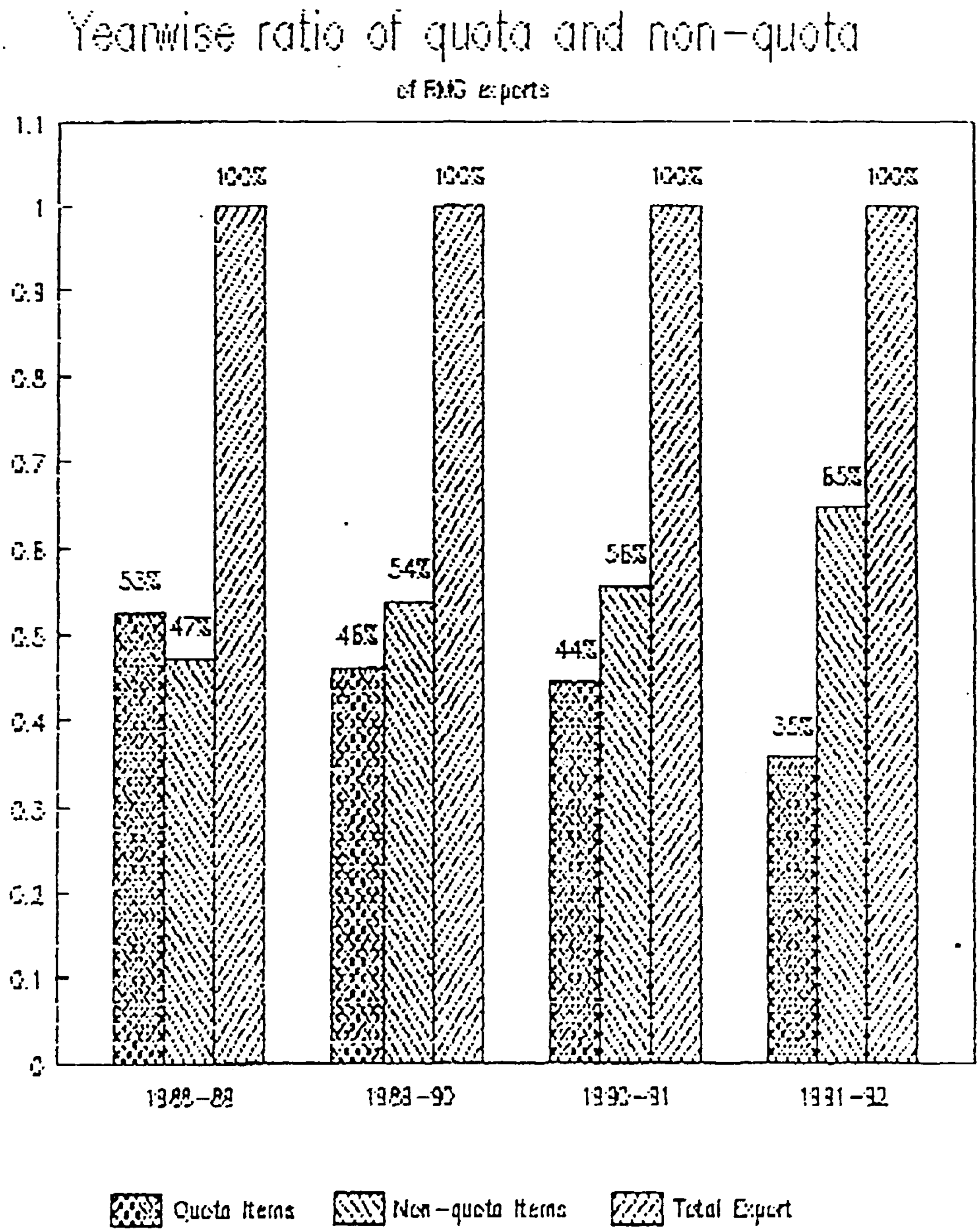
PREPARED BY: RDTI, BGMEA.

Value of Quota and Non-quota Export



	In USD '000,000'					
	Quota		Non-quota		Total Export	
1988-89	248	53%	223	47%	471	100%
1989-90	288	46%	336	54%	624	100%
1990-91	385	44%	482	56%	867	100%
1991-92	419	35%	763	65%	1182	100%

Prepared by IBA Consultant.
Data source EPB.



In USD '000,000'

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Prepared by IBA Consultant.
Data source EPB.

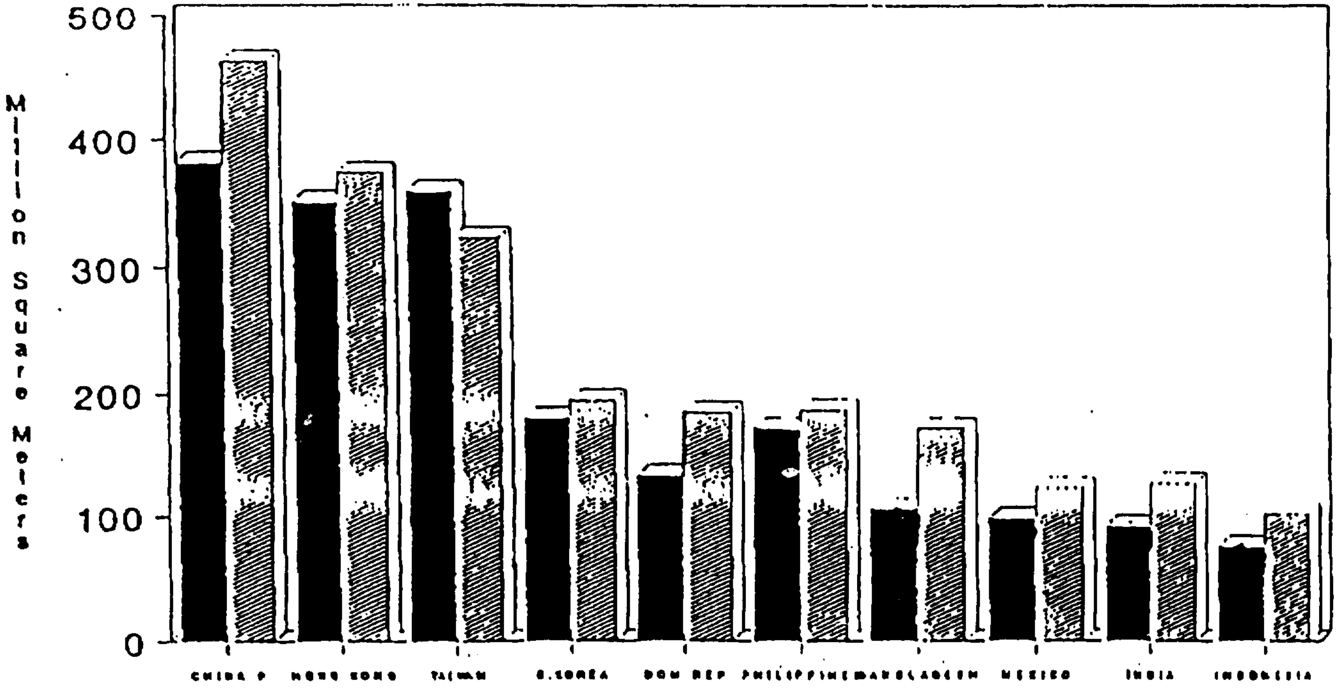
U.S. IMPORTS OF GARMENTS
BANGLADESH - THE 7TH LARGEST SUPPLIER

- Bangladesh is the 7th largest exporter of garments to the United States.
- For January to June, 1992 Bangladesh has 5% of the U.S. apparel market on a quantity basis and 2.83% on a value basis.
- Bangladesh is a major exporter of the following products to the United States:
  - Woven shirts 46.4 million pieces
  - Knit shirts 21.4 million pieces
  - Trousers 31.0 million pieces
- There are 84 U.S. garment products. Bangladesh is subjected to quotas on 28 products. There are 56 more products where trade is developing.

Prepared by: RDTI, BGMEA.

Annex : 5 (b)

US GENERAL IMPORTS OF APPAREL
TOP 10 SUPPLIERS
JANUARY-JUNE



EXPORT OF MAJOR PRODUCTS TO THE EC
BANGLADESH IS THE LARGEST SUPPLIER

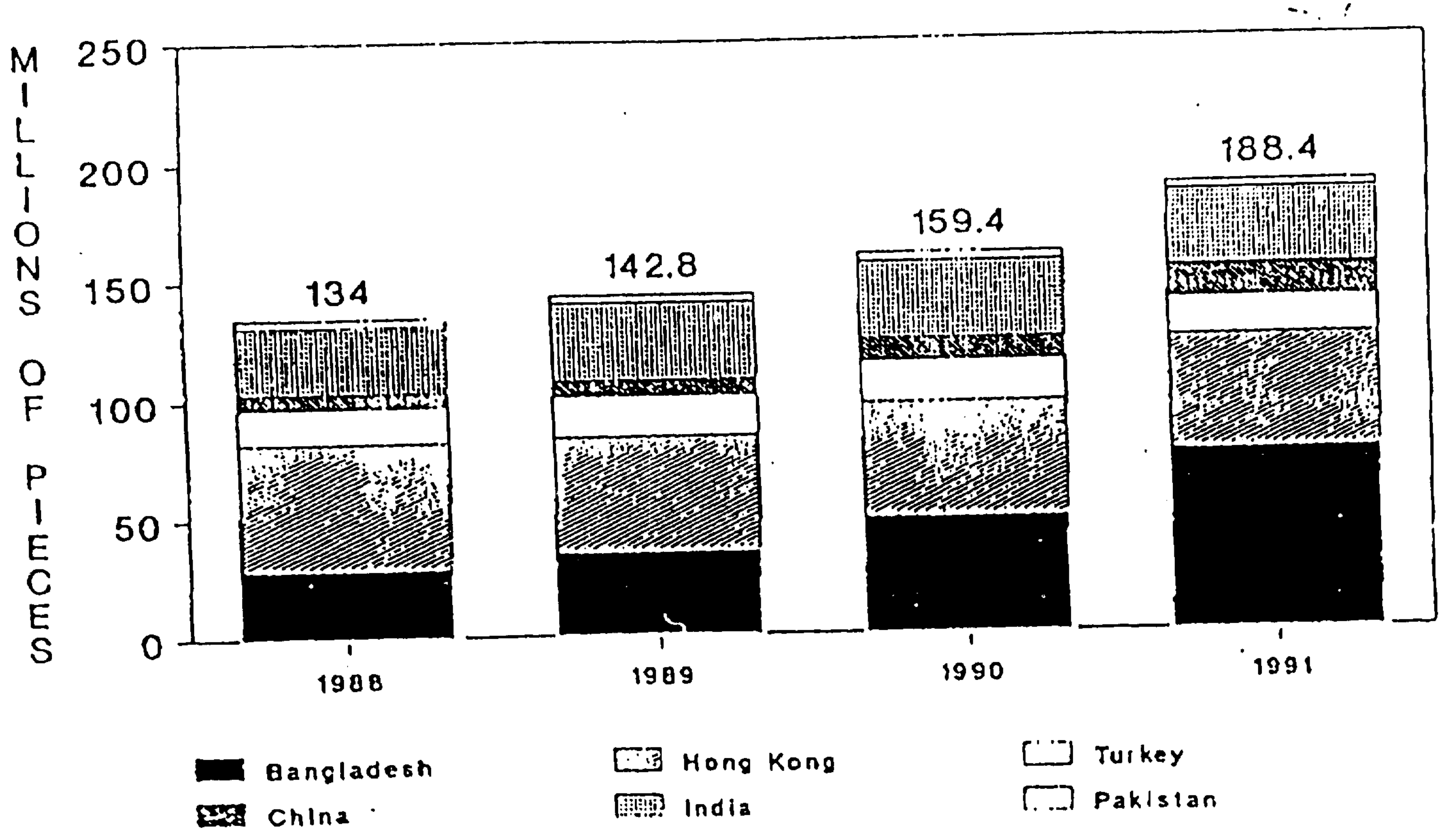
- In T-shirts, Trousers, Blouese, Shirts and Bed Linen Bangladesh has a share of more than 1% in EEC market.
- Bangladesh is the largest supplier if T-shirts & shirts amongst all the suppliers to the EEC market.
- In 1991 Bangladesh had 14% share of T-shirts & 22.6% share of shirts of total EEC import.
- Export of T-shirt in 1991 has increased about 400% from the export in 1989.
- Export of shirts in 1991 has increased about 220% from the export in 1989.

Annex : 5 (d)

EEC SHIRT IMPORTS
BANGLADESH - THE LARGEST SUPPLIER

- 57% of the EEC shirt imports is sourced from six countries. The rest of the trade is sourced from over 40 additional countries.
- With 22.6% of the import market in 1991 Bangladesh was the largest exporter of shirts to the EEC.
- EEC imports of shirts increased by 86% in 1991 compared to 1990. This trade increased 74.2% in 1990 compared to 1989 and is expected to increase furthet in 1992.
- Bangladesh has begun to develop fabric for the T-shirt industry. It is estimated that over 50% of the T-shirts will be made from Bangladeshi fabrics by the end of 1992.

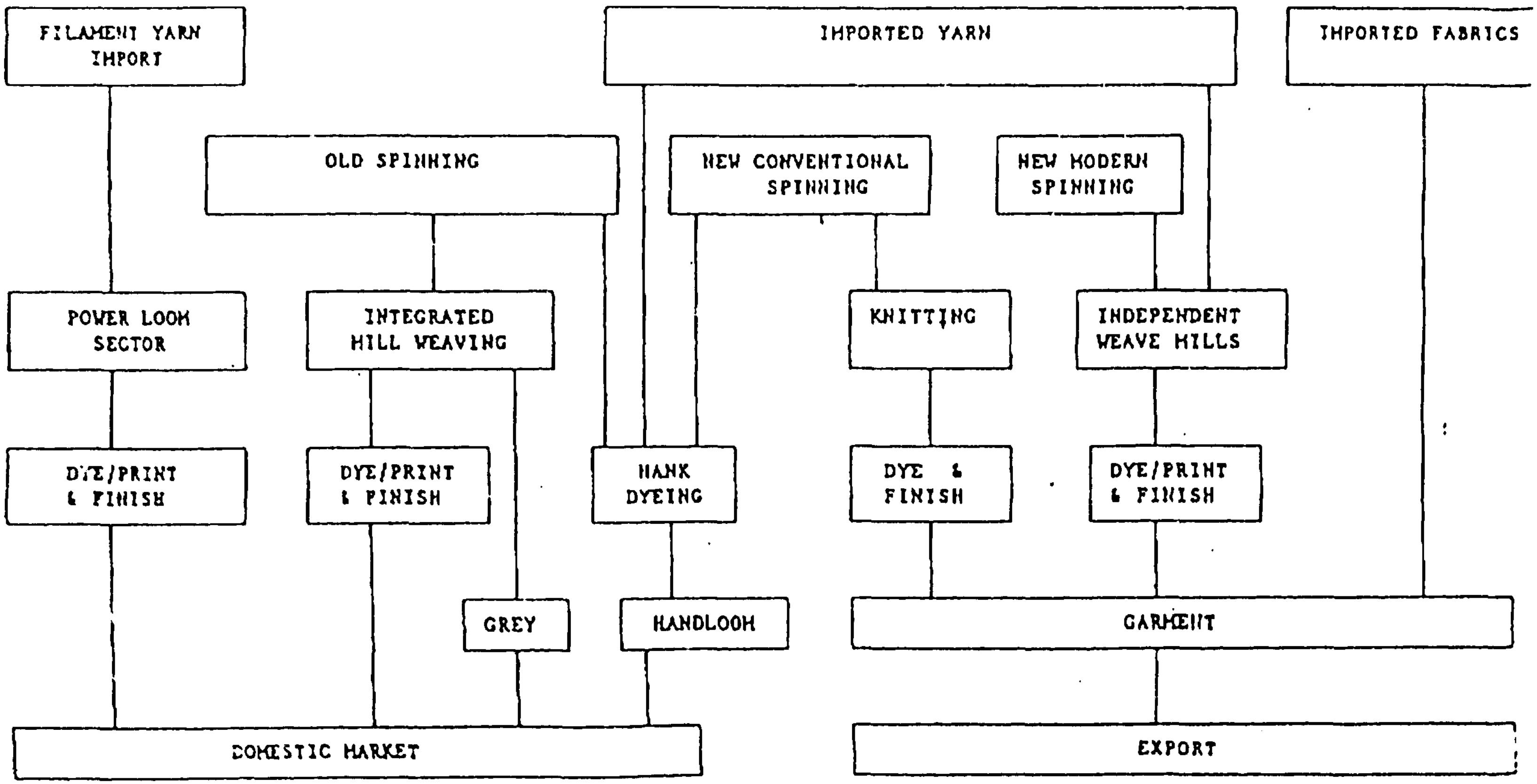
EEC SHIRT IMPORTS
BANGLADESH - THE LARGEST SUPPLIER



Annex : 6

BANGLADESH TEXTILE INDUSTRY: CURRENT STRUCTURE

REPORT ON THE TEXTILE INDUSTRIES RESTRUCTURING STUDY - PHASE I (WORLD BANK)



APPENDIX 4

A BRIEF STUDY ON CASE 4 : WEAVING AND DYEING MILL

Contents

1. GENERAL AND BASIC CONDITIONS
    1.1 General
    1.2 Basic Conditions
2. THE PROJECT : WEAVING AND DYEING PLAN
    2.1 Weaving and Dyeing Plan
    2.2 Process Flow Chart
    2.3 List and Basic Specifications of Main Production Machinery
3. THE PROJECT : CIVIL, MECHANICAL AND ELECTRICAL WORKS
    3.1 Civil Works
    3.2 Mechanical Equipment and Works
    3.3 Electrical Equipment and Works
4. IMPLEMENTATION SCHEDULE AND MILL ORGANIZATION
    4.1 Implementation Schedule
    4.2 Mill Organization
5. INVESTMENT COST
6. FINANCIAL EVALUATION
    6.1 Fundamental Conditions for Calculation
    6.2 Sales Revenue
    6.3 Production Cost
    6.4 Financial Evaluation

1. GENERAL AND BASIC CONDITIONS

1.1 General

Through preliminary discussions among prospective sponsors of the project, which took place on the 14th and the 15th of June, 1993 in Dhacca, Bangladesh, in an attempt to decrease the initial investment cost as well as to improve cash-flow returns (IRR) at the outset of the operation stage, the eliminating of the spinning facility from the base case was discussed. It was agreed that a brief study on this idea would be added to the final report.

This case study is hereafter called "CASE 4."

1.2 Basic Conditions

1) The Project

The project in Case 4 has no spinning facility, thus raw yarn (Ne 60/2 and Ne 80/2) for producing designated fabrics in the weaving and dyeing mills should be purchased from outside (imported). In this case, the availability of Ne 80/2 yarn is to be scrutinized prior to the final decision.

The principles of the project are the same as those mentioned in the base case, based on the joint-venture company, to be designed by Japanese consultants and managed by Japanese experts.

2) The Site

The project site has been coined the "STM" site. The total land requirements for the site area is estimated to be 60,000 m^2. One tenth of the area shall be reclaimed with suitable soil (averaging 1.0 m in depth), and existing STM buildings are to be demolished.

A block plan of the mill can be seen in Figure A-9.

3) Water Supply

Ten deep wells will be dug and a water quantity of 15 m^3/hour per well is estimated.

4) Power Supply

Two sets of natural gas generators are to be used for production purposes, and power from the BPDB will be utilized only for administration and emergency purposes.

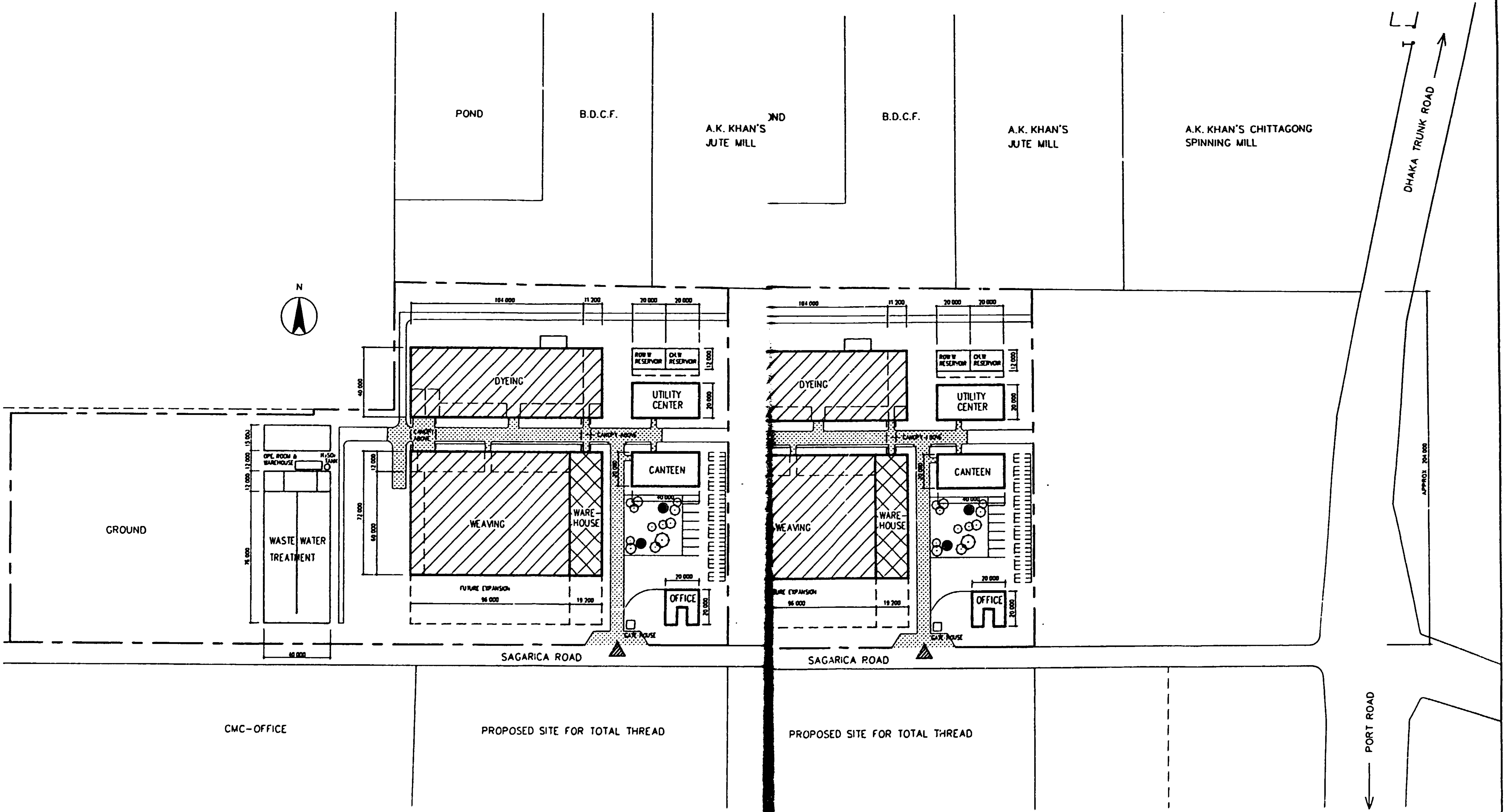


Figure A-9 : BLOCK PLAN OF PROPOSED MILL (Case 4)

SECTION 1

SECTION 2

5) Environmental Impact Assessment
Please refer to Chapter 5 of this report.

2. THE PROJECT : WEAVING AND DYEING PLAN

2.1 Production Capacity and Product-mix

The production capacity and requirements for raw materials can be seen in Table A-7. Figure A-10 graphically represents the kinds of final products. Operating conditions are the same as applied in the base case, as follows:

- 3 shifts with 4 groups
- 8 hours per shift
- 350 days per year

2.2 Process Flow Chart

The process flow chart of the weaving department can be seen in Figure A-11. That of the dyeing department is the same as the base case.
(Please refer to Figure 6-7 in Chapter 6.)

2.3 Specifications and Layout of Main Machinery and Equipment

These are also the same as the base case. (Please refer to 6.3 and 6.4 in Chapter 6.)

3. THE PROJECT : CIVIL, MECHANICAL AND ELECTRICAL WORKS

3.1 Civil Works

1) Site Area : 60,000 m^2

2) Building Area : 14,902 m^2
- Weaving Building : 6,912 m^2
- Dyeing Building : 4,608 m^2
- Warehouse : 1,382 m^2
- Utility/Warehouse : 800 m^2
- Admin. Office and Canteen : 1,200 m^2

3) Site Preparation
- Demolishing of existing structures
- Reclamation of the land will average 1.0 m in depth in an area of 6,000 m^2.

Table A-7 : PRODUCTION CAPACITY AND RAW MATERIAL REQUIREMENTS AT EACH STAGE

Production Capacity Final Products	Stage II Dyeing & Finishing 30,000 km/y	Stage I Weaving 96 Loom	Raw Materials Procured From Outside
Ne 80/2 Broad 4,318 km/y	2,820 km/y	26 Loom	Yarn 3,245 BLS/y
	1,498 km/y	14 Loom	Yarn 1,775 BLS/y
Ne 60/2 Gaberdine 3,170 km/y	3,170 km/y	24 Loom	Yarn 4,671 BLS/y
Ne P/C 45 Poplin 22,125 km/y	3,300 km/y	32 Loom	Yarn 3,279 BLS/y
	19,212 km/y		Fabric 19,366 km/y

Yarn Dyed Others

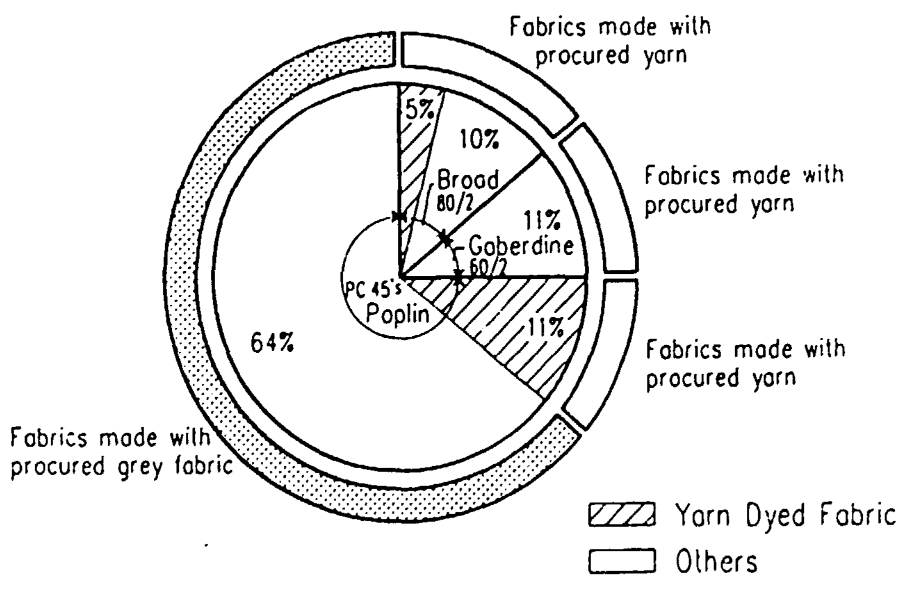


Figure A-10 : PRODUCTION OF FINAL PRODUCTS AND PROSPECTIVE MATERIALS

Fabric	Broad				Gaberdine 2/2 Twill		Poplin	
Construction	CM 80/2 x CM 80/2 / 127 x 73				CM 60/2 x CM 60/2 / 131 x 60		P/C 45 x P/C 45 / 110 x 76	
Yarn Dyed			Yarn Dyed				Yarn Dyed	
Warp / Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Supply-Source	Outside	Outside	Outside	Outside	Outside	Outside	Outside	Outside

Machinery	No. of Mach.
W-1 Winder (Soft Winding)	1
(Cheese Dyeing)	–
W-2 Winder (Rewinding)	2
W-3 Warper	1
W-4 Warper (Soft Beaming)	2
(Beam Dyeing)	–
W-5 Sizer	1
W-6 Sizer (Beam Dyeing)	1
W-7 Tying Machine	1
W-8 Reaching-in Machine	5
W-9 Air Jet Loom	96
W-10 Inspecting Machine	2
W-11 Folding Machine	1

Flow Chart

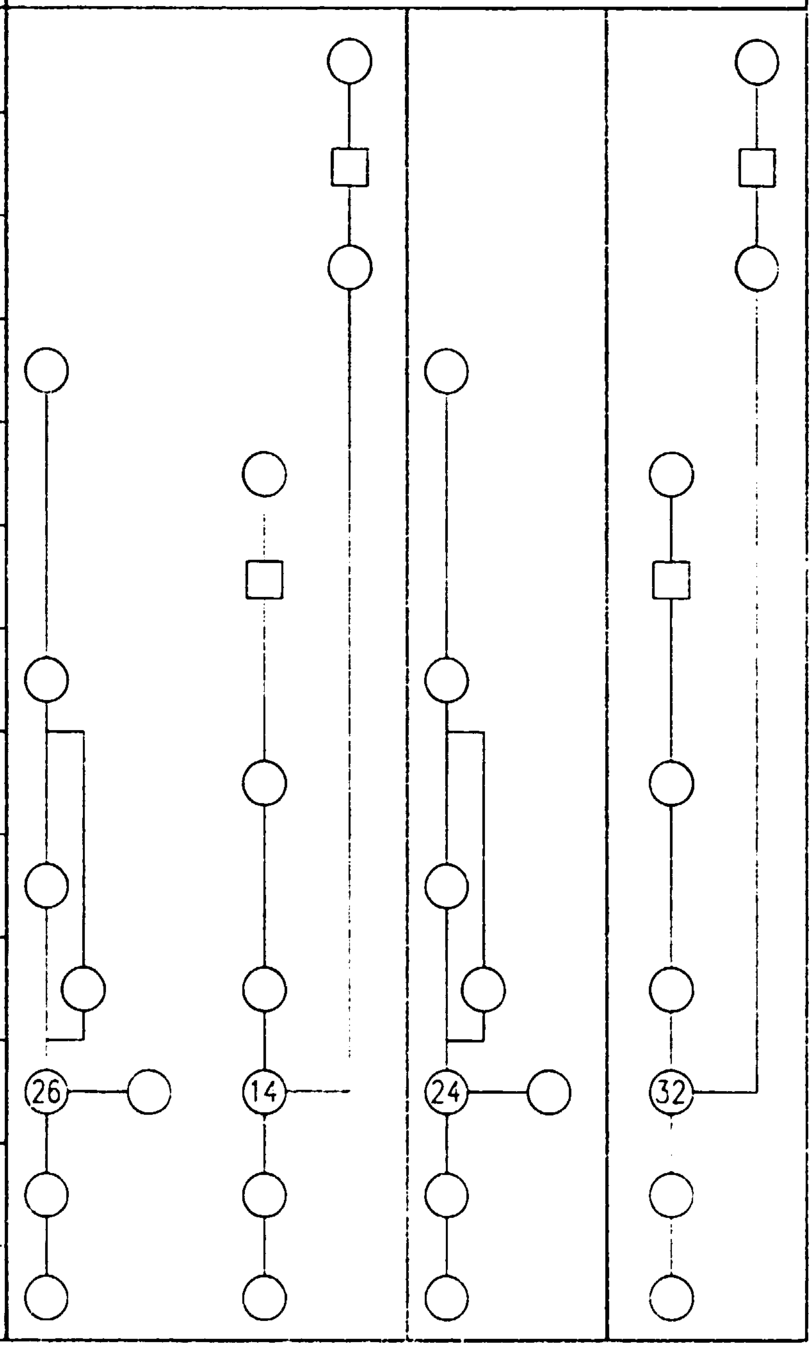


Figure A-11 : PROCESS FLOW CHART OF WEAVING

4) External Works
   - Road work
   - Fencing
   - Underground water tanks, etc.

5) Specifications of Civil Works
   As per Chapter 6 of this report

3.2 Mechanical Equipment and Works

1) Air Conditioning Equipment (Weaving Mill)
   The design and specifications for air conditioning system and equipment are basically as per Chapter 6 of this report, summarized below:
   - Central air conditioning system;
   - Underground ducts for return air;
   - Absorption-type refrigerator;
   - Inside temperature and humidity to be maintained:
     Temperature ------29 ℃ - 31 ℃
     Humidity ----------60 % - 68 %

2) Water supply
   - Water Consumption
     - For air conditioning/dyeing ---- 3,395 m^3/day
     - For Potable water ---------------- 50 m^3/day
   - Source of Water
     - For air conditioning/dyeing ---- deep well (150 mm dia. and 150 m deep)
     - For potable water ---------------- from city water

3) Compressed Air and Fire Fighting Equipment
   Basic idea is as per the base case.

3.3 Electrical Equipment and Works

1) Power Generation
   - Power Consumption
     Installed capacity -------3,526 KW
     Mean of power load ----2,515 KW (summer), 2,365 KW (winter)

- Generator (2 sets)
  Natural gas generator, producing 415V, 50 Hz and 3 Ph-4W
  Gas consumption to be 764,000 m^3/month

2) Power reception from BPDB : 100 KW

3) LT Wiring, Lighting, Lighting Equipment, etc.
   As per the base case

4. IMPLEMENTATION SCHEDULE AND MILL ORGANIZATION

4.1 Implementation Schedule

Although spinning facilities are deleted from the base case, it is estimated that the implementation schedule of Case 4 will be nearly the same as that of the base case indicated in Figure 1-10.

4.2 Mill Organization

The proposed mill organization is shown in Figure A-12. The total number of employees, excluding 5 directors, is estimated at 712, consisting of:

- Weaving Department -- 269
- Dyeing Department ---- 355
- Utilities ------------------ 60
- Administration --------- 28

5. INVESTMENT COST

The investment cost is tabulated in Table A-4.

Table A-4 Investment Cost

Unit: US$ x 1,000

Items	Local	Foreign	Total
1. Land			
- Land Cost (60,000 m^2)	1,853	-	1,853
- Site Preparation/Development	327	-	327
Sub-total	2,180	-	2,180

2. Production Machinery			
- Weaving Machinery	-	11,693	11,693
- Dyeing and Finishing	13	10,262	10,275
Sub-total	13	21,955	21,968
3. Civil Works			
- Building Construction	2,977	1,073	4,050
- Civil Works	471	-	471
- External Work	88	-	88
- Provisional Sum	210	-	210
Sub-total	3,726	1,073	4,799
4. Mechanical and Electrical Works			
- Utility Equip./Works	374	10,378	10,752
- Environment	454	355	809
Sub-total	828	10,733	11,561
5. Office Equipment			
Office Equip./Cars/Bus	94	287	381
Sub-total	94	287	381
6. Pre-operational Expenses			
- Management Fee & Administrative Exp.	26	548	574
- Pre-study Cost	-	143	143
- Consulting & Engineering Fee	36	1,865	1,901
- Erection Cost of Machinery	94	672	766
- Raw Materials for Commissioning	-	228	228
- Other Pre-operational Expenses	56	-	56
Sub-total	212	3,456	3,668
PROJECT BASE COST	7,053	37,504	44,557

7. Interest During Construction

1994	416,000
1995	2,305,000
	US $2,721,000

8. Working Capital

1994 US $6,756,000

TOTAL INVESTMENT COST US $54,034,000

6. FINANCIAL EVALUATION

6.1 Fundamental Conditions for Calculation

1) Exchange Rate

   U.S.$ 1 = Tk. 40.- = ¥ 105

2) Fund Raising Plan

   - Loan -------- 70% of the Investment Cost
   - Equity ------ 30% of the above

3) Loaning Conditions

   - Local Portion
     - a) Interest : 12 % per annum
     - b) Amortization : 10 years with no grace period
     - c) Repayment : annual installment

   - Foreign Portion
     - a) Interest : 10 % per annum
     - b) Amortization : 10 years with a grace of 2 years
     - c) Repayment : annual installment

4) Capacity Utilization

   70 % for the 1st year and 100 % for the 2nd year onward.

5) Depreciation

   Straight line method is employed.

   - Land -------------------------------- not depreciated
   - Building ---------------------------- 20 years
   - Machinery, Equipment, etc. ----- 10 years
   - Interest during construction
     and working capital ----------- 5 years for amortization

6) VAT/Duties

   No consideration on VAT/Duties is taken into account on the assumption that the site is designated as EPZ.

6.2 Sales Revenue

- 1st Year : 70 % of the 2nd year
- 2nd Year onward :

a) cotton broadcloth	4,318,000	m
b) cotton gaberdine	3,170,000	m
c) P/C poplin	22,512,000	m
Total	30,000,000	m
unit price	1.787	$/m
Sales amount	$ 53,610,000	

6.3 Production Cost

1) Cost of Raw Materials

- 1st Year : 70 % Of the 2nd Year
- 2nd year onward :

a) cotton yarn		
Ne 60/2	4,670 bales	$ 7,005,000
Ne 80/2	5,020 bales	$ 10,516,900
b) P/C yarn		
Ne 45/1	3,280 bales	$ 2,886,400
c) grey cloth		
19,365,000 m		$ 12,703,000
Total		33,111,300

2) Cost of Other Raw Materials

- 3rd Year onward :

sizing materials	$ 243,000
chemicals & dyestuffs	2,677,000
packing materials, etc.	551,000
Total	3,471,000

3) Cost of Power and Utility

- 3rd Year onward :

electricity	$ 19,000
natural gas	1,272,000
water treatment cost	154,000
water	2,000
Total	1,447,000

4) Cost of Maintenance

- 3rd Year onward

maintenance		$ 186,000
spare parts		570,000
Total		756,000

5) Direct Labour Costs

- 2nd Year onward

wages for weaving	267 persons	$ 156,540
〃 dyeing/fin.	354 persons	212,520
Total		369,060

6) Factory Overhead

- 1st Year onward

indirect labour costs		
for utility section	70 persons	$ 55,000

7) Administrative Overhead

- 1st Year onward

management fee (3 expatriate directors/ 5 expatriate managers/ 2 expatriate division heads)		$ 994,000	
wages for office laborers	20 persons	$ 20,000	
		1st year	2nd year
training fee		$ 840,000	$ 206,000
administrative non-labor cost		19,000	
Total	1st year	1,873,000	
	2nd year	1,239,000	
	3rd year onward	1,033,000	

8) Marketing Overhead

- 1st Year onward

marketing labour cost	10 persons	$ 9,300
marketing non-labour cost		116,200
Total		125,500

9) Summary of Production Costs (excluding depreciation and financial costs)

- 4th Year onward $ 40,368,500

6.4 Financial Evaluation

1) Break-even point

- break-even ratio including financial cost : 60%
  break-even ratio excluding financial cost : 41%
- The investment is regarded as very safe from this figure.

2) Debt service ratio

1st year	2.77	5th year	2.01	9th year	2.61
2nd	2.80	6th	2.14	10th	2.82
3rd	1.81	7th	2.27	11th	2.18
4th	1.91	8th	2.43	12th	2.34

The repayment ability of the project is evaluated sound.

3) Internal rate of return (IRR)

- 21.47 %
- acceptable for a new project

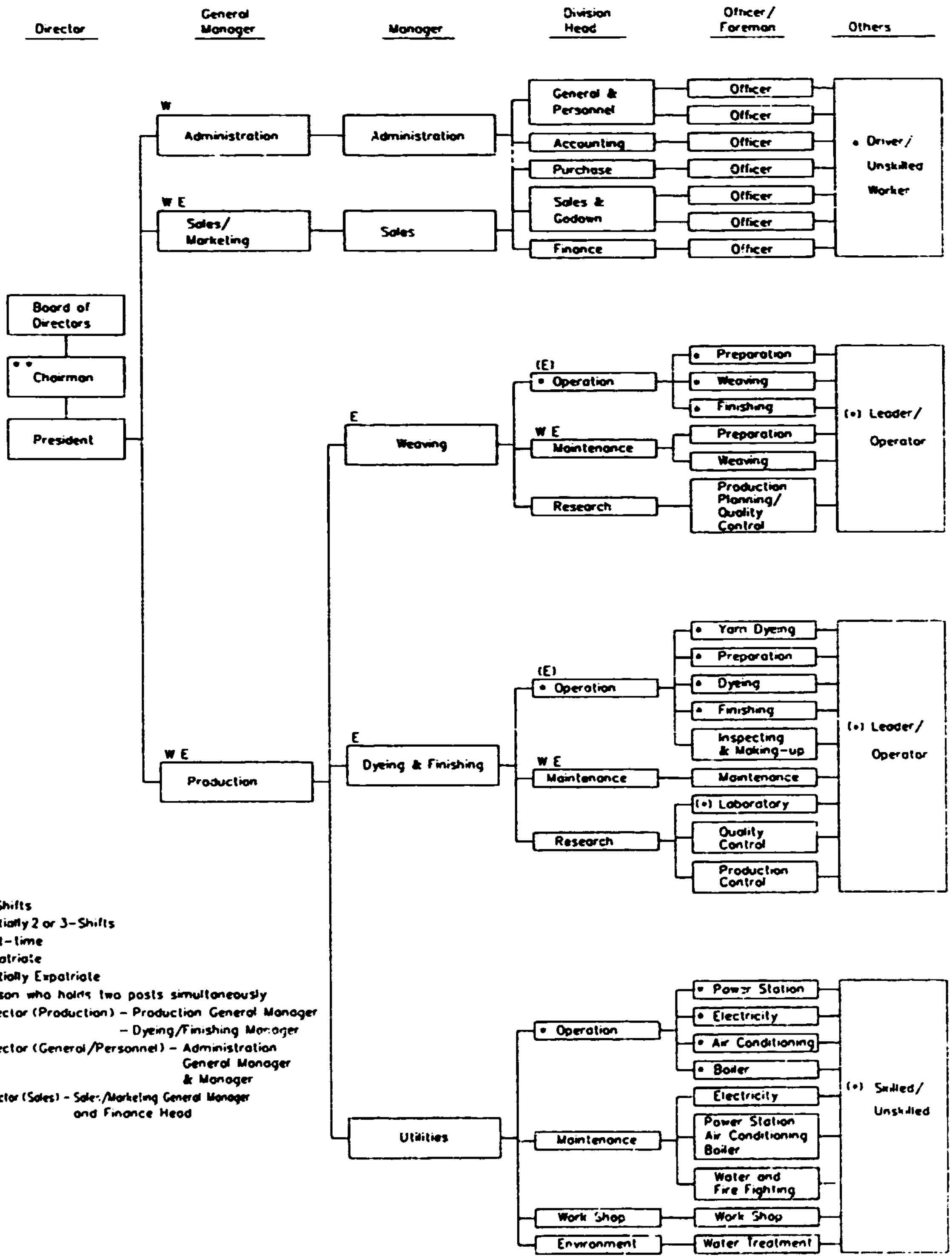
4) Sensitivity analysis of IRR

- 6 % increase in sales 27.02 %
- 6 % decrease in sales 15.25 %
- 6 % decrease in operating costs 25.60 %
- 6 % increase in operating costs 16.96 %
- 6 % decrease in initial investment 22.98 %
- 6 % increase in initial investment 20.11 %

5) Conclusion

Based upon the aforementioned evaluation, the project can be judged as financially sound.

The schedules of the financial statements of this case are attached at the end of this Appendix.



- • : 3-Shifts
- (•) : Partially 2 or 3-Shifts
- • • : Part-time
- E : Expatriate
- (E) : Partially Expatriate
- W : Person who holds two posts simultaneously
  - Director (Production) – Production General Manager – Dyeing/Finishing Manager
  - Director (General/Personnel) – Administration General Manager & Manager
  - Director (Sales) – Sales/Marketing General Manager and Finance Head

Figure A-12 : COMPANY ORGANIZATION

CASE 4

ITM in Bangladesh
28 June 1993
case 4

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: thousand US dollar

Total initial investment during construction phase

fixed assets:	47277.54	84.036 % foreign
current assets:	6756.33	100.000 % foreign
total assets:	54033.87	86.032 % foreign

Source of funds during construction phase

equity & grants:	17277.07	88.424 % foreign
foreign loans :	31704.00	
local loans :	5052.80	
total funds :	54033.87	86.947 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	23696.80	40612.50	40402.50
depreciation :	4286.15	4286.15	4286.15
interest :	3776.74	3716.10	3655.47
production costs	31759.69	48614.75	48344.12
thereof foreign	91.01 %	92.51 %	92.64 %
total sales :	37527.00	53610.00	53610.00
gross income :	5767.31	4995.25	5265.88
net income :	5767.31	4995.25	5265.88
cash balance :	7578.02	7604.05	5905.21
net cashflow :	11860.04	11825.43	13236.36

Net Present Value at: 10.00 % = 37058.95
Internal Rate of Return: 21.47 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

Total Initial Investment in thousand US dollar

Year	1994	1995
Fixed investment costs		
Land, site preparation, development	2180.000	0.000
Buildings and civil works	1440.000	3359.000
Auxiliary and service facilities	3468.000	8093.000
Incorporated fixed assets	0.000	381.000
Plant machinery and equipment	6586.500	15381.500
Total fixed investment costs	13674.500	27214.500
Pre-production capital expenditures.	2546.085	3842.453
Net working capital	0.000	6756.331
Total initial investment costs	16220.580	37813.290
Of it foreign, in %	77.237	89.804

Total Production Costs in thousand US dollar

Year	1996	1997	1998	1999	2000
% of nom. capacity (single product).	70.000	100.000	100.000	100.000	100.000
Raw material 1	18068.000	33211.000	33112.000	33112.000	33112.000
Other raw materials	1794.000	3380.000	3471.000	3471.000	3471.000
Utilities	102.000	154.000	156.000	156.000	156.000
Energy	847.000	1291.000	1291.000	1291.000	1291.000
Labour, direct	258.300	369.000	369.000	369.000	369.000
Repair, maintenance	165.000	218.000	186.000	186.000	186.000
Spares	409.000	570.000	604.000	570.000	570.000
Factory overheads	55.000	55.000	55.000	55.000	55.000
Factory costs	21698.300	39248.000	39244.000	39210.000	39210.000
Administrative overheads	1873.000	1239.000	1033.000	1033.000	1033.000
Indir. costs, sales and distribution	125.500	125.500	125.500	125.500	125.500
Direct costs, sales and distribution	0.000	0.000	0.000	0.000	0.000
Depreciation	4286.154	4286.154	4286.154	4286.154	4286.154
Financial costs	3776.736	3716.102	3655.469	3277.795	2900.122
Total production costs	31759.690	48614.760	48344.130	47932.450	47554.780
Costs per unit (single product)	1.512	1.620	1.611	1.598	1.585
Of it foreign, %	91.008	92.508	92.642	92.705	92.774
Of it variable, %	84.633	78.986	79.428	80.111	80.747
Total labour	2121.600	1598.300	1392.300	1392.300	1392.300

ITM in Bangladesh --- 28 June 1993

Total Production Costs in thousand US dollar

Year	2001	2002	2003	2004	2005
% of nom. capacity (single product).	100.000	100.000	100.000	100.000	100.000
Raw material 1	33112.000	33112.000	33112.000	33112.000	33112.000
Other raw materials	3471.000	3471.000	3471.000	3471.000	3471.000
Utilities	156.000	156.000	156.000	156.000	156.000
Energy	1291.000	1291.000	1291.000	1291.000	1291.000
Labour, direct	369.000	369.000	369.000	369.000	369.000
Repair, maintenance	186.000	186.000	186.000	186.000	186.000
Spares	570.000	570.000	570.000	570.000	570.000
Factory overheads	55.000	55.000	55.000	55.000	55.000
Factory costs	39210.000	39210.000	39210.000	39210.000	39210.000
Administrative overheads	1033.000	1033.000	1033.000	1033.000	1033.000
Indir. costs, sales and distribution	125.500	125.500	125.500	125.500	125.500
Direct costs, sales and distribution	0.000	0.000	0.000	0.000	0.000
Depreciation	4286.154	4286.154	4286.154	4286.154	4286.154
Financial costs	2522.448	2144.774	1767.101	1389.427	1011.753
Total production costs	47177.110	46799.430	46421.760	46044.080	45666.410
Costs per unit (single product)	1.573	1.560	1.547	1.535	1.522
Of it foreign, %	92.845	92.917	92.990	93.064	93.140
Of it variable,%	81.393	82.050	82.718	83.396	84.086
Total labour	1392.300	1392.300	1392.300	1392.300	1392.300

Total Production Costs in thousand US dollar

Year	2006	2007	2008-10
% of nom. capacity (single product).	100.000	100.000	100.000
Raw material 1	33112.000	33112.000	33112.000
Other raw materials	3471.000	3471.000	3471.000
Utilities	156.000	156.000	156.000
Energy	1291.000	1291.000	1291.000
Labour, direct	369.000	369.000	369.000
Repair, maintenance	186.000	186.000	186.000
Spares	570.000	570.000	570.000
Factory overheads	55.000	55.000	55.000
Factory costs	39210.000	39210.000	39210.000
Administrative overheads	1033.000	1033.000	1033.000
Indir. costs, sales and distribution	125.500	125.500	125.500
Direct costs, sales and distribution	0.000	0.000	0.000
Depreciation	256.300	256.300	256.300
Financial costs	634.080	317.040	-0.000
Total production costs	41258.880	40941.840	40624.800
Costs per unit (single product)	1.375	1.365	1.354
Of it foreign, %	92.951	92.897	92.841
Of it variable,%	93.068	93.789	94.521
Total labour	1392.300	1392.300	1392.300

Net Working Capital in thousand US dollar

Year	mdc	coto	1996	1997	1998	1999	2000-10
Coverage	mdc	coto					
Current assets &							
Accounts receivable	30	12.0	1974.733	3384.375	3366.875	3364.042	3364.042
Inventory and materials	1	360.0	6756.614	6756.759	6756.764	6756.764	6756.764
Energy	15	24.0	35.292	53.792	53.792	53.792	53.792
Spares	60	6.0	68.167	95.000	100.667	95.000	95.000
Work in progress	10	36.0	602.731	1090.222	1090.111	1089.167	1089.167
Finished products	15	24.0	982.138	1686.958	1678.208	1676.792	1676.792
Cash in hand	15	24.0	115.013	102.125	93.625	92.208	92.208
Total current assets			10534.690	13169.230	13140.040	13127.760	13127.760
Current liabilities and							
Accounts payable	30	12.0	1808.192	3270.667	3270.333	3267.500	3267.500
Net working capital			8726.495	9898.564	9869.709	9860.264	9860.264
Increase in working capital			1970.164	1172.069	-28.855	-9.445	0.000
Net working capital, local			190.858	275.122	272.128	272.128	272.128
Net working capital, foreign			8535.637	9623.442	9597.581	9588.137	9588.137

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

ITM in Bangladesh --- 28 June 1993

Source of Finance, construction in thousand US dollar

Year	1994	1995
Equity, ordinary ..	8216.186	9060.885
Equity, preference.	0.000	0.000
Subsidies, grants .	0.000	0.000
Loan A, foreign .	6407.900	25296.100
Loan B, foreign..	0.000	0.000
Loan C, foreign .	0.000	0.000
Loan A, local....	1596.500	3456.300
Loan B, local....	0.000	0.000
Loan C, local....	0.000	0.000
Total loan	8004.400	28752.400
Current liabilities	0.000	0.000
Bank overdraft	0.000	0.000
Total funds	16220.590	37813.290

Source of Finance, production in thousand US dollar

Year	1996	1997	1998	1999	2000- 5	2006- 7
Equity, ordinary ..	0.000	0.000	0.000	0.000	0.000	0.000
Equity, preference.	0.000	0.000	0.000	0.000	0.000	0.000
Subsidies, grants .	0.000	0.000	0.000	0.000	0.000	0.000
Loan A, foreign .	0.000	0.000	-3170.400	-3170.400	-3170.400	-3170.400
Loan B, foreign..	0.000	0.000	0.000	0.000	0.000	0.000
Loan C, foreign .	0.000	0.000	0.000	0.000	0.000	0.000
Loan A, local....	-505.280	-505.280	-505.280	-505.280	-505.280	0.000
Loan B, local....	0.000	0.000	0.000	0.000	0.000	0.000
Loan C, local....	0.000	0.000	0.000	0.000	0.000	0.000
Total loan	-505.280	-505.280	-3675.680	-3675.680	-3675.680	-3170.400
Current liabilities	1808.192	1462.475	-0.333	-2.833	0.000	0.000
Bank overdraft	0.000	0.000	0.000	0.000	0.000	0.000
Total funds	1302.912	957.195	-3676.013	-3678.513	-3675.680	-3170.400

Cashflow Tables, construction in thousand US dollar

Year	1994	1995
Total cash inflow . .	16220.580	37813.290
Financial resources .	16220.580	37813.290
Sales, net of tax . .	0.000	0.000
Total cash outflow . .	16220.580	37813.280
Total assets	15804.400	35508.730
Operating costs . . .	0.000	0.000
Cost of finance . . .	416.185	2304.553
Repayment	0.000	0.000
Corporate tax . . .	0.000	0.000
Dividends paid . . .	0.000	0.000
Surplus (deficit) .	0.000	0.004
Cumulated cash balance	0.000	0.004
Inflow, local	3596.500	3456.300
Outflow, local	3692.290	3855.258
Surplus (deficit) .	-95.790	-398.958
Inflow, foreign . . .	12624.080	34356.980
Outflow, foreign . . .	12528.290	33958.020
Surplus (deficit) .	95.790	398.961
Net cashflow	-15804.400	-35508.730
Cumulated net cashflow	-15804.400	-51313.130

Cashflow tables, production in thousand US dollar

Year	1996	1997	1998	1999	2000	2001
Total cash inflow	39335.190	55072.480	53611.670	53610.000	53610.000	53610.000
Financial resources	1808.192	1462.475	1.667	0.000	0.000	0.000
Sales, net of tax	37527.000	53610.000	53610.000	53610.000	53610.000	53610.000
Total cash outflow	31757.170	47468.430	47706.460	47312.530	50399.700	50022.030
Total assets	3778.356	2634.545	-29.189	-12.278	0.000	0.000
Operating costs	23696.800	40612.500	40402.500	40368.500	40368.500	40368.500
Cost of finance	3776.736	3716.102	3655.469	3277.795	2900.122	2522.448
Repayment	505.280	505.280	3677.680	3678.513	3675.680	3675.680
Corporate tax	0.000	0.000	0.000	0.000	0.000	0.000
Dividends paid	0.000	0.000	0.000	0.000	3455.400	3455.400
Surplus (deficit)	7578.020	7604.051	5905.207	6297.469	3210.301	3587.973
Cumulated cash balance	7578.023	15182.070	21087.280	27384.750	30595.050	34183.020
Inflow, local	148.775	70.558	0.000	0.000	0.000	0.000
Outflow, local	3334.050	3935.304	3692.854	3635.215	3974.581	3913.948
Surplus (deficit)	-3185.275	-3864.746	-3692.854	-3635.215	-3974.581	-3913.948
Inflow, foreign	39186.420	55001.920	53611.670	53610.000	53610.000	53610.000
Outflow, foreign	28423.120	43533.120	44013.610	43677.320	46425.120	46108.080
Surplus (deficit)	10763.290	11468.800	9598.063	9932.684	7184.883	7501.922
Net cashflow	11860.040	11825.430	13236.350	13250.940	13241.500	13241.500
Cumulated net cashflow	-39453.090	-27627.660	-14391.307	-1140.357	12101.140	25342.640

Cashflow tables, production in thousand US dollar

Year	2002	2003	2004	2005	2006	2007
Total cash inflow	53610.000	53610.000	53610.000	53610.000	53610.000	53610.000
Financial resources	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax	53610.000	53610.000	53610.000	53610.000	53610.000	53610.000
Total cash outflow	49644.350	49266.680	48889.000	48511.330	52568.820	52378.600
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs	40368.500	40368.500	40368.500	40368.500	40368.500	40368.500
Cost of finance	2144.774	1767.101	1389.427	1011.753	634.080	317.040
Repayment	3675.680	3675.680	3675.680	3675.680	3170.400	3170.398
Corporate tax	0.000	0.000	0.000	0.000	4940.450	5067.266
Dividends paid	3455.400	3455.400	3455.400	3455.400	3455.400	3455.400
Surplus (deficit)	3965.648	4343.320	4720.996	5098.668	1041.176	1231.398
Cumulated cash balance	38148.670	42491.990	47212.990	52311.660	53352.830	54584.230
Inflow, local	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, local	3853.314	3792.681	3732.047	3671.414	8045.950	8172.766
Surplus (deficit)	-3853.314	-3792.681	-3732.047	-3671.414	-8045.950	-8172.766
Inflow, foreign	53610.000	53610.000	53610.000	53610.000	53610.000	53610.000
Outflow, foreign	45791.040	45474.000	45156.960	44839.920	44522.880	44205.840
Surplus (deficit)	7818.965	8136.004	8453.043	8770.082	9087.125	9404.164
Net cashflow	13241.500	13241.500	13241.500	13241.500	8301.050	8174.234
Cumulated net cashflow	38584.140	51825.640	65067.140	78308.640	86609.690	94783.920

Cashflow tables, production in thousand US dollar

Year	2008	2009	2010
Total cash inflow . .	53610.000	53610.000	53610.000
Financial resources .	0.000	0.000	0.000
Sales, net of tax . .	53610.000	53610.000	53610.000
Total cash outflow . .	49017.980	49017.980	49017.980
Total assets	0.000	0.000	0.000
Operating costs . . .	40368.500	40368.500	40368.500
Cost of finance . . .	-0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax . . .	5194.081	5194.081	5194.081
Dividends paid . . .	3455.400	3455.400	3455.400
Surplus (deficit) .	4592.020	4592.020	4592.020
Cumulated cash balance	59176.250	63768.270	68360.290
Inflow, local	0.000	0.000	0.000
Outflow, local	8299.581	8299.581	8299.581
Surplus (deficit) .	-8299.581	-8299.581	-8299.581
Inflow, foreign . . .	53610.000	53610.000	53610.000
Outflow, foreign . . .	40718.400	40718.400	40718.400
Surplus (deficit) .	12891.600	12891.600	12891.600
Net cashflow	8047.419	8047.419	8047.419
Cumulated net cashflow	102831.300	110878.800	118926.200

Net Income Statement in thousand US dollar

Year	1996	1997	1998	1999	2000
Total sales, incl. sales tax	37527.000	53610.000	53610.000	53610.000	53610.000
Less: variable costs, incl. sales tax.	26879.300	38399.000	38399.000	38399.000	38399.000
Variable margin	10647.700	15211.000	15211.000	15211.000	15211.000
As % of total sales	28.373	28.373	28.373	28.373	28.373
Non-variable costs, incl. depreciation	1103.655	6499.651	6289.652	6255.650	6255.652
Operational margin	9544.045	8711.349	8921.348	8955.350	8955.348
As % of total sales	25.432	16.249	16.641	16.705	16.705
Cost of finance	3776.736	3716.102	3655.469	3277.795	2900.122
Gross profit	5767.309	4995.246	5265.879	5677.555	6055.227
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	5767.309	4995.246	5265.879	5677.555	6055.227
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	5767.309	4995.246	5265.879	5677.555	6055.227
Dividends paid	0.000	0.000	0.000	0.000	3455.400
Undistributed profit	5767.309	4995.246	5265.879	5677.555	2599.827
Accumulated undistributed profit	5767.309	10762.550	16028.430	21705.990	24305.810
Gross profit, % of total sales	15.368	9.318	9.823	10.590	11.295
Net profit, % of total sales	15.368	9.318	9.823	10.590	11.295
ROE, Net profit, % of equity	33.381	28.913	30.479	32.862	35.048
ROI, Net profit+interest, % of invest.	17.912	15.997	16.392	16.457	16.457

Net Income Statement in thousand US dollar

Year	2001	2002	2003	2004	2005
Total sales, incl. sales tax	53610.000	53610.000	53610.000	53610.000	53610.000
Less: variable costs, incl. sales tax.	38399.000	38399.000	38399.000	38399.000	38399.000
Variable margin	15211.000	15211.000	15211.000	15211.000	15211.000
As % of total sales	28.373	28.373	28.373	28.373	28.373
Non-variable costs, incl. depreciation	6255.654	6255.651	6255.653	6255.651	6255.652
Operational margin	8955.346	8955.349	8955.347	8955.349	8955.348
As % of total sales	16.705	16.705	16.705	16.705	16.705
Cost of finance	2522.448	2144.774	1767.101	1389.427	1011.753
Gross profit	6432.898	6810.574	7188.246	7565.922	7943.594
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	6432.898	6810.574	7188.246	7565.922	7943.594
Tax	0.000	0.000	0.000	0.000	0.000
Net profit	6432.898	6810.574	7188.246	7565.922	7943.594
Dividends paid	3455.400	3455.400	3455.400	3455.400	3455.400
Undistributed profit	2977.499	3355.174	3732.846	4110.522	4488.194
Accumulated undistributed profit	27283.310	30638.490	34371.330	38481.860	42970.050
Gross profit, % of total sales	11.999	12.704	13.408	14.113	14.817
Net profit, % of total sales	11.999	12.704	13.408	14.113	14.817
ROE, Net profit, % of equity	37.234	39.420	41.606	43.792	45.978
ROI, Net profit+interest, % of invest.	16.457	16.457	16.457	16.457	16.457

ITM in Bangladesh --- 28 June 1993

Net Income Statement in thousand US dollar

Year	2006	2007	2008	2009	2010
Total sales, incl. sales tax	53610.000	53610.000	53610.000	53610.000	53610.000
Less: variable costs, incl. sales tax.	38399.000	38399.000	38399.000	38399.000	38399.000
Variable margin	15211.000	15211.000	15211.000	15211.000	15211.000
As % of total sales	28.373	28.373	28.373	28.373	28.373
Non-variable costs, incl. depreciation	2225.795	2225.796	2225.797	2225.797	2225.797
Operational margin	12985.210	12985.200	12985.200	12985.200	12985.200
As % of total sales	24.222	24.222	24.222	24.222	24.222
Cost of finance	634.080	317.040	-0.000	0.000	0.000
Gross profit	12351.130	12668.160	12985.200	12985.200	12985.200
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	12351.130	12668.160	12985.200	12985.200	12985.200
Tax	4940.450	5067.266	5194.081	5194.081	5194.081
Net profit	7410.675	7600.898	7791.122	7791.122	7791.122
Dividends paid	3455.400	3455.400	3455.400	3455.400	3455.400
Undistributed profit	3955.275	4145.499	4335.722	4335.722	4335.722
Accumulated undistributed profit	46925.320	51070.820	55406.550	59742.270	64077.990
Gross profit, % of total sales	23.039	23.630	24.222	24.222	24.222
Net profit, % of total sales	13.823	14.178	14.533	14.533	14.533
ROE, Net profit, % of equity	42.893	43.994	45.095	45.095	45.095
ROI, Net profit+interest, % of invest.	14.784	14.550	14.317	14.317	14.317

Projected Balance Sheets, construction in thousand US dollar

Year	1994	1995
Total assets	16220.590	54033.870
Fixed assets, net of depreciation	0.000	16220.580
Construction in progress	16220.580	31056.950
Current assets	0.000	6756.331
Cash, bank	0.000	0.000
Cash surplus, finance available	0.001	0.000
Loss carried forward	0.000	0.000
Loss	0.000	0.000
Total liabilities	16220.590	54033.870
Equity capital	8216.186	17277.070
Reserves, retained profit	0.000	0.000
Profit	0.000	0.000
Long and medium term debt	8004.400	36756.800
Current liabilities	0.000	0.000
Bank overdraft, finance required.	0.000	0.000
Total debt	8004.400	36756.800
Equity, % of liabilities	50.653	31.975

Projected Balance Sheets, Production in thousand US dollar

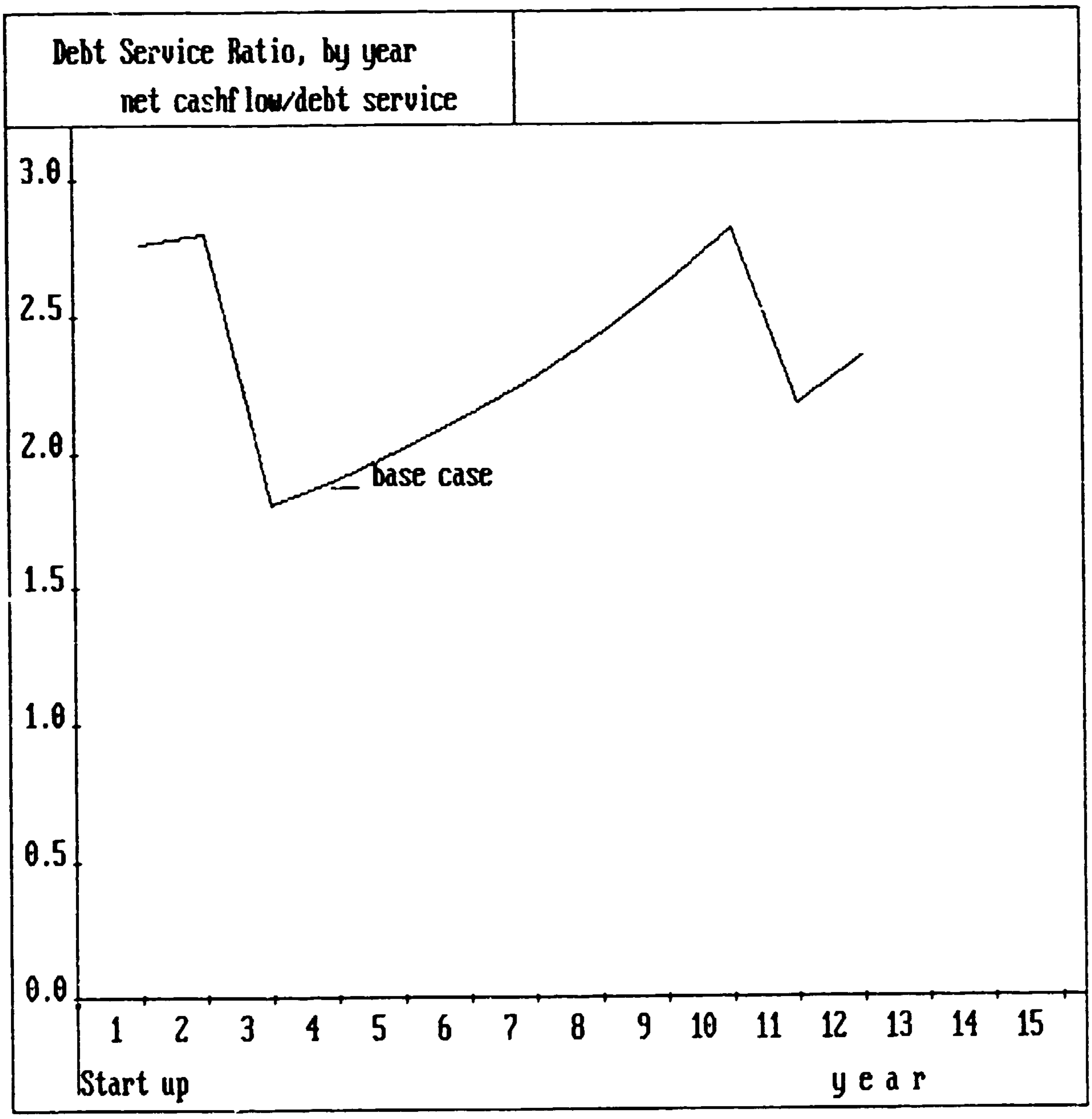
Year	1996	1997	1998	1999	2000
Total assets	61104.090	67056.530	68646.400	70645.440	73024.980
Fixed assets, net of depreciation	42991.380	38705.230	34419.070	30132.920	25846.760
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	10419.670	13067.110	13046.420	13035.560	13035.560
Cash, bank	115.013	102.125	93.625	92.208	92.208
Cash surplus, finance available	7578.023	15182.070	21087.290	27384.760	34050.460
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	61104.090	67056.530	68646.400	70645.440	73024.980
Equity capital	17277.070	17277.070	17277.070	17277.070	17277.070
Reserves, retained profit	0.000	5767.309	10762.550	16028.430	21705.990
Profit	5767.309	4995.246	5265.879	5677.555	6055.227
Long and medium term debt	36251.520	35746.240	32070.560	28394.880	24719.200
Current liabilities	1808.192	3270.667	3270.333	3267.500	3267.500
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	38059.710	39016.910	35340.890	31662.380	27986.700
Equity, % of liabilities	28.275	25.765	25.168	24.456	23.659

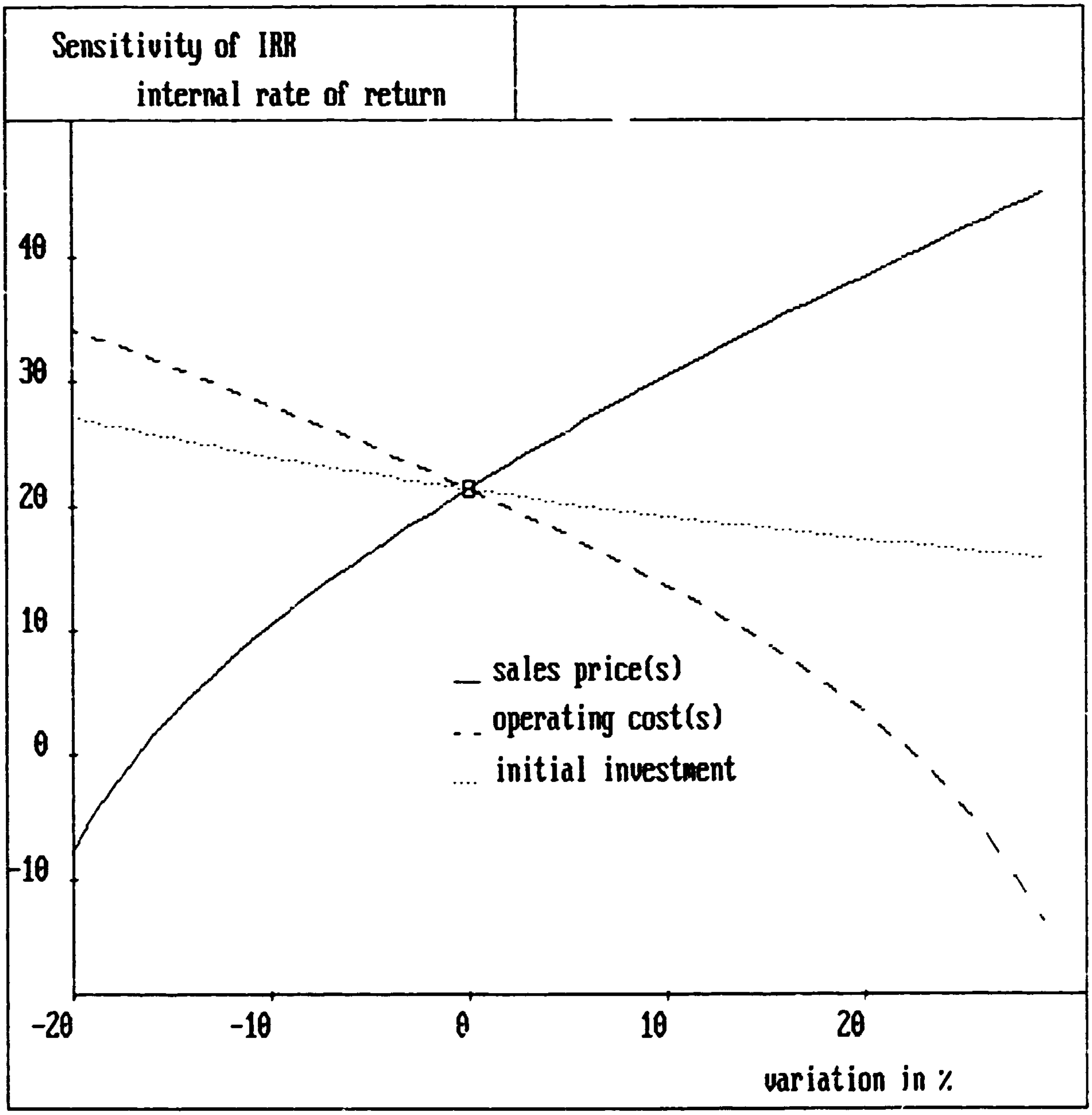
Projected Balance Sheets, Production in thousand US dollar

Year	2001	2002	2003	2004	2005
Total assets	72326.800	72006.300	72063.460	72498.300	73310.820
Fixed assets, net of depreciation	21560.610	17274.450	12988.300	8702.145	4415.991
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	13035.560	13035.560	13035.560	13035.560	13035.560
Cash, bank	92.208	92.208	92.208	92.208	92.208
Cash surplus, finance available	37638.430	41604.080	45947.430	50668.400	55767.050
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	72326.800	72006.300	72063.460	72498.300	73310.820
Equity capital	17277.070	17277.070	17277.070	17277.070	17277.070
Reserves, retained profit	24305.810	27283.310	30638.490	34371.340	38481.860
Profit	6432.898	6810.574	7188.246	7565.922	7943.594
Long and medium term debt	21043.520	17367.840	13692.160	10016.480	6340.797
Current liabilities	3267.500	3267.500	3267.500	3267.500	3267.500
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	24311.020	20635.340	16959.660	13283.980	9608.297
Equity, % of liabilities	23.838	23.994	23.975	23.831	23.567

Projected Balance Sheets, Production in thousand US dollar

Year	2006	2007	2008	2009	2010
Total assets	74095.700	75070.800	79406.530	83742.250	88077.970
Fixed assets, net of depreciation	4159.691	3903.391	3647.091	3390.791	3134.492
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	13035.560	13035.560	13035.560	13035.560	13035.560
Cash, bank	92.208	92.208	92.208	92.208	92.208
Cash surplus, finance available	56808.240	58039.640	62631.680	67223.700	71815.710
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	74095.700	75070.800	79406.530	83742.250	88077.970
Equity capital	17277.070	17277.070	17277.070	17277.070	17277.070
Reserves, retained profit	42970.050	46925.330	51070.830	55406.550	59742.280
Profit	7410.675	7600.898	7791.122	7791.122	7791.122
Long and medium term debt	3170.397	-0.001	-0.001	-0.001	-0.001
Current liabilities	3267.500	3267.500	3267.500	3267.500	3267.500
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	6437.897	3267.499	3267.499	3267.499	3267.499
Equity, % of liabilities	23.317	23.014	21.758	20.631	19.616


Debt Service Ratio, by year
net cashflow/debt service
3.0
2.5
2.0
1.5
1.0
0.5
0.0
base case
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Start up
y e a r


Sensitivity of IRR
internal rate of return
40
30
20
10
0
-10
-20
-10
0
10
20
variation in %
sales price(s)
operating cost(s)
initial investment

VALUES chart description [STANDARD]

Sensitivity of IRR
internal rate of return

	sales price	operating c	initial inv	
-20.0	-7.69	34.25	27.21	21.47
-19.0	-5.01	33.67	26.86	
-18.0	-2.64	33.08	26.53	
-17.0	-0.52	32.49	26.20	
-16.0	1.41	31.89	25.88	
-15.0	3.17	31.29	25.56	
-14.0	4.81	30.68	25.25	
-13.0	6.34	30.06	24.95	
-12.0	7.79	29.45	24.65	
-11.0	9.17	28.82	24.36	
-10.0	10.48	28.19	24.07	
-9.0	11.74	27.55	23.79	
-8.0	12.95	26.91	23.52	
-7.0	14.12	26.26	23.25	
-6.0	15.25	25.60	22.98	
-4.0	17.42	24.26	22.46	
-3.0	18.47	23.58	22.21	
-2.0	19.49	22.89	21.96	
-1.0	20.49	22.18	21.71	
0.0	21.47	21.47	21.47	
1.0	22.44	20.75	21.24	
2.0	23.38	20.02	21.00	
3.0	24.31	19.27	20.78	
4.0	25.23	18.52	20.55	
5.0	26.13	17.75	20.33	
6.0	27.02	16.96	20.11	
7.0	27.90	16.16	19.90	
8.0	28.77	15.34	19.68	
9.0	29.62	14.50	19.48	
10.0	30.47	13.64	19.27	
12.0	32.13	11.85	18.87	
13.0	32.95	10.92	18.67	
14.0	33.77	9.96	18.48	
15.0	34.57	8.96	18.29	
16.0	35.37	7.93	18.10	
17.0	36.16	6.85	17.91	
18.0	36.94	5.72	17.73	
19.0	37.72	4.54	17.55	
20.0	38.49	3.30	17.37	
21.0	39.25	1.98	17.20	
22.0	40.01	0.58	17.02	
23.0	40.77	-0.93	16.85	
24.0	41.51	-2.56	16.68	
25.0	42.26	-4.34	16.52	
26.0	42.99	-6.29	16.35	
28.0	44.46	-10.81	16.03	
29.0	45.18	-13.38	15.87	

-- variation in %