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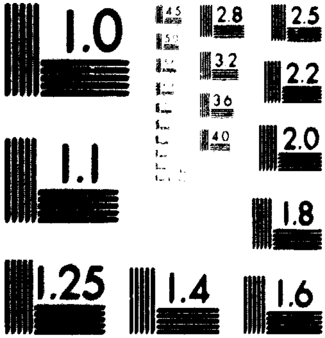

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NATIONAL BUREAU OF STANDARDS 1963 A

Shirley Institute

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Client Report

CONFIDENTIAL

(R) SECTOR STUDY OF THE ETHIOPIAN TEXTILE INDUSTRY.

FINAL REPORT.

VOLUME ONE

U.N.I.D.O. Contract No. 79161
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VOLUME ONE

CONTENTS

APPENDICES

Appendix 'A' (Section 7.1)

Job description of 35 occupations in textile factories

Appendix 'B' (Section 7.2)

Descriptions of job evaluation techniques

Appendix 'C' (Section 4.2)

Details of wage piece rate systems used in the Textile Mills of Dire Dawa.

INTRODUCTION

In accordance with the Terms of Reference of the contract between the U.N.I.D.O. and the Shirley Institute, we have carried out a survey of the textile industry in Ethiopia with the object of providing the Government of Ethiopia with the necessary data for an appraisal of that industry.

The survey covered the various manufacturing establishments which comprise the National Textile Corporation. These include spinning and weaving mills, dyeing, printing and finishing works, knitting and garment factories. The field work related to the textile market of Ethiopia included interviews with merchants and retailers, and the analysis of manufacturing statistics and trade statistics provided by the Central Statistical Office, Addis Ababa.

This draft final report is presented in two volumes. Volume One is concerned with the supply and consumption of textiles in Ethiopia, and other matters pertaining generally to the textile industry as a whole.

The three parts of volume Two contain the technical reports on each of the N.T.C. establishments, together with a register of the machinery and other equipment installed in those establishments. Tables are provided which show the quantity and kind of textiles produced, and the numbers of workers employed in the production departments.

The report is a draft and is presented for discussion and comment by representatives of U.N.I.D.O., of the Ethiopian Ministry of Industry, and the National Textile Corporation. On receipt of their comments the final report will be completed and despatched.

EXECUTIVE SUMMARY

Introduction

The National Textiles Corporation of Ethiopia has under its control a number of vertical, single and multi-process plants situated in various parts of the country. In addition to spinning, weaving and dyeing and finishing of mainly cotton fabrics, other activities include knitting, garment making, woven and stitch bonded blanket making, a small amount of woollen carpet manufacture, and cotton ginning.

Total employees are approximately 24,000 whilst the main items of equipment amount to 182,000 ring spindles, 2,900 looms, 200 knitting machines and 6 fabric finishing works. Production in 1979 was 80.3 million m^2 of fabric, approximately 10,000 tonnes of sales yarn, and 4.4 million garments of which 3.6 million were knitted.

An overall summary of the equipment and production of the N.T.C., classified by factory establishments, is provided by Table 1.

1. Textile Supply and Demand - 1979

Supply

The volume of textile products produced by the N.T.C. for the year ending July 1979 was as follows:

Woven cotton	80,327,951	M^2
Woven woollen types	31,757	M^2
Carpets	15,578	M^2
Total	80,375,286	

Cotton sales yarn	8581	tonnes
Acrylic sales yarn	1401	tonnes
Knitwear	3,582,346	pieces
Blankets	999,093	pieces

Imports for 1977 (latest available data), were:

Yarn: 2145.7 tonnes of which 76% man-made and 17% cotton.
Fabric: 27.3 million M^2 of which 74% man-made and 21% cotton.
Clothing: 3.445 million knitted, 3.940 million woven.
Total supply, 1979: 203.2 million M^2 or 35,112 tonnes of fibre.

Demand

On the assumption that the 1974 supply was equal to demand, and demand has grown at an annual rate of 5%, the estimated demand for 1979 is 222.5 million M^2 of fabric equivalent, or 42,053 tonnes of fibre. The estimated shortfall between supply and demand in 1979 is, thus, 19 million M^2, or 3,676 tonnes of textile fibre.

Current fibre consumption (excluding bast, jute, ramie etc.) is estimated at 1.28 kg per capita compared with 1.5 kg estimated by the F.A.O. for East African countries in 1974.

Type of fibre consumed is approximately 80% natural, 20% man-made. Demand is considered to be 70% natural, 30% man-made.

2. Demand Projections to 1985

Expected additional N.T.C. capacity between 1980 and 1985 is:

Adei Abebe extension	2,500 tonnes
Kombulcha new mill	5,600 tonnes
Change doubled yarns to singles in twills	1,370 tonnes
Extend working hours of mills	4,553 tonnes
Total	13,823 tonnes

The demand projection for 1985 based on an annual growth rate of 5% is 56,092 tonnes of fibre, giving a shortfall of 17,061 tonnes.

It is concluded that another new mill of similar capacity to Kombulcha will be needed during the next five years, if imports are to be maintained at current levels. It is recommended that the bulk of the additional capacity becoming available up to 1985 should be directed to the production of man-made textiles including blend of natural and man-made.

The demand projection for 1990 is for 72,000 tonnes of textile fibre with an estimated shortfall of 33,000 tonnes. It is recommended that a further three new mills be provided between 1985 and 1990.

3. Woven Cloth Rationalization

Recommended that the cheaper plain fabrics be concentrated at Akaki, and that denim production be concentrated at Akaki on Ruti looms.

Twill fabrics of doubled yarns should be changed to singles yarn. The benefits will be 12,693 spindles available for other productions, and an annual saving in production costs estimated at up to 4 million Birr. Some balancing equipment will be required at Asmara Textile Mills and at Ethiopian Fabrics. Cloth width: production of wider cloth up to 5 cm less than reedspace will increase wearing capacity by 12 million M^2.

Extra hours: Mills should extend working hours to 7920 per annum as at Dire Dawa and introduce a 4th shift. The gain will be an extra 12½ million M^2 per annum production. Employees for 4th shift mainly available from existing general shift (day workers). Effect will be to reduce hours per worker per week from 56 (as at Dire Dawa), to 42. Reduced fatigue will improve labour productivity.

Recommend working party, to include market experts, to consider the suggestions made in report.

4. Management Systems

Recommend standard costing system for all N.T.C. factories with N.T.C. responsible for introduction. System of use of financial data for control information contained in supplement to report.

Wage systems – some mills have incentives, others none. Wages rates very mixed between mills and generally unsatisfactory. Rational method of incentives in force at Dire Dawa. Recommend it as basis for introduction of incentives into other mills.

Incentive systems must be based on prior work study. No work study practised in N.T.C. factories. Recommended technique be adopted and work study department set up within N.T.C. with trained men in the mills.

Production control systems in mills generally satisfactory but suggest recruitment of clerical labour to take load off production and general management.

5. Centralised Purchasing

Recommended for items used in quantity, e.g. cardboard tubes, heald wires, dyestuffs and chemicals.

6. Manufacture of Accessories

Small scale industries have a potential for the manufacture of fairly simple accessories in wool, metal and leather. There is scope for import substitution of a number of items.

7. Job Classification and Evaluation

Descriptions of 35 textile jobs are provided in Appendix 'A'. Several systems of job evaluation are available and a description of one such system which is considered relevant to the Ethiopian textile industry is given in Appendix 'B'.

8. Man-Power Requirements

Managerial and Technical. The functional role of the central mangement of the N.T.C. is discussed and methods of approach to overcoming the current shortage of management personnel are suggested.

Estimates are given of the current production labour force, the projected labour force to 1985 and the annual wastage of the several broad categories of employees, i.e., technicians and technologists; craftsmen; semi-skilled workers, and unskilled. It is recommended,

(a) that the facilities at the Bahr Dar textile college be expanded for the training of technical management and technologists,

(b) that a technical training school be established for the training of general mechanics, electricians and other engineering trades,

(c) that general mechanics and electricians be given further training on textile machinery and equipment in a technical school specializing in textiles,

(d) that 'in-house' training schools be established at the major N.T.C. mills for 'off the shop floor' training of spinners, weavers, knitters and other semi-skilled jobs.

The development of training facilities for technicians and craftsmen should be treated with urgency.

9. Maintenance

Methods of improving maintenance are described by the more effective use of control systems, by monitoring, and by assistance to the mills of the central N.T.C. staff in the identification and fulment of future maintenance training requirements. The advantages of planned maintenance are described but centralised maintenance is not recommended.

10. Cotton Growing and Ginning

Five Agricultural Development Corporations returned completed questionnaires. Their total area under cotton is 43,343 hectares with an annual cotton seed production of 70,316 tonnes or 16.22 quintals per hectare. Cultural practice is generally good and improving by the training given to farmers and workers.

Four cottons were tested at the Shirley Institute. All were good for spinning up to count 40^s Ne, and three were suitable for counts up to combed 60^s Ne.

Questionnaires were returned from four active ginneries, Tendaho, Kalitti, Idget and Adei Abebe. A fifth ginnery of eight stands at the Asmara Textile mills is inoperative for lack of cotton seed. The Kalitti gin is a brush gin and the rest saw gins.

None of the gins has the means for controlled drying of cotton and it is recommended that equipment for this purpose be installed.

11. Quality of Production

The products of the N.T.C. mills are made from generally good quality cotton yielding yarns and fabrics of good strengths. Poor spinning practice, however, produces uneven yarns suffering from thick places and neps. Though coarse yarns tend to be of better quality than the fine yarns, all yarns show excessive count variation.

Fabrics did well in strength tests but from observation in the mills, the cloth contained many weaving faults such as broken picks, broken warp threads and thick and thin starting places. Colour fastness was poor, but more serious was the lack of dimensional stability leading to excessive shrinkage in washing.

12. Effluent Disposal and Treatment

Methods of effluent disposal practised by the mills are,

(a) direct into a local river,

(b) direct into mains drainage,

(c) by evaporation and seepage.

Several factories gave partial treatment prior to discharge by the use of settling tanks thus reducing the suspended solids and allowing for pH correction.

Estimates of capital and running costs of treatment plants are given in Section 12 of the report.

13. Manufacturing Costs

Cost comparisons are made for counts Ne 20^s and 32^s between N.T.C. yarns and yarns produced in Hong Kong, Japan and Pakistan. The most important single factor is the cost of cotton. In the N.T.C. costing cotton prices are 203, 208.5, 171, 177, and 177.5 US cents per kg. For 20^s count produced with the higher priced cotton the N.T.C. manufacturing costs are approximately 12% higher than the Pakistan costs, whilst with the cheaper cottons the N.T.C. costs are very slightly below the Pakistan figures. The Hong Kong and Japanese manufacturing costs are substantially higher than those for the Pakistan and N.T.C. yarns.

For count Ne 32^s, the N.T.C. costs are considerably below those shown for all three foreign yarns. For this count the N.T.C. cotton cost and the conversion costs are below those of the three foreign yarns.

Comparisons have been made of the manufacturing costs of a plain cotton sheeting, with 20^s count warp and weft and a weight of approximately 156 gm/m^2, between two N.T.C. fabrics and one each from Hong Kong and Pakistan. The N.T.C. fabrics have the lowest manufacturing cost, largely due to lower conversion costs.

14. Labour and Machine Productivity

Spinning productivity is expressed in operative hours to produce 100 kg of yarn and weight of yarn produced per 1000 spindle hours.

When the labour productivity values are adjusted to a nominal count 20^s, the range for the N.T.C. spinning mills is from 31 to 195. Dire Dawa has the highest level of productivity with 31 operative hours per 100 kg of yarn, whilst the Idget mill has the lowest labour productivity with 195 operative hours per 100 kg. The remaining mills have values between 50 and 83. The average for Kenya mills is 36, and 42 for Pakistan mills. Thus only the Dire Dawa mill compares favourably with those figures.

Machine productivity compares well with the values obtained in the USA, West Germany, Pakistan and Kenya. Indices are quoted for counts 20^s and 32^s with Dire Dawa and Ethiofil providing the best results.

In calculating the N.T.C. spindle productivity levels, an efficiency of 85% was assumed in the absence of any firm estimate from the mills themselves.

Weaving labour productivity is expressed in operative hours per 100,000 M of weft inserted. For production on automatic looms the calculations are complicated by the fact that large numbers of automatic looms are run as non-automatic, i.e., weft replenishment is done manually. Allowing for the effects of this, the productivity figures for the N.T.C. mills compare unfavourably with those given in the report for a number of foreign countries. In Kenya, for example, weaving labour productivity is twice as high as it is in the N.T.C. mills.

The average loom efficiency is estimated at 76.3%. A realistic level of attainable efficiency would be 85%.

15. Condition of Equipment and Recommendations

All items of production and auxiliary equipment were assessed as to condition and placed in one of four categories, viz.

1. In good or new condition requiring no modification or overhaul. Many years of useful life remaining.
2. In reasonable condition but requires or will shortly require some minor degree of overhaul or modification to ensure several future years of useful life.
3. In poor condition, or obsolete, but capable of being brought back into good condition by a major overhaul or modification.
4. Obsolete or worn out and should be replaced.

The condition of each item in the machine registers of Volume II is indicated by one of those four categories, e.g. condition 1, 2, etc.

Most of the machines fell into categories 2 and 3. Where modification or overhaul is indicated an estimate of the probable cost is also given.

The recommendations for all the factories are summarised in Table 2 of this Executive Summary. In addition to the recommendation a brief statement of the likely benefit is given, and an estimate of the probable cost in US $. An indication of the degree of urgency is given by splitting the recommendations into those that should be carried out in the immediate future up to 1982, and those that may be left until the years 1983 and 1984.

No attempt has been made to evaluate the benefits in financial terms for the recommendations are numerous and the benefits often difficult to evaluate financially. For example many of the proposed changes will result in improved quality, or better working conditions, and most commonly, prolong the working life of the equipment.

The estimated expenditures associated with the recommendations are summarized in Table 3. The cost estimates are classified by mill; time period; process; and buildings and services. They are further classified as to purpose, i.e., overhaul, renewal and addition.

The total estimated cost of all the recommendations is 25.5 million US $, being made up of overhaul, 6.2 million US $, renewal, 13.8 million, and additions, 5.6 million. The largest individual items in the Table are concerned with the renewal of spinning and weaving equipment at Akaki, and the renewal of the mill building at Idget.

For more detailed information on the recommendations contained in Tables 2 and 3, reference should be made to the appropriate section of the mill reports in Volume II.

16. Fibre Substitution

The question of the substitution of Ethiopian cotton by cheaper imported varieties has been considered in detail in the report on the Asmara Textile Mills (pages H/19 - H/22, part II of volume 2). It is concluded there that the export price that could be obtained for the Ethiopian cotton would not be sufficient to justify the exchange.

Partial substitution of rayon for cotton in blends of 20/80 rayon/cotton is recommended, (see section 16 volume 1). Benefits are to be obtained in processing performance and in the cost of raw fibre.

17. Storage Facilities

Storage facilities are generally adequate in most mills but there are some exceptions. The building of the Ethiopian Sewing Thread mill is overcrowded and storage areas grossly inadequate. Many durable articles are stored in the open. Storage of cotton seed prior to ginning is a serious problem at Idget. Bale stores there are inadequate leading to deterioration of the cotton and mixing of bales in ginning.

The geographical distribution of the industry is such that centralised storage for mill supplies is not feasible for most of the items used by the mills, with the exception of dyestuffs and chemicals. The bulk purchase and centralised storage of such commodities is feasible and should lead to purchasing economies.

Most of the production of the mills is sold in the Addis Ababa area. Centralised storage of those products, together with a centralised sales organisation is a desirable rationalization of the existing fragmented arrangements.

18. Working Environment

With the exception of the Asmara Textile mill all spinning departments were contaminated with airborne fibre dust in various degrees of unacceptability. Probably the worst conditions are at Idget which has no air conditioning system, only water sprays to increase humidity. The cotton-wool making plant at the Ethiopian Textile Industry is also badly affected by airborne fibre. At Bahr Dar, Akaki, Idget, and Dire Dawa much of the absenteeism of workers is due to chest complaints and asthma, particularly amongst w_rkers in spinning. Immediate action should be taken to enforce the use of face masks in all departments where excessive airborne dust is present. The longer term solution lies in the improvement of existing but inadequate or inefficient air conditioning plants, and their installation where they do not yet exist.

Lighting levels are generally inadequate, particularly in weaving. At the Asmara Textile mill the lighting level in the weaving shed was down to less than 20 lumens in some areas. A satisfactory level is 100 lumens.

Machine covers and guards were generally provided but the cards at Debre Berhan were an exception. Serious machine hazards are present there and action is recommended to make the machinery safer.

There is a need for more adequate protective clothing in the wet finishing departments and for workers handling dangerous chemicals.

Ear plugs should be provided for all weaving shed workers and their use should be made mandatory.

The point has been made elsewhere that the working hours in the mills are frequently excessive, up to 56 hours per week, for example, at Dire Dawa. The introduction of a 4th shift and a reduction in working hours to an average of 42 per week should be a priority aim. It is also recommended that a substantial free or subsidised meal should be provided for workers in their meal break.

19. Exports and Imports Substitution

For the time being we see no possibility of successful entry into the export market for the products of the N.T.C. Most of the neighbouring countries of Ethiopia are expanding their own textile industries and are themselves seeking export outlets. The present quality standards of much of the N.T.C. production is such as to make them unacceptable in the markets of the developed countries.

Scope exists for import substitution but a preliminary requirement is the expansion of the capacity of the Ethiopian Textile Industry. It is clear from what has been written about the demand projections above, that considerable expansion of capacity is required merely to keep up with the anticipated rising demand without increasing imports. However, when capacity is adequate to cut into the imports, attention should concentrate on fabrics of man-made fibres and blends of man-made fibres and cotton. More immediately, action can be taken to reduce the added value of the types of textile imports, by substituting cloth imports for garment imports. This will require the expansion of the garment making capacity, but this can be done fairly quickly and cheaply compared with the expansion of textile production capacity.

From the garment import statistics provided in the report, major items which merit consideration for domestic manufacture are mens and boys cotton jackets and trousers, (which will include jeans), and mens and boys cotton knitted underwear. The category 'various' in the mens and boys outerwear statistics is not clarified in the import statistics but it is thought to be made up of mainly tee-shirts, which can be treated as knitted cotton underwear.

The knitting capacity of the N.T.C. is currently under-utilised particularly at Kalitti. Re-organisation of and further investment in the knitting and sewing plant there will yield a much higher production which may be aimed at import substitution of knitted cotton underwear and tee-shirts.

20. General Recommendations

Under the Section dealing with woven cloth rationalization some recommendations are made on broad areas of specialization of mills. The key is to concentrate on the cheaper plain fabrics and denims at Akaki and to reduce the range at other mills. This would enable Akaki to also narrow the range of counts in spinning.

The point has also been made in the report on Akaki in Volume 2, that the looms at Akaki are worn out and should be replaced, and that the weaving and other buildings are in a poor state of repair and in need of extensive renovation.

The demand projection to 1985 show the need for another new mill of similar capacity to Kombulcha, to be brought in to production before 1985.

Bringing these various points together, it is suggested that the N.T.C. consider expanding the capacity of Akaki, as part of a programme of building renovations and weaving re-equipment.

The numbers of air jet looms suggested as replacements for the existing 725 Sacamoto looms was 360. This number would provide at least as much production as the 725 Sacamotos, and would need only half the floorspace. If however, the number of air jets was increased to 700, thus filling the original area of floorspace, the woven cloth output of Akaki would be approximately doubled.

Extra spinning capacity would also be needed and open-end spinning should be considered. The capital cost would be higher than for ring spinning equipment but rotors will provide more even yarn than rings, and even yarn is essential for the weft in air jet looms, i.e., the open-end machines would provide the weft and the existing ring spinning provide the warp yarn.

Capital expenditure would be incurred in the weaving shed renovation, the purchase of 700 air jets, a new building for the open-end spinning department, and the open-end spinning machines themselves together with the necessary spinning preparation machinery. The total capital expenditure involved has not been estimated, but it will certainly be less than the cost of a new mill on the scale of Kombulcha, plus the cost of replacement looms at Akaki, and the renovation costs of the Akaki buildings.

The proposal also has the merit of increasing production capacity with little addition to the existing experienced labout force.

Other recommendations for consideration by the N.T.C. are:

(a) The production of the plain weave Standard fabric at Dire Dawa be transferred to Akaki, after re-equipment of the Akaki mill, and the Kovo looms at Dire Dawa be replaced by modern high speed automatic pirn change looms for the production of polyester/cellulosic fabrics. Certain balancing changes will be necessary in spinning preparation and spinning, and in finishing.

(b) The Asmara Textile mill and Bahr Dar should concentrate on the production of better quality plain weaves and twills.

(c) Ethiopian fabrics should concentrate on twills.

(d) To improve the quality of screen printing, and to obtain economies in the printing process, all screen printing should be concentrated in a single factory at Addis Ababa.

(e) All dyeing and finishing in the Asmara area should be concentrated at the Asmara Textile mill.

(f) The production of hand knitted sweaters at the Asmara Sweater Factory should be discontinued, and production concentrated on middle quality acrylic sweaters in non-fashion styles.

(g) All the knitting plants are suffering from an acute shortage of designers and skilled technicians. It is recommended that foreign ex-patriates be recruited to bring the plants and their products up to an acceptable standard, and to train Ethiopian counterparts as the successors.

(h) The Kalitti knitting and sewing plant is in need of complete re-organisation and much re-equipment. The recommendation on ex-patriates applies here.

(i) Blanket production should be concentrated on woven acrylic and stitch-bonded cotton waste, i.e. the production of woven cotton blankets should be discontinued. Woven acrylic blankets should be produced at Gulele and Debre Berhan, and stitch-bonded fabrics at Adei Abebe.

(j) It is recommended that the production of woollen type fabrics at Debre Berhan be discontinued, and the carpet production also. If the N.T.C. are to produce carpets the tufted method of production is recommended rather than weaving. It should be pointed out, however, that the production rate of a tufting machine is 50 times faster than that of a loom. Before embarking upon that method of production, therefore it would be necessary to determine that a sufficient market exists.

TABLE 1

SUMMARY OF EQUIPMENT, PROCESSES, AND PRODUCTION

	ADDIS ABABA							ASMARA					OTHER AREAS			TOTAL
	A Adei Abeba	B Akaki & Kaleti	C Idgit Mill	D Eth. Sewing Thread Co.	E GTGC.	F Augusta Shirt Factory	G Gulele Factory	H Asmara Textile Mills	I Ethiopian Spinning	J Ethiopian Textile Ind.	K Ethiopian Fabrics	L Asmara Sweater Factory	M Bahr Dar	N Debre Berhan	O Dire Dawa	TOTAL
No. of employees:	1493	5686	1289	411	1107	260	0	2800	352	497	801	294	2745	611	5476	23,822
No. of shifts:	3	3	3	3	3	1		3	2	2	3	1	3	3	3	
Hours per year:	6750	6840	6795	7425	6272	2099	0	5865	5224	4125	6688	2280	7667	6862	7920	
I Production Equipment																
(a) Spinning & Doubling																
Ring Spindles - cotton	10,720	49,672	10,632					25,384	7992		7568		20,000		50,352	182,320
" " - acrylic															5100	5,100
" " - wool														620		620
" " - condenser								384							294	678
Box Spinning spindles		600														600
Doubling Spindles	360	4796		1728				3224	144		2160		224		10,952	23,588
Combing Machines		4						9							6	19
(b) Weaving																
Cotton Looms		829						426			136		406		1076	2,873
Blanket Looms - cotton		24						14							6	44
" " - acrylic	14	10												40		64
Woollen Looms							48							10		58
Carpet Looms														1		1
(c) Stitchbonding Machines	3															3
(d) Knitting																
Circular Machines		14						38		49						101
Flat Bed Machines		2						2		15		4				23
V Bed Machines												6				6
Manual Flat Bed		2														2
Manual V Bed												78				78
(e) Sewing																
Sewing Machines		39			228	89		158		200		42				756
II Finishing Processes																
Yarn dyeing/bleaching		X	X	X				X		X	X		X		X	
Loose Stock dyeing	X													X		
Fabric dyeing		X						X		X	X		X		X	
" bleaching		X						X		X	X		X		X	
" printing		X						X		X	X		X		X	
" raising	X	X						X			X			X	X	
" finishing		X					X	X		X	X		X		X	
III Cotton Wool Making										X						
IV Ginnery	X	X	X					X								
V Annual Production 1978/79																
Woven Cotton Cloth (thousand M^2)		26,319						4233			1854		19,036		28,886	80,328 (000 M^2)
" Woollen Cloth (thousand M^2)														32		32 "
" Carpet (thousand M^2)														16		16 "
Cotton sales yarn (tonnes)	2272	1100	1394					308	404				815		1194	7,487 (tonnes)
Sewing & embroidery yarns (tonnes)				300											252	552 "
Cotton Knitting sales yarn (tonnes)															142	142 "
Acrylic sales yarn (tonnes)															1401	1,401 "
Woven Cotton blankets (000)		166						27							73	266 (000)
Stitchbonded Cotton blankets (000)	146															146 "
Woven Acrylic blankets (000)	212	78												299		589 "
Shirts (000)					275	172										477 (000)
Other Garments - Woven (000)					334	40										374 "
Household Linen (000)					62	10										72 "
Knitted Garments (000)		601						1166		1684		132				3,583 "
Cotton Wool (tonnes)										13						13 (tonnes)
Sanitary Towels (tonnes)										7						7 (tonnes)

TABLE 2

SUMMARY OF RECOMMENDATIONS IN MILL REPORTS

	Recommendation	Benefit	Approximate Capital Cost 1980-82 (U.S. $)	Approximate Capital Cost 1983-84 (U.S. $)
ADDI ABEBE Spinning	(1) Install four high production cards. Scrap eight old conventional cards.	(1) Increased production and better balance.	(1) 268,000	
	(2) Replace one assembly winder. Replace one post doubling winder.	(2) Improved yarn quality and lower production costs.	(2) 133,000	
	(3) Overhaul air conditioning plant.	(3) Control of air condition to give better performance of production machines	(3) 68,000	
AKAKI Spinning	(1) Replace draw-frames with high speed two delivery machines.	(1) (2) Higher output to balance higher ring frame output. Better quality yarn to give better weaving performance.	(1) 2,810,000 (2)	
	(2) Convert Howa cards to high production tandem units.			
Spinning and Weaving	(3) Overhaul air conditioning plant.	(3) Better control of air conditions.	(3) 100,000	
Weaving	(4) Replace one cone-winder.	(4) Replacement of obsolete Leesona 44 machine with less labour intensive winder.	(4) 50,000	
	(5) Install three new beamers and creels. Scrap six existing Allen beamers.	(5) Six Allen machines becoming worn out. New beamers will improve quality and lower labour and maintenance costs.	(5) 200,000	
	(6) Purchase three warp knotting machines and frames.	(6) Reduce labour costs of warp preparation.	(6) 60,000	
	(7) Renovate weaving shed.	(7) Bring building and services in weaving up to standards necessary for efficient performance of processes. Include a revised lay-out of preparation equipment.	(7) 500,000	
	(8) Replace Sacamoto looms with 360 air-jet looms.	(8) Sacomoto looms worn out. Air jets easier to maintain, will cut production costs.	(8)	3,600,000
Finishing	(9) Convert singeing machine to run on alternative fuel.	(9) Machine not running because of problems with gas fuel - unobtainable.	(9) 14,000	
	(10) Replace jig dyeing machines with large diameter machines.	(10) Increased production and versitility.	(10)	123,000
	(11) Change bearings to external mounting on hot flue machine.	(11) Present internal mounting creates problems.	(11) 16,000	
	(12) Complete overhaul of Artos clip stenter	(12) Overhaul will extend working life.	(12) 41,000	
KALITI Knitting and Spinning	(1) Complete re-organization with replacement of old machines, and provision of new cutting room equipment, (laying-up tables, band knives etc.).	(1) To obtain production increase of up to 100%	(1) 150,000-200,000	

continued

TABLE . Continued

		Recommendation		Benefit		Approximate Capital Cost 1980-82 (U.S. $)	Approximate Capital Cost 1983-84 (U.S. $)
[illegible] MILL ([illegible]) Spinning	(1)	Install two new roving frames and five cards.	(1)	To balance production processes.	(1)	282,000	
	(2)	Overhaul of machines listed in mill report.	(2)	To bring back into good condition.	(2)	430,000	
	(3)	Build new mill.	(3)	Present building has reached end of its useful life.	(3)		3,250,000
	(4)	Transfer of machinery from old to new mill.	(4)	Self explanatory.	(4)		360,000
Yarn bleaching	(5)	If bleached yarn production is increased extra bleaching capacity will be needed.	(5)	To balance production.	(5)	No estimate possible until extend of increased production decided.	
ETHIOPIAN SEWING THREAD Winding	(1)	Replace cone-winding and twisting frames.	(1)	Machine worn out. Replacements will give improved quality yarn.	(1)	186,000	
GENERAL TEXTILE and GARMENT FACTORY	(1)	Replace worn out and obsolete sewing machines.	(1)	To improve production, quality, and maintenance.	(1)	250,000	
GULELE	(1)	Modify loom shuttle boxes.	(1)	To take large shuttles for blanket weaving.	(1)	190,000	
	(2)	Instal acrylic waste spinning equipment at Adei Abebe and cop winders at Gulele.	(2)	To provide weft supply for blanket weaving at Gulele.	(2)	1,750,000	
ASMARA TEXTILE MILLS Spinning	(1)	Overhaul the oldest opening line.	(1)	To prolong the life of the equipment.	(1)	20,000	
	(2)	Replace 20 old draw frames with six new ones.	(2)	Old frames worn out; new frames will give better quality product.	(2)	400,000	
	(3)	Overhaul four roving frames.	(3)	To prolong the life of the machines.	(3)	150,000	
	(4)	Overhaul winding frames.	(4)	To prolong the life of the machines.	(4)	100,000	
Weaving	(5)	Instal fluorescent lighting in weaving shed.	(5)	To bring lighting levels up to standard required for weaving.	(5)	40,000	
Finishing	(6)	Recondition impregnation unit and washing range.	(6)	Improved efficiency of bleaching	(6)	27,000	
	(7)	Recondition chain merceriser washing range.	(7)	To restore to proper working order.	(7)	41,000	
	(8)	Automatic jiggers, recondition.	(8)	To restore to good condition including automatic control.	(8)	14,000	
	(9)	Drying-range, replacement by 12 cylinder high pressure range.	(9)	Improved efficiency and higher production.	(9)	77,000	
	(10)	Replace or overhaul clip stenter.	(10)	Restore to satisfactory efficiency.	(10)	(a) Replacement 205,000 or (b) Overhaul 68,000	
	(11)	Extension and conversion to pin/clip.	(11)	Increase in drying rate.	(11)		96,000
	(12)	Recondition plaiting machine.	(12)	To prolong useful working life.	(12)	14,000	
	(13)	Recondition yarn drying machines.	(13)	To prolong useful working life.	(13)	21,000	

continued

3.

TABLE 2 Continued

		Recommendation		Benefit		Approximate Capital Cost 1980-82 (U.S. $)	1983-84 (U.S. $)
ASMARA TEXTILE MILLS General	(14)	Restore air conditioning to full working order.	(14)	Improve atmosphere and give correct temperature and humidities for production processes.	(14)	325,000	
	(15)	Provide instruments for a quality control department.	(15)	To monitor quality standards of processes.	(15)	120,000	
ETHIOFIL Spinning	(1)	Instal an additional scutcher and lap-former.	(1)	Reduction of weight/yard in lap.	(1)	140,000	
	(2)	Overhaul of air conditioning system and restoration of automatic control equipment.	(2)	Restoration of optimum air conditions for spinning processes.	(2)	50,000	
	(3)	Improve testing facilities.	(3)	To monitor quality levels of processes.	(3)	65,000	
ETHIOPIAN FABRIC Spinning	(1)	Replacement and additional machines, in opening, carding and roving.	(1)	To increase production and balance processes.	(1)		559,500
	(2)	Reconditioning of cards, draw frames, ring frames and doublers.	(2)	To restore the machines to good condition.	(2)	480,000	
General	(3)	Instal full air conditioning in spinning and weaving.	(3)	To provide satisfactory environment for operatives and processes.	(3)		950,000
Finishing	(4)	(a) Recondition chainless merceriser, or (b) replace with a new wider machine.	(4a) (4b)	To extend working life of the equipment. To allow processing of wider fabrics.	(4a) (4b)	85,000	470,000
	(5)	Replace cylinder drying range.	(5)	Increase in capacity and efficiency.	(5)	65,000	
	(6)	Overhaul of hot flue machine and screen printer.	(6)	To extend working life of equipment.	(6)		130,000
BAHR DAR Spinning	(1)	Overhaul of spinning preparation and spinning frames.	(1)	Increased production and improved quality of yarn.	(1)	400,000	
Winding	(2)	New guides and clearers.	(2)	Improved weaving performance.	(2)	35,000	
	(3)	Modification to pirn winders (bunch building facility).	(3)	To provide pirns for automatic looms.	(3)	30,000	
	(4)	Provide new sizing machine.	(4)	To increase sizing capacity.	(4)	250,000	
	(5)	Provide replacement size cooking equipment.	(5)	To replace worn out wooden kettles.	(5)	10,000	
	(6)	Repair brakes on warping machines.	(6)	Improved quality of warps.	(6)	7,000	
	(7)	Provide weft detectors on looms.	(7)	To convert 234 looms to automatic pirn changers.	(7)	(a) 120,000 (Loepte photo-cell detectors) or (b) 25,000 (electrical feelers).	
General	(8)	Provide additional air conditioning equipment in spinning preparation, winding and weaving.	(8)	To provide satisfactory control of environment in the departments concerned.	(8)		550,000
	(9)	Provide under-drawn ceilings in spinning and weaving.	(9)	To reduce condensation and improve air-conditioning plant performance.	(9)	280,000	
Finishing	(10)	Makers overhaul and modifications to shearing machine.	(10)	To restore to proper working order.	(10)	3,500	
	(11)	Overhaul mercerising range.	(11)	To cure frequent break-downs.	(11)	13,000	

continued.

TABLE 2 Continued

		Recommendation		Benefit		Approximate Capital Cost 1980-82 (U.S. $)	1983-84 (U.S. $)
BAHR DAR Finishing	(13)	Purchase 3 extra re-action chambers for bleaching/impregnation machine.	(13)	To increase production rate.	(13)	25,000	
	(14)	Pad/hot flue machine, complete overhaul and extension by maker.	(14)	To restore to good working order.	(14)	55,000	
	(15)	Makers overhaul of No. 1 stenter.	(15)	To rectify generally poor condition of machine.	(15)	50,000	
	(16)	Overhaul of automatic controls on No.2 stenter.	(16)	To restore automatic controls to working order.	(16)	18,000	
DEBRE BERHAN Spinning	(1)	Recondition cards.	(1)	To restore to good working condition.	(1)	240,000	
	(2)	Overhaul spinning frames.	(2)	Increased production, prolonged working life of the machines.	(2)	25,000	
	(3)	Overhaul winding machines.	(3)	To extend useful working life.	(3)	30,000	
Weaving		The action with regard to blanket and other weaving at Debre Berhan should be considered in relation to the overall policy to be adopted by N.T.C. on blanket production, woollen type cloth and carpet production. This is dealt with elsewhere in the report.					
Finishing	(4)	Major overhaul of centrifuge hydro-extraction.	(4)	To prolong working life.	(4)		5,000
	(5)	Drying unit - renovate.	(5)	To bring back into working use.	(5)	11,00	
	(6)	Overhaul decatising unit.	(6)	To prolong working life.	(6)		6,000
	(7)	Overhaul pressing machine.	(7)	To prolong working life.	(7)		6,000
DIRE DAWA Spinning	(1)	Instal 3 draw frames, 1 lap former and 8 combers, No. 5 Mill.	(1)	To balance production after increases in efficiency.	(1)		405,000
	(2)	Instal 2 draw frames in No. 1 Mill.	(2)	To replace worn out machines and give lower production costs.	(2)	70,000	
	(3)	Overhaul of roving frames in Mill No. 5.	(3)	To prolong life of machines and improve quality of production.	(3)	120,000	
	(4)	Overhaul ring frames in Mill No. 1.	(4)	Prolong working life and increase machine productivity.	(4)	450,000	
	(5)	Overhaul ring frames in Mills No. 3 & 5.	(5)	Prolong working life.	(5)		760,000
Weaving	(6)	Overhaul of Koa pirnwinders.	(6)	Restoration of automatic features to improve labour and machine productivity.	(6)	200,000	
	(7)	Replacement of Schlafhorst pirnwinders.	(7)	Old machines worn out and must be replaced to maintain weft supply to looms.	(7)	750,000	
General	(8)	Overhaul of air conditioning plant.	(8)	Restoration of air conditioning plant to full working order.	(8)	440,000	
Finishing	(9)	Recondition of singeing and desizing machine and conversion to take alternative fuel.	(9)	To give better quality process.	(9)	34,000	
	(10)	Replacement of automatic jiggers.	(10)	To ensure continued production in preparation, present machines worn out and difficult to get spare parts.	(10)	164,000	164,000
	(11)	Overhaul of screen printers by makers.	(11)	To prolong useful life of machines.	(11)	22,000	
	(12)	Overhaul of hank bleaching machines by makers	(12)	To prolong useful life of machines.	(12)		25,000

TABLE 3

SUMMARY OF EXPENDITURES ASSOCIATED WITH RECOMMENDATIONS IN MILL REPORTS
(000 US $)

	Spinning			Weaving			Finishing			Knitting/Sewing			Buildings/Services			Total			
	Over-haul	Renew	Addition	Over-haul	Renew	Addition	Over-haul	Renew	Addition	Over-haul	Renew	Addition	Over-haul	Renew	Addition	Over-haul	Renew	Addition	Total
Adei Abebe																			
1980-82		401											68			68	401	-	469
1983-84																			
[illegible]																			
1980-82		2,810			250	60	71				175		600			671	3,245	60	[illegible]
1983-84					3,600			123									3,723		[illegible]
[illegible]																			
1980-82	430		282											3,610		430	3,610	282	4,322
1983-84																			
Eth. Sewing Thread																			
1980-82		186															186		186
1983-84																			
[illegible]																			
1980-82											250						250		250
1983-84																			
[illegible]lele																			
1980-82					190	1,750											190	1,750	1,940
1983-84																			
[illegible]ara Textile Mills																			
1980-82	270	400					117	282					325	60		712	842	-	1,554
1983-84								96									96		96
[illegible]thiofil																			
1980-82			140										50		65	50	-	205	255
1983-84																			
[illegible]thiopian Fabrics																			
1980-82	480						85	65								565	65	-	[illegible]
1983-84			658				130								950	130		1,608	[illegible]
[illegible]r Dar																			
1980-82	435			7	10	400	167		25						280	609	10	705	[illegible]
1983-84															550			550	550
[illegible]ebre Berhan																			
1980-82	295						11									306			[illegible]
1983-84							17									17			[illegible]
Dire Dawa																			
1980-82	570	70		200	750		56	164					440			1,266	984	-	[illegible]
1983-84	1,360		400				25	164								1,385	164	400	1,949
Total																			
1980-82:	2,480	3,867	422	207	1,200	2,210	507	511	25		425		1,483	3,770	345	4,677	[illegible]	3,002	[illegible]
1983-84:	1,360	-	1,058	-	3,600		172	383	-		-		-	-	1,500	1,532	[illegible]	2,558	[illegible]
	3,840	3,867	1,480	207	4,800	2,210	679	894	25		425		1,483	3,770	1,845	6,209	13,756	5,560	[illegible]
Grand Total		9,187			7,217			1,598			425			7,098					

1. TEXTILE SUPPLY AND CONSUMPTION

1.1 Estimate of Consumption for Year Ending July 1979

Introduction

The estimate of textile consumption was obtained from the N.T.C. Production Report dated Hamle 1971 (EC), and the import statistics for 1977 (GC).

Table 1/1, Estimate of Textile Consumption 1978/79 details the supply of textiles and lists the broad categories, e.g. fabric, yarn, garments. Class of fibre is indicated though it was not possible to break down the man-made fibres into their particular fibre types.

Bast fibres, jute and ramie are excluded from Table 1/1. Such fibres are not taken into account in the published F.A.O. estimates of textile consumption per capita. Ethiopian consumption will be compared to that of other developing countries on the F.A.O. basis of estimation and it is for that reason that bast and jute fibres etc are not included in the overall estimate of supply. They are mentioned, however, in the section dealing with imports.

Duplication of quantities has been avoided. Fibre imports do not appear as such for they are represented in the various outputs of domestic production. Knitted garments produced by the NTC are shown because the yarn and knitted fabric going into those garments are not shown elsewhere. Garments of woven cloth produced by the NTC garment factories are not shown, however, because the cloth used in those garments appears in the NTC fabric production figures.

The factory aspects of the study were concentrated on the NTC factories which account for the overwhelming proportion of factory based textile production. A share company, the Ethio-Japanese Synthetic Fabrics company was excluded. It is understood that this factory produces 6.5 million m^2 per year of continuous filament fabrics. Whilst this output figure is not included in the supply estimates shown in the report, the yarn going into that fabric is imported and is included in the import statistics used, and therefore, in the overall estimate of fibre consumption.

The various forms of textiles represented in the Table have been converted into the equivalent quantities of square metres of fabric, and their fibre weight. The conversion factors used are shown in the Table.

TABLE I/1

ESTIMATE OF TEXTILE CONSUMPTION - 1978/79

	NTC Production 1978/79	Imports (1977)	Total	Conversion Factor	Cloth Equivalent (10^6 m^2)	Conver. Factor
Woven Cloth						
Cotton cloth ($10^6 m^2$)	80.3	5.9	86.2		86.20	160g/
Woollen cloth "	<.1	0.2	0.2		0.20	350g/
M/m cloth	-	20.5	20.5		20.50	125g/
Yarn						
Cotton yarn (tonnes)	8581 (1)	361	8942	160g/m^2	53.36 (2)	
M/m yarn "	1401	1623	3024	160g/m^2	18.90	
Various (3) "		162	162	160g/m^2	1.01	
Knitwear Garments				m^2 per item		gm.per
Woollen (000)	-	40	40	0.95	0.04	320
Cotton "	3452	1907	5359	0.75	4.15	125
M/m fibre "	130	1134	1264	0.73	0.92	80
Various (3) "	-	364	364	0.83	0.30	125
Woven Cloth Garments						
Woollen (000)	-	18	18	2.26	0.04	778
Cotton "	-	1519	1519	2.74	4.16	534
M/m Fibre "	-	151	151	2.04	0.31	392
Various (3) "	-	2252	2252	1.47	3.31	409
Household & Other Made-up Articles						
Cotton (000)	-	1229	1229	0.34	0.41	85
M/m fibre (000)	-	3440	3440	0.75	2.58	60
Tents and Tarpaulins						
Cotton Tents (000)	-	75.4	75.4	30.0	2.26	15 kg
Cotton Tarpaulins ($10^6 m^2$)	-	0.8	0.8		0.81	500 g/m
Blankets						
Woollen (000)	-	1	1	3.45	<.01	2000
Cotton "	410	45	455	3.50	1.59	1850
M/m fibre	589	29	618	3.50	2.16	2000
			Totals:		203.21	

Notes: (1) Includes 700 tonnes of rural hand spun yarn

(2) 403 Tonnes of yarn used for sewing thread is not included in the cloth equivalent calculation

(3) Fibre type not specified in the import statistics, but thought to be mainly cotton.

For hand woven cloth a conversion factor of 160 grammes per square metre has been used, i.e. a similar conversion factor to that used for the factory woven cloth. This compares with a figure of 63 gm/m^2 used in the previous draft, and which was arrived at in an earlier project conducted in 1975.

In their comments on the first draft report the N.T.C. provided the Shirley Institute for guidance, with an N.T.C. market study conducted in 1978*. Included in that document is the statement '... the assumption is made that the national demand for traditional fabrics (i.e. handwoven), would stabilize in the long run at about 60 million square metres (roughly equivalent to 12,000 tonnes of yarn) per annum'. Thus, the N.T.C. envisage hand woven fabric to have an average weight of 200 g/m^2. The Shirley Institute consider this to be a gross over-estimate of the fabric weight.

From that market study and elsewhere it is clear that the N.T.C. consider total textile consumption in terms of square metres of cloth, rather than weight of textile fibre. In our opinion consumption in terms of cloth area can be misleading, particularly when the estimate of area is calculated from other measures, such as weight of yarn.

We remain convinced that the average weight of hand woven fabrics is about 63 gm/m^2. Hence the yarn supply of 7688 tonnes to hand weaving would result in 121.1 million m^2 of cloth. If the N.T.C. estimate of 200 gm/m^2 is used the resultant cloth would amount ot 38.44 million m^2.

The conversion factor of 160 gm/m^2 is a compromise, though the area of cloth thus calculated is considered to be an under-estimate. However, this is not a vital point because the unit of consumption that really matters is the weight of yarn and this remains accurate regardless of measures of conversion into fabric.

* The need for Establishing a Second Integral Factory, N.T.C. Addis Ababa, February 1978.

1.2 Summary of Production - National Textiles Corporation

The annual production of the NTC factories for the year ending July 1979, is estimated as shown in Table 1/2, viz:

Table 1/2

Annual Production of NTC Factories - Year Ending July 1979

		$metre^2$
Woven cotton fabrics		80,327,951
Woven woollen type fabrics		31,757
Carpets		15,578
	Total	80,375,286
		Tonnes
Cotton yarn for sale, and sewing thread:		8581[(1)]
Acrylic yarn for sale		1401
	Total	9982
		Pieces
Knitwear		3,582,346
Blankets		999,093
	Total	4,581,439

Other products for which the raw materials are included in the above outputs:

Sewing thread 403 Tonnes
(includes 300 tonnes output and 103 tonnes singles stock)

Woven cloth garments and other made-up articles 675,942 pieces, including the production of G.T.G.F.

[(1)] Includes 700 tonnes of rural hand spun cotton yarn for use by hand loom weavers

A very small amount of Polyester/Viscose fabric was produced and has been included in the figures for woven cotton fabrics.

Woven woollen type fabrics for retail sale were produced in small quantities at Debre Berhan, the annual production being confined to just under 32 000 square metres. This was a blend fabric containing some wool fibre.

The carpet figure shown in the table refers to the production of a single Wilton loom, again at Debre Berhan.

Cotton yarns produced for conversion into fabrics within the NTC mills are not shown. The yarn production figures given refer to yarns which are sold for use outside the NTC predominantly to hand loom weavers.

The knitwear figures refer in the main to cotton weft knit fabrics made up into underwear and other forms of light clothing. An exception is the production of man-made fibre sweaters at the Asmara Sweater Factory; they account for 130 000 of the 3.6 million pieces shown in the Table.

'Blankets' include both woven and stitchbonded with the former being in the majority. Cotton waste and acrylic waste are the fibres used.

1.2.1 National Textile Corporation Production - Woven cotton fabrics

Woven cotton fabrics represent the major product of the NTC mills. Their types, estimates of production quantities, and their end-uses are given in Table 1/3.

Of the 80 million square metres produced 47% is apparel fabric; an equal quantity is multi-purpose fabric, and the remaining 6% has various end-uses of which household applications is by far the most important.

The fabrics are listed in Table 1/3 under three headings, (i) apparel; (ii) apparel/domestic and (iii) other end-uses.

TABLE 1/3

ANALYSIS OF WOVEN COTTON FABRIC PRODUCTION

APPAREL

Fabric	Production m^2 (000)	%
Poplin	12 380	32.8
Twill	10071	26.7
Drill	8963	23.7
Printed plain	2702	7.2
Dyed plain	1682	4.5
Jean/denim	747	2.0
Shirting	456	1.2
Flannel	385	1.0
Calico	161	0.4
Lining	142	0.4
Poly/viscose suiting	41	0.1
Tropical suiting	36	0.1
Sateen	17	< 0.1
Total	37783	100.0

APPAREL/DOMESTIC

Fabric	Production m^2 (000)	%
Grey sheeting	20446	54.2
Mamamudi	3424	9.1
Dyed sheeting	3214	8.5
Mull	3065	8.1
Abujedid	2546	6.7
Kuttu	1683	4.5
Gauze	1323	3.5
Malmal	905	2.4
Moridian	650	1.7
Grey chick	416	1.1
Chindies	34	0.1
Savad	6	< 0.1
Total	37712	100.0

OTHER END-USES

Fabric	Production m^2 (000)	%
Household		
Bedsheets	4033	85.1
Curtaining	597	12.4
Towelling	111	2.3
Sub-total	4741	
Industrial		
Canvas	1	< 0.1
Surgical		
Bandages	2	< 0.1
Miscellaneous		
Sailcloth	66	1.4
Bed warps	23	0.5
Sub-total	89	
Total	48	(100.0)

In the 'apparel' list, poplins, twills and drills account for 83% of the total. These are the better quality and more expensive fabrics produced by the N.T.C, and together with the other items in the 'apparel' list, their market is in the Urban areas of the country.

The 'apparel/domestic list contains poorer quality fabrics, most of which are plain weave and are sold in loomstate form i.e. unbleached or undyed. The most important single item is grey sheeting which makes up 54% of the total. Fabrics in this list have a wide variety of uses, e.g. home-made trousers and other garments, bed linen, curtains and as substitutes for some of the traditional hand-woven fabrics. They are purchased in the rural areas which constitute nearly the whole of the market for these fabrics.

The final list, 'other end uses' is a miscellaneous list made up of four small groups of fabrics i.e. household, industrial, surgical and miscellaneous. The household group is the most important and includes bed sheets, curtaining and towelling. Bed sheets at 4 million square metres account for 83% of all fabrics covered by the list.

Table 1/4

SUMMARY OF END-USES — WOVEN COTTON PRODUCTION - N.T.C. OUTPUT (1978/79)

End use	Production m^2 (000)	% of total
Apparel	37783	47.0
Apparel/Domestic	37742	47.0
Household	4711	5.9
Industrial	1	<0.1
Surgical	2	<0.1
Miscellaneous	89	0.1
Total	80328	100.0

1.2.2 N.T.C. PRODUCTION OF YARN FOR SALE

Most yarns produced in the N.T.C. spinning mills are consumed within the Corporation in the manufacture of woven and knitted fabrics and sewing thread. The rest, comprising 7478 tonnes of cotton yarn and 1401 tonnes of acrylic yarn is sold by the spinning mills for use elsewhere.

All the acrylic yarn was produced at Dire Dawa in counts 2/32s and 2/36s for the cottage or independent hand knitting industry. The end use is invariably apparel.

The most important market for cotton sales yarn is hand loom weaving, which took almost 7000 tonnes, or 89% of the cotton sales yarn available. The major counts were 10s (2436 tonnes), and 21s (3484 tonnes). A complete breakdown is given in Table 1/5.

The production figures for NTC sales yarns given by Table 1/5 exclude the yarns supplied to the Ethiopian Sewing Thread Co. In the production year 1978/79 the total quantity supplied was 403 tonnes of singles yarn, of that amount, 103 tonnes is assumed to be stock and work in progress because the output from the Sewing Thread Co, during the period was only 300 tonnes. The market share breakdown was as follows:

	Market	Tonnes
Sewing thread -	domestic	159
	industrial	8
	crochet	2
	Sub-total	169
Embroidery thread -	hand knitting	59
	skelma/telet	46
	Sub-total	105
Other threads		26
Grand total		300

TABLE 1/5

N.T.C. PRODUCTION OF COTTON SALES YARNS - 1978/79

Count (Ne)	Hand Loom Weaving (tonnes)	Hand Knitting (tonnes)	Other Uses (tonnes)	Total (tonnes)	% Share
6½s	263	–	–	263	3.5
9s	–	–	5	5	–
10s	2436	–		2436	32.6
16s	–	11		11	1.2
20s	–	–	225	225	3.0
21s	3484	–		3484	46.6
24s	–	142	20	162	2.2
30s	–	–	41	41	0.5
40s	708	–		708	9.5
60s	97	–		97	1.3
80s	–	–	< 1	<1	–
2/20s	–	–	< 1	<1	–
4/10s	–	–	< 1	<1	–
4/12s	–	–	< 1	<1	–
4/60	–	–	3	3	–
Others	–	–	43	43	0.6
	6988	153	337	7478	100.0

1.3.1 Yarn Supply for Hand Loom Weaving

The quantities and sources of yarns supplied to hand loom weavers are given in Tables 1/6 and 1/7. Table 1/6 shows the quantities supplied by the N.T.C. spinning mills for the years 1972, 1975, and 1978. An additional 700 tonnes of hand spun weft yarn is included in the table. Between 1975 and 1979 the quantity of yarn provided by the N.T.C. mills dropped by 567 tonnes, from 7555 to 6988 tonnes. Three mills contributed to the reductions, Dire Dawa, (20% down), Asmara Textile Mills, (68% down), and the second source of supply in Asmara, the Ethiofil spinning plant, down by 72%.
The total reduction from the three mills was 1206 tonnes, of which 639 tonnes was replaced by increased production in the remaining mills.

TABLE 1/6

YARN SUPPLY FOR HAND LOOM WEAVING (Tonnes)

Year	1972	1975	1978/79	1975 - 1979
Factory				
DIRE DAWA	1 002	1491	1 195	-296
BAHR DAR	629	432	811	+379
AKAKI	1 704	880	1 057	+177
ADEI ABEBE	1496	2 053	2 122	+ 69
ASMARA TEXTILE MILLS	941	960	308	-652
IDGET	1 374	1 379	1 393	+ 14
ETHIOFIL	460	360	102	-258
TOTALS	7 606	7555	6988	-567
HANDSPUN YARN (1)	700	700	700	
GRAND TOTALS	8 306	8 255	7 688	

Source: NTC Factory returns - 1978/79

NOTES

(1) Estimate based on the findings of the advance report of the Rural Survey of Cottage Industries.

The second table in this section, Table 1/7 shows the quantities of each yarn count supplied by the mills to the hand loom yarn market. All mills produced count 21s Ne, and five of the seven also produced count 10s Ne. These two counts make up 85% of the total weight of yarns produced for hand loom weaving. Dire Dawa produced 97% of the 708 tonnes of count 40s Ne, which is the yarn in shortest supply in the hand weaving yarn market.

TABLE 1/7

FACTORY PRODUCED YARN FOR HAND LOOM WEAVING (1978)

Breakdown by Yarn Count (Tonne)

Count / Factory	6½s	10s	21s	40s	60s	Total
DIRE DAWA	–	24	390	684	97	1 195
BAHR DAR	–	543	268			811
AKAKI	–	542	515			1 057
ADEI ABEBE	183	762	1 177			2 122
ASMARA TEXTILE MILLS	–	–	284	24		308
IDGET	80	565	748			1 393
ETHIOFIL	–		102			102
TOTALS	263	2 436	3 484	708	97	6 988

Source: NTC Factory Returns 1978/79

From interviews in Addis Ababa with retailers, wholesalers and travelling merchants, it was evident that the demand for yarn by hand loom weavers is greater than the supply.

Indeed, the shortage is such that some sales yarns, especially count 40s, are being bought at up to double their nominal retail price. This situation is expected to ease in 1981 when the new capacity at Adei Abebe goes into production.

1.4 TEXTILE IMPORTS

Data on textile imports was obtained from the Central Statistical Office, Addis Ababa. The information received relates to the year 1977 and is the most recent available. Statistics were available for yarns, fabrics and made-up textile articles but not for fibre. Broad estimates of fibre imports were, however, obtained from the Statistical Abstract (1977), for the year 1976. They are as follows:

Fibre	Tonnes imported (1976)
Wool/animal hair	135.2
Cotton	96.2
Jute	9210.6
Synthetic and artificial fibres	749.3

In estimating current textile consumption in Ethiopia the wool, cotton and synthetic fibre imports will be represented in the output figures of the NTC factories, either as yarn, cloth or garments. For this reason they have been omitted from the import statistics in Table 1/1.

Import figures for bast, jute, ramie etc have also been omitted from Table 1/1 for the reasons given in section 1.1. The bulk of such imports is jute fibre. This is not processed by the NTC and we have no information on its use or end product. It is possible that it is used in the handicraft sector for the manufacture of mats and wall hangings.

1.4.1 YARN IMPORTS

In 1977 yarn imports totalled 2145.7 tonnes of which the two major fibre types were man-mades, at 1623 tonnes, and cotton, at 361.4 tonnes. The balance was made up of wool, silk, metal, glass and bast yarns.

Table 1/8 lists yarn imports by fibre type for 1977

TABLE 1/8

YARN IMPORTS BY FIBRE TYPE - 1977

Fibre type		Quantity (tonnes)	
Wool		27.1	1.3%
Cotton		361.4	16.8%
Man-made		1 623.0	75.7%
Silk		99.9	4.6%
Metalised		19.5	1.0%
Glass		3.2	0.1%
Flax/Ramie		5.0	0.2%
Jute/bast		6.6	0.3%
	Total	2 145.7	100%

Woollen yarns

The amount of woollen yarn imported is small, (27.1 tonnes) and is obtained from the U.K.

Cotton yarns

Out of a total of 361.4 tonnes 278.2 tonnes were in the count range of 20s - 40s, and came chiefly from Pakistan and India with a small amount from China. Of the balance, 35.7 tonnes in the count range 40s - 60s, and 4.5 tonnes in counts over 60s all came from India. A small amount of mercerised and coloured yarn was imported from Pakistan and India.

Man-made fibre yarns

It has been impossible to calculate the amount of each fibre type of man-made yarn entering the country, but it has been assumed that Polyester, nylon, and Acrylic yarns dominate this sector. The rapid growth of man-made fibres has been the most significant feature of the textile imports and consumption in recent years.

A total of 1623 tonnes was imported, the major suppliers being Japan, Taiwan and Italy.

Silk

As no silk was imported for retail sale or for use in the nationalized textile industry it is assumed that all of the 99.9 tonnes of silk imported was for private sector use.

Supplier's were Taiwan, China, South Korea and Japan.

Metalised yarns

Nearly 20 tonnes was imported from Taiwan and Japan for the private sector, chiefly for use as decorative threads in speciality fabrics.

Miscellaneous yarns

The remaining imports of yarns were made up of glass fibre, flax, ramie jute and bast amounting to 11.6 tonnes in total.

1.4.2 FABRIC IMPORTS

Fabric imports are a significant contribution to the total textile consumption in Ethiopia. Penetration of man-made fibre fabrics has taken place over a relatively short period of time and is expected to be a continuing trend. The range of fabrics is wide, from top quality woollen fabrics, selling at high prices to low quality nylon and printed cotton fabrics.

In 1977, the total amount of fabric imports was 27.73 million square metres,[1] with fabrics constructed of man-made fibres being the most significant, with imports totalling 20.49 million square metres. Cotton with imports of 5.87 million square metres and jute with 1.03 million were the two other major fibre types.

Table 1/9 is an analysis of fabric imports in 1977, classified by fibre type, and is followed by comments of the various fabric imports under their respective headings.

TABLE 1/9

ETHIOPIAN FABRIC IMPORTS - 1977

Fibre type		000 sq. metres	%
Wool		39.7	0.1
Wool mixture		204.7	0.7
Cotton		5 877.2	21.2
Man-made		20 492.2	74.1
Flax/ramie		64.4	0.2
Jute		1 034.6	3.7
Silk (inc.noil)		18.0	–
	Total:	27 730.8	100.0

(1) Ethiopia Statistical Abstract - 1977. C.S.O.

1.4.2.2 COTTON FABRICS

The constructions and types of cotton fabric imports vary widely from heavy proofed-tarpaulin fabrics down to low quality dyed and printed light-weight qualities. For the purpose of this study it was decided to incorporate all the fabrics into five broad categories as follows:

Tarpaulin/waterproof canvas

A total of 814 thousand square metres was imported into the country with the major supplier being Hungary, with nearly 92% share of the total. As all tarpaulin covers are imported a number of commercial vehicles operating in the Addis area were inspected. In every case the fabric was found to be of the very heavy proofed type which is difficult to handle because of its weight. Lightweight fabrics would be easier to handle and to store when not required. These latter types ot fabrics have been developed for general and tropical use, and are usually PVC coated polyester or nylon base fabric.

The balance of fabric are used for awnings, sunblinds, tents, protective covers etc.

Drills and Jean - Fabrics

A total of nearly 194 thousand square metres of drill and jean fabric was imported,mainly from China. Most went for retail sale rather than to garment-making factories.

Most of the fabrics inspected during field studies were found to be of low quality. Demand for this type of fabric is expected to increase because of its cheapness and durability as a work wear fabric.

Shirting and Sheeting

The range of shirting and sheeting materials imported amounts to 68 000 square metres and is of medium quality. A third of the total comes from China, with other substantial amounts obtained from Czechoslovakia and Japan. It is understood that a small proportion was a waterproof finish for use in umbrella manufacture.

Some of the shirting material inspected was of a printed candy stripe which was aimed at the lower end of the market. This type of fabric was selling at about 10 Birr per square metre, with the better qualities selling at about 13 Birr per square metre.

It would appear that there is some opportunity for local produced cotton shirting, particularly poplin type, increasing market share at the expense of the imports. Fabric inspected from Bar Dar textile mills was of a similar quality to the imported cloths, but is is claimed that there is a consumer bias against Ethiopian made textiles. This statement became more apparent as the field work developed and generally the indications are that it is true. Some conclusions have been reached on this subject and are dealt with later in this report.

Terry fabrics

The total of 2 975 000 square metres of terry fabric was supplied mainly by China (63%) and Pakistan 35%. Virtually all the fabric was of low quality and low price. Although the volume is high and would appear attractive as a product to compete with, it is doubtful if the fabric could be manufactured cheaply enough in Ethiopia to be competitive. On the other hand, at the top end of the market there is scope to compete with expensive imported towels which are already made up, but the quality of fabric and subsequent making up would have to be of the highest quality to be competitive.

Dyed/Printed Cottons

The main input of 1.79 million square metres comes from China (97%). It is mainly plain woven dyed or printed for use as apparel. Prices varied, but were in the region of 8 to 10 Birr per linear metre. The market sector aimed at is that dealing in low priced textiles. Field work revealed that sales were slow for these fabrics with consumers, even at the lower end of the soci-economic group who preferred, where their budgets allowed, the better quality textiles available.

1.4.2.3 Man-made Fibre Fabrics

As with cotton fabrics, a wide range of fabric types are being imported for retail sale with a smaller amount going into making up. For the purpose of this report it has been decided to incorporate all the fabrics into four broad categories.

Shirting

A total of 80 000 square metres were imported in 1977 from China (41%) Italy(41%) and the balance of 18% from West Germany and France. Colour woven and printed fabrics were on display for retail sale, mainly of Polyester/cotton and a small amount of nylon.

As with cotton sheeting it was claimed that a proportion of the total import was waterproofed for umbrella manufacture, but no evidence was seen.

Continuous filament

This is the largest item of man-made fibre fabric imports and the product with the most rapid growth. The total imported was 13.66 million square metres, with Japan the most important supplier, with 86% share of the imports. Other major suppliers include Taiwan 7%, and South Korea with 2%. Although the percentage share of the latter two countries is small, the value is significant.

The most dominant fibre within this group is Polyester with substantial amounts of acrylic,acetate and nylon.

Japanese imports all appeared to be of good quality aimed at the better end of the market, with retail prices around 16 Birr per linear metre. The imports from Taiwan and South Korea were at the bottom end of the market, and were retailing at 4 Birr per square meter, (nylon taffeta type fabrics). Also at the bottom end of the market were some Japanese imports, e.g. 2 x 2 rayon 36" wide at approximately the same price.

TABLE 1/10

SOME TYPICAL STRUCTURES OF IMPORTED FILAMENT FABRIC

Type	Weave	Den.Warp	Den.Weft	Ends per cm.	Picks per cm.	Width cm.
Rayon	Plain	120	120	93	56	92
Rayon	Plain	120	120	93	67	112
Rayon	Satin	120	120	120	70	69
Acetate	Plain taffeta	100	100	100	73	92
Acetate	Twill	75	120	138	80	92
Nylon	Plain taffeta	70	70	106	84	92
Nylon	Plain	30	30	96	91	92
Polyester	Plain taffeta	75	75	106	87	92
Polyester	Twill	75	75	129	98	92
Polyester	Satin	50	50	63	112	71
Polyester	Plain	75	75	63	65	150

Man-made Staple Fabrics Including Blends

The major suppliers are West Germany with 63%, Japan 20% and Czechoslovakia with 10%. The total of 5.06 million square metres is likely in the long term, to increase as the advantages of polyester/cotton blends for apparel become appreciated by the Ethiopian consumer. Polyester/cellulosic blends are being increasingly used world-wide for apparel and household end uses. Their attractions are relative cheapness, durability, and easy-care properties.

Blends of 65%/35% polyester cotton are currently available in Ethiopia, competing successfully with local produced cotton and polyester/cotton fabrics.

During field work it was apparent that there is a resistance to local produced polyester/cotton, from Dire Dawa. The main reasons given were that the colour range was not as wide as imported products, and that there was a tendency for the colour to fade in sunlight.

Jersey Knitted

Good quality screen printed jersey fabrics are becoming acceptable in Ethiopia. Selling at an average price of 10 Birr per square metre this type of fabric is slowly increasing its market share. The prints, in particular those from Japan, are clean and colourful and are an obvious attraction to women for dresses. Usually of tricot knits, 100% polyester, width (58"), with a fabric weight of 133 g/metre square.

Total imports are running at just under 100 thousand square metres, with Japan and Taiwan providing most of it.

1.4.2.4 Flax/Ramie

Imports at 64 thousand square metres are in the main supplied by Hungary, (89%), in the form of woven waterproof fabrics similar in construction to cotton tarpaulins and for the same end uses.

Jute

India supplies the whole of this fabric which totals 1.03 million square metres. It is used in the manufacture of industrial sacks and bags.

1.4.3 Imports of Clothing and Other Made-up Articles -1977

The data on made-up textile imports was extracted from the External Trade Statistics published the Central Statistical Office, Addis Ababa.

The multiplicity of items listed in the published statistics have been classified according to sex of user, outerwear and underwear, and 'other'. The assembled data are presented in Tables 1/11 to 1/14.

For each item in the Tables the number imported is given, together with the equivalent area of cloth that the number represents. The estimate of the cloth equivalent was obtained by the use of conversion factors expressing the average area of cloth required to obtain a given garment. The Tables also indicate the chief countries of origin for each article.

Mens and Boys Outerwear - Table 1/11

The table lists coats, trousers, suits, shirts etc. The total number of such garments imported in 1977 was almost 3 millions, representing 4.7 million square metres of cloth. Unfortunately, 75% of the total was unspecified in the offical statistics, except as 'Mens and Boys outerwear not elsewhere specified'. From enquiries at the Statistical Office, it was found that most garments in this category are tee-shirts, pyjamas, and dressing gowns. The most common fibre was cotton and over 90% came from Korea.

Of the other items shown in the table the two largest in numbers imported were cotton trousers, (291,000), and cotton jackets (235,100), the chief country of origin was Hong Kong in both cases.

Womens and Girls Outerwear - Table 1/12

1.3 million garments were imported, 73% were of woven fabrics and the rest knitted. The outstanding item in the woven imports was 'cotton suits and costumes', accounting for 800,000 or 84% of the total woven garments. India was the main supplier. Of the knitted garments 64% were of synthetic fibre with Taiwan and China supplying over a half.

Imports of Underwear - Table 1/13

The numbers of items are expressed in thousands of dozens which is conventional for underwear statistics. The grand total imported was 257.6 thousand dozens (i.e. 3.09 millions). The majority (63%), were mens and boys garments, of which 90% were knitted cotton, almost entirely from India, and the rest knitted synthetic. In contrast the womens and girls underwear was predominently of synthetic fibres with cotton accounting for a mere 14% of the total. All were of knitted fabrics.

Other made-up articles - Table 1/14

Most items in the table are for apparel or household use whilst the rest are items for industrial or military purposes. In terms of numbers the most important item was printed nylon head scarves at 286.2 thousand dozen, (3.43 millions) with Japan as the major supplier. Large quantities of cotton tents (75,400) were imported, of which 65,000 came from Italy.

Imported Clothing - General Comments

From information obtained in the field studies it is clear that most imported clothing is sold in the large urban centres, especially Addis Ababa and Asmara, and that most purchasers are urban dwellers. A small proportion of imported clothing is second-hand, estimated at 10%, and is not shown in the Tables. They are almost entirely items of outerwear for men and women, and originate in the European countries.

As with the new clothing imports, the second-hand have their main outlets in the urban areas but they are also in demand by rural dwellers living within reasonable travelling distance of the urban markets.

1.5 YARN AND FABRIC OFF-TAKE

From the information contained in sections 1.1 to 1.4 inclusive, and from discussions with various organisations in Addis Ababa, the following is the best estimate that can be arrived at of yarn and fabric off-take in the year ending July 1979.

(a) Yarn off-take to meet the needs of:

	Tonnes
(i) Handloom weavers and independent knitters	
Cotton yarn from NTC sources	7141
Hand-spun cotton yarn	700
Imported cotton yarn	361
(ii) Other private sector	
Cotton yarn from NTC sources	337
(iii) Sewing and embroidery thread	
Domestic consumers	159
Hand knitters	59
Industrial and other consumers	82
(iv) Cotton yarn consumed by NTC	
Woven cloth and garments	12 848
Knitted cloth and garments	431
Cotton blankets	488

	Man-made yarns	Tonnes
(i)	NTC produced acrylic yarn for cottage knitters	1401
(ii)	Imported staple yarn used by NTC	417
	" " " " " private sector	750
(iii)	Imported continuous filament yarn used by private sector	286
(iv)	NTC produced staple yarns for blanket production	1178
	Other yarns	
(i)	Wool and woollen type yarns used by NTC	38
(ii)	Miscellaneous yarns used by private sector	132
	Total	26,808

(b) Fabric off-take to meet the needs of:

			Million m^2 per Annum
(i)	Sales to general public		
	(a)	Imports	25.0
	(b)	NTC Mills	78.5
	(c)	Handloom weavers	53.4
		Total	156.9
(ii)	Organized production of wearing apparel		
	(a)	NTC factories	2.4
	(b)	Independent factories	0.3
		Total	2.7
(iii)	Other purposes		
	(a)	Industrial fabrics	
		Imported bags, Tarpaulins, Tents etc	1.9
Grand Total - Fabric			161.5

1.6 EXPECTED CHANGES IN MARKET REQUIREMENTS

The pattern of demand for textiles is determined to a considerable extent by what the consumer can afford. Buyers are discriminating between products not merely in terms of price and type of fabric but also in quality and design.

As the disposable income of the Ethiopiam consumers increases the individuals textile choice will shift towards fabrics of a higher standard than those currently purchased. Thus, the heavier hand woven fabrics may be replaced by factory made cheap blankets, grey sheeting may be displaced by dyed and bleached sheeting and twills, and 100% cotton fabrics will, in part, be replaced by fabrics of cotton and man-made fibre blends.

In general, the cheaper, low quality plain weave fabrics predominently sold in the rural areas will contract in demand whilst the twills, plain dyed poplins, screen prints, and fabrics containing man-made fibres will grow in demand.

The biggest change expected in market demand is in fabrics utilizing man-made fibres. Polyester/cotton blends are expected to expand at a faster rate than any other class of textiles. Fabrics into which such blends will be successful are bed sheets, shirtings, mens casual trousers and jackets, and ladies dress fabrics. The easy care and hard wearing properties of such fabrics make them attractive to the consumer. Types of fabrics appropriate for those markets are plain weaves in weights 90 to 160 gm/m^2, bleached, dyed, and printed. For mens outerwear heavier fabrics in the weight tange 200 to 300 gm/m^2 are preferred, in plain and twill weaves, mainly dyed.

Fabrics in 100% continuous filament bulked polyester will be in demand for mens and womens outerwear. Weaves will be plains and twills piece dyed.

The demand for cotton denim for jeans, other casual wear and workwear is expected to increase at a rapid rate. In the case of jeans fabric the expansion in demand will be accelerated if the product is made available to the consumer in the form of a garment rather than a piece of cloth, which he must take to a tailor. Factory produced jeans will probably be of a better quality and cheaper than those produced by the street tailor. Expansion of production of this type of garment will also provide an element of import substitution. The point that the rate of increase in demand for a particular fabric may be determined by the garment manufacturing facilities available also applies in other cases such as shirtings, blouse fabrics, and weft knitted cottons for Tee-shirts and underwear. Hence, the expansion of factory organised garment making c[c] such garments will leave an impact on the demand for suitable fabrics.

In the urban areas screen printed fabrics in woven and knitted polyester and rayon are popular. Those imported are most in demand because of their superior quality and the variety of choice. Demand is expected to grow and N.T.C. products could satisfy most of the market requirement provided that the quality and patterns reach the standard of the imports. It is important that the N.T.C. should not attempt to provide more variety than is economically viable. Short production runs lead to higher cost and lower quality. Production plans for screen printed fabrics should be preceded by a market survey to identify those styles which are bought in quantity. Minimum production runs recommended are 20,000 metres in a maximum of four colourways.

TABLE 1/11

IMPORTS OF MENS AND BOYS OUTERWEAR - 1977

Type	Fibre	Total No. (000)	Estimated Equivalent Sq. Metres (000)	Main Suppliers (volume 000)	
Overcoats	Wool	4.8	12.0	Czechoslovakia	2.9
				Israel	1.9
Suits	Wool	2.4	9.0	Hungary	0.7
				Hong Kong	0.6
				Italy	0.6
	Cotton	45.1	169.1	Hong Kong	24.0
				India	14.0
	Man-made	9.3	35.1	Hong Kong	7.8
Trousers	Wool	4.0	6.0	Czechoslovakia	2.9
	Cotton	291.2	436.8	Hong Kong	162.7
				Malta	61.1
	Man-made	50.4	75.6	Hong Kong	39.5
Jackets	Wool	3.5	7.8	Czechoslovakia	3.0
				Italy	0.5
	Cotton	235.1	528.1	Hong Kong	110.1
				Israel	81.1
	Man-made	13.6	30.5	Republic of Korea	9.2
Woven	Cotton	41.8	55.7	Hong Kong	18.9
				Republic of Korea	6.0
				Taiwan	5.3
	Synthetic	37.7	50.3	Taiwan	9.3
Knitted shirts	Synthetic	4.1	3.6	Hong Kong	1.3
				China	1.0
Others	Various	2252	3300	Korea	2084
	Total:	2995	4719.6		

TABLE 1/12

IMPORTS OF WOMENS AND GIRLS OUTERWEAR - 1977

Type	Fibre	Total No. (000)	Estimated Equivalent Sq. Metres (000)	Main Suppliers (volume 000)	
Woven					
Coats & Jackets	Wool	1.0	2.3	Israel	0.9
	Cotton	11.5	26.8	Hong Kong	9.4
Suits & Costumes	Wool	0.2	0.6	All Italy	
	Cotton	800.4	2 801.4	India	698.6
	Man-made	30.7	107.4	India	21.3
Dresses	Wool	0.1	0.1	All U.K.	
	Cotton	13.4	16.6	Hong Kong India	6.0 3.0
	Man-made	3.8	4.7	U.K. Italy	2.2 0.9
Shirts	Wool	2.1	3.1	All Hong Kong	
	Cotton	80.7	121.0	India Japan	38.1 40.2
	Man-made	0.8	1.2	Hong Kong	0.7
Blouses	Man-made	2.2	2.2	All Hong Kong	
	Sub-total:	946.9	3 087.4		
Knitted					
Dresses) Suits) Skirts) Costumes)	Wool	10.1	15.5	Hong Kong Taiwan	6.0 4.0
	Cotton	2.8	4.3	Italy	1.1
	Synthetic	226.9	347.9	Taiwan China	60.0 50.4
	Regenerated	3.4	5.2	U.K.	1.0
	Others	110.9	170.0	Taiwan Poland	45.5 7.3
	Sub-total:	354.1	542.9		
	Grand Total:	1 301.0	3 630.3		

TABLE 1/13

IMPORTS OF UNDERWEAR - 1977

Construction	Fibre type	Total (000 dozen)	Estimated Equivalent Sq.Metres (000)	Main Suppliers	
Mens & Boys					
Knitted	Cotton	145.5	1309.5	India	144.0
Knitted	Synthetic	17.0	107.0	Hong Kong	9.5
				China	2.5
				Taiwan	2.8
Sub-total		162.5	1416.5		
Womens & Girls					
Knitted	Cotton	13.2	118.8	Hong Kong	7.1
				China	4.0
				India	1.2
Knitted	Wool	2.5	22.5	Hong Kong	1.3
				China	1.0
Knitted	Synthetic	52.3	329.4	Hong Kong	14.4
				Taiwan	9.4
				Poland	8.0
Knitted	Regenerated	6.0	37.8	Ft.Afar	3.5
				Taiwan	1.2
Knitted	Others	21.1	132.8	Hungary	9.6
				China	2.5
				Korea	2.4
Sub-total		95.1	641.3		
Grand Total		257.6	2057.8		

TABLE 1/14

IMPORTS OF OTHER MADE-UP ARTICLES - 1977

Product	Fibre type	Quantity (000)	Equivalent Sq. Metres (000)	Main Suppliers	
Handkerchiefs	Cotton	82.5 (doz)	247.5	Czechoslovakia	44.3
				Hungary	21.9
Head scarves	Nylon (printed)	286.2 (doz)	2575.8	Japan	124.3
				W.Germany	88.4
Mufflers	Cotton	2.1 (doz)	25.2	China	2.0
Bed sheets	Polyester/ cotton	5.5	20.6	U.S.A.	3.1
				W.Germany	1.0
Table cloths	Cotton	0.7	2.1	Taiwan	0.3
Towels	Cotton	15.4 (doz)	34.6	U.S.A.	7.5
				Hungary	2.1
				Hong Kong	1.4
Bed Covers	Cotton	27.9	104.6	India	12.8
				Netherlands	5.0
				Poland	5.0
Blankets	Wool	1.1	3.8	U.K.	0.4
				Denmark	0.3
				U.S.S.R.	0.2
Blankets	Cotton	45.0	157.9	China	31.8
				Hong Kong	7.2
				Taiwan	6.0
Blankets	Man-made	29.4	103.1	Japan	11.4
				U.S.A.	7.2
				Italy	5.1
Sub-total			3275.2		
Industrial Textiles					
Bags	Polyproplene	40.5	81.0	Netherlands	12.5
Bags	Jute	490.6	981.2	India	206.6
				Pakistan	244.2
Tents	Cotton	75.4	2262.0	Italy	65.0
Sub-total			3324.2		
Grand total			6599.4		

2.0 DEMAND PROJECTIONS

2.1 Rate of Growth

Any reasonably accurate estimate of the rate of growth in textile demand should be based upon several groups of data, viz.

1. Rate of population growth
2. Rate of change in G.D.P. (gross domestic product)
3. Statistics of personal disposable incomes
4. Income distribution, particularly the differences between the urban and the rural populations.

Data was not available to provide estimates of items 3 and 4, whilst that for item 2 was limited and gave no indication of any change taking place. The only firm evidence available was on item 1, rate of population growth and it was upon this single parameter that the original assessment of the rate of growth in textile demand was made.

In their comments upon the draft final report the N.T.C. requested that the demand projections be recalculated on the basis of the following assumptions, viz.

1. *That demand and supply were in equilibrium in 1974*
2. That the total rate of growth in textile demand from 1974 onwards is 5%.

This has been done and the results are presented below.

TABLE 2/1

Demand Forecast for Textiles

Year	Millions M^2	Year	Millions M^2
1974	174.388	1982	257.577
1975	183.055	1983	270.455
1976	192.208	1984	283.978
1977	201.818	1985	298.177
1978	211.909	1986	313.086
1979	222.504	1987	328.740
1980	233.630	1988	344.177
1981	245.311	1989	362.436
		1990	380.558

The demand forecast in terms of weight of fibre is shown in Table 2/2 below. The average weight of fibre per square metre is derived from the information contained in Table 1/1, 'Estimate of Textile Consumption'. The fibre weight equivalent values shown in that Table are the starting weights of fibres required to produce the quantities of the various categories of textiles listed, i.e. the amount of fibre lost through process waste is taken into account. Exceptions are, woven cotton cloth, and the three categories of yarn listed under the 'Yarn' heading. The relevant process waste allowanced for those items are:

Woven cloth: 16% (includes spinning and weaving process waste)
Cotton yarns: 10%
Man-made yarn: 5%
Various yarn: 8% (estimated)

The equivalent fibre weights shown for those items in Table 1/1 are adjusted as follows:

Woven cotton cloth:	13,792 tonnes x 1.16 = 15,999
Cotton yarn:	8,942 tonnes x 1.10 = 9,836
Man-made yarn:	3,024 tonnes x 1.05 = 3,175
Other yarn:	162 tonnes x 1.08 = 175

The estimate of total fibre weight consumed is now adjusted from 35,112 tonnes to 38,377 tonnes.

Taking the 1978/79 cloth equivalent total of 203.21 million square metres, the average starting weight of fibre per square metre is 189 g/m^2. Using the cloth figures shown in Table 2/1, the demand forecast in terms of starting fibre weight is as shown in Table 2/2:

TABLE 2/2

Fibre Demand Forecast

Year	Tonnes	Year	Tonnes
1974	32,950	1983	51,116
1975	34,597	1984	53,672
1976	36,327	1985	56,355
1977	38,144	1986	59,173
1978	40,051	1987	62,018
1979	42,053	1988	65,049
1980	44,156	1989	68,500
1981	46,364	1990	71,925
1982	48,682		

Comparing the 1978/79 estimate of consumption* with the 1979 estimate of demand the consumption estimate is 91% of the demand estimate, a shortfall of 19 million square metres of cloth or 3,676 tonnes of fibre.

2.2 <u>Fibre consumption per caput</u>

Assuming a population estimate for 1979 of 30 millions, the total fibre consumption per caput, excluding bast, jute, ramie etc., is 1.28 kg.

Comparable data for other East African countries is not available for any year after 1974. However, the data published by the F.A.O. for the years 1970-74 is of value because the fibre consumption per caput of 1.5 kg in the East African countries remained unchanged during those five years and is likely to have remained so. A summary of the F.A.O. statistics is given in Table 2/3, 'Fibre Consumption - East Africa'.

The table shows that whilst the overall growth of fibre consumption only matched the population increase, (hence, consumption per caput remained static), man-made fibres increased their share of the market at the expense of cotton and wool, viz.

	1970	1971	1972	1973	1974
Natural fibres(%)	76	75	74	73	72
Man-made fibres (%)	24	25	26	27	28

For comparison, the 1979 estimate of consumption for Ethiopia, analysed by fibre type is:

	Tonnes	% Share
Cotton	26,697	76.0
Wool	99	<1.0
Man-made fibre	7,188	20.5
Various	1,128	3.2
	35,112	100

* See Table 1/1 Estimate of Textile Consumption - 1978/79.

TABLE 2/3

Fibre Consumption - East Africa

	1970 000 tonnes	%	1971 000 tonnes	%	1972 000 tonnes	%	1973 000 tonnes	%	1974 000 tonnes	%
Cotton										
Mill consumption	57.5		60.2		62.1		74.4		78.4	
Net imports	44.8		41.8		38.0		38.7		38.0	
Available for home use	102.3	71	102.0	70	100.1	70	113.1	70	116.4	69
Wool										
Mill consumption	0.4		0.5		0.7		0.4		0.3	
Net imports	6.2		7.4		5.9		4.9		5.1	
Available for home use	6.6	5	7.9	5	6.6	4	5.3	3	5.4	3
Man-made cellulosic										
Mill consumption	13.8		13.5		13.2		9.2		9.4	
Net imports	9.5		10.4		11.3		15.5		16.1	
Available for home use	23.3	16	23.9	16	24.5	17	24.7	15	25.5	15
Man-made synthetic										
Mill consumption	1.8		2.5		3.3		5.2		5.1	
Net imports	9.7		10.4		9.0		13.6		16.2	
Available for home use	11.5	8	12.9	9	12.3	9	18.8	12	21.3	13
Total available for home use	143.7	100	146.7	100	143.5	100	161.9	100	168.6	100
Total available per caput (kg)	1.5		1.5		1.4		1.5		1.5	

Source: Per caput fibre consumption, 1970-1972 F.A.O. June 1974
1973-1974 F.A.O. July 1976

'Various' fibres refers to textile imports the fibres of which are not identified in the import statistics. From the types of articles involved it is considered that the bulk, say two thirds, are of cotton. On that assumption, the estimated proportions of natural and man-made fibres become, natural 80%; man-made 20%, compared with the corresponding 1974 figures of 72% and 28% in the F.A.O. statistics quoted in Table 2/3.

If the estimated shortfall of 3676 tonnes mentioned above was to be supplied in man-made fibres the respective shares of natural and man-made fibres in the Ethiopian market would become, natural, 73%; man-made, 27%, i.e. a similar split to that for the East African countries in 1973.

2.3 Projections to 1985 and 1990

Estimates or supply and demand for 1985 and 1990 are given by Table 2/4. The quantities of the various textile items are classified by fibre types and expressed in tonnes of fibre. Current consumption figures were extracted from Table 1/1.

The demand projections are calculated on an annual growth rate of 5% with the consumption in 1974 as the basis.

The total projected demand has been broken down by type of textile article with the allocation of quantities to each type based on the proportions of the 1978/79 consumption estimates. The figures for blankets are an exception; their demand projection is taken from the separate section dealing with blanket demand shown elsewhere in the report.

Shown in the Table are the probable sources of increased production from the N.T.C. during the period 1980 to 1985; they are:

1. Adei Abebe extension : 2,500 tonnes of yarn
2. New Mill, Kombulcha : 5,600 tonnes of cloth
3. Change from doubled to singles yarn (i.e. to coarser counts : 1,370 tonnes
4. Extend working hours of mills (machinery) to 7920 hours per year exclusive of meal breaks : 4,353 tonnes

Total : 13,823 tonnes

Othe. potential sources of increased N.T.C. production are from increased machine efficiency and from increased cloth widths, i.e. greater utilisation of the width of existing looms. The maximum practical attainable efficiency in weaving is considered to be 85%, or an increase of 8.7% from the present overall average of 76.3%. On the basis of existing cloth widths and working hours per year an improvement of 8.7% in loom efficiency would result in an annual increase in cloth production of approximately 10 million M^2, representing 1,890 tonnes of starting fibre.

Potential extra production from maximum utilisation of loom reed space is 12.3 million M^2 per annum, representing 2,325 tonnes of starting fibre.

With an increase in working hours per year to 7920 the potential gain in production from those two sources is increased further, (see Table 3/3).

The figures given above are the maximums that might be obtained. The actual that will be achieved will undoubtedly fall short, being dependent upon the degree of success in improving maintenance, yarn quality, operative skills, the supply of spare parts and the willingness of the market to accept wider fabric. For these reasons it is difficult to forecast what increased production may be achieved from improved loom efficiencies and increased with cloth width, and that is why those factors have not been taken into account in estimating future increases in N.T.C. production.

The demand projection for 1985 is for 56,092 tonnes of fibre. N.T.C. production for that year is forecast at 39, 031 tonnes leaving a shortfall of 17,061 tonnes, viz.

	Demand (tonnes)	N.T.C. Production (tonnes)	Shortfall (tonnes)
Cotton	43,070	36,260	6,810
Man-made	11,221	2,771	8,450
Wool	144	1	144
Various	1,657	-	1,657
Total	56,092	39,031	17,061

Assuming that the 'various' category is made up of two thirds cotton and the rest man-made fibres, we get:

	Demand (tonnes)	%	N.T.C. Production (tonnes)	%	Shortfall (tonnes)	%
Natural fibres	44,324	79	36,260	93	8,064	47
Man-made	11,768	21	2,771	7	8,997	53
Total	56,092	100	39,031	100	17,061	100

If the demand patternfor natural and man-made fibres is to follow that shown in the F.A.O. statistics for East African countries, i.e. approximately 70% natural fibres, 30 percent man-made, the supply and demand summary becomes:

	Demand (tonnes)	%	N.T.C. Production (tonnes)	%	Shortfall (tonnes)	%
Natural fibres	39,264	70	36,260	93	3,004	18
Man-made	16,828	30	2,771	7	14,057	82
Total	56,092	100	39,031	100	17,061	100

The implications of these figures are:

(i) that if the 1977 levels of imports is not in increase substantially, a further new mill of at least similar capacity to Kombulcha will be needed before 1985 and

(ii) *that most of the additional capacity that becomes available between* now and 1985 should be devoted to the production of man-made fibre textiles.

Lack of adequate data prevents a detailed forecast of the types of man-made fibres, but it is suggested that the major forms should be:

blends of: polyester/cotton,
polyester/rayon,
cotton/polynosic rayon,
100 per polyester staple yarns and fabrics.

Continuous filament nylon and cellulosic fabrics are outside the main stream of N.T.C. production facilities and it is recommended that the supply of such fabrics be left to the private sector factories and to imports.

For 1990 the demand projection is 72,000 tonnes with a projected shortfall of 33,000 tonnes. If the 1985 demand projection can be met by the measures outlined above, the additional capacity required between 1985 and 1990 will be 16,000 tonnes, i.e., the output of a further three new mills of similar size to Kombulcha.

2.4 Industrial Fabrics

The market for industrial fabrics in Ethiopia is largely confined to agriculture, the transport industry, the shoe industry, and the armed forces.

In agriculture the need is for textiles in the form of containers for produce, or as protective covering as with bales of cotton. The fibre used for most sacks is commonly jute or some other bast fibre.

The transport industry uses textiles in the form of waterproofed coverings for trucks. Most are of cotton though a few are of bast or man-made fibres.

In the shoe industry cotton canvas is used for shoe linings and for the uppers also in some shoes, (plimsolls, sneakers, pumps etc).

The armed forces use industrial textiles in many forms, but the most common by far are tents and equipment covers, usually of tarpaulin.

There is a lack of hard factual information on the current consumption of textiles for the various end uses mentioned above, and their probable trends. We also lack some information on what fibres are used for what purpose. In the circumstances it is only possible to express an opinion on future trends in the consumption of industrial fabrics.

2.4.1 Agriculture

Sacks, chiefly of jute, are used for the transport and storage of cereals, oil seeds, pulses and cotton seed. With the introduction by the Government of of the various agricultural advisory bodies, together with the provision of fertilizers and pesticides, the production of all the main crops, including coffee, is expected to increase at a rate faster than the rate of increase in the population. The demand for sacks, therefore, is expected to increase in similar proportions.

2.4.2 Waterproofed Coverings

The bulk of articles under this heading are tarpaulins for use as vehicle covers and as protective covering for equipment and stores kept in the open. The whole of the supply is imported. Between 1975 and 1977 imports rose from 72;475 square metres per annum, to 0.75 million square metres. This ten-fold increase over such a short period can only be attributed to the exceptional requirements of the armed forces. Trends in civilian consumption are expected to follow the increase in the numbers of goods vehicle registered, on which no data was available. 95% of tarpaulins are made from cotton, and the rest from flax and ramie.

2.4.3 Tents

Between 1975 and 1977 the number of tents imported annually into Ethiopia rose from approximately 1 500 to 70 400. In 1977 60 000 tents were imported from Italy, and 9 000 from unspecified countries. The average value per tent of those two lots was 40 Birr, compared with an average value, of 440 Birr for the remaining 1 400 tents imported from several different countries.

The civilian demand for tents is probably the 1 400 more expensive tents imported in 1977, which represent about 42 000 square metres of fabric. It is assumed that the large items of imported tents are for the armed forces, and whilst they will have a continuing demand for tentage it is not possible to estimate quantities. All the tents imported were of cotton fabrics.

2.4.4 Shoe fabrics

Cotton fabrics used in the manufacture of shoes cannot be identified in the general production statistics. They tend to be fairly simple fabrics, usually of heavy cotton, a type which is already being produced by the N.T.C.

Because shoe manufacture is labour intensive and uses leather, the industry in Ethiopia is expected to grow at a rate faster than the population growth rate. The demand, for shoe fabrics is thus expected to increase substantially and merits special investigation by the N.T.C.

2.5 Blankets

Five types of blankets are available in Ethiopia, viz:

1. Cottage industry woven from sheep and goat hair
2. Woven cotton
3. Stitch-bonded cotton
4. Woven synthetic waste
5. 100% wool woven

The cottage industry woven blanket made from sheep wool and goat hair is called Bana. No information is available on the quantity produced but it is thought to be small in relation to the total blanket supply.

Woven cotton blankets are produced from condenser spun waste yarn. Stitch bonded blankets too are produced from cotton with a quantity of waste in the mixture. Woven synthetic waste blankets are pattern woven to give a large check fabric which is invariably raised. These three types make up more than 99% of the blankets sold in Ethiopia (excluding Bana blankets). 93% are produced in the N.T.C. mills and 7% are imported. There is also a small production in the private sector for which no information is available. We understand, however, that the numbers are comparatively insignificant.

The fourth category is woven 100% wool. This is an expensive blanket imported in small quantities, (1100 in 1977). None are produced in Ethiopia. The supply of blankets to the Ethiopian market in 1979 is estimated at 1.074 millions of which 42% were cotton, 58% synthetic, and less than 0.01% pure wool. A breakdown of the qualities and sources of supply is given in Table 2/6 below.

BLANKET SUPPLY - 1978/79

Mill	Cotton (000)	Synthetic (000)	Pure wool (000)	Total (000)
Adei Abebe	145.6	212.1	—	357.7
Akaki	165.5	77.5	—	243.0
Asmara Textile Mill	26.5	—	—	26.5
Debre Berhan	—	298.9	—	298.9
Dire Dawa	72.5	—	—	72.5
Total N.T.C.Mills	410.1	588.5	—	998.6
Imports (1977)	45.0	29.4	1.1	75.5
Grand Total	455.1	617.9	1.1	1074.1

Discussions about the blanket market were held with sales representatives in the blanket producing mills, and with merchants in Addis Ababa. The information obtained, on which there was general agreement, is summarized as follows:

(i) The demand for cotton blankets is predominantly rural

(ii) Cotton blankets are being used as substitutes for the traditional heavy hand-woven cotton fabrics, (gabbi)

(iii) The better quality synthetic fibre blankets are making inroads into the cotton blanket market.

(iv) The urban demand for synthetic blankets is large in relation to the comparative sizes of the urban/rural populations. This is attributed to the higher income per capita of the urban population, which is estimated at least three times the income per capita in the rural areas.

(v) The demands for synthetic blankets is estimated to be twice as great as the supply.

On the basis of these opinions and estimates, demand projections to 1985 and 1990 have been arrived at and are given by Table 2/6. The underlying assumptions are:

(i) The current demand for cotton blankets does not exceed supply, and will increase at the same rate as the population increase.

(ii) The current demand for synthetic blankets is 50% greater than supply, this assumption discounts by a half the estimates of demand/supply discrepancy provided by sales managers and merchants.

(iii) The higher purchasing power per head in urban areas creates a higher urban demand for synthetic blankets and this is assumed to be three times that of demand per head in the rural areas.

TABLE 2/6

DEMAND PROJECTIONS - BLANKETS

	1979 (000)	1985 (000)	1990 (000)
Cotton blankets:	455	534	617
Synthetic blankets			
Urban	380	555	750
Rural	547	621	694
Total	927	1 176	1 444
Grand Total	1 382	1 710	2 061

To satisfy the 1985 demand projections without the aid of imports would require the following increased production from the N.T.C. mills.

	Extra Production (000)	% Increase in Production over 1979
Cotton blankets	124	30
Synthetic blankets	587	100

Whilst the required increase in cotton blanket production can be obtained with little addition to the present N.T.C. resources, the much larger increase in synthetic blankets can only be achieved through considerable investment in production equipment.

Notes: (1) Includes 700 tonnes of rural hand-spun yarn.
(2) Fibre type not specified in the import statistics but considered to be mainly cottons

TABLE 2/4

ESTIMATES OF TEXTILE SUPPLY AND DEMAND - PRESENT AND PROJECTED (TONNES)

	1978/79			1980 - 1985 Source of extra N.T.C. production			1985			1990		
	N.T.C. Production	Imports	Total Supply	Adei Abebe and Kombulcha	Discontinue Doubled Yarns	Extend Hours to 7920	Demand Projections	N.T.C. Production	Shortfall	Demand Projections	N.T.C. Production	Shortfall
Cotton Fibre												
Woven cloth and garments	12 848	1 755	14 603	5 600	-	3 087	24 430	21 535	2 895	31 505	21 535	9 970
Knitted cloth and garments	432	238	670	-	26	59	974	517	457	1 256	517	739
Yarns	8 581 (1)	361	8 942	2 500	1 344	1 025	14 295	13 450	845	18 434	13 450	4 984
Other made-up articles	-	104	104	-	-	-	151	-	151	195	-	195
Tents, Tarpaulins	-	1 536	1 536	-	-	-	2 232	-	2 232	2 879	-	2 879
Blankets	758	84	842	-	-	-	988	758	230	1 141	758	383
Sub-total	22,619	4,078	26,697	8,100	1,370	4,171	43,070	36,260	6,810	55,410	36,260	19,150
Man-made Fibre												
Woven cloth and garments	-	2 621	2 621	-	-	-	3 809	-	3 809	4 912	-	4 912
Knitted cloth and garments	10	91	101	-	-	-	147	10	137	189	10	179
Yarn	1 401	1 623	3 024	-	-	182	4 614	1 583	3 031	5 950	1 583	4 367
Other made-up articles	-	206	206	-	-	-	299	-	299	386	-	386
Blankets	1 178	58	1 236	-	-	-	2 352	1 178	1 174	2 888	1 178	1 710
Sub-total	2,589	4,599	7,188	-	-	182	11,221	2,771	8,450	14,325	2,771	11,554
Wool												
Woven cloth and garments	< .1	84	84	-	-	-	122	< .1	122	157	< .1	157
Knitted garments	-	13	13	-	-	-	19	-	19	24	-	24
Blankets	-	2	2	-	-	-	3	-	3	4	-	4
Sub-total	< .1	99	99	-	-	-	144	< .1	144	185	< .1	185
Various Fibres (2)												
Woven cloth garments	-	921	921	-	-	-	1 338	-	1 338	1 726	-	1 726
Knitted garments	-	45	45	-	-	-	65	-	65	84	-	84
Yarn	-	162	162	-	-	-	254	-	254	328	-	328
Sub-total	-	1,128	1,128	-	-	-	1,657	-	1,657	2,138	-	[illegible]
GRAND TOTAL	25,208	9,904	35,112	8,100	1,370	4,353	56,092	39,031	17,061	72,058	39,031	33,027

3.0 WOVEN CLOTH RATIONALISATION

The constructions of the woven fabrics in production at the N.T.C. mills have been examined with view to rationalisation, i.e. to reduce their variety with the object of obtaining longer production runs and the economies of scale. A list of N.T.C. fabrics currently produced is given by Table 3/1.

In the five N.T.C. weaving mills a total of 76 different woven fabrics are produced. Plain weaves number 43, twills 27, with dobby weaves and towels making up the remaining six. Where rationalisation is possible it is usually between fabrics of roughly similar weights and widths; such fabrics have been considered and in very few cases is there opportunity for rationalisation. Other methods of achieving economies through product changes have also been considered and these are dealt with below.

3.1 Plain Weaves

The weight distribution of plain weaves is as follows:

grammes per m^2	number of fabrics
1 - 50	2
51 - 100	4
101 - 150	29
151 - 200	6
201 - 250	1
251 - 300	–
301 - 350	–
351 - 400	1
	43

None of the fabrics outside the range 101 - 150 g/m^2 is suitable for substitution by a modified construction which could be used by two or more existing fabrics. The 29 fabrics inside that range present some limited opportunities for rationalisation as is shown by Table 3/2.

The poplin and the shirting of Ethiopian Fabrics are close in weight and width but these constructions are sufficiently different to make it doubtful if the buyer of the shirting would accept a quality nearer to the inferior poplin construction, viz;

Poplin	91 x 41	24s/16s
Shirting	89 x 56	30s/24s

At Bahr Dar a dyed poplin and the Khaki linen are in the same weight range and width. Reference to Table 3/1 shows that their constructions are identical and only their colours are different. They are in fact the same fabric.

If the fabrics are compared between mills it will be seen that the Abujedid produced at the Asmara Textile Mills is close to the grey sheeting produced at Akaki, viz;

Abujedid	42 x 38	14s/14s	$39\frac{1}{2}$" RS	150 looms
Grey sheeting	40 x 40	14s/14s	$39\frac{1}{2}$ RS	226 looms

The grey sheeting is a feasible substitute for the Abujedid, but to gain any advantage from the substitution it is necessary to produce both fabrics in one mill, i.e. all at Akaki or all at the Asmara Textile Mills. Akaki produces several other fabrics with 14s warp and weft, it would seem sensible to move the Abujedid production from Asmara to Akaki. A balancing production must then be moved from Akaki to Asmara and this should be the dyed poplin, i.e.

52 x 44 24s/24s which is produced on 160 loom at Akaki.

The effect would be to concentrate further Akaki production into counts 14s and 20s which already represent a high proportion of Akaki output, and to increase the quantities of counts 24s already produced at Asmara. There are ramifications, however, which must be considered. The switch from 14s to 24s will place higher demands on the spinning capacity of Asmara Textile Mills, and reduce demand on spinning at Akaki, hence Asmara spinning capacity must be increased. This can be achieved by the transfer of what would then be surplus ring spindles from Akaki to Asmara, or alternatively, from Idget which already has surplus ring spindles. The effects upon the finishing department at Asmara must also be considered. It is already inadequate for the weaving output and will probably need some expansion.

3.2 Twill Weaves

The terms twill and drill are used loosely in the Ethiopian textile industry. For the purpose of this report the term twill will be used for both and for fabrics described as blue jeans.

3.2.1 Twills in singles yarns

At Akaki there are four dyed twills in the following two constructions:

88 x 40	14s/14s	228 g/m^2	25 looms
80 x 44	14s/14s	226 g/m^2	140 looms

Recommended constructions: 84 x 42 14s/14s.
The main benefit will be an increase in weaving production of approximately 2%.

Blue jean fabric is produced at three mills in three different constructions but all using 9s in warp and weft. Cloth weights vary between 260 and 299 g/m^2. It is recommended that this cloth be standardised at approximately 300 g/m^2, given by a construction of 68 x 42 9s/9s.

3.2.2 Twills in doubled yarns

It is recommended that singles yarns be substituted for doubled in those fabrics using doubled yarn. Their wearing properties will remain satisfactory and, if mercerised, they will still be of good appearance.

The use of singles yarn is not detrimental to the fabric provided the count used is equal to the resultant count of the doubled yarns. Fabric strength is slightly reduced but not to the extent where it would affect the wearing performance of the garment. Only when the cloth is used for high performance industrial uses, e.g. coated and used in inflatable products, is the higher strength of the doubled yarns necessary for satisfactory performance.

For apparel use generally singles yarns in twills are the norm throughout the worlds textile industries. Only rarely are doubled yarns used and then only for very expensive luxury products.

In considering the Ethiopian textile market it is found that, as in other countries the consumer purchases fabric for a specific need and within a chosen price range. The technical specifications are of minimal importance compared

Substitution of singles yarns for doubled will reduce spinning production costs, eliminate doubling costs, and weight for weight will require fewer ring spindles. Spinning preparation capacity will normally not be affected, except where the single components of the doubled yarns are manufactured from combed cotton. The coarser substitute in such cases may be carded, or combed for better appearance. If carded, the elimination of combing will provide a further cost reduction.

The cost advantages and the effect upon spindle capacity have been estimated. The calculations employed many approximations and the results must be treated as good estimates and not precise costing. They are, however, sufficiently reliable to enable conclusions to be drawn.

Eight twill fabrics produced in five mills have been examined; they are listed in Table 3/4 together with details of the cost calculations leading to the estimates of savings. The doubled yarn costs for the two fabrics produced at the Ethiopian Fabrics mill are from the cost data provided by that mill. All the other costs in the Table are based upon the cost data provided by the Akaki mill. This was necessary because only Akaki provided the data in sufficient detail to allow the calculations to be made. Nevertheless, a certain amount of interpolation was required to arrive at cost estimates for those counts which are not produced at Akaki.

Cost estimates are given for singles, carded and combed, per kilo on cone; i.e. fibre and processes up to and including cone-winding. The cost of combing is the average cost of the Akaki combing process; it does not include the cost of the fibre removed at combing, probably about 15%. We do not know the value placed by the mill upon combing waste. It will certainly go back into the mixing but probably at a value lower than the value of the new fibre in the same mixing. The estimated cost of combed singles yarn must, therefore, be regarded as an under-estimate, and the savings shown an over-estimate.

The total annual production of the eight fabrics in the five mills is 11.5 million m^2. The total annual savings from the use of singles yarn is 4 million Birr for carded warp and weft, and 3.77 million Birr for combed warp and carded weft.

Singles yarn will be twice the weight of the single component of the doubled yarns, i.e. half the Ne count. The effect of this change will be to more than double the weight output per spindle. Table 3/5 details the changes in output at the five mills, and provides estimates of the numbers of spindles that would be released for extra production. This latter estimate is summarised thus:

Mill	Spindles Released	% of Total Spindles in Mill
Akaki	2,250	5.1
Ethiopian Fabrics	861	11.4
Asmara Textile Mills	1,815	14.0
Bahr Dar	165	<1.0
Dire Dawa	7,302	14.5
Total	12,693	

The total spindles made available for extra production is 12,693, representing 6.96% of all ring spindles installed in N.T.C. mills. Increased output from spinning preparation will be needed to supply the newly available ring spindles. The percentage increases required will be similar to the percentage figures shown above. In the cases of Akaki, Bahr Dar and Dire Dawa the increases can be supplied by the existing preparation equipment without the need for additional balancing machinery. At the Asmara Textile Mills drawframe capacity is insufficient and would need expansion. The whole of spinning preparation will need expansion at the Ethiopian Fabrics mill.

The scale and type of the balancing machinery required may be assessed from the data and comments on the relevant processes, given in the mill reports in Volume 11.

3.3 Towels

The towelling produced at Akaki is a very high quality construction, i.e. 88 x 48, 2/32s/13s. It is recommended that the following construction would be an acceptable alternative:

54 x 42 Pile 2/20s Ground 2/20s Weft 14s
Pile to ground ratio 3.75 : 1

For all other towels produced within the N.T.C. the following constructions are recommended.

Medium quality:	48 x 34	Pile 6s/Ground 14s/weft 12s.
Lower quality:	44 x 29	Pile 6s/Ground 14s/weft 14s.

The effects of these changes would be to reduce the yarn costs per square metre by the use of coarser yarns, and to increase the rate of production by reduced numbers of picks per inch.

3.4 Cloth Width

A number of fabrics are of similar constructions but differ in width. There may be good reasons why different widths are produced, but frequently they are merely traditional. Wherever possible the width of the cloth produced should be the maximum possible within the reedspace of the looms. In this way the woven fabric production of the N.T.C. can be increased by a significant amount with the existing weaving resources. There are many examples of loom under-utilization, viz;

Ethiopian Fabrics. French twill. Reedspace occupied by warp, 43¾". Width of reed, 64". Number of looms 16.

In this example the 16 looms weaving the French twill are being operated at only 68% of their capacity.

Bahr Dar. Dyed twill. Reedspace occupied by warp, 44¾". Width of reed, 71". Number of looms 6. Percentage utilization of loom capacity, 63%.

The effect on output of utilizing the maximum amount of reedspace has been calculated with the results shown in Table 3/3. The table also shows the effect of increased working hours, and increased loom efficiency.

If all the looms within the N.T.C. were producing cloth in widths within 5 cm of the loom reed width, an extra 12 million square metres per annum could be produced. This is approximately 13% of the 1979/80 production target of 91 million square metres.

Garment makers may object that because their patterns are arranged to accommodate cloth of a particular width, a wider cloth would result in extra waste. If, however, the garment makers re-arrange their patterns to suit the wider cloth, not only will they incur no extra waste, but they may actually reduce the amount below that obtained with the original narrower fabric. Experience in European shirt factories is that as shirting widths have gradually moved from the traditional 36", to the current 44" to 48", and sometimes wider, the percentage waste has dropped from about 15% to 8-10%.

Denim fabrics for jeans are another example where a traditionally 36" cloth is now produced in widths from 45" to 60", bringing a saving in cutting waste to the garment maker.

Market constraints must obviously be considered before increasing the width of any particular fabric, but unless there are overwhelmingly good reasons for maintaining the traditional width, it is strongly recommended that the N.T.C. adopt a policy of increasing cloth widths to obtain maximum utilization of the looms.

3.5 Equipment Utilization

If the working hours throughout the N.T.C. vertical mills were increased to those worked at Dire Dawa, i.e. 7,920 per year, an extra 12½ million m^2 of fabric would be produced each year. The quantities for each of the mills are shown in Table 3/3.

The figure of 7,920 hours is exclusive of meal breaks.

At Dire Dawa those hours are worked per year with a three-shift system, which means that many operatives are working 56 hours per week. This is excessive and a four-shift system is recommended, giving operatives an average working week of

42 hours inclusive of meal breaks. Some additional employees will be required to operate a four-shift system but not 33% more. For example, at Dire Dawa in No.2 Weaving Mill there are 11 loom fixers per shift and 22 on day work, i.e. a total of 55. On four shifts a figure of 14 per shift would be feasible, i.e. 30 looms per fixer which is a low work load for a loom fixer. Similarly with weavers in No.2 Mill, there are 57 per shift plus 27 spare weavers per shift, i.e. a total of 252 over the three shifts. On a four shift system with 63 weavers per shift the number of looms per weaver is the reasonable figure of 6.7.

A proportion of the existing labour force at all mills are employed as 'stand-ins' for absentee workers. The number of absentees can be high in some mills. It is suggested that the level of absenteeism will drop if the average working hours per week is reduced to 42 without any reduction in pay. In that event the 'stand-in' labour and day shift labour will provide much of the extra work-force required to man the fourth shift.

There are several four-shift systems in existence. Shown below is one such system which is employed successfully in a number of U.K. factories.

Shift:	A 6a.m.-6p.m.	B 6p.m.-6a.m.	C 6a.m.-6p.m.	D 6p.m.-6a.m.
Monday	12	12	R	R
Tuesday	12	12	R	R
Wednesday	12	12	R	R
Thursday	12	12	R	R
Friday	R	R	12	12
Saturday	R	R	12	12
Sunday	R	R	12	12
Monday	R	R	12	12
Tuesday	R	R	12	12
Wednesday	R	R	12	12
Thursday	R	R	12	12
Friday	12	12	R	R
Saturday	12	12	R	R
Sunday	12	12	R	R
Total for 2 weeks: (hours)	84	84	84	84

3.6 Recommendations

From what has been written above it is clear that a programme of rationalisation of fabrics must involve an overall review of all the N.T.C. mills, their facilities, their products, and their markets. It is recommended that a working party be set up with the responsibility for drawing up such a programme. The working party should have as its members representatives of N.T.C. technical, production and marketing management. They should consider;

(i) to what extent the current range of fabrics can be reduced

(ii) what can be done to increase cloth width

(iii) the scope for changes in fabric constructions to reduce costs and increase productivity, e.g. lower ends and picks with coarser counts and broader widths.

Any accurate assessment of those three considerations must involve the opinions and judgement of individuals with a wide experience of the market, and the tastes of the consumers. On the basis of the conclusions reached by the working party it will be possible to decide on the extent to which individual mills can become specialised.

The following recommendations are put forward for consideration by such a working party:

(1) Because the Akaki mill is presently capable of producing poor quality fabric only, i.e. the looms and working practices are such as to produce faulty fabric, production at Akaki should be concentrated on cheap fabrics limited to counts 14s and 20s, and on denims using 9s Ne yarn. This specialisation will increase productivity and tend to enable the other mills to concentrate on fabrics in which quality has a higher priority.

The concentration of all of the N.T.C. denim production at Akaki is desirable because of the position of the mill in relation to the major market for denim, which is the organised garment making industry located in the Addis Ababa area.

The demand for denim for jeans and jackets as work-wear and casual wear is growing. It is felt that the N.T.C. would be justified in putting approximately 100 looms on to denim fabric of 300 g/m^2, the construction of which has already been dealt with. The 96 Ruti looms at Akaki would seem to make a suitable unit for denim production. The twill fabrics currently woven on those looms could be transferred to the other mills.

(2) Bahr Dar should concentrate on its production of plain weaves and twills using counts 13s, 16s, and 21s but the quality standards aimed at should be superior to those common at Akaki.

(3) Ethiopian Fabrics should concentrate on twills and suitings, (most of their looms are already producing such fabrics).

(4) Asmara Textile Mills should exchange its Abujedid production for the dyed poplin from Akaki.

(5) Dire Dawa should continue with the production of fabrics in the finer counts, fabrics for which quality standards of production are important.

The production of polyester/cotton and polyester/rayon fabrics should be developed further and expanded. It is envisaged that the T.M.D.D. will eventually become the major manufacturing source of polyester/cellulosic textiles within the N.T.C.

TABLE 3/1

CLOTH CONSTRUCTIONS OF WOVEN FABRICS PRODUCED IN N.T.C. MILLS

Mill	Fabric	Width in Reed (in)	Cloth Width (in)	Ends per in	Picks per in	Ne Counts Warp		Cloth Weight oz/yd^2	g/m^2	Looms Width in	No.
						Warp	Weft				
Akaki	(6) Mohamudi	40	36	44	44	14	14	4.8	163	50	59
	(7) "	40	36	44	44	14	14	4.8	163	54	3
	(8) Grey Sheeting	39.5	36	40	40	14	14	4.3	146	44	226
	(10) Calico	46	42	56	56	20	20	4.2	143	50	5
	(11) "	46	42	40	36	20	20	2.85	97	50	5
	(13) Dyed Chadder	51	49	52	44	20	20	3.4	116	54	10
	(14) "	67	60	52	44	20	20	3.7	125	72	23
	(16) Dyed Poplin	39.5	36	52	44	24	24	3.0	102	44	180
	(17) Grey Chick	39.5	36	40	40	24	24	2.5	85	44	21
	(18) Sail cloth	46	42	34	28	2/14	2/14	6.65	226	50	5
Ethiopian Fabrics	(1) Poplin	42	40.5	91	41	24	16	3.5	118	48	11
	(3) Shirting	41.3	40	89	56	30	24	3.8	127	48	6
	(6) Flannel	41.3	39.3	56	43	24	12	4.25	144	64	9
	(10) Suiting	63.4	62.6	71	46	2/30 Poly Viscose	2/40	4.9	165	64	3
	(11) Trop. Suiting	63	62	56	41	2/30 cotton	2/24	4.9	168	64	11
Asmara Text. Mills	Abujadid	39.5		42	38	14	14	3.9	133	44	150
	Gauze	37.5		24	20	36	36	0.8	28.5	44	30
	Poplin	40		59	43	24	20	3.2	107	44	40
	Print. Poplin	39.5		59	51	24	20	3.4	116	44	48
	Bed Sheets	70		50	51	20	20	3.5	117	75	19
Bahr Dar	Dyed Poplin	39	36	66	51	21	28	3.7	125	48	26
	" "	39	36	51	29	16	21	3.4	115	48	40
	Khaki linen	39	36	51	29	16	21	3.4	115	48	30
	Abujedid	39	36	51	30.5	16	13	4.1	139	48	25
	Flannel	39	36	51	40.5	21	9	5.1	174	48	15
	Kuta	46.7	36	25.5	30.5	16	21	2.7	91	48	30
	Malmal	46	42	29	20.3	16	28	1.9	65	52	5
	D. Sheet	60	54	51	38	16	21	3.8	129	71	46
	G. "	58.6	54	51	38	21	21	3.2	107	71	36
	D. "	69.4	63	63.5	61	21	28	3.9	133	87	22
	D. "	64	71	63.5	45.7	21	21	4.0	135	87	25
Dire Dawa (2)	Standard Plain	36	36	50.5	45.7	13.5	18	4.3	145		362
	New Sheet	38½	38½	53	52	21	21	3.5	115		35
	Bed Sheet	64	62½	64	53	20	_0	4.1	139		12
	Blanket	63.2	61	14.2	15	13.5	1	11.3	380		6
Dire Dawa (5)	White Mull	43.7	43.75	41.2	30	40	40	1.2	41		66
	Broad	38	38	125	65	40	40	3.3	110		82
	C. Broad	38.5	38.75	131.8	70	40	40	3.5	115		34
	N. Sheet	38.5	38.25	53	52	21	21	3.5	115		48
	T/C. Tussor	47	47.5	110	48	2/45 Poly Cotton	2/34	5.2	170		10
	C/B. Poplin	38.5	38.5	91	50	20	20	4.8	163		48
	Standard	36	36	50.5	45.7	13.5	18	4.3	146		57
	Bed Sheet	64	62.5	64	53	20	20	4.0	136		12

TABLE 3/1 (continued)

Mill	Fabric	Width in Reed (in)	Cloth Width (in)	Ends per in	Picks per in	Ne Counts Warp	Weft	Cloth Weight oz/yd^2	g/m^2	Looms Width (in)	No.
Akaki	(1) Sanforized Twill	47.5	41	104	52	2/32	13	8.1	276	52	80
	(2) Dyed Twill	43	41	88	40	14	14	6.75	228	52	16
	(3) "	43	41	88	40	14	14	6.75	228	54	9
	(4) "	39.5	36	80	44	14	14	6.7	226	44	90
	(5) "	30.5	28	80	44	14	14	6.7	226	36	50
	(9) Moradian	33.5	28	80	44	20	20	5.1	172	50	26
Ethiopian Fabrics	(2) 3/1 Lining	39.4	38.6	58	51	24	12	4.7	158	48	15
	(4) 3/1 Twill	44	42.8	112	48	2/30	2/30	7.5	254	48	33
	(5) 2/1 Gaber	44	42.8	112	43	2/30	2/30	7.3	247	48	9
	(7) Fr.Twill	43.7	42	68.6	38	16	16	4.75	161	64	16
	(9) 3/1 Jean	44.9	43.3	63.5	40.5	9	9	8.2	278	48	11
	(12) 3/1 Sateen	?	29	127	48	24	12	6.4	216	?	?
	(13) 3/1 Drill	?	43	89	40.5	12	12	7.4	250	?	?
	(14) 3/1 Sateen	?	42	94	66	30	30	3.7	124	?	?
Asmara Text.Mills	Twill	44.5	43.5	110	51	2/34	2/28	6.9	235		37
	Blue Jeans	44	44.8	60	41	9	9	7.7	260		11
	Fr.Twill	44	44	48	43	2/26	2/26	4.8	160		28
Bahr Dar	Khaki Drill	39.6	36	81	38	16	13	6.0	204	47	31
	"	39.6	36	81	38	16	13	6.0	204	51	26
	Blue Jeans	45.6	42	66	40.6	9	9	8.8	299	51	18
	G.Drill	44.8	42	76	33	16	13	5.3	181	51	23
	G.Drill	44.8	42	76	33	16	13	5.3	181	71	2
	D.Twill	44.7	42	117	40.6	2/34	2/28	7.1	240	71	6
Dire Dawa	T/C Twill	45.4	44	107	53	2/34	2/34	6.5	218		10
	Twill	44	44	114.5	55	2/32	2/24	8.1	280		216
	Fr.Twill	39.5	39.5	57.2	43	2/24	2/24	5.7	194		50
	Drill	38.7	38.5	81.5	45	13.5	10	7.2	245		25
Akaki	Curtain Dobby Twill	61.3	54	72	44	20	20	4.5	153	72	21
	Jacquard Twill	68.0	58	88	46	2/32	13	7.3	246	72	4
Ethiopian Fabrics	(8) Dobby	42.1	40.6 103 cm	91.5	48.3	24	16	4.9	165	48	12
Akaki	Towels	2x33.6	24	88	48	2/32	13			68	4
Asmara Text.Mills	Towels	53.5		56	41	14	20				5
Dire Dawa	Towels		42	56	60	13.5	21			52	6

TABLE 3/2

N.T.C. Plain Weave Fabrics in the Weight Range 101-150 g/m^2

Cloth Weight (g/m^2)	101-110	111-120	121-130	131-140	141-150
Mill					
1 Alkali	Dyed Poplin (36")	Dyed Chadder (49")	Dyed Chadder (60")		Grey Sheeting (36") Calico (42")
Ethiopian Fabrics		Poplin (40½")	Shirting (40")		Flannel (39¼")
Asmara Textile Mills	Poplin (40")	Printed Poplin (39¼") Bed Sheet (70")		Abajedid (39½")	
Bahr Dar.	Grey Sheeting (54")	Dyed Poplin (36") Khaki Linen (36")	Dyed Poplin (36") Dyed Sheeting (54")	Abajedid (36") Dyed Sheeting (63") Dyed Sheeting (71")	
Dire Dawa	Broad Cloth (38")	New Sheeting (38") Combed Broad (39")		Bed Sheet (62½")	Standard (36")

Table 3/3

Overall Summary of Present and Potential

Note		Ethiopian Fabrics
(1)	Number of looms	136
	Mean loom speed (rpm)	199
	Mean reedspace (cm)	134
	Mean warp width in reed (cm)	114
(2)	Percent reedspace utilisation (%)	88
	Mean cloth width, loomstate (cm)	111
(3)	Mean picks per cm	17.76
(4)	Mean production per loom running hour (M^2)	7.46
(5)	Hours worked per year (excludes meal breaks)	6450
(6)	Maximum production at 100% efficiency (10^6 M^2)	6.54
(7)	Actual or target annual production (10^6 M^2)	4.25
(8)	Loom efficiency calculated (%)	65.00
	Potential annual production (10^6 M^2)	
(9)	(a) Present efficiencies and hours 100% R.S. Utilisation	4.83
	(b) " " , 7920 hrs p.a. " "	5.94
	(c) 85% efficiency, 7920 hours p.a. 100% R.S. Utilisation	7.76

Notes:

Woven Cloth Production

Asmara Textile Mills	Akaki	Bahr Dar	Dire Dawa	All Mills
406	821	408	1067	2838
177.5	174	172.6	156.3	169
117	120	147	129	128
102	105	120	108	108
91	91	85	87	88
100	95	115	101	101.6
16.20	17.07	14.87	19.57	17.60
6.57	6.12	8.01	4.84	5.97
4830	6840	7672	7920	7331
12.88	34.36	25.07	40.90	119.75
9.79	26.77	20.58	30.00	91.39
76.00	78.00	82.00	73.3	76.3
10.76	29.40	24.21	34.48	103.7
17.64	34.04	24.99	34.48	117.1
19.95	37.18	25.88	39.97	130.7

Notes to Table 3/3

1. Number of looms

The numbers of looms quoted for each mill are those employed on flat cotton and polyester/cotton fabrics. Excluded are looms weaving blankets, terry towels, and jacquard weaves.

2. Percent reedspace utilisation

It has been assumed that the amount of reedspace available for warp is the full reedspace less 5 cm. Thus, the percentage reedspace utilisation is given by $100 \frac{\text{mean warp width in reed (cm)}}{\text{mean reedspace (cm)} - 5 \text{ cm}}$

3. Mean picks per cm

Defined as the average number of picks per cm in the loomstate cloth.

4. Mean production per loom running hour

$$\text{Cloth width(M)} \times \frac{\text{loom speed (ppm)} \times 60}{\text{picks per M}} = M^2$$

5. Hours worked per year

The figures quoted in the Table are based on the information provided in the mill questionnaires and allows for a 30 minute meal break on each shift. The figure at 4830 hours for Asmara Textile Mills is taken from the detail on their 1979 production Target covering 345 days at 14 working hours per day.

6. Maximum production at 100% efficiency

Annual production calculated thus:
Number of looms x mean production per loom running hour x hours per year.

7. Actual or target annual production

For four of the five mills the figures shown are the target productions for 1979/80, based upon the production programmes provided. In the case of the fifth mill, the actual production is given for the Ethiopian year covering 1978/79 in the Gregorian calender.

8. Loom efficiency calculated

Given by $100 \times \frac{\text{Actual or target production}}{\text{Maximum production at 100\% efficiency}}$

9. Possible production in 7920 hours per year

Obtained thus; 352 days of 22½ hours per day. This is the annual numbers of working days, currently worked at Dire Dawa which is operated more intensively than the other mills and yields 7920 working hours per year.

The possible production figures are given by:
$7920 \times \text{mean production per loom running hour} \times \text{number of looms} \times \frac{\%\text{ loom efficiency}}{100}$

continued

continued.

10. <u>Possible production with 100% reedspace utilisation</u>

The figures shown under this heading demonstrate the benefits of weaving wider fabrics. They are obtained by multiplying the present production figures in 7920 hours by:

$$\frac{100}{\text{present reedspace utilisation}}$$

TABLE 3/4 - ESTIMATE OF SAVINGS FROM THE SUBSTITUTION OF SINGLES YARNS FOR DOUBLED YARNS

Mill:	Akaki	Ethio Fabrics		Asmara Textile Mills		Bahr Dar	Dire Dawa		
Ends per inch	100	112	112	110	48	117	114		
Picks per inch	52	48	43	51	43	40.6	55	43	
Warp count (Ne)	2/32	2/30	2/30	2/34	2/26	2/34	2/32	2/24	
Weft count (Ne)	13	2/30	2/30	2/28	2/26	2/28	2/24	2/24	
Cloth weight g/m^2	276	254	248	235	160	240	280	194	
Annual production m^2(000)	2570	531	25	621	597	134	5736	1283	
Warp weight tonnes	431.5	103.3	4.4	93.4	50.6	22.5	979.7	141.9	
Weft weight tonnes	-	44.3	1.8	52.5	44.9	9.6	626.3	107.0	
Estimated yarn cost per kg									
Warp (Birr)	5.956	6.303	6.303	5.939	5.756	5.939	5.956	5.562	
Weft (Birr)	-	6.303	6 303	5.900	5.756	5.900	5.562	5.562	
Annual yarn cost									
Warp (000 Birr)	2570	651	28	555	291	134	5835	789	
Weft (000 Birr)	-	279	11	310	258	57	3483	595	
Total annual cost (000 Birr)	2570	930	39	865	549	191	9318	1384	
Suggested counts									
Warp (Ne)	16	15	15	17	13	17	16	12	
Weft (Ne)	13	15	15	14	13	14	12	12	
Estimated cost kg									
Warp, carded (Birr)	4.583	4.391	4.391	4.650	3.801	4.650	4.583	3.573	
Warp, combed (Birr)	4.754	4.562	4.562	4.821	3.972	4.821	4.754	3.644	
Weft, carded (Birr)	-	4.428	4.428	4.172	3.801	4.172	3.573	3.573	
Annual yarn cost									
Warp carded (000 Birr)	1978	454	19	434	192	105	4490	507	
Warp combed (000 Birr)	2051	471	20	450	201	108	4657	517	
Weft carded (000 Birr)	-	196	8	219	171	40	2238	382	
Annual savings									
(a) Warp carded (000 Birr)	592	197	9	121	99	29	1345	282	
(b) Warp combed (000 Birr)	519	180	8	105	90	26	1178	272	
(c) Weft carded (000 Birr)	-	83	3	91	87	17	1245	213	Total
Total (a) + (c) (000 Birr)	592	280	12	212	186	46	2590	495	4413
(b) + (c) (000 Birr)	519	263	11	196	177	43	2423	485	4117

Total annual production : 11,547, 000 m^2

Average saving per m^2 (a) + (c) : 0.382 Birr, (b) + (c) : 0.357 Birr

TABLE 3.5

SUBSTITUTION OF SINGLE FOR DOUBLED YARNS - EFFECT ON SPINNING CAPACITY

Mill		Ne	Production per frame hr kg	Annual Production (tonnes)	Capacity Required (000 spindle hours)
Akaki	Present count:	32/2	4.77	341.5	28,637
	Substitute count:	16/1	12.20(est)	341.5	11,197
				Difference:	17,440
				Hours per year:	6,840
				Spindles released:	2,550
				% of total spindles:	5.1%
Ethio Fabrics	Present count:	30/2	6.20	137.4	8,865
	Substitute count:	15/1	17.70(est)	137.4	3,105
				Difference:	5,760
				Hours per year:	6,688
				Spindles released:	861
				% of total spindles:	11.4%
Asmara Textile Mills	Present count:	34/2	4.09	85.7	8,381
	Substitute count:	17/1	10.40(est)	85.7	3,296
				Difference:	5,085
	Present count:	28/2	5.64	47.8	3,390
	Substitute count:	14/1	12.80(est)	47.8	1,494
				Difference:	1,896
	Present count:	26/2	5.70	89.0	6,246
	Substitute count:	13/1	13.80(est)	89.0	6,580
				Difference:	3,666
				Total difference:	10,647
				Hours per year:	5,865
				Spindles released:	1,815
				% of total spindles:	14%
Bahr Dar	Present count:	34/2	4.80	19.6	1,633
	Substitute count:	17/1	11.00(est)	19.6	713
				Difference:	920
	Present count:	28/2	6.00	8.3	553
	Substitute count:	14/1	16.00(est)	8.3	207
				Difference:	346
				Total difference:	1,266
				Hours per year:	7,667
				Spindles released:	165
				% of total spindles:	1%
Dire Dawa	Present count:	32/2	5.75	871.9	60,654
	Substitute count:	16/1	13.90(est)	871.9	25,091
				Difference:	35,563
	Present count:	24/2	9.00	854.7	37,987
	Substitute count:	12/1	21.75(est)	854.7	15,719
				Difference:	22,268
				Total difference:	57,831
				Hours per year:	7,920
				Spindles released:	7,302
				% of total spindles	14.5%
			Grand total spindles released:		12,528
			Percent of total N.T.C. ring spindles:		6.95%

4.0 MANAGEMENT SYSTEMS

4.1 Cost Accounting Systems

Managements were questioned on the cost accounting systems used in their mills. In very few cases was information available and even then in broad terms only.

The Asmara factories provided the least information. Because of their particular difficulties, and recent shut-down with the consequent dispersion of executive staff, they have not yet re-introduced normal management control procedures, including cost control, although they are working towards that end. They have received help from N.T.C. accountants in obtaining cost estimates and the consultants were referred to the N.T.C. for information.

Mills claiming to operate production cost systems were Dire Dawa, Bahr Dar, and Debre Berhan. Although the management at Akaki claimed not to have a costing system the N.T.C. provided the consultants with a detailed breakdown of Akaki manufacturing costs for the various fabrics and yarns produced. It is assumed that the breakdown and estimates of product costs had been arrived at by the N.T.C. accountants themselves. The records provided in respect of Akaki have been examined and our conclusion is that the system of cost estimation used is sound and based on principles which yield accurate results. It is clear that adequate cost centres have been defined, and that the allocation of costs to those centres reflect the relative inputs for the different products.

The system in use at Dire Dawa is one employing weighted inputs based upon a specified norm. For spinning the norm is count 20s Ne carded; whilst for weaving it is a twill fabric

The system was installed some years ago by the then Japanese management and was that employed by the Fuji Spinning Co. in Japan. It is important with such systems that the assumptions implicit in the weightings should be checked periodically, the frequency depending on the source of cost. In the case of raw materials such as dye-stuffs and chemicals a monthly cost check is desirable and is in fact carried out at Dire Dawa.

Other factors such as machine speeds and labour productivity should be checked annually. This has not been done at Dire Dawa since the departure of the Japanese approximately three years ago.

Reasonable costing systems are in use at Bahr Dar and Debre Berhan, but in most other mills such systems are minimal or non-existent. The problem is most acute at the Ethiopian Sewing Thread Co. where the production costs for each of the wide variety of yarns produced is unknown. So far as we can gather price is assessed on the average cost of yarn by weight, i.e. $\frac{\text{total cost}}{\text{total weight}}$ + profit. Costing in this way inevitably results in many anomalies and reduces the scope for efficient management control.

It is recommended that a standard costing system be introduced into all the N.T.C. factories; that the principles of the system should be those on which the Akaki system is based, and that the N.T.C. staff should have the responsibility for its introduction.

Provided with this report is a supplement "Portfolio of Management Control Information and Interpretation". The purpose of this document is to demonstrate the financial statistics that may be extracted from the accounts and how they may be used to assist the management in the efficient control of the enterprise.

4.1.1 Cost control

It is not possible in the space of this report to give a full description of the way in which cost accounts to be used by management are prepared. A wide knowledge of accountancy is required to establish a properly integrated system in which the cost accounts tie up with the financial accounts. To attain this objective requires considerable discipline and effort.

The starting point is the computation of the standard costs of the materials and services that go into the production of each item manufactured. This entails some basis of estimation of the price of raw materials be adopted, always a difficulty in the textile industry where frequent changes are normal and have to be allowed for. In practice this difficulty can be overcome and a complete set of cost accounts, based on standard costs, can be prepared at short intervals, say monthly.

Cost accounts are of greater significance to management than the financial accounts, for not only do the cost accounts disclose the operating profit or loss for the period, but they also show the results analysed under each department or each cost factor that has a significant effect upon the results. The financial results say what the result is, but the cost accounts also say how and why.

Cost accounts are so devised that each item of cost in the standard cost of the products of the mill, whether for materials or for individual processes, becomes the object of an account. Where the actual expense on the one hand is compared with the production valued at the standard cost on the other. The difference represents a profit or loss, an indication of some variation from the normal or standard. The greater the variation the more attention is required from management or cost factor in question.

The control of material costs may require to be delayed until a physical stocktaking has been done before the full results can be ontained. Other items of cost, however, e.g. the departmental performance, rates of output, yield, and the calculation of the profit or loss on sales can be readily available for each monthly period, or whatever interval is chosen.

4.2 Systems of Wage Payment

Methods of wage payments varied between the different mills. In most cases the systems used were those which had been installed by the original proprietors prior to the nationalisation of the industry. Most changes that have taken place since appear to have been confined to increasing the levels of payment rather than changes in methods of assessment or of incentive.

Six factories had wage systems based on fixed day rates or monthly salaries with no element of incentives related to output. They were:

Asmara Textile Mills	Ethiofil
Ethiopian Textile Industries	Idget
Ethiopian Fabrics	Ethiopian Sewing Thread Co.

All the remaining plants had incentive schemes for production workers. In some cases skilled workers such as loom mechanics were covered by the incentive scheme whilst in other cases they were paid a regular monthly salary.

The minimum rate of pay was 1.92 Birr per working day or shift, or 50 Birr per month of 26 working days. This minimum rate was common to all the mills and was paid to unskilled beginners, usually for the first few months of service. There were no other points of consistency between the mills.

Wage rates at Bahr Dar were higher than elsewhere for all workers (except beginners), whether they were on a fixed monthly wage or on incentive. See Tables 4/1 and 4/2 for examples.

At the Asmara Textile Mills no incentive schemes were operated; workers were paid according to the skill level of their jobs and length of service. Thus, for each individual job or occupation a range of wage rates were paid according to length of service. The averages are given in Table 4/1.

At Ethiopian Fabrics all operatives, skilled and unskilled started on 50 Birr per month and gained increases for length of service and for supervisory responsibility. No increase was paid for skill differentials. Hence an unskilled operative with long service would earn more than a skilled operative or a mechanic with less service. This particular system was felt by the management to be unsatisfactory.

The most rational system of incentive payments was that employed at Dire Dawa and its extension to all N.T.C. mills is recommended. Details of the Dire Dawa scheme for spinning and weaving are reproduced as Appendix 'C'.

4.3 Work Study

In no mill was there any form of work study as it is normally defined. Any effective and equitable system of payment by results must be based upon measured work. Whilst it may be expedient for wage incentives to be introduced quickly without prior measurement of the work to be done, such incentive schemes must inevitably break down because of the anomalies they invariably contain.

The fundamental purpose of an incentive system is to offer a financial incentive to a worker or a group of workers to produce work of an acceptable quality over and above a specified quantity.

The success or failure of the system depends upon the fairness and accuracy with which the 'specified quantities' or standards are set, and whether or not they are guaranteed against unjustified changes. Other factors are important but the vital part of the system is the standard set.

It is essential that the standards set should be based upon facts and the only way that these facts can be gathered is through carefully detailed analytical studies which comprise the techniques of the subject of work study.

Ideally the studies will be made in three steps before the standards are established. These are

1. Development of the job rate structure through or programme or job evaluation

2. Method and motion studies with the objectives of work simplification and job standardisation

3. Time studies to establish the standard times required to carry out the job at a specified qualitative level.

Time standards established in this systematic way can be used not only for the incentive system itself but for:

1. the development of standard costs
2. the basis of standards used in developing operating budgets
3. making cost estimates
4. preparing production schedules and plans

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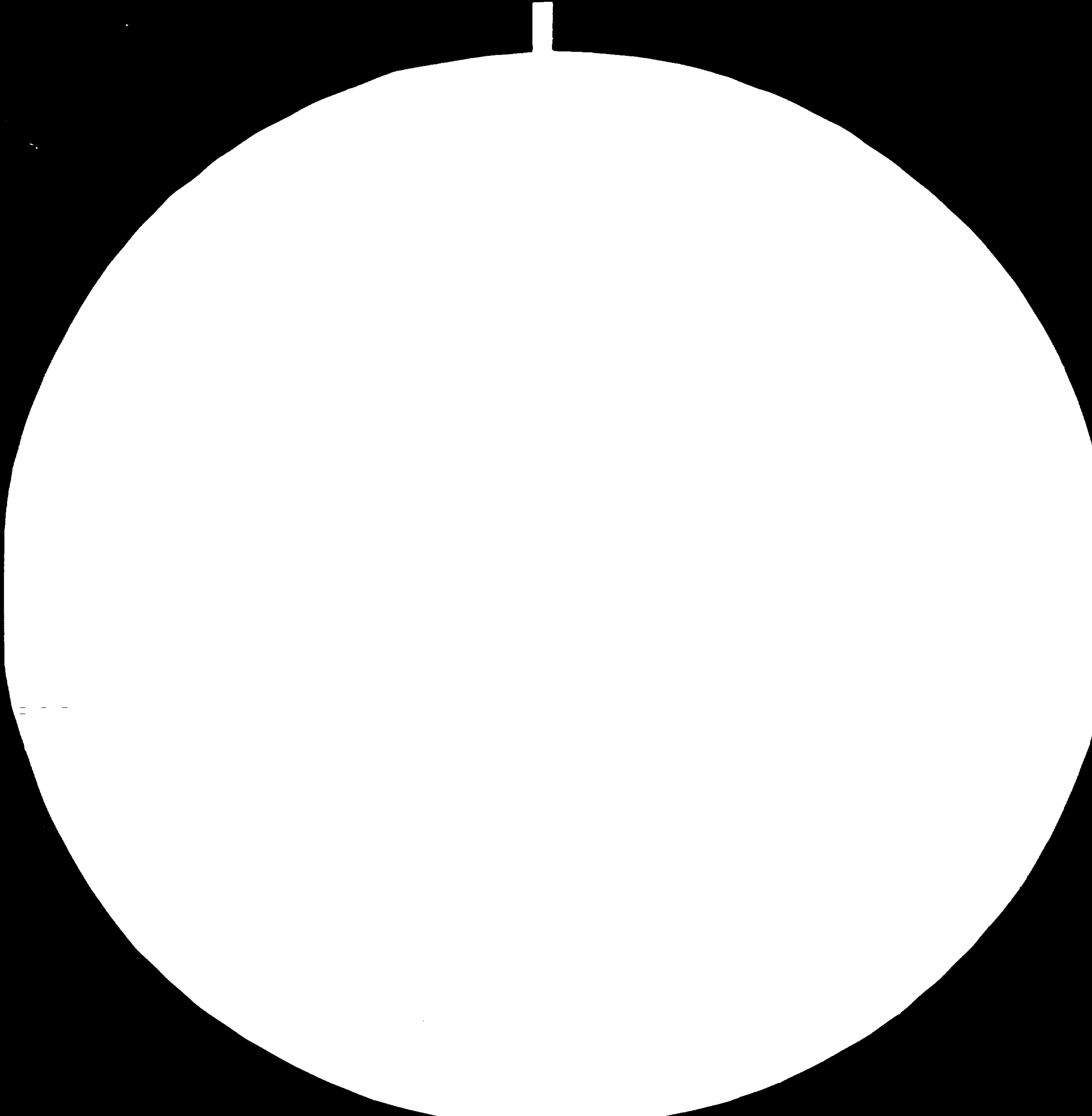
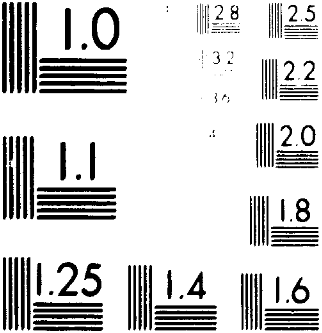




MICROCOPY RESOLUTION TEST CHART

To develop data that are used for such a variety of purposes it is essential that each study be made in detail and with accuracy, and carried out by a competent trained work study engineer.

It is strongly recommended that the N.T.C. should set up a centralised work study department for the purpose of conducting studies in the mills prior to the introduction of rational wage incentive systems. A central department is preferred to individual mill work study departments in order to achieve consistency of measurement throughout the N.T.C. There is some justification for a small work study staff within the mills for the sole purpose of monitoring the machine stoppage rates, yarn breakage rates, etc., i.e. to detect significant deviations from the standards established by the central work study body.

4.4 Production Planning and Control

Annual production targets are established for each mill by agreement between mill management and the N.T.C. The target takes the place of the annual sales forecast used in private industry.

There are few style or product changes during the course of the year and, thus, few interruptions to the production plan drawn up to meet the annual target. The number of different products or fabrics produced in each mill is relatively small and long production runs are the norm. Under these conditions production planning and control is a relatively easy task and this is reflected in the low numbers of people employed on those two functions. In most mills the work involved in arriving at the production target is carried out by the management with little or no assistance from specialist staff, whilst the production control systems are operated by production department managers with a minimum of clerical labour.

Most mills have adequate systems of daily production reports to departmental managers, with weekly summaries to general managers showing progress against target complete with explanations of short-falls. An exception is the Ethiopian Sewing Thread factory which has no formal system of production control. The factory has a wide variety of yarn and thread products and its efficiency would improve from the introduction of a production control system.

The control systems seen were working reasonably well but in an informal manner which can lead to occasional problems or omissions. It is desirable that a uniform system be adopted for use in all the NTC mills, and that the system, together with its charts and forms be devised by a suitably experienced person.

There is not space here to describe an appropriate system in detail but the following is an account of the main parts of the subject.

Production control may be defined as that function of management which plans, directs and controls the material supply and processing activities of an enterprise so that specified products are produced to meet an approved sales programme.

In production control three main levels of progressive planning have become established, i.e. programming, ordering and despatching. Programming plans the production output of the factory as a whole. Ordering plans the output of intermediate products from the various process departments and the requisition of raw materials from outside suppliers, to meet the programme. Finally, dispatching plans the output from particular machines and groups of machines.

The plans made at these three levels are known respectively as the production programme, the order schedule, and the daily plan or daily order of work.

They are described in more detail as follows:

1. Production Programming

This is the job of deciding when each product should be completed and of developing a 'Production Programme' which will give delivery of products at the times required to meet the Sales Programme. Inside this aim, the programme should be so arranged that it gives the best possible compromise between even loading of labour and plant and the optimum use of capital.

2. Ordering

Once a programme has been adopted, the next job is to place orders on the buyer and on the processing departments for the materials needed to make the products, and to so arrange the ordering quantities and delivery schedules that all items are delivered in time to meet the Production Programme. Once again the best compromise must be reached, inside the framework already laid down in the Programme, between even loading of labour and plant and the optimum use of capital.

3. Dispatching

When the orders have been issued, the next job is to bring together the plant, labour, and materials required for each production operation and to issue instructions to the operators concerned. For the best results the work must be so arranged that the last operation will be completed before the due-date specified on the order, and so that the best compromise is reached between even loading of labour and plant and the optimum use of capital. These functions are grouped together under the general term 'dispatching', which in broad terms can be said to cover the day-to-day control of production orders in process departments. It will be seen that 'dispatching' is really an extension of the same general principles already put into effect, in programming and ordering.

The 'Production Programme' is an expression of the supposedly optimum arrangement of production in terms of the products and the factory; 'ordering' is a further analysis of this same programme in terms of materials and the departments; finally, 'dispatching' is a further analysis or breakdown of the programme in terms of production operations and the process machines on which they are to be carried out.

In all three of these production control levels the essential factor is time. The programme planner must devise a programme which will produce

THE RELATIONSHIP BETWEEN PRODUCTION PROGRAMMING, ORDERING, AND DISPATCHING

Production control level	Works level controlled	Division of product involved
Production programming	The factory	The products
Ordering	Departments	supplies and materials
Dispatching	Machine	Production operations

products in time to meet the sales requirement; the order clerk must issue and schedule orders so that the materials will be ready in time to achieve the production programme, and the dispatcher must issue job cards or other instructions to the operators in such a way that the last operations on all parts will be completed before the due-dates given on the orders.

TABLE 4/1

Selection of Wages Paid in N.T.C. Mills
(Birr)

Mill:	Akaki A	Akaki B	Bahr Dar A	Bahr Dar B	Debre Berhan A	Debre Berhan B	Adei Abebe A	Adei Abebe B	Dire Dawa A	Dire Dawa B	Asmara Tex. Mills A	Asmara Tex. Mills B	Ethiopian Fabrics A	Ethiopian Fabrics B	Ethiopian Sewing A	Ethiopian Sewing B
Beginners	50	-	50	-	50	-	50	-	50	-	50	-	50	-	50	-
Direct Workers																
Unskilled	-	-	84	-	-	-	-	58	-	75	55	-	85	-	-	-
Semi-skilled	-	96	-	156-182	-	95	-	117	-	110	66	-	85	-	75	-
Skilled	-	143	-	208	-	141	-	-	-	-	180	-	85	-	120	-
Mechanics/ technician	-	118	312	-	-	-	250	-	100	-	195	-	85	-	180	-
Tradesmen			364	-											280-450	
Supervisors/ Foremen			416	-			450	-	210	-	230	-			360	-

Note: Columns 'A' — Fixed monthly wages

Columns 'B' — Average monthly wages of employees working on incentives.

TABLE 4/2

Selection of Wages Paid in Knitting and Sewing Factories

Factory:	Kaliti		Asmara Sweater		Eth. Text. Industry	
	A	B	A	B	A	B
Beginner	50	-	50	-	50	-
Unskilled	50	-	-	59	52	-
Sewing machinist	-	117	-	65	78	-
Circular knitter	-	130	-	-	91	-
Hand knitter	-	-	-	208	-	-
Mechanic	150	-	127	-	300	-
Supervisor						
Male	300	-	-	-	-	-
Female	-	-	120	-	130	-

Notes: 'A' Fixed monthly wages

'B' Average monthly wages of employees working on incentives

5.0 CENTRALISED PURCHASING

INTRODUCTION

It is usually accepted by the major industrialised nations that in large groups of companies, particularly Nationalised Industries, a central purchasing policy is essential for the control of the substantial level of purchases required to maintain productive output.

In our opinion the size and scope of the Ethiopian textile industry warrants the introduction of central purchasing policy.

5.1 CURRENT SITUATION

Excluding major machinery and plant requirements which need Ministry approval, purchasing decisions are usually undertaken by each establishment independently of other mills in the NTC group: each department in the Mill deciding on requirements virtually on a daily basis. The request is submitted by the departmental manager, or master, to a senior manager, normally the General Manager, or Senior Accountant. When approval has been obtained, the order is placed, usually with an existing supplier of long standing. No reference is made to other possible suppliers at this stage.

Difficulties are experienced when the existing supplier is unable to fulfil the order. Management do not appear to have the necessary purchasing expertise to locate new suppliers, resulting in valuable time being spent in exploring the limited library of alternative sources. This is borne out in some mills where spare parts have become difficult to obtain through the advancing age of the machinery, which has, in the eyes of the original manufacturer, become obsolete.

5.2 ADVANTAGES OF A CENTRALISED PURCHASING

A central purchasing policy has important advantages over the present method of purchasing practised by the individual mills in the NTC group of Companies.

Some initial difficulties will be experienced, notably through a lack of technical knowledge by the purchasing staff in the purchase of spare parts for the wide range of production machinery within the group. Nevertheless, these difficulties should be overcome with training and experience.

Major advantages are detailed below:

(i) Full-time purchasing officers

The employment of full-time purchasing officers, after the necessary training, results in new sources of supplies to be located, with particular emphasis on potential Ethiopian suppliers through the organised and small-scale industries. A library of all current and potential suppliers should be instituted and regularly maintained, enabling alternative sources to be quickly identified, if an existing supplier cannot fulfil an order.

(ii) Budget Control

To obtain maximum financial benefit from a central purchasing policy strict fiscal limits should be imposed. Agreed limits should be set by the NTC based on estimated requirements from the mill budgets, taking into account current price levels which should be obtained from the suppliers library previously mentioned.

Difficulty will be experienced in setting the fiscal limits for spare parts as future needs may not be apparent when the fiscal budget is set for the financial year.

With strict financial discipline being imposed, the advantages of bulk purchasing and price arrangements will become critical. The scope for the bulk purchase of dyestuffs is illustrated by the Table of annual mill consumption (Table 5/1).

(iii) Stock Control

As previously commented on, current purchasing practice does not take account of the NTC group requirements, no records of stocks held by individual mills being available to mills of a similar operating nature. Overstocking occurs, particularly on consumables which are imported, where suppliers impose minimum order levels, usually at a premium price.

To eliminate an 'overstock' situation the central purchasing office should maintain stock records for all mills, and when necessary transfer stock from one mill to another. Each month a stock record of all stocks of raw materials, consumables and spare parts held by the mills should be issued to senior management at NTC.

(iv) Bulk Purchasing

Many types of consumables are common to all mill users irrespective of differences in makes of machinery installed. Examples are cone formers, tubes, heald wire, drop pins for warp stop motions, dyestuffs and chemicals. The bulk purchase of dyestuffs gives considerable opportunity for obtaining economies in their price. The annual consumption of all the NTC factories is in excess of 200 tonnes, at an estimated cost of US $ 5 million. Supplies are obtained from West Germany, France, U.K., and Italy. Table 5/1 shows the annual NTC consumption broken down by mill and type of dyestuff.

TABLE 5/1

Annual Dyestuff Consumption - N.T.C. Mills - 1978/79

	Reactive Kgs	VAT Kgs	Sulphur Kgs	Direct Kgs	Dispersed Kgs	Dispersed/ VAT Kgs	Modified/ Basic Kgs	Azoic	Pigment*	Total
DIRE DAWA	13,200	14,400	9,100	500		6,600	29,700		5,700	79,200
ETHIOPIAN SEWING	12,000	14,400		2,160						28,560
ASMARA TEXTILE MILLS	3,720	470	625	1,625			2,260	2,000		10,700
ETHIOPIAN TEXTILE IND.	1,300			2,820						4,120
ADEI ABEBE									Not included on several returns	
BAHR DAR	3,000	2,300	7,364					1,740		14,404
DEBRO BERHAN										
AKAKI	9,900	3,510	1,320	1,400				820		16,950
ETHIOPIAN FABRICS	6,800	11,550	6,800		1,000			8,000		34,150
TOTALS	49,920	46,630	25,209	8,505	1,000	6,600	31,960	12,560		188,084

* Pigment Colours not declared in most cases - the grand total will be in excess of 200,000 Kgs.

6.0 THE MANUFACTURE OF TEXTILE ACCESSORIES

Current textile accessory purchasing policy for NTC mills dates prior to Nationalisation when the companies were in the private sector. Each mill obtained its supplies from overseas. This situation still exists, mainly for the following reasons:

(i) No facilities for manufacturing requirements within the NTC mills.

(ii) No knowledge of the manufacturing capabilities of the small scale and organised industries by mill managements.

The future situation regarding manufacturing facilities within the NTC group appear to remain unchanged, but it is our opinion that consideration should be given to the building and equipping of a small engineering works for the supply of accessories and spare parts. This recommended policy is long term and will not meet the requirements of the textile industry over the next few years and in endeavouring to reduce imports, other sources have to be identified.

In 1977 Hasida carried out a survey of the cottage industries and of small scale industry. (The Ethiopian Government defines a small scale industrial operation as 'an individual activity which uses motive power and machines and has fixed assets not exceeding 200,000 Birr, excluding buildings'.)

The Hasida reports have been studied and discussions have been held with members of the staff of Hasida. The conclusion we have reached is that the cottage industries are not likely to be a useful manufacturing source of accessories for the textile industry because of the somewhat primitive production methods employed.

Small scale industry is more promising, although Hasida officials admit that the level of skills within the industry are unknown, and that the probability of enterprises being able to interpret technical drawings doubtful, it is possible that with the aid of samples, reproductions may be possible.

From the information available it would appear that four Sectors of the small-scale industry would be of interest to the organised textile industry for the possible supply of some accessories. These are noted below.

6.1 WOODWORK

There are 88 identified operations manufacturing in Ethiopia, of which 43 are located in Addis Ababa. Five of the establishments employ 40 or more employees and a further two employ 30-39 employees. Total gross value of production for all wookwork enterprises in 1977 was estimated at nearly 6 million Birr.

The size of the seven establishments employing 30 or more employees warrant consideration as possible suppliers of wood products such as bobbins, pirns, and possibly picking sticks.

6.2 METAL WORK

A total of 63 enterprises have been identified manufacturing metal products, 34 in Addis Ababa. The establishments are smaller in size than woodwork factories, and this is reflected in the number of employees with 60 enterprises employing less than 10 employees each. Total value added for the industry in 1977 was estimated at 1.4 million Birr.

Although only three establishments employ more than 10 employees, it may be possible for the manufacture of reeds, heald wires, and drop wires, and some small spare parts.

As previously stated, the long-term policy should be for NTC to build and equip its own engineering concern in an effort to substantially reduce or eliminate imports of, in particular, spare parts. It is not envisaged that the small-scale industry would be able to reproduce large items and in any quantity.

6.3 LEATHER

The twenty-three companies identified in leather goods manufacture are all located in Addis Ababa. Four of the enterprises employ 40 or more employees and should be considered as possible suppliers of spinning belts and loom accessories.

6.4 PLASTIC

Only two enterprises have been identified which are engaged in manufacturing plastic products, one in Addis Ababa and one in Nagreth. Total employment for the two companies is estimated at twenty-four only and must pose doubts about their ability to produce such items as cone formers and bobbins, but there may be scope for smaller items, such as buttons.

This does not necessarily mean that these two enterprises should be precluded from any possible survey as potential suppliers of cone formers and bobbins.

6.5 OTHER SOURCES OF SUPPLY

The other potential sources of supply lie within the organised manufacturing industry, where a number of naterionalised companies are engaged in manufacturing products from raw materials, e.g. wood, metal, plastic, and leather.

It is thought that these companies would most likely be able to reproduce the required textile accessories in the quantities reauired by the NTC mills. Unlike the small-scale and cottage industries where information to date has been difficult to obtain, the organised industry's capabilities are known through the appropriate Government department in Addis Ababa.

Initial enquiries through the Department of Industry by officials of NTC should quickly establish the possibilities or producing NTC requirements. Our understanding is that the nationalised industries responsible for wool, metal, plastic, and leather output produce mainly raw materials for direct industrial use, or for further processing by the small-scale industries which would indicate that the most likely source of supplies is to be found in the small-scale industries.

Under current circumstances it is highly unlikely that the export of consumables is feasible. Concentration on obtaining supplies from Ethiopian industry for the textile industry must be the first priority.

6.6 ANNUAL CONSUMPTION OF WEAVING ACCESSORIES

An estimation of annual demand for weaving accessories is shown in Table 6/1. The information containeJ in the Table has been obtained by using information provided by three NTC mills and using this information also as a basis for calculating the estimated consumption where no information was obtained. Figures in the Table underlined are those figures which were obtained during the field work.

6.7 ANNUAL CONSUMPTION OF SPINNING ACCESSORIES

The following estimate of spinning consumables is based upon the annual consumption figures for Dire Dawa and Akaki and increased proportionately to provide an estimate for all the NTC mills.

Item	Annual Consumption
Rings	40,000 units
Aprons	30,000 metres
Spindles	18,000 units
Card clothing	
(1) Metallic	75 tonnes
(2) Flexible	25 tonnes
Flyers	1,000 units
Travellers	20 million units
Spinning tubes and cone formers	12 tonnes

Table [illegible]

Estimated Annual Weaving Consumable Purchases 19[illegible]

	Loom Type	No. In Mill	Shuttles	Pirns	Picking Sticks	Check Straps	Heald Wires	Reeds	Pickers	Weft Feeler	Weft Feeler Spring
AKAKI	[illegible]	225	2,939	274,015	4,467	3,332	525,625	[illegible]	[illegible]	[illegible]	[illegible]
	RUTI	96	1,440	24,000	480	622	144,000	15	[illegible]	164	120
	JACQUARD	4	16	1,283	24	16	-	1	[illegible]	7	5
	[illegible]	4	16	1,449	24	16	[illegible]	1	[illegible]	7	5
BAHR DAR	[illegible]	360	1,494	178,920	2,263	1,684	261,000	[illegible]	[illegible]	[illegible]	[illegible]
	RUTI	48	540	12,000	240	336	[illegible]	7	[illegible]	[illegible]	65
DIRE DAWA	TOYODA	445	22,300	[illegible]	1,200	3,000	1,500,000	[illegible]	[illegible]	1,108	274
	RUTI	24	420	6,000	120	168	36,000	4	[illegible]	41	52
	KOJO	[illegible]	840	[illegible]	[illegible]	1,862	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	PICANOL	125	500	24,000	180	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AKAKA TEXTILE MILLS	NORTHROP	406	1,685	202,010	2,563	1,900	78,000	23	1,425	695	550
TOTALS		2,841	33,090	766,921	12,266	13,646	3,517,525	439	9,122	4,268	4,834
Average Per Loom Per Annum Pirn Change Manual 4.6 Shuttle Change 35.1				270	4.3	4.8	1,239	0.15	3.2	1.7	1.35

	Loom Type	Transfer Hammer	Drop Wires	Picker Insert	Weft Fork Stand	Weft Fork Slide	Lug Strap	V Belt	Leather Belts	Connecting Hooks	[illegible]
AKAKI	[illegible]	[illegible]	464,000	3,392	144	31	551	4,622	2,704	4,645	[illegible]
	RUTI	72	61,440	449	10	11	73	585	358	614	[illegible]
	JACQUARD	3	2,560	18	1	1	1	24	15	25	[illegible]
	[illegible]	3	2,560	18	1	1	1	24	15	[illegible]	[illegible]
BAHR DAR	[illegible]	270	230,400	1,684	72	41	274	2,166	[illegible]	[illegible]	[illegible]
	RUTI	36	30,720	[illegible]	10	5	36	[illegible]	[illegible]	[illegible]	[illegible]
DIRE DAWA	TOYODA	486	414,720	3,032	[illegible]	73	492	[illegible]	2,417	[illegible]	[illegible]
	RUTI	18	15,360	112	5	3	18	[illegible]	39	[illegible]	[illegible]
	KOJO	[illegible]	[illegible]	[illegible]	79	45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	PICANOL	96	[illegible]	600	25	14	240	781	477	[illegible]	[illegible]
AKAKA TEXTILE MILLS	NORTHROP	[illegible]	260,000	1,900	81	46	80	[illegible]	[illegible]	[illegible]	[illegible]
TOTALS		[illegible]	1,856,480	13,291	566	321	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Average Per Loom Per Annum		0.75	653	4.7	0.2	0.1	0.7	[illegible]	[illegible]	6.4	[illegible]

Note: The figures underlined are actual figures taken from mill records. All other figures are estimates based upon the actual figures, the types of looms in the mill, and the number of looms.

7.0 JOB CLASSIFICATION AND EVALUATION

Introduction

The production equipment used in the Ethiopian textile industry is typical of that employed in textile industries throughout the world. The processes of spinning, weaving and finishing are also similar and it thus follows that the duties of the operatives will also be broadly the same as those of textile operatives in other countries, as indeed they are.

Consideration has been given as to how the consultants may best help the N.T.C. to evolve a system of job classification and evaluation. It was felt that the N.T.C. would benefit from examples of the approach to job classification and evaluation systems adopted elsewhere. Suitable examples of each system have been chosen and are presented in Appendices 'A' and 'B'.

7.1 Job Classification or Job Description (Appendix 'A')

A total of 43 job descriptions are provided in the Appendix. They cover unskilled, semi-skilled and skilled occupations carried out in spinning, weaving and finishing. The method of description was evolved by the United States Employment Service of the Department of Labour in the early 1940s. Although there are socio/economic differences between the Ethiopian and United States industries, the type of machinery employed in the U.S. textile industry in the 1940s was similar in many respects to that in use in Ethiopia today. Hence, the jobs carried out in the U.S. then are relevant to those performed today in the Ethiopian textile industry.

Each of the jobs listed in Appendix 'A' is described by eight points, viz.:

1. Work performed
   A concise description of the duties associated with the job.

2. Special requirements of the job
   Examples are manual dexterity for piecing in the case of a spinner, or care in the arrangement of bales for mixing in the job of bale breaking. For many jobs there are no such special requirements of the operative and the section is left blank.

3. Machine, tools and materials

'Machines' refers to the production machine being tended; 'tools' to the implements used, e.g. trucks, cans, brushes, oilcans, etc., whilst 'materials' refers to the production material being processed, e.g. card sliver

4. Qualifications for employment

Sex: Self explanatory

Age: Usually an age range may be given with a preference indicated.

Education: This may be nil in a very simple routine job that requires no reading or writing ability, ranging up to high school education with three years technical training in the case of skilled mechanics or electricians.

Physical requirements: Where heavy lifting is involved strength would be a prime requirement. In other cases good eye-sight and colour vision for cloth inspection, or stamina for jobs requiring long periods of standing or walking are examples.

Temperament: Jobs such as drawing-in warp ends require a patient temperament. For many other jobs, however, no particular temperament need be specified.

5. Working conditions

Examples are, noisy, quiet, dusty, warm, humid, etc.

6. Nature of work

Examples, routine, standing, monotonous, light, simple, etc.

7. Training

Unskilled work may require little training and that will usually be given on the job itself. The more complex the job the longer the training required and the more comprehensive the description given.

8. Relation to other jobs

The relationship to other jobs may be defined in terms of, (i) that to which a change would constitute a promotion yielding higher pay and/or greater responsibility, and (ii) those jobs on a similar level usually within the same department.

7.2 Job Evaluation (Appendix 'B')

In suggesting a job evaluation system to the N.T.C. we are concious of the difficulties that can arise in the straight transfer of a technique from an industrial environment in a developed country to one in a developing country. For example, the relative values of the weights, or values, that may be attached to the two factors, 'skill' and 'working conditions' will depend upon the social and economic circumstances of the community

For this reason we have reproduced a report on a job evaluation study carried out in the textile industry of another developing country, i.e. India. The study was conducted by the Ahmedabad Textile Industry Research Association amongst the mills of their members. Appendix 'B' consists of the introduction to their report together with descriptions of the various job evaluation techniques available. A copy of the full report will be provided to the N.T.C.

8.0 MANPOWER REQUIREMENTS - MANAGERIAL AND TECHNICAL

In order to make some assessment of future requirements in this field, it is necessary that there is a recognisable organisational structure covering the centralised and production unit functions.

8.1 Centralised Functions

It is deemed that the roll of the central organisation of the N.T.C. is:

To be responsible to the Ministry of Industry for the effective control of industrialised textile manufacture within Ethiopia and to ensure that existing and planned resources are fully utilised in fulfilling the demand of the Goverment's economic budget.

To fulfil this role, it follows that manufacturing units should be accountable to the central N.T.C. organisation. In order to effectively control the industry, it further follows that Central N.T.C. should have a functional organisational structure apart from a purely administrative function which would appear to be the present prime role.

Over the next decade the demand on the textile industry will be for higher production in order to reduce/eliminate the foreign exchange currently expended on imported textiles and to meet the increasing home market demand for textiles. The higher production demand is only going to be met by increasing the productivity of existing resources, and by the efficient operation of additionally created resources. It is therefore of some importance that the central N.T.C. organisation should create a structure that will be a sound vehicle for effecting the required changes to meet these objectives.

At this stage, it is possible to define those areas of required impetus if these objectives are to be met. In the opinion of the survey team, these would be, Production Management, Training and Management Services, including Technical Work Study, Personnel and Engineering Functions. The basic organisational structure of the Central N.T.C. operation would then be:

MINISTRY OF INDUSTRY

Manufacture Demand

General Manager NTC

Assistant Gen. Manager

Regional Production Managers | Manufacturing Man. (Garments) | Financial Manager | Management Services Manager | Training Manager | Project Engineering

Accountant/s
Spinning
Weaving
Finishing
Work Study
Personnel
Engineering
Quality Control

Manufacturing U its

In creating such an organisation structure the objective would be to place the most experienced and capable persons in these senior positions in order that their experience and expertise may be transmitted to the operational units and to further the cross- fertilisation of knowledge and management skills.

The prime roles and responsibilities of these senior posts would be:

Regional Production Manager/Manufacturing Managers

Responsible to the General Management for the operation of a regional group of manufacturing units, maximising the utilisation of resources, placement of manufacturing work in the most appropriate unit, specialisation of manufacture to units etc. etc.

Financial Manager

To advise the General Management on financial policy and to regularise the accounting function within production units.

Management Services Manager

To be responsible for the provision of Technical and Management Services Staff to act in an advisory capacity to the Regional Production Managers and Production Units.

Training Manager

Responsible to the General Management for the updated identification of training needs and the means of fulfilling these. To co-ordinate the training activities within production units.

Project Engineer

Responsible for the planning and implementation of forward production units and to meet the forward production demand.

It is considered that the formation of such an organisational structure is a pre-requisite for the industry to meet the future demands of higher volume production and improve productivity. As such, assuming that the recommendation is adopted, a target date of 12-15 months should be accepted for the structure re-organisation of the central activity. Since such posts will require the most able and experienced persons available, they will only be filled over the next three years, by recruiting from the industry and using expatriate staff working with an Ethiopian counterpart who would eventually succeed to the post. In the longer term, such posts would be expected to be filled by selection of the most able from industry.

8.2 Production Units - Manpower Requirements

The shortage of management and technical staff at all levels within the industry is a recognised fact. In the short term there is no immediate remedy to this, other than the recruitment of expatriate staff for fixed period 2 to 3 year contracts. The adoption of such a policy would provide for the most rapid means of improving productivity and for the training of their future successors and immediate subordinates, allowing time in which to formulate and put into practice training activities that will ensure technical and management succession in the years ahead. It is for this latter reason, that the establishing of a centralised training function is considered essential.

For the continuous advancement of the industry it is essential that a policy of 'promotion of the ablest' be adopted. That a person having proved his capability in a given position is advanced to a more demanding position, preferably in the same discipline, and progresses until such time as his capability has been met; or alternatively supported by additional training, his capability is extended to areas of General Management. The maximum utilisation of human resources is vital to NTC interests; and a recognisable promotional ladder that is seen to work, is a strongly motivating factor for the individual.

A current practice is to take graduates from university or polytechnic college and to introduce these as first line supervisors in production units. Not surprisingly, educational advantages are rapidly lost and senior management is confronted by additional problems of ineffective first line supervision. It is obvious that such recruitment sources are going to be the main line of candidates for technical and managerial positions over the next decade; what is necessary is, they receive additional training which enables them to effectively occupy the posts for which they are intended, such training to consist of:

(i) Specific assignments of set duration in the more progressive manufacturing units, when results obtained can be constructively criticized.

(ii) External experience in progressive manufacturing units

(iii) Formal management education as distinct from technical or scientific education

(iv) Structured work experience involving central supervision in addition to immediate unit management.

Short of a very detailed survey of man-power requirements, it is not possible to be precise as to what exact requirements will be over the next three and ten year periods. But making some basic assumptions, it is possible to arrive at a numerical quantity that will serve for immediate purposes.

Assuming:

(i) That a centralised function is established

(ii) That a positive promotional policy is adopted

(iii) That one new major production unit is brought on stream during the next 3 years, and three such units over the next 10 years,

then the likely number of senior and middle management vacancies occurring in a period of 3 years (due to promotion, natural wastage and down grading) will average six per unit. Since there will be sixteen such units, total vacancies occurring the three year period will be 100, and over a 10 year period, during which a further two additional major production units are brought on stream, a total of 318 such vacancies are likely to occur.

It is recognised that smaller production units are likely to be created during this period; but assuming that the associated management requirements can be met within the above totals.

8.2.1 Estimate of Production Labour Requirements to 1985

An analysis of the current production labour force within the N.T.C. spinning, weaving and finishing establishments is given by Table 8/1. The work force is classified by four categories, i.e.:

(i) Technicians and Technologists.

Specialist functions are covered by this category, such as production planners and controllers; chemists; quality controllers; work study engineers; designers and some technical managers and supervisors.

(ii) Craftsmen.

Includes production machine mechanics, electrians and the various skilled trades employed on maintenance and workshop work.

(iii) Semi-skilled.

Includes all machine operators or attendants, e.g. weavers, knitters, spinners, winders, etc. The degree of skill involved varies considerably between the different occupations. A jacquard weaver would be at the most skilled end of the range whilst a winder would be at the other extreme.

(iv) Unskilled.

Labourers, carriers of cloth, bobbins etc., sweepers and cleaners are typical examples.

An estimate of the annual wastage of each category of labour is given in the Table. The values shown were obtained from textile industries in other countries and have been used here in the absence of similar information in respect of the Ethiopian textile industry.

The estimated annual wastage for 1980, including the expected new work force at the Adie Abebe extension, is:

	Technicians	Craftsmen	Semi-skilled	Unskilled
1980 Labour turnover	41	137	837	507

An estimate for 1985 is also given and this includes the expected numbers of production employees at the new Kombulcha plant, viz.

	Technicians	Craftsmen	Semi-skilled	Unskilled
1985 Labour turnover	46	154	941	570

These estimates of labour turnover provide a rough and ready guide to the scale of the training facilities required by the spinning, weaving and dyeing and finishing sectors of the textile industry. Additional production units on the scale of Kombulcha will increase the demand on training facilities in a similar amount to that estimated above for Kombulcha.

8.2.2 Provision of Training Facilities

Technicians and Technologists: Specialists in one or more management techniques, e.g. work study, scheduled maintenance systems, production planning and control etc., it is essential that they have a broad understanding of all of the main textile processes. A suitable training institution exists at Bahr Dar and it is recommended that this should form the base on which to build a larger, and if necessary, a wider ranging establishment.

Craftsmen: The shortage of craftsmen in industry is a problem common to all developing countries and is particularly severe in Ethiopia. One method of approach would be to set up one or more technical training schools to train general mechanics and electricians. This for the benefit of all Ethiopian industry and not merely the N.T.C.

Completion of technical school training might then be followed by more specialized training on textile machinery and equipment, this in a separate textile training establishment. From there the new textile craftsmen would enter the mills and work under close supervision for a minimum of one year, by which time they should be sufficiently competant to work to normal production standards and requirements.

Semi-skilled operatives: It is recommended that 'in-house' training schools be established at Akaki, Dire Dawa, Bahr Dar and Asmara Textile Mills, for the training of machine attendants such as spinners, weavers, knitters and other operatives performing jobs which require organised training for periods up to approximately six months.

The training should be carried out off the factory floor in s separate training department equipped with classrooms, and machinery typical of the kind on which the trainee will be employed. The training school should be staffed by trained, full-time instructors.

Unskilled: A simple induction programme followed by 'on the job' training is sufficient.

The provision of technical management, specialist technicians and skilled craftsmen is of paramount importance and should be given priority over all other considerations. The task of bringing into being the necessary training facilities complete with structured courses and qualified instructors is immense. It is recommended that the N.T.C. should seek the advice and assistance of U.N.I.D.O. in connection with the training of maintenance workers; U.N.E.S.C.O. on vocational training in the final years of general education, and the I.L.O. on the establishment of technical training systems at all levels.

TABLE 8/1

ESTIMATE OF PRODUCTION LABOUR REQUIREMENTS – TO 1985

	Technicians & Technologists	Crafts-men	Semi Skilled	Unskilled	Total
Percent of Production Labour Force					
Spinning	5	10	57	28	100
Weaving	3	10	67	20	100
Finishing	5	10	60	25	100
Estimated Classification of Current Labour Force					
Spinning	325	650	3705	1820	6500
Weaving	156	520	3484	1040	5200
Finishing	67	135	810	338	1350
Total:	548	1305	7999	3198	13050
Estimated Numbers at Adie Abebe Extension					
	32	65	370	183	650
Grand Total (1980):	580	1370	8369	3381	13700
Estimated Annual Labour Wastage					
Percent:	7	10	10	15	
Numbers (1980):	41	137	837	507	1522
Estimate of Production Labour Force at Kombulcha					
Spinning	42	85	485	238	850
Weaving	20	68	456	136	680
Finishing	9	17	102	42	170
Total:	71	170	1943	416	1700
Grand Total (1984):	651	1540	9412	3797	15400
Estimated Annual Labour Wastage (1985)					
Numbers:	46	154	941	570	1711

9.0 MAINTENANCE

9.1 Introduction

Much of the textile machinery seen in the Ethiopian mills is in need of rehabilitation. In individual mill reports, the condition of the machinery has been assessed and those machines which require some degree of rehabilitation work have been identified. In order that this work should have a longer, rather than short term benefit to the mills, and that the machinery be prevented from falling back to its present condition, then at the end of this rehabilitation programme all the mills visited should be in a position to operate a level of maintenance superior to that currently practiced. The purpose of this section of the report is therefore to:

(a) discuss ways in which mills can use established organisation and control systems to help lift their current maintenance practices to a higher level.

(b) identify methods of monitoring and refining the level of maintenance achievement in future years.

(c) suggest likely roles for N.T.C. in assisting the mills to identify and fulfil future maintenance training requirements.

Throughout this report the word maintenance is defined as "work undertaken in order to keep or restore equipment to an acceptable standard". It therefore covers the normally accepted primary functions of the works engineering and maintenance departments such as:

- the maintenance of buildings, property, roads, waterways, road transport, plant, machinery and equipment.
- provision and maintenance of services such as compressed air, steam for process and space heating, effluent and waste disposal, air conditioning, hot water supplies etc.

- provision and maintenance of utilities such as electricity, gas and water.
- operation and maintenance of private power plant should it be installed.

However with the advent of a greater ecological awareness, the disciplines and practices within the sphere of the maintenance departments' responsibility have increased. They now often include a number of secondary functions for example;

- plant protection, safety and security, fire precautions.
- administration of insurance.
- cost control and budgeting of engineering services.
- stores procurement and storekeeping.
- execution of plant development programmes.

This is not to say however that even these broader definitions define the limits of influence of a modern maintenance department. Recent thinking has introduced and developed the concept of terotechnology,(1) which brings to bear all disciplines relevant to the specification and design for reliability of the physical assets, to the installation, commissioning, maintenance, modification and replacement, and to the feedback of information on design performance and cost of assets. It is with this 'total', or terotechnological approach in mind, and which is so necessary in order to appreciate exactly what is an 'acceptable standard' (in the definition of maintenance above), that we examine the level of textile maintenance in Ethiopia.

(1) Terotechnology. Definition: A combination of management, financial and engineering and other practices applied to physical assets in pursuit of economic life-cycle costs.

9.2 Maintenance Organisation

9.2.1 Systems and Structure

The administrative structure which has been drawn up for many of the textile mills in Ethiopia requires a Technical Manager to be responsible for both maintenance on the one hand, and production on the other. This structure has in our opinion contributed to the general down-grading of maintenance activities to such an extent that it is now common-place in the mills we visited for production requirements to overrule maintenance needs whenever they are in conflict. Clearly there is little harm in this providing it is an occasional occurrence. In our opinion this is not the case however, and there is therefore an urgent need to strengthen maintenance representation at senior management level.

We therefore propose, in as many instances as possible, that a Maintenance Manager or Work Engineer is appointed to operate alongside the Production Manager, both being directly responsible to the General Manager. The only exceptions we would make are in mills which are too small to support such a large administrative burden. Augusta Shirt Factory is an example, and here the present Production Manager would continue to be responsible for both the Head of Maintenance and the Production Foreman.

In this way managements will be able to increase the influence of maintenance on their decision making. However in order for the new structure to work the Maintenance Manager must be aware of the factors effecting the day to day running of the machinery. Consequently, the condition monitoring and maintenance work reporting must be carried out by his men, rather than production work force. Some clear split in duties between these two work forces is therefore necessary and it is certain that the traditional split worked in European mills is unsuitable.

We therefore further recommend managements to consider for use an organisational structure in which the use of any tools or gauges for machine adjustment, maintenance or whatever is exclusively limited to the maintenance work force alone. Thus any alteration to the air conditioning plant will only be made with the authority of the Production and Maintenance Managers, as will any changes to machine settings arising from a need to produce different goods, or to process different raw materials, and that the new settings will be made by the work force responsible for ensuring the accuracy and reliability of those settings.

9.2.2 Control Systems

A lack of effective control systems is an unfortunate feature of the Ethiopian textile maintenance departments. It would in our opinion be quite wrong to introduce a complex accounting and recording system if by so doing, we are simply adding to the confusion which already exists. We therefore propose three systems of increasing complexity which managements could introduce sequentially as their maintenance awareness and standards improve.

The first of these systems is concerned with the concept of machine reliability, and can be introduced relatively quickly. It consists of a simple log to quantify plant reliability and establish its characteristics, namely what part of the conventional 'bath-tub' curve (see Figure 1), is relevant to each particular item of machinery. The life cycle failure risk curve (known as the 'bath-tub' curve) is typical of all operating mechanisms with relatively high, but falling failure rates at the stage of life A - B, slow but relatively stable failure rates over time-span B - C, followed by rapidly rising failure rates over the later life defined by time span C - D.

if it is acknowledged that any plant unit can be in one of the following four states:

State 1	-	Operating and in service,
State 2	-	Not operating; undergoing planned maintenance,
State 3	-	Not operating; undergoing repair following breakdown,
State 4	-	Not operating; but available to operate when required,

then a reliability log (see Figure 2), can be constructed in which the relevant entry is made for each main item of processing machinery each operating day of each month. The information in the reliability log would show the failures occurring (State 3) against operating time (State 1), and how they are related to planned maintenance work (State 2) or stand-by availability (State 4).

Other refinements which the log would permit are:

1) the instantaneous failure rate of, (for a family of identical units) tabulated in Figure 3 is simply;

$$f = \frac{n}{t}$$ where n is the number of failures

from a population of identical units in a short operating time t.

2) The cumulative failure risk, fr, for a single unit is defined as;

$$ft = \frac{n}{n_{max}}$$, where n is the number of failures

of an individual unit in time t and n_{max} is the maximum of failures possible for the individual unit in time t.

Relating this to the state of plant defined in the reliability log, we get for the 'cumulative' failure risk ft.

$$ft = \left(\frac{\text{Plant in State 3}}{\text{Plant in State 1 plus Plant in State 3}} \right)$$

3) Reliability can be defined as: v = 1 - ft, and hence;

$$r = \left(\frac{\text{Plant in State 1}}{\text{Plant in State 1 plus Plant in State 3}} \right)$$

The reliability record of cumulative failure risk, ft, plotted against cumulative operating time from any chosen starting point in time (say following a major overhaul, or plant shutdown) would clearly indicate whether the failure risk is decreasing with operating time (Section A - B), increasing with operating time (Section C - D, Figure 1) or is stable and therefore due to random causes. Planned maintenance attention should be guided by such information coupled with engineering detail of where such failures are occurring, or which components cause the failures to occur, and the cause of such failures.

This leads us to the second system necessary to exercise maintenance control. It should only be introduced after the first system is established and there already exists some feedback regarding which machines need planned maintenance and the likely nature of this maintenance work. This second system is the operation of a Maintenance Work Record (See Figures 4A and B). The basis of the recording system is in fact the plant register so that work on a machine is always recorded with that machine. Figure 4 illustrates an example supplied by Kalamazoo, but many others are available. The section devoted to machine description should include the important settings for the machine, for example, if a card for a ring frame is examined, it should show such parameters as:

- total draft
- draft constant
- back draft
- change wheel*, back draft wheel*, helical wheel*,
- twist and twist wheel*
- roller pressure settings
- spindle speed
- front roller speed
- motor pulley diameter
- ring traveller, ring diameter, ring type;

(* number of teeth on each wheel.)

and on the back of this card is entered the nature of each maintenance task carried out and the name of the mechanic who did the job. (This information may need to be dictated to the record clerk who will enter it on the card).

The final stage of control is to record all costs associated with maintenance duties. At this stage the maintenance department will be used to recording individual tasks and it will, with aid of other departments be possible for the maintenance cost clerk to not only enter the cost of direct (maintenance) wages, but also the cost of spare parts and materials, and providing a standard cost system is in operation the indirect costs associated with the lost production arising from the stoppage. However, this latter stage is likely to be a number of years away in the majority of mills, and it will be advisable before introducing any scheme to examine the alternative facilities which are available on the market to any mill so interested.

9.2.3 Reward System

In most of the mills we visited it was normal practice for the maintenance work force to earn slightly higher rates of remuneration than their production counterparts. This is a relatively common feature as it reflects the often longer training periods which are necessary especially in countries where formal apprenticeships are served.

However, the level of payment for graduates in Ethiopia is substantially higher than that of a highly experienced artisan, who may occupy a supervisory post and yet has had no formal training. This, in part, has developed from managements determination to attract new graduates into the textile industry, but it has led in some instances to confrontations between the graduates and the artisans. Occasionally it has resulted in the premature departure of the graduate. We therefore recommend to management the practice of introducing graduates into maintenance departments with work which has a strong development bias, and which has a well defined envelope in terms of scope of activity, duration, resources (labour and financial) and objectives. In this way individual graduates are introduced to the existing work force, with its already well established relationships, gradually, and only those graduates who succeed in accomplishing their tasks easily and successfully will quality for promotion.

9.2.4 Technological Environment

The rate at which technological change is taking place, the relative significance that it has in the eyes of senior management and the impact it will have upor the skills and structure of the work force are all clearly related. In the U.K., a number of studies have been undertaken with the task of examining this inter-relationship and in one such exercise (2) the participating companies' own perception of themselves in a spectrum that rates technological change both in terms of its significance to the business and the speed with which it will take place is reproduced in Figure 5. Two features of this picture are of interest in an Ethiopian context. Firstly, owing to the relatively high level of textiles imported into the U.K., business confidence at the time of the survey was low, and consequently the likelihood of investment in new technology similarly so. Textiles therefore probably occupies on the figure an uncharacteristically low rating. This we believe would certainly be the case if a similar exercise were undertaken in Ethiopia. Secondly, the position of textiles relative to mechanical, and electrical engineering is of interest. Though textiles is expected to show a relatively slow rate of technological change with only little or average significance, the rate of technological change in mechanical engineering is expected to be faster and in electrical engineering rapid with changes of major significance occurring.

Though processing technology is therefore likely to alter little, the electrical and mechanical components which go into the design and manufacture of these processing machines may indeed be subjected to rapid technological change. In fact this process is already well under way as can be seen from the increasing use of electronic devices both to control the operation of machines and to monitor their performance.

Theoretically it is possible for countries such as Ethiopia, by buying selectively, to minimise or delay the introduction of these high technology units.

(2) Training for skills. A programme for action, Manpower Services Commission, U.K.

However there are a number of processes which tend to counter any behaviour in this direction. Work at the Shirley Institute carried out on behalf of the ILO, Geneva. though incomplete as yet, is revealing a number of interesting relationships which we believe have general application far beyond the relatively narrow field in which the research is carried out. This work shows that though low technology, labour intensive machinery operated in a traditionally low level of amenity building, offers clear economic advantages to firms in low wage-level countries; this advantage in favour of the labour intensive machinery is substantially lost when the same machinery is housed in a modern, relatively expensive high level of amenity building equipped to modern air conditioning, lighting, and noise abatement standards. And the pressures on firms in Ethiopia to install high level of amenity buildings is considerable. Illness from respiratory diseases is already acknowledged as a leading cause of absenteeism, but in addition there are important social reasons why the working environment should be kept to relatively high standards in Ethiopia, arising for example, from the need for a work force traditionally used to agricultural employment, working in the oppressive environmental conditions found in Idget and Kalitti.

In Ethiopia, a country in which adequately trained labour resources are already overstretched, this is not the only advantage arising from the employment of high technology processing machinery. The work at Shirley also shows that in mills with this type of machinery the number of managers, supervisors and technicians can be expected to be substantially lower than in a mill with low technology machinery of the same total capacity.

We therefore conclude that it is necessary for the Ethiopian textile mills to recruit (in some instances) and to train to a higher standard (in all instances) the artisans it employs in their maintenance departments, in order that they can raise the standard of their present production and at the same time look forward to the use with equanimity of machinery built to a level of technology consistent with their long term social and economic objectives.

9.3 <u>Training and the Role of N.T.C.</u>

Nowhere in this review of maintenance have we made any recommendations for or against preventive, corrective or indeed simply planned maintenance schemes. Our reason for this apparent omission should now be clear. Without adequately trained artisans to operate such schemes, maintenance management are committing themselves to greater work loads, instructing, supervising, monitoring and inspecting whatever work of this nature is carried out by their present untrained work force. In addition without adequate cost control there is no way of monitoring the effectiveness of the planned maintenance schemes, once they are introduced. It is therefore clearly necessary for the training and introduction of adequate control systems to precede the general recommendation in favour of such schemes and in this respect we believe the N.T.C. has an important role to play.

The development of a training programme for artisans to be taught in turn in each of the mills, with the correct theoretical and practical training balance is best carried out after extensive discussion with the management of each mill. But it is N.T.C. who are in the best position to co-ordinate such a training programme, and who have the authority to impose such a programme on what we believe will be a reluctant management. Such a training course will explain the concepts of all aspects of planned maintenance and help the textile mills by making their artisans more receptive to the ideas and objectives of these schemes once they are introduced.

After the schemes have been generally accepted in most of the mills, N.T.C. would be recommended to establish maintenance auditing teams, which could be recruited from all the mills' maintenance departments to examine one or two mills in detail each year. The duration of each auditing teams activities would be from 5 to 8 weeks depending on the size of the mill to be examined, and its purpose as well as examining the maintenance practices, activities, performance parameters etc., would also include the dissemination of techniques within the industry.

9.4 Recommended Maintenance Systems

9.4.1 Introduction

The aim of a maintenance system is to preserve the capital equipment so that the rate at which it acquires relative operating inferiority is determined exclusively by external developments. The maintenance system must be adequate to maintain the machine's performance throughout its economic life, having regard both to the type of equipment and the scale of activity, i.e. machine-hours per annum operated. Maintenance can be classified into two categories - breakdown action and preventive or planned maintenance. Unfortunately, even modern textile mills are not infrequently operating without planned maintenance. It finds favour because the payroll cost is low and maintenance department overheads are reduced to the bare essentials as no planning, recording, scheduling or associated paperwork is involved.

In the early stages of operation in a new plant, the uneconomic aspects of the system will not be apparent, but in two or three years breakdowns will increase in both frequency and severity, production disruption and costs will steadily increase and employee moral and piecework earnings will move in the opposite direction. These second-order effects accelerate the deterioration, and workshop staffing is increased to keep up. Even this is not the end of the cost effects of 'low cost' maintenance. A modern textile mill is a highly integrated manufacturing unit and a dislocation in one area quickly disrupts activities over adjacent departments introducing balancing problems, bottle-necks and in some cases - especially in dyeing and finishing - deteriorating quality.

Breakdown maintenance systems are no longer adequate for modern textile mills, and a planned maintenance system is essential if costs and quality standards are to be maintained.

9.4.2 Planned maintenance

The basic principle of planned maintenance (PM) is that selected machines are taken out of production on a time programme and detailed scheduled work done so as to maintain their productive potential - quantitatively and qualitatively - until the next servicing date. This work clearly costs money both directly and indirectly, and for this reason the machines on the PM programme should be selected. Some machines will be found not to justify the 'full treatment' of a planned programme. For example, bobbin stripping machines in automatic loom weaving mills are relatively robust and simple and could not produce high dislocation costs. On the other hand, operating with one sizing machine would be taking risks if only operator lubrication plus breakdown service is relied on. The decision will be based on the type of equipment, its dislocation cost potential and the timespan of detection of machine-induced quality defects. These are not strictly functional engineering decisions, and the general manager responsible for plant performance and operating profitability is the final arbiter of 'how much maintenance and applied to what'.

The practical organisation of the facilities, compilation of each machine maintenance schedule, the scheduling of the work in the most effective and least disruptive way, and the quality of the work performed, is the chief engineer's responsibility.

The most difficult and time-consuming part of introducing a PM system is compilation of the individual machine maintenance specifications. Not all manufacturers provide such documents and drawings, and those who do, err on the over-conservative side and produce schedules in which the cost of the insurance is prohibitively expensive. For this reason there is no substitute for general experience supplemented by appropriate textile processing knowledge. The schedule will give a complete list of all parts requiring attention, the frequency of such attention, what is to be done, the tools and drawings required for the job, and finally the type of maintenance skills required, i.e. fitter, electrician, instrument mechanic, semi-skilled, etc.

It will be clear that the total scheduled maintenance load by craft skills can be accumulated from all the individual machine PM schedules, and a Gantt chart built up for the annual programme. This programme will not only make full use of all the artisans and semi-skilled but will fit in with holidays and production commitments and the process routes of the principle products. For example, if a washing range is normally integrated to a particular can-set, it is inadmissible to schedule the two machines independently. With skilful manipulation the technical requirements of the whole PM programme can be achieved with no requirement for additional men in a particular skill group in a particular week, and no weeks when work opportunity for a particular skill is not fully available. This can only be achieved by the PM personnel adhering to the job specification. If, in the course of the work, a major defect is revealed, this is noted on the job report and subsequently undertaken by other specialist staff. Thus, the job reports, showing parts replaced and work outside the specification, not only indicate the necessity for non-scheduled work but when recorded and periodically analysed indicate the necessity for a major redesign of a particular motion, or possibly increased frequency of PM servicing. Where the machines concerned are numerous - such as looms or ring frames - this analytical work can be particularly useful, as a general modification pays off over the whole battery of machines.

Many modern textile machines are now built with the major elements removable and replaceable, so that the work becomes benchwork in special fixtures under better conditions. In wet-processing, duplication of special characteristic motors and electronic control instrumentation is mandatory. Not only is the down-time almost eliminated, but the rectification is no longer a 'rush-job', which is frequently an expensive short-term palliative. Furthermore, semi-skilled labour can be used for the removal and re-installation, and specialist labour retained for the rectification work and approval of the replacement in situ. Whenever skilled craftsmen are not using their specialist skills, an unnecessary overhead expense is being incurred.

9.4.3 Stores Procedures

Stores procedures can be ineffective both as regards storage conditions and records systems. Every part replaced on every machine should be entered on the machine record card at current cost. A loom record card, for example, is normally subdivided into the primary motions, shedding, weft insertion, beat-up, let-off and take-up. In this way it becomes possible not only to have the present cost per million picks, but the cost history showing trends, as well as the technical comparison of upkeep of the major motions in different mechanics sets and on different types of products. Not only is this important technically, but these facts should be available to the product costing department. It is good practice to issue technical summaries to spinning, weaving and finishing managers bi-annually, together with moving annual total figures and summary comparisons with other units in the group. The stores can also be a suitable location for special cleaning equipment, as this generally requires a minimum of supervision and stores personnel can generally supervise it adequately. Heald- and reed cleaning equipment, and shuttle trueing machines can, for example, be conveniently located in the weave room stores.

The advantages of planned maintenance are shown in Table 9/1.

Table 9/1 ADVANTAGES OF PLANNED MAINTENANCE

Advantage	Result
Increased machine availability due to reduced incidence of breakdown	Improved production efficiency and greater reliability of customer service
Improved machine performance due to elimination of worn or damaged parts and consistently satisfactory settings	Improved product quality, lower scrap loss, and longer machine service life
Fewer major repairs due to consequential damage of breakdowns	Better utilisation of maintenance labour force and reduction in shop overtime
Reduction in need for stand-by equipment	Capital savings
Better control of spare parts	Reduction in stores stock without sacrifice of performance
Attention focused on common sense cause of failure	Improvement in design and reduction in breakdown frequency

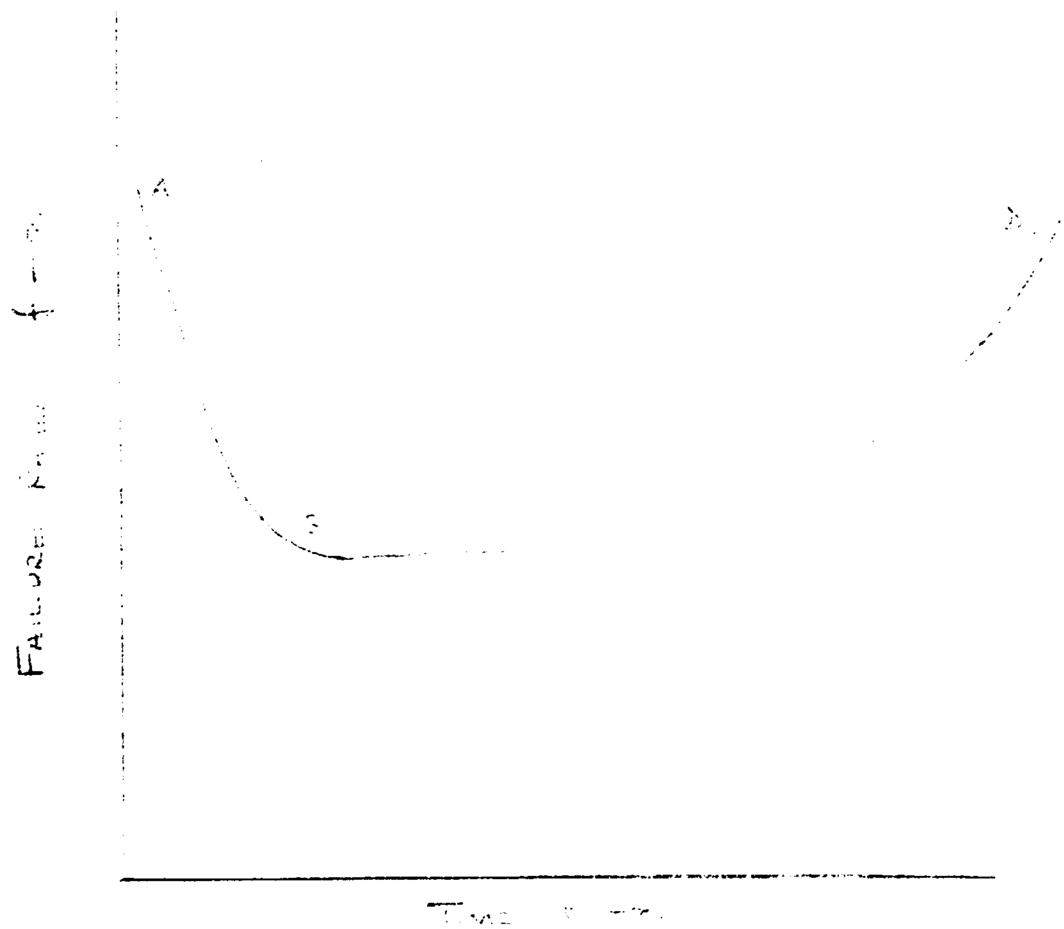


FIGURE [illegible]

FAILURE [illegible] 'BATH-TUB' [illegible]

State 1: operating and in service

State 2: not operating – undergoing planned maintenance

State 3: not operating – undergoing repair following sudden breakdown

State 4: not operating – but available to operate when required

Plant No.	Month........................																														Remarks
	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	29	30	31	

FIGURE 2: RELIABILITY LOG.

WEEK ENDING.	OPERATING TIME (HOURS)	FAILURES IN WEEK	INSTANT FAILURE RATE, f	CUMULATIVE FAILURE RATE ft.	REMARKS & CALCULATIONS.

FIGURE 3. SYSTEM RELIABILITY RECORD.

FIGURE 4A.

PLANT AND MACHINERY RECORD (MECHANICAL)

MAKER	MAKERS NO	COST
SUPPLIER	NEW/SECOND HAND	DATE

DESCRIPTION | SPARES

DRIVE

INSURANCE	GUARANTEE
POLICY NO RENEWABLE	

Date	Location	Ref.	Notes

EXPECTED LIFE ______ YEARS

Weight	Area

SERVICES REQUIRED

A.C. Single ______ A.C. Three ______ D.C. ______

Gas ______ Water ______ Vacuum ______

Air at ______ lbs. Square Inch

Steam at ______ lbs. Square Inch

Hydraulic Oil ______ Dust Extraction

Type of Foundation

Lifting Tackle

Coolant

Lubricants

Drive	H.P.	Speed	Ref

Drawing Nos.

Kalamazoo 1511-611

TITLE BELOW THIS LINE

OOA	LOCATION	DESCRIPTION	CATEGORY	NUMBER
		INSPECTIONS J F M A M J JY. A S O N D		

INSPECTIONS			MAINTENANCE - REPAIRS - OVERHAULS							
DATE	INIT.	REF.	DATE	DETAILS			DATE	DETAILS		

Figure 4B.

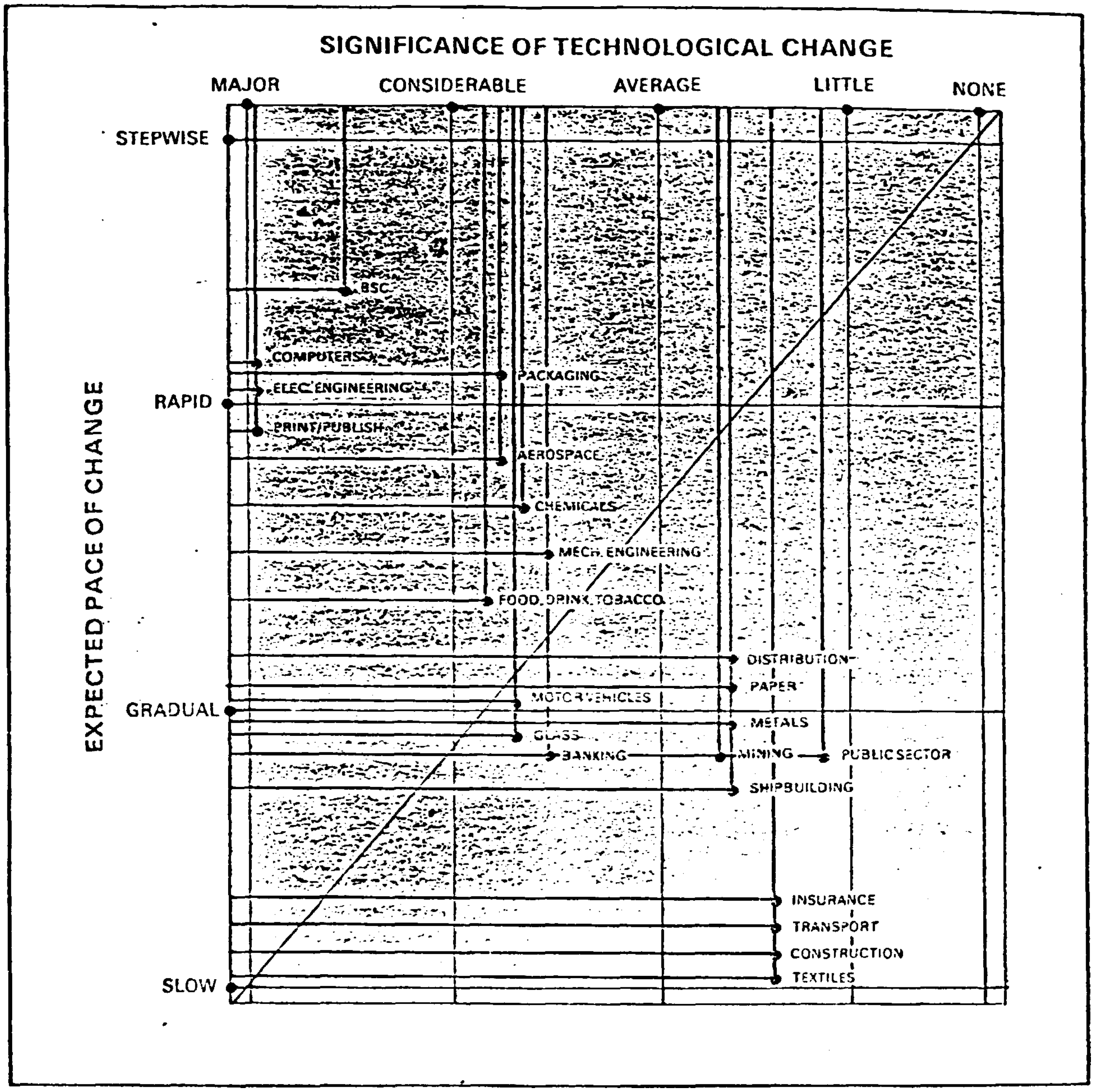


Figure 5.

Relative Perceived Significance of Technological Change 1977 — 1987.

Type of machine	AKAKI No.	AKAKI Detail	ETHIOFIL No.	ETHIOFIL Detail	ASMARA TEXTILE MILLS No.	ASMARA TEXTILE MILLS Detail
Hydraulic press	1					
Radial arm drill	3					
Shaper	2	80cm.40cm table			1	'Marcini & Bossi' 500mm
Lathe	5	1x2m, 2x2.75m, 2x3m	1	2m width	3	Turri 250:280. Tos. Type L27
Tooling lathe	1	Indian				
Horizontal drill						
Vertical drill			1			
Straight milling machine	3	West German, E.German, Swedish				
Vertical milling machine					1	'Cuber 59R' 27mm taper
Universal " "					1	M.B.
Tool grinding machine	1				1	Pedestal type
Surface grinding machine					1	'EABO 2'
Disc grinding machine					2	1 Telisatti, 1 Tos.
Cross cut power saw	1				1	'Visconte 320'
Power saw (carpentry)						
Band saw "						
Mitre cutting saw						
Mortise cutter						
Hack sawing machine						
Electric arc welder	2				3	Made in Asmara, One portable.
Gas welder					3	Portable
Soldering set						
Planer						
Thicknesser						
Spindle moulder						
Combined cutter and notcher	1					
Abrasive cutting machine					1	'CIFES'
Rolling machine	1	1.5m width			1	1m width
Fly press					2	1 home-made
Work bender					2	With 6 vices
Powered centering head						
Buffing/grinding/ polishing pedestal						
Jacking unit						
Bench shearing machine					1	
Casting furnace	3					
Heat treatment oven					1	50cms x 30cms x 1.5m
Air compressor					1	CECCATO Model 4389
Electrical equipment					4	Testing Stations
Bending machine					1	1.5m wide sheet metal (home-made)
Motor rewinders					1	Power unit
Ammeters					2	'CLIPPON'
Standby generator						

Type of machine	BAHR DAR No.	BAHR DAR Detail	DIRE DAWA No.	DIRE DAWA Detail	DEBRE BERHAN No.	DEBRE BERHAN Detail	IDGET No.	IDGET Detail
Hydraulic press					1	60tons capacity 1972		
Radial arm drill					2	1 @ 20 mm 1 @ 25 mm		
Shaper	1	ASM						
Lathe	4	1 Tarrew 1 Hindustan 1 3.5m 1 1.5m	8	Widths from 0.6 to 3m	2	2m bed 25 cm chuck, 2m-30cm	3	2 @ 1.5m bed 1 on order awaiting collection
Tooling lathe								
Horizontal drill							1	
Vertical drill	2	WMW Pedestal type	1	British			2	Pedestal type
Straight milling machine	1	'Remag'	4	Various			1	
Vertical milling machine								
Universal " "	2	1 Heckert 1 Hindustan					1	
Tool grinding machine								
Surface grinding machine			3	2 Japanese 1 German	1	25cm wheel		
Disc grinding machine	1	For sharpening saw blades						
Cross cut power saw	2	1 Deber T200 1 MMC (not wkg)					1	
Power saw (carpentry)	2							
Band saw "	1	Not working	1	Italian				
Mitre cutting saw			1	German				
Mortise cutter			2	1 W.German, 1 Japanese				
Hack sawing machine			3	1 Czech, 1 Italian, 1 Ethiopian				
Electric arc welder			3	15KW, 19KVA, 15KW				
Gas welder								
Soldering set					1	For reed repairs		
Planer			3	1 Japanese, 2 Italian				
Thicknesser			1	IWM Japan				
Spindle moulder			1					
Combined cutter & notcher			1	Ethiopian				
Abrasive cutting machine								
Rolling machine					1	3m wide, for sheet metal		
Fly press							1	
Work bender								
Powered centering head								
Electrical equipment					1	Coil winding m/c		
Bending machine								
Motor rewinders								
Ammeters								
Standby generator					1	Emergency lighting		

10.0 COTTON GROWING AND GINNING

Information on cotton growing was obtained by questionnaire from five Agricultural Development Corporations, viz.

Tendaho
Middle Awash
Awash Valley
Upper Awash
Rift Valley

The information provided is shown in Table 9/1

10.1.1 Areas, Production and Yield

Total area under cotton for all five Corporations was stated to be 43,343 hectares, with an annual production of cotton seed of 703,159 quintals, i.e. 70,316 tonnes, or an average of 16.22 quintals per hectare. Areas and yields for the five Corporations are as follows:

Corporation	Area (Hectares)	Production (quintals)	q/hectare	Lint Cotton Yield* lb/per acre	Total (Tonnes)
Tendaho	20643	226,259	10.96	343	7919
Middle Awash	4690	122,640	26.15	816	4292
Awash Valley	8600	110,639	12.86	401	3872
Upper Awash	6227	156,421	25.12	784	5475
Rift Valley	3183	87,200	27.40	855	3052
Total	43,343	703,159	16.22	507	24,610

* Note: Yield based on a ginnery out-turn 35%

The estimated yield in pounds per acre is exceptionally good with an overall average of 507, whilst three of the Corporations range between 784 and 855 lb. per acre. Yields in lb per acre obtained in neighbouring countries in the two seasons 1974/5 and 1975/76 were as follows:

	74/75	75/76
Kenya	68	69
Sudan	394	205
Tanzania	195	161
Egypt	640	600
Uganda	52	49
World:	369	356

The yields for Middle Awash, Upper Awash and Rift Valley are so high in relation to the Tendaho and Awash Valley yields, and to the results obtained in neighbouring countries, that a query must be put on the accuracy of the data provided in their answers to the questionnaire.

10.1.2 Cultural Practice

From the replies given cultural practices in the cotton growing areas are good. Some are clearly of recent adoption and will provide benefits in the future. The correct use of pesticides and fertilisers is general as too is irrigation. There is an awareness of the need for instruction and training and appropriate courses are being provided. The Ministry of State Farms has recently established a Research and Advisory Department which is active in the provision of a wide range of advice to the Corporations.
Our conclusion is that the present policy for the improvement of cotton growing is sound and will produce the desired results.

10.1.3 Cotton Quality

Four samples of Ethiopian cotton have been tested at the Shirley Institute in connection with a previous project. Those same four samples have now been spun to count 40s Ne and tested for strength and appearance. Both sets of results are shown below:

1. Cotton Test Results

	Source of sample			
	Tendaho	Middle Awash	Upper Awash	Rift Valley
Effective fibre length	39	40	34	41
Mean fibre length	29	31	25	29
% short fibre	15	23	31	31
Classers length (USA)	$1^3/32$	$1^1/8$	$1^1/32$	$1^5/32$
Fibre fineness	158	160	140	149
Maturity ratio	0.98	1.01	0.85	0.87
Pressley (0) $lb/1000\ in^2$	101.6	105.4	98.8	98.2
" (1/8") gm/tex	25.6	23.8	22.1	23.2
Micronaire	3.9	4.3	3.6	3.6

2. Yarn Test Results

Lea count strength product:	2837	2683	2089	2370
Blackboard appearance:	Fairly regular and clean	Fairly regular and clean	Rather irregular fairly clean	Fairly regular and clean

A lea count strength product of approximately 2000 is considered to be the minimum requirement for good spinning and on that basis it will be seen that all four samples are clearly capable of being spun at the count used for the test, i.e. 40s Ne. However, the Upper Awash sample is just about at its limit at that count.

The other three cottons tested would produce good combed yarns at least up to count 50s Ne, and probably up to 60s.

10.2 Cotton Gins

Completed questionnaires were returned from four ginneries, viz, Tendaho, Kaliti; Idgit; and Adei Abebe. A fifth N.T.C. ginnery is located at the Asmara Textile Mills, Asmara, and consists of eight stands manufactured by Platt-Lummus. It has been closed down for several years and no qualified person was available to provide information on it during our visit to Asmara.

The Tendaho ginnery located at Dubty serves the Tendaho Agricultural Corporation and the needs of private cotton farmers within a radius of 70 km of Dubty. Its output of cotton lint supplies the Ethiopian textile mills and a small proportion goes for export, (975 tonnes in 1979).

The replies received from the other three ginneries are incomplete, but from the information provided it is understood that the gins at the Idgit and Adei Abebe mills provide lint for both their own spinning plants and those of other N.T.C. mills. The Kaliti gins appears to supply the Akaki mill only.

Situated in a cotton growing area the Tendaho ginnery operates only during the harvest from December to May. Seed cotton is fed to the gin on arrival, thus, no storage facilities are required. The Idgit gin operates for 28 weeks of the year from December to June, whilst the Adei Abebe and Kaliti gins operate for 42 weeks and 48 weeks respectively.

Storage of seed cotton prior to ginning occurs at the latter three ginneries. The storage facilities are frequently inadequate during the height of the harvest, leading to some unplanned mixing in the course of ginning.

Problems also occur with the storage of the cotton bales and this frequently leads to deterioration of the fibre, particularly when bales are stored in the open.

The Kaliti gin is a brush gin whilst the rest including that at Asmara are saw gins.

None of the ginneries possess means for the controlled drying of cotton and it is recommended that equipment for this purpose should be installed. From studies conducted by the U.S.Department of Agriculture it has been shown that ginning performance is at an optimum when the moisture content of the lint is between 5% and 7%. In the case of staples of 1.^{1}/8" and longer it is most important that the moisture content should not exceed 7%. By keeping within these limits a cleaner cotton with fewer neps is obtained, whilst wear on the gin is minimized

TABLE 10/1

COTTON GROWING - REPLIES TO QUESTIONNAIRES

Agricultural Development Corporation;	TENDAHO	MIDDLE AWASH	AWASH VALLEY	UPPER AWASH	RIFT VALLEY
Area name/ area size (hectares):	Dubte / 10,562 Dit Bakari/ 10,081	Andbara Angelele Dofan Bolhamo Yalo } /4,690	Amilbara / 1,200 Gewane / 400 Dubte DetBahari/ 2,500 Assoita / 4,500	Avadir Aware Melka Merti-Jeju Nuou-Eva } /6,227	Mille / 1,100 Jewane / 2,083
Total area:	20.643	4,690	8,600	6,227	3,183
Annual production of cotton seed in quintals: 1974/75	227,000	79,856	26,905 - excludes Gewane and Assaita	126,005	
75/76	168,111	96,005	87,171 - excludes Gewane	151,202	34,000
76/77	188,914	96,540	107,758 -	156,829	44,810
77/78	203,017	103,848	110,639	93,377	60,280
78/79	226,259	122,640 (forecast)	N/A	(156,421 forecast)	87,200
Type of cotton grown	Acala 1517/D upto 1977/8 Acala 1517/70 current	Acala 1517/70	Acala 1517/ C & D	1517/70	1517/70
Method of control of seed multiplication	Isolated in commercial fields as far as practicable.	None - seed obtained from Tendaho	Fresh acid - delinted seeds used from each years crop.	None	None - seed obtained from Tendaho

Average monthly rainfall (mm)		TENDAHO 1978		MIDDLE AWASH 1965 - 76		AWASH VALLEY 1978 Amibara/Gewane		Dubte/Assaita		UPPER AWASH	RIFT VALLEY
Jan	July	0	9.0	8.8	110.2	3.6	79.3	1.7	60.3	Data not available	Data not available
Feb	Aug	52.0	21.3	52.7	122.5	43.1	140.0	9.2	57.6		
March	Sept	0	42.9	52.0	42.3	30.6	50.8	19.6	19.5		
Apl.	Oct	6.0	4.0	45.3	11.1	37.5	5.6	20.8	2.9		
May	Nov	27.0	0	27.1	23.1	28.6	13.6	9.8	2.9		
June	Dec	0	0	23.8	2.8	21.6	4.8	6.6	0.9		

Average monthly temperature (^{o}C)	TENDAHO 1978 Min	Max	MIDDLE AWASH 1965 - 76	AWASH VALLEY 1978 Amibara/Gewane	Dubte/Assaita	UPPER AWASH	RIFT VALLEY
Jan	15.1	32.7	31.4	23.5	25.6	Data not available	Data not available
Feb	17.6	32.9	32.2	24.1	25.9		
Mar	20.0	35.3	33.9	25.6	28.3		
Apl	21.0	39.3	35.6	27.5	29.3		
May	22.0	41.1	36.9	28.0	31.3		
June	24.3	42.6	37.7	29.0	32.8		
July	23.4	39.0	35.0	28.3	31.1		
Aug	23.3	40.5	33.2	26.3	31.4		
Sept	22.7	38.1	34.9	26.5	31.3		
Oct	18.6	36.7	35.1	24.9	29.1		
Nov	16.5	36.9	32.3	23.2	26.8		
Dec	15.9	32.3	31.3	22.1	24.6		

i /1

TABLE (continued)

	TENDAHO	MIDDLE AWASH	AWASH VALLEY	UPPER AWASH	RIFT VALLEY
Type and scale of irrigation	Basin (flood) irrigation over the whole area.	Irrigation by water pumps over the whole area.	By pump and direct river supply to gravity canal. Field application by ridge and furrow and by flood (border) irrigation.	Ridge and furrow application No information provided on means of water supply	Ridge and furrow applications at 18 day intervals. No information provided on means of supply.
Quantities and types of fertilisers used per year.	22,000 quintals of rea per year at 2q/ha.	DAP. 200 quintals Urea. 1600 quintals	Amibara: Urea at 150 kg/ha on 500 ha. Jewane: No fertiliser Dubte: Urea @ 200 kg/ha on 900 ha.	Urea 9300 quintals DAP c050 " ANS 1050 " K_2O 850 "	None previously used but plan to use urea at 1 quintal per hectare on 50 of the area of the current crop (1979/80).
Quantities and types of insecticides used per year	Endoalfan 45,390 lts DDT/Monocrotophos 61,669 lts Thiometonazinphos mothyl 41,917 lts Carbaryl 8,363 lts Triazolios 2,640 lts Ethyl Parathion 1,684 lts	Quantities and types used vary according to nature of infestations. Major pests are bollworms, leaf-eaters, sucking pests and mites. Whole area is treated 5 - 7 times per season.	No information provided	Thiodau 25% 34,740 lts DDT/azodrin 16,200 lts Ciratoon 250 32,400 lts Dunban 24% 32,400 lts Rogur L40 16,200 lts	Quantities and types vary from season to season. Usually spray 8 - 10 cycles per season. See separate list of pesticides used.
Distribution system for fertilisers and insecticides	Fertilisers: Tractor mounted spreaders. Insecticides: Aerial spraying.	Fertilisers: Manual applications. Insecticides: Aerial spraying	Fertilisers: Manual Application. Insecticides: Aerial spraying.	Fertilisers: Tractor mounted spreader. Insecticides: By tracter in early stages of infestation. Aerial spraying more usual.	Fertilisers: Side dressing. Insecticides: Aerial sparying.
Is a Government Advising Service available? What kind of advice is available.	Research and Advisory Department recently established in Ministry of State Farm Development. Co-ordination of national variety trails undertaken by Institute of Agricultural Research.	Ministry of State Farms Development provides advice on pest control, machinery engineering work and construction.	Advice on a broad field received from the Institute of Agricultural Research.	None	Yes, particularly on combating pests and deceases. Crop Protection Division of Ministry of State Farms arranges supply of, pesticides and aircraft spraying programmes. Also provides advice on chemical usage and organizes seminars for skill upgrading of staff and workers.
What method of picking is employed	Hand picking	Hand picking	Hand picking	Hand picking	Hand picking
System of crop rotation	Sorghum grown as break crop with cotton.	None	Two-crop rotation-maize and cotton. Full rotation pattern not practised.	None	None

	TENDAHO
What other crops are grown with cotton	Sorghum
What is the marketing system for the purchase of seed cotton from farmers.	Not applicable - only ginning services given to farmers.
Price paid to farmers for seed cotton	Not applicable
Prices obtained for lint cotton and cotton seed	Lint: 3.1 Birr per kg. average. Cotton seed for planting: 1.0 Birr per kg.
Location of ginneries serving the area.	Dubte - well located for the farms of the lower awash valley.
What measures for improved production have been introduced.	Consistently low yielding plots are left fallow for one season. Also weedy plots. Fumeral areas are completely abandoned. Plans under way to substitute sorghum for cotton on each plot every five years. Double cropping trials are in progress. Efficiency of pesticides is determined each season for addition or withdrawal of chemicals. Furrow irrigation is being introduced gradually for the following purposes: (a) the economic use of water, (b) to allow the wider use of improved hand and machine operations. (c) the more economic use of fertilisers.

TABLE 10/1 (continued)

MIDDLE AWASH	AWASH VALLEY	UPPER AWASH	RIFT VALLEY
Maize and sesame	Maize for settler farmer consumption only.	Maize; Tobacco; Citrus; Banana; Kinaf.	None
Not applicable	Not applicable	Not applicable	Not applicable
Not applicable	Not applicable	Prices paid are fixed by the Government for the different grades.	For the last three seasons 110.65 Birr per quintal of raw cotton; price determined by Government agency for 1.1 '82 inches staple length which is taken as representative of unclassified cottons.
No information	Lint: Birr 279.8 - 324.25 per 100 kg. Cotton seed: All, Birr 17 - 21 per 100 kg.	Contracts made on basis of Government fixed prices. Crop sold as raw cotton.	Crop sold as raw cotton to textile mills who have it ginned. Contracts made on basis of Government fixed prices.
Addis Ababa, the Corporation does not have its own ginnery.	The Corporation does not have its own ginnery. Farms in the lower awash use the Tendaho gin at Dubte. Those in Gewane and Amibara use the Adey Alaka and Shoa gins at Addis Ababa.	The Corporation does not have its own gins. Production area served by ginnery 200 km away. No location given.	The Corporation does not have its own gins. Those used are in the Addis Ababa area.
Farm managers have been given short training courses with good results. Fertilisers are introduced 5-6 years after the land is first cultivated. No definite results is yet apparent. To protect the plant from pests and deceases seed is treated with H_2SO_4 and seed dressing. Scouting procedures have been adopted to identify the pest situation and the spraying schedule.	Farm layout is being improved including engineering work, levelling and canal construction. Maize planting before cotton has had the effect of depressing weeds and most common cotton pests. An increase in the use of fertiliser is planned.	Attempting to improve cultural practice by introducing pre-plant irrigation systems.	The use of fertiliser will continue to be increased as long as positive results are obtained. Plant protection measures are being adopted and will eventually be employed throughout the cotton growing area. Cultural practises were inadequate but effort is being put into their improvement by training the labour. Pre-plant irrigation has been demonstrated to the labour force as part of programme to change from traditional practise to a more scientifically based one. *Training now given in* (a) time of irrigation (b) time of ploughing, discing etc. (c) use of modern cultivating equipment. (d) field sanitation. (e) right picking time, work also being done on improved field layout, levelling, and the construction of dykes and channels to protect farms against flood danger.

TABLE 10/2

REPLIES TO COTTON GIN QUESTIONNAIRES

Name and location of ginnery	TENDAHO DUBTE	KALITI ADDIS ABABA	PROGRESS (IDGET) ADDIS ABABA	ADEI ABEBA ADDIS ABABA
Facilities for storing seed cotton	None, seed fed to gin on arrival	Covered store	Stored in two cellars for 24 hrs	No problem?
Description of facilities for drying cotton.	None	None	None	Not clear
Description of cleaning machines	See process floor below	1 inclined cleaner 1 vertical cleaner installed 1975. Maker Continental Moss-Gordon Gin, Co.	Regal feeders above the gins service as cleaning machines	Attached with fans and gravity
Description of extracting machines	Suction-separator —vaccuum wheel- -Distributor-Extractor-Gin- -Condenser (clean)-Press	None	No information	No information
Description of gins	Platt-Lummus-88 saw Imperial Gin-8S saw	Brush gin Continental Moss-Gordon Gin Co. Installed 1975	Murray & Hardwicke, 120 saw gins	Saw gins
Number of gin stands	8	2	2	2
Age of gins	Platt-Lummus- 2-17 years " " 2-15 years Imperial 4-5 years	4 years	10 + years	9 years and 6 years
H.P. per gin stand	Platt-Lummus - 40 H.P. Imperial - 50 H.P.	75 H.P.	30 H.P.	70 H.P.
Type of fuel used	Gas oil	Mains electricity	No information given	Oil
Description of press	Double box press, (20 inch x 41 inch) with tramper	Hydraulic press Continental Moss-Gordon	Hardwicke - Eter (20 inch x 42 inch) Box standard and Hi-density press	No information given
Dimensions and weight of bale	105 cm x 83 cm x 53 cm 195 kg	105 cm x 90 cm x 51 cm 179 kg	104 cm x 52 cm x 96 cm 165 kg	1.1 m^3 205 kg
Facilities for storing bales	In open yard on wooden planks raised off the ground	Covered store of adequate size	Storage capacity is inadequate. Bales left in open at peak periods	Inadequate space due to building work in progress.

1./2

TABLE (continued)

	TENDAHO DUBTE	KALITI ADDIS ABABA	PROGRESS (IDGET) ADDIS ABABA	ADEI ABEBA ADDIS ABABA
Working hours of ginnery				
per day	16	16	24	24
per week	96	96	144	144
per year	2304	4400	4032	6000
Months of year in which ginnery operates	December to May inclusive	All months of the year	December to June inclusive	December to September inclusive
Throughput of bales per season:	Own crop: 35,000 - 40,000 Farmers: 12,000 - 15,000	No information given	Up to 100,000 quintals (Note: This represents 55,866 bales or 179 kg)	Variable
Ginnery out-turn				
Good season %	36.73	No information	95% Note: The question	1st pick 34-35%
bad season %	33.42	No information	93% question has not	2nd pick 32-34%
average %	35.23	33%	94% been understood	3rd pick 30-32%
Average waste %	1.41	2.0	5.0	Good season: 2.0 Bad season: 4.0 Average: 3.0
Average yield of linters as percent of seedcotton	0.50	10.0?	Nil	No information given
Average yield of cotton seed as percent of seed cotton	63.36	62.0	Nil	64%
Use to which cotton seed is put.	Processing of edible oil.	Oil mills	Used for processing oil and soap	Not known
Percent of seed retained for planting	1.70	None	Nil	Not known
Treatment given to seed before issue for planting	Machine and acid de-linting	None	Nil	Not known
Prices obtained for	Averages			
lint	3.10 Birn per kg	Internal mill consumption	Internal mill consumption	Variable - see
linters	0.58 Birn per kg	" "	" "	Ministry of Commerce
cotton seed not for planting	17-20 Birn per quintal	17-20 Birn per quintal	19 Birn per quintal	
cotton seed for planting	1.00 Birn per kg	None	None	
Growing areas served by ginnery	70 km radius of Dubte	Upper awash Lower awash Middle awash	Nil	No information given

1 /2

TABLE (continued)

Name and location at ginnery	TENDAHO DUBTE	KALITI ADDIS ABABA	PROGRESS (IDGET) ADDIS ABABA	ADEI ABEBE ADDIS ABABA
Market for lint - type of customers and quantities purchased.	Domestic textile mill - 66,250 quintals, Export - 9,750 quintals	Internal consumption	Nil	Textile manufacturers
Transport problem - bale to users	None	None	None	None
Location of spinning mills supplied	Addis Ababa Asmara, Bahir Dar Dire Dawa	6 km (akaki)	Within the country	Adei Abebe Asmara, Bahir Dar Dire Dawa
Facilities for storing cotton bales at ports (export and import)	Open and closed stores available at Assab	Not known	Not known	Not known
Location of ports	Assab	Nil	Nil	Assab and Masawa
Transport facilities, ginnery to port - adequacy of	Adequate rental Transport available	Nil	Nil	Nil

11.0 QUALITY OF PRODUCTION

11.1 General

A satisfactory level or quality is generally regarded as that which is acceptable to the customer. Most of the products of the N.T.C. are easily sold which implies that the quality achieved is satisfactory. There is a general shortage of textiles in Ethiopia and in those circumstances the level or quality demanded by the puchaser is reduced. However, for some particular products for which there are alternative sources of supply the customer is more discriminating; examples are printed fabrics, dyed polyester/cellulosic fabrics, sweaters and some other garments of cotton knit fabrics.

The quality of the N.T.C. produced articles is compared unfavourably with the imported alternative in the case of fabrics, and the cottage industry product in the case of sweaters. Dyed polyester/cellulosic fabrics produced at Dire Dawa are criticized for their lack of colour fastness, and are particularly prone to light fading. Print fabrics are rejected for poor printing technique and unattractive designs, whilst sweaters are difficult to sell because they are produced in styles which are out of fashion. Thus, the criticisms of the quality standards of N.T.C. products are due to poor productive techniques and to the aesthetic aspects as represented in the design of patterns and the style of garments.

Production techniques can be improved by observing good working practices. The provision of satisfactory designs and styles which are competitive in quality and price with the imported or cottage industry products is a much more difficult problem to overcome. Not only must the designs and styles be attractive <u>and</u> price competitive, but they must be provided in wide variety and this is a major difficulty for the comparatively small Ethiopian textile industry serving the small Ethiopian market. Most important fabrics come from countries with large textile industries with extensive export markets.

Their production runs are long, giving low production costs and the opportunity to achieve high quality standards. They are able to make up export consignments containing a variety of fabric designs chosen from their total export range. For the N.T.C. to match the variety of designs offered by importers would involve uneconomically short production runs with comparatively low standards of quality in the product.

To enable the N.T.C. to compete successfully with imports it is first necessary to carry out a detailed survey of the market in apparel and household textiles. From the results of the survey it will be possible to define those products which give the N.T.C. suitable competitive opportunities in terms of production runs, design and quality.

11.2 Production Quality of Yarn and Fabric

The quality of the yarn and fabric has been dealt with in some detail in the reports on the individual mills. Standards vary between individual mills but the general impression is that there is considerable scope for improvement throughout. The causes of poor quality are badly maintained machinery, a lack of quality awareness by workers, usually due to inadequate training, and a lack of quality control procedures and testing facilities in the mills.

The chief defect in quality standards are as follows:

Yarn: Irregularity; weak places, neps

Loomstate cloth: Broken picks; starting places; broken warp threads; soiling

Finished cloth; Shade variation, poor colour fastness, off-register printing.

A number of textile samples from the N.T.C. mills have been tested at the Shirley Institute. The spinning sample results have been compared with those published by Uster, under the title 'Uster Statistics'. This publication contains the statistical distribution of world wide test results on cotton sliver, rovings and yarn.

Fabric and medical cotton wool samples have been tested against appropriate British Standards. A summary of the results is given below the detailed results including fabric samples after rubbing tests will be provided to the N.T.C.

11.2.1 Slivers and Rovings

Evenness tests were carried out on the Uster II Evenness Tester. Material speed was 8 metres per minute and the test duration five minutes.

All the samples showed a degree of irregularity worse than the averages in the Uster Statistics, whilst most were in the lowest 5%, i.e. 95% of the test results embodied in the Uster Statistics were better than the results for our samples.

11.2.2 Yarns

In the count of 'thin places' and'imperfections' most yarns gave good results. They tend to be less good, however, in respect of 'thick places' and 'neps'. The courser yarns were better than the finer yarns.

All the yarns were strong and most gave strength results (breaking load), beyond the good end of the range covered by the Uster Statistics. Extensibility was less good with only three samples giving results better than average; these were samples 36, 37, and 38. There was a tendency for the finer yarns to be worse than the coarse.

Yarns were tested for count variation and all showed excessive variation around the nominal count. The results obtained lie at the poorer end of the Uster Statistics range.

11.2.3 Fabrics

Tests were carried out for strength, dimensional stability, and colour fastness. Tensile and tear strength tests were conducted on the woven fabrics and bursting strength tests on the knitted. With regard to the strength aspects, none of the fabrics are particularly weak and would, we think, possess sufficient strength for the apparel and household textile end-uses envisaged. However, we would suggest that fabrics 2, 4, and 10 be restricted to shirts, dresses, and lighter use, also that the Denim (Fabric 15) be regarded as a fashion rather than a workwear type.

The biggest failure of these fabrics in the mechanical sense is their dimensional stability. For apparel end-uses we would suggest that 2% (or 3% in some cases) is about the most that would be tolerated with the woven fabrics, and many of the samples exceed this in at least one direction. With knitted fabric a higher shrinkage can be tolerated since such fabrics can often be pulled out again after washing, but even so the dimensional changes shown by fabrics 7 and 8 seem excessive.

Conclusions Regarding Fabrics

Taking the results of the tests overall, we would say that with the fabrics the factors most suspect are the dyeing and finishing. Better selection of dyestuffs to give improved colour fastness is needed, as is also better control of finishing tensions to minimum shrinkage; even Fabric 1 which is said to be Sanforised gives a warp shrinkage higher than the 1% we would expect for an effectively fully-shrunk cloth.

11.3 Quality Improvement

Improvement of quality within the N.T.C. factories is an urgent and large task. The causes of the existing low standards of quality are numerous and affect every processing department in every mill. Some mills are better than others but none achieves a quality level of output that could be considered as satisfactory. Amongst operatives there is a lack of awareness of the importance of quality in their output which is attributable to inadequate basic training, inadequate supervision and inspection, and a near absence of standards. Where direct workers are paid on a production incentives system, quality is sacrificed for output with little attempt at corrective measures by the management. Poor machine maintenance and a lack of spare parts is another contributory cause of   quality in most production departments.

A significant and permanent improvement in quality can only be brought about by a wide-scale improvement in every aspect of production management. The essential first steps include the employment of larger numbers of trained and proficient technical managers; the upgrading of the skills of direct workers' by organised training programmes instituted within the mills, and the establishment in mills of quality control departments with responsibility for monitoring the quality of production and the performance of production machines.

The setting up of quality control departments is the most important single step that the N.T.C. can take in a programme of quality improvement. Each quality control department should be headed by a qualified textile engineer who has received specialised training in quality control for the textile industry. Whilst his direct responsibility is to the general manager at the mill, he is also responsible for the provision of regular reports on quality monitoring to the heads of all the production departments. In addition, he will be expected to issue standards for waste percentages, for yields, and for establishing the optimum speed of machines in relation to quality. In these latter functions the quality control department will be expected to work in conjunction with the production control and maintenance departments.

There is not space here to deal with all the responsibilities and test procedures of an effective quality control department, but the following is a list of the main function and activities of such a department:

1. Performance of tests and inspections at strategic points, from raw materials through finished product, in order to detect any faulty conditions at the source and as soon as they arise.

2. Maintenance and statistical control charts, where considered advisable, as an aid in detecting trends towards 'out-of-control' conditions before actual unsatisfactory product makes its appearance.

3. Establishment of proper production levels, which will combine machine efficiency with product quality.

4. Checking upon maintenance of efficiency levels, through analysis of machine downtime records. Low machine efficiency may indicate excessive stoppage due to end breaks, which in turn may be caused by unsatisfactory processing of stock.

5. Establishment of proper waste standards and controls. In many departments, low waste goes hand in hand with higher quality. In other departments, such as combing either high or low waste indicates faulty machine setting, since removal of predetermined waste percentages is essential to uniform quality and costs.

6. Keeping regular machine maintenance and overhaul schedules, essential to good production and quality.

7. Controlling production poundages. This means that the weights produced in each department, as determined from counters, clock readings or actual weighings, should be com red. After adjustments for waste, moisture and in-progress inventories, the totals for one department should agree with those for the next department in the various stages of processing.

TABLE 11/1

RESULTS OF FABRIC TESTS

Fabric No.	Strength Tests Tensile (kg/5 cm) on Woven Fabrics		Tear (kg)		Bursting on Knitteds	* Dimensional Stability on Washing	
	Warp	Weft	Through Warp	Through Weft	lb/sq.in.	Warp or Wale-way	Weft or Coarse-way
1	168	103	2.0	2.3	–	– 1.5	–3.5
2	64	31	1.0	0.8	–	– 2.5	–4.9
3	124	52	3.6	2.9	–	– 1.5	–0.8
4	76	35	1.0	0.7	–	+ 0.6	–2.0
5	118	86	2.7	3.5	–	– 2.1	+2.5
6	–	–	–	–	118	– 7.1	–9.6
7	–	–	–	–	108	–14.3	+25.5
8	–	–	–	–	121	–14.0	+9.3
9	–	–	–	–	108	– 9.2	–6.6
10	61	44	3.3	2.1	–	–12.0	–9.5
11	177	63	3.8	3.5	–	– 5.9	–1.5
12	100	79	2.1	2.3	–	– 8.7	–0.8
13	146	79	2.6	5.3	–	– 4.9	–1.3
14	107	43	3.9	4.3	–	– 3.8	+4.9
15	163	84	4.6	4.0	–	– 9.7	–0.2

*– = shrinkage
 + = extension

Additional tests   Sample 5 identified as all cotton

Sample 13 Warp R36.0/2 tex, R16.4/2 cotton cts.
Weft R44.8/2 tex, R13.2/2 cotton cts.
(R denotes resultant count)

TABLE 11/2

SPINNING MILL SAMPLES RECEIVED FOR TESTING

Sample No.	Description			Mill
1	Card 'T' sliver	-	polyester	T.M.D.D.
2	Card 'B' sliver	-	cotton	"
3	Card 'A' sliver	-	cotton	"
4	Card 'Ap sliver	-	cotton	"
5	Vonnel V138 PD3 sliver			"
6	Drawing 2nd passage 'A'	-	cotton	"
7	Drawing 3rd passage	-	Tetron/cotton	"
8	Roving 'A' 0.83	-	cotton	"
9	Roving 'A' 0.83	-	cotton	"
10	Roving Vonnel V138	-	acrylic	"
11	Roving 'A' 1.38	-	cotton	"
12	Roving 'A' 1.38	-	cotton	"
13	Roving 1.38	-	Tetron/cotton	"
14	Roving 1.38	-	Tetron/cotton	"
15	Card sliver	-	cotton	Ethiopian Fabrics
16	Roving-draw frame, 1st pass			"
17	Roving-draw frame 2nd pass			"
18	Speed-frame roving 0.80			"
19	Ring tubes - 2 each of count Ne 9^s, 12^s, 16^s, 24^s, 30^s, $30/2^s$			"
20	Extra 'A' card sliver			Asmara Textile Mills
21	Extra 'B' card sliver			"
22	Extra 'A' 1st pass drawing after combing			"
23	Extra 'A' 2nd pass drawing			"
24	Extra 'B' 1st pass drawing			"
25	Extra 'B' 2nd pass drawing			"
26	2 roving bobbins, Extra 'A' combed			"
27	2 roving bobbins, Extra 'B' carded			"
28	10 ring bobbins, Extra 'B' carded 24^s Ne			"
29	10 ring bobbins, Extra 'A' combed 60^sNe			"
30	Card sliver for count 20^s Ne			Mill 'X' *
31	Comber sliver			"
32	Card sliver 0.120			"
33	Drawing - 1st pass			"
34	Drawing - 2nd pass			"
35	2 roving bobbins			"
36	10 ring bobbins - count 32^s Ne			"
37	10 ring bobbins - count 20^s Ne			"
38	10 ring bobbins - count 24^s Ne			"

* Identity of mill not given

TABLE 11/3

Sample No.	Description	Mill
1	Sanforized army twill - cotton	T.M.D.D.
2	Dyed broad - cotton	"
3	Polyester/cotton twill -	"
4	Polyester/cotton broad - printed	"
5	French twill -printed - cotton	"
6	Warp knit, 'Z' stripe - cotton	Eth. Text. Ind.
7	Weft knit, 2/2 rib - cotton	"
8	Weft knit, 1/1 rib - cotton	"
9	Weft knit, 2/2 rib - cotton	Asm. Text. Mills
10	Loomstate plain weave - cotton, 44/36,	Ethiopian Fabric
11	Blue twill - A-18, cotton	"
12	Tropical suiting F.43 - cotton	"
13	Drill - cotton $2/32^s$ / $2/26^s$	"
14	Blue french twill - D26	"
15	Denim J - 38	"

12.0 EFFLUENT DISPOSAL AND TREATMENT

12.1 Several of the Mills visited during the Survey reported that the Local Authority in the area, exercised some degree of control on the quality of effluent discharged. Generally however, there was no evidence that this had been specified, in quantifiable terms, at the factory level.

Only in one reported instance (AKAKI), had the Local Authority complained of effluent discharges. In this particular case, inadequately treated effluent had been discharged into the nearby river, the water of which was used by downstream communities for domestic purposes.

The main methods of effluent disposal encountered were:

(a) Direct to river.

(b) Direct to main town sewers.

(c) By evaporation and seepage.

- Several of the units visited effected partial treatment prior to discharge, mainly by the use of settling tanks, thereby reducing the suspended solids content, and allowing for pH correction.

It is now apparent, that the Ministry of Health, Division of Environmental Health, has issued specifications for the condition of industrial treated waste water as follows:

Component of Quality	Unit	Max. permissible conc. in discharged waste water before entering receiving watercourse
B.O.D.5 day	mg/l	30
C.O.D.^{2}	mg/l	90
Total dissolved solids 110°C	mg/l	1000
Suspended solids	mg/l	40
Chromium (III)	mg/l	2.0
Chromium (VI)	mg/l	0.1
Iron	mg/l	1.0
Phenole	mg/l	0.2
Oil or grease	mg/l	20
pH	-	6.5 - 8.5
Cyanide	mg/l	0.1
$N(NH_4)$	mg/l	5.0
H_2S	mg/l	0.5
Free chlorine	mg/l	0.5
Temperature	°C	30 - 35

The quality requirements normally defined are those for B.O.D.5., Suspended Solids and pH. In respect of these, the Ministry of Health figures quoted are fairly common to those encountered in W.Europe. Typical figures quoted in the U.K. are:

	Unit	Ethiopian Min.of Health	U.K.-Commonly Quoted
B.OD.5 day	mg/l	30	20
Suspended Solids	mg/l	40	30
pH		6.5/8.5	6.0/9.0

Figures for C.O.D. are not normally specified.

The control of pH, removal of B.O.D. and Suspended Solids can be achieved by a two stage process consisting of Biological treatment (percolating filtration/biological sludge) preceded by flow balancing and neutralisation. A common treatment sequence being:

PRIMARY TREATMENT - Screening.
Mixing - with pH adjustment.
Balancing.

SECONDARY TREATMENT - Biological Filtration/Aeration.
Final sedimentation.

Such treatment is normally employed to meet the quality requirements for B.O.D., Suspended Solids and pH quoted above. This treatment however, cannot be guaranteed to reduce the C.O.D. or Total Dissolved Solids from which, it will be appreciated that it is not possible to give precise capital costs without a detailed knowledge of the situation at each of the production units concerned. A broad guide to capital and running costs for individual production units may be gained from the following table; the above factors having been taken into consideration.

	Capital Cost Per m^3, handling capacity/hour. U.S. Dollars	Running Cost Per m^3, handling capacity/hour. U.S. Dollars
PRIMARY TREATMENT	2,000	0.06
SECONDARY TREATMENT	6,000	0.15
TERTIARY TREATMENT	4,000	0.25

The capital cost of introducing such treatment systems to existing N.T.C. production units would be exceedingly high, and probably prove to be an intolerable financial burden to the production unit. It is therefore recommended that compliance to the Ministry of Health's requirements should be approached in programmed stages, over a period of time, consistent with economic capability and other government environmental development schemes having a bearing on this issue.

12.2 Effluent Treatment Plant

12.2.1 Preparation of Effluent for Treatment

As much as 75% of the waste flow is composed of comparatively clean water. This water should be segregated from the more concentrated wastes for direct discharge to the drains or river. Some may be used for the dilution of more concentrated wastes; the quantities and methods involved are a matter for individual mill study.

Wastes containing large amounts of acid or alkali may be diluted with other mill wastes. Small amounts of acid may be neutralized by the natural alkalinity of the water, or by chemicals added in the treatment process. Excess alkali above that producing a pH of 9.0 to 9.5 should be removed prior to treatment because the usual coagulant is dissolved by excessive caustic.

Dye waste should be decolorized prior to treatment. This may be done by mixing the dye waste with the bleaching waste prior to treatment. Where the bleaching waste is absent or insufficient the addition of chloride of lime to the dye waste will normally have the desired effect.

12.2.2 Primary Treatment

Primary treatment of the effluent consists of equalization of the waste, coagulation with chemicals, sedimentation, sludge removal and drying, and final disposal of the sludge. For mills of the size of those in Ethiopia where the finishing works are processing upwards of ten million metres of cloth per year, the continuous flow method of treatment is recommended. The principle components of such a plant are:

1. Equalization tank
2. Mixing trough with lime feed machine and ferric chloride orifice box
3. Coagulation tank
4. Settling tank
5. Sludge beds

The equalization tank should have a capacity of at least three hours maximum flow of effluent. The tank is of concrete and has a drain line connected to the sludge pump line running from the settling tank to the sludge beds.

Perforated-pipe aerators are installed in the equalization tank and are connected to an air compressor. The air requirement is 0.5 cu.ft. per gallon of effluent.

The waste is pumped from the equalization tank to a mixing trough where the chemicals are added. From there it enters the bottom of the coagulation tank which has a capacity detention period of approximately 20 minutes.

From the coagulating tank the waste passes through large holes in the dividing wall with the settling tank which should be equipped with a sludge collecting device. The capacity of the settling tank should be sufficient to provide a $1\frac{1}{2}$ hour detention period for maximum flow. The sludge may be gravity drawn or pumped to sludge beds for drying.

The capacities of the various tanks for continuous flow treatment of effluent is given by the following table:

CAPACITY AND DIMENSION OF TANKS FOR CONTINUOUS-FLOW TREATMENT OF TEXTILE WASTES

Rate of flow of waste gal.per hr.	Equalizing				Coagulation				Settling			
	Capacity cu.ft.	Width ft.*	Length ft.*	Average water depth ft.*	Capacity cu.ft.	Width ft.*	Length ft.*	Average water depth ft.*	Capacity cu.ft.	Width ft.*	Length ft.*	Average water depth ft.*
5000	2 000	11	36	5	220	7	7	5	1 000	7	29	5
10000	4 000	14	46	6	440	9	9	6	2 000	9	37	6
15000	6000	18	56	6	660	11	11	6	3000	11	45	6
20000	8000	18	63	7	880	11	11	7	4 000	11	52	7
25000	10000	19	64	8	1 100	12	12	8	5000	12	52	8
30000	12000	21	70	8	1 320	13	13	8	6000	13	57	8

* Inside dimensions

12.2.3 Sludge Drying and Disposal

The method used for sludge drying and disposal must be determined in the light of local conditions, e.g. extent of rainfall; availability of land, proximity to human habitation etc.

A common method adopted involves the use of sludge beds. A typical sludge drying bed consists of a lower layer of 6-12 inches of coarse gravel in which are laid the under-drain lines of 6 to 8 inch diameter tiles, the lines spaced 6 to 10 feet apart. An upper layer of 6 to 18 inches of sharp sand is laid over the gravel. Sludge is pumped from the settling tank to the beds which are filled to a depth of about 12 inches. The sludge is left on the bed until the water content is reduced to below 90% when it can be removed by shovel. In good drying weather sludge may be removed in ten days. The sludge bed area required per 1 000 gallons of effluent treated is approximately 4 square feet for each day required for drying.

The dried sludge has no value and can only be used for in-filling.

12.2.4 Secondary Treatment

The primary treatment described above will reduce the suspended solids by about 50%, and the B.O.D. by about 30%. To achieve the standards laid down by the Ethiopian Ministry of Health, i.e. B.O.D. 30; suspended solids 40; pH 6.5/8.5, it will be necessary to introduce a secondary treatment of the wastes, based upon a biological filter.

The filter is composed of a circular bed of stones supported by a proper under-drainage system. The waste from the primary settling tank is applied to the filter by a rotary distributor. The depth of filter stones should be six feet and they should be of hard granite gravel or crushed rock with a size varying between $2\frac{1}{2}$ and $3\frac{1}{2}$ inches in diameter. The area of the filter is determined by the B.O.D. load to be applied, or approximately 17 square feet of filter surface per pound of B.O.D. with a standard depth of six feet.

After biological filtration the waste passed through a secondary settlement tank of similar design to that described above for the primary settlement. The detention period is one hour, average water depth six feet and width about 25% of the length. The sludge from this tank is pumped back to the raw waste as it enters the mixing trough, and is treated with the sludge from the primary process. The liquid effluent may be discharged directly to the river or the municipal drainage system.

13.0 Manufacturing Costs

General

Manufacturing costs have been analysed as far as the data available permits. For most products there are omissions of detail which present difficulties in arriving at conclusions on the cost patterns of those products.

Given below is a cost analysis for three counts of cotton yarn produced in Hong Kong, Japan and Pakistan. For comparison, estimates of the cotton and conversion costs are given for counts 20^s and 32^s produced at Akaki and Dire Dawa, and for count 20^s only produced at Ethiofil.

Weaving and dyeing and finishing costs are also compared for fabrics of close though not identical constructions. They are plain weave sheeting type fabrics all with count 20^s warp and weft.

13.1 Yarn Cost Comparisons

Yarn production costs in US cents per kilo are shown in Table 13/1 for carded counts Ne 20^s, 32^s and combed 50^s, for three major Asiatic exporting countries. The costs quoted are for yarn on cone.

Cotton costs:

Cost of raw cotton delivered to the mill and includes allowances for all process waste during the course of manufacture into yarn.

Labour costs:

The actual cost of all labour from bale opening to cone winding, (excludes maintenance labour). Process supervisors are included but not mill management. The labour cost is for direct and indirect workers and includes fringe benefits.

Manufacturing supplies:

The actual cost of all supplies for maintenance work, (oil, card clothing, rolls etc.) and includes the labour cost of maintenance and workshop personnel.

Mill overhead:

This includes the cost of steam, electricity, operating expenses and mill management.

Depreciation:

Depreciation costs are based upon the allowances given in the respective countries.

Selling expense:

An average of 4% of conversion costs plus the cost of cotton.

Admin. and Finance:

An average of 4½% of the conversion costs plus the cost of cotton.

The costs of cotton for the Hong Kong and Japanese yarns are based on the prices of American cottons of the staple lengths shown in the Table, except for the Japanese combed 50^s which is a long staple Pima. The cottons used by the Pakistan mills are Punjab cottons; they are of a lower price than the American cottons and, together with the low labour cost in Pakistan provide that country with a cost advantage over their competitors.

Cost comparisons are made with Ethiopian counts 20^s and 32^s in Table 13/2. The Ethiopian cost figures are based on the information provided by the three mills, Dire Dawa, Akaki and Ethiofil. Conversion costs for those mills are expressed as a total figure because the information is not available to analyse it into the categories shown for the foreign mills. It has been assumed that the Ethiopian conversion figures provided are made up of those items listed as conversion costs for the foreign mills, i.e. labour; manufacturing supplies; mill overhead and depreciation.

For Dire Dawa two cost estimates are given for count 20^s. The first, (column (a)), is derived from the Dire Dawa figures of:

20^s	Material cost per kg	4.17 Birr
	Other conversion costs (kg)	1.06 Birr

The second cost estimate (column (b)), is based upon the Dire Dawa figure for $20^s/2$, viz.

Material cost per kg	3.42 Birr
Other conversion costs (kg)	0.76 Birr.

Thus, the second set of costs are for a two-fold yarn, i.e., doubled, but the conversion cost is lower than that for the singles. Whilst the explanation for the difference in material costs is probably due to the use of a better quality cotton in the singles yarn, no explanation can be offered for the difference in the conversion costs.

Two costs are also shown for 20^s produced at Akaki, one for weft and one for warp. The figures for both yarns are close with a difference of less than two cents per kg in the totals.

A higher figure is shown for 20^s produced at the Ethiofil mill. This is due to the higher cost of the cotton, i.e. 203 cents/kg compared with 177 cents/kg for Akaki.

The totals for the Ethiopian produced count 20^s are considerably lower than the Hong Kong and Japanese costs. Where the lower priced cotton is used, as at Akaki the Ethiopian costs are comparable with the Pakistan figures. The conversion costs themselves are similar for Ethiopia and Pakistan.

For count 32^s the cost of production at Dire Dawa and Akaki are considerably below the figures for the foreign mills quoted in Table 13/2. The lower cost of the Ethiopian cotton is the chief reason for the difference though conversion costs are lower also, particularly at Dire Dawa. The values for Dire Dawa are derived from the figures provided for $32^s/2$ by subtracting an estimate of the cost of doubling.

13.2 Weaving Cost Comparisons

The comparisons are provided for a sheeting type fabric with count 20^s warp and weft. Manufacturing costs are given in Table 13/3 for fabrics made in Hong Kong and Pakistan, and two fabrics produced at Akaki and Dire Dawa.

The Hong Kong and Pakistan fabrics are similar in construction, i.e. count 20^s Ne warp and weft, 60 ends and picks per inch. They differ in width but the costs of production are shown in the Table per square metre.

The Akaki fabric is Calico 145, with 20^s warp and weft, 62 ends and 56 picks per inch. This fabric is lighter in weight than the two foreign cloths, i.e. 141 g/m^2 against 156 g/m^2. In the Table yarn costs are given for the actual construction, and for a yarn weight adjusted to 156 g/m^2. The manufacturing cost given in the Table does not include finishing costs for the cloth is sold loomstate. The manufacturing cost was obtained by subtracting from the grey room unit value the cost of the coned yarn, the difference accounting for all the costs of conversion of yarn into fabric.

The Dire Dawa cloth is a 62½'' wide bed sheeting with 20^s warp and weft, 64 ends and 53 picks per inch. The weight per square metre is almost identical to the foreign fabrics at 158 g/m^2. The manufacturing cost includes yarn at the higher of the two costs quoted for 20^s in Table 13/2, and dyeing and finishing costs in addition to the costs of weaving and weaving preparation.

Whilst the detailed costings are not available for the Ethiopian fabrics the total manufacturing cost made up of yarn costs and conversion costs is felt to be reasonably accurcte. In making comparisons with the foreign costings the differences in the construction should be borne in mind, particularly the lower numbers of picks per inch in the two Ethiopian fabrics, a difference of four picks in one case and seven in the other. The effect of these differences will be to reduce the total manufacturing costs by approximately 3.5% in the case of the Akaki fabric, and slightly under 2% for the Dire Dawa fabric.

The overall conclusion is that the two Ethiopian fabrics have lower production costs than either of the two foreign fabrics shown in the Table, and this in spite of the cost of the cotton used in the Dire Dawa yarn being higher than that used in the Pakistan cloth.

TABLE 13/1

Yarn Production Costs in US Cents/Kg (1979)

Hong Kong

	20^s Carded	32^s Carded	50^s Carded
Cotton cost	236.0 (15/16")	258.0 (1 1/16")	279.0 (1 3/16")
Labour	38.3	54.7	65.8
Manf. supplies	4.1	6.2	12.3
Mill o/head	7.5	11.4	22.2
Depreciation	8.1	12.6	24.1
Sub-total	294.0	342.9	403.4
Selling	11.8	13.7	16.1
Admin. and Finance	13.2	15.4	18.2
Total	319.0	372.0	437.7

Japan

	20^s Carded	32^s Carded	50^s Carded
Cotton cost	239 (1")	258 (1 1/16")	332 (1 9/16")
Labour	67.4	86.7	146.0
Manf. supplies	4.0	6.7	9.7
Mill o/head	8.8	10.4	14.6
Depreciation	6.7	8.7	10.4
Sub-total	325.9	370.5	512.7
Selling	13.0	14.8	20.5
Admin. and Finance	14.7	16.7	23.1
Total	353.6	402.0	556.3

Pakistan

	20^s Carded	32^s Carded	50^s Carded
Cotton cost	178 (29/32")	221 (1 1/16")	254 (1 1/16")
Labour	22.5	32.0	57.5
Manf. supplies	4.6	8.2	18.5
Mill o/head	13.5	24.7	55.1
Depreciation	13.2	23.5	53.0
Sub-total	231.8	309.4	438.1
Selling	9.3	12.4	17.5
Admin. and Finance	10.4	13.9	19.7
Total	251.5	335.7	475.3

TABLE 13/2

Cotton and Conversion Costs in US Cents/Kg (2)

	Hong Kong	Japan	Pakistan	Dire Dawa (a)	Dire Dawa (b)	Akaki Warp	Akaki Weft	Ethiofil
Count Ne 20^s Carded								
Cotton cost	236.0	239.0	178.0	208.5	171.0	177.5	177.0	203.0
Conversion costs								
Labour	38.3	67.4	22.5					
Manf. supplies	4.1	4.0	4.6					
Mill of head	7.5	8.8	13.5					
Depreciation	8.1	6.7	13.2					
Sub-total	58.0	86.9	53.8	53.0	38.0(1)	51.6	50.2	53.0
Total cost	294.0	325.9	231.8	261.5	209.0	229.1	227.2	256.0
Count Ne 32^s Carded								
Cotton cost	258.0	258.0	221.0	171.0		190.2		
Conversion costs								
Labour	54.7	86.7	32.0					
Manf. supplies	6.2	6.7	8.2					
Mill of head	11.4	10.4	24.7					
Depreciation	12.6	8.7	23.5					
Sub-total	84.9	112.5	88.4	45.0		75.8		
Total cost	342.9	370.5	309.4	216.0		266.0		

Note (1) Conversion cost is for 20/2^s and will include doubling costs.
(2) Ethiopian Birr converted to US $ at rate of 2 Birr = 1 US $

TABLE 13/3

Comparative Costs of Cotton Sheeting - US Cents

	Hong Kong		Pakistan		Akaki		Dire Dawa	
Warp/Weft Ne	20 x 20		20 x 20		20 x 20		20 x 20	
Construction	60 x 60		60 x 60		62 x 56		64 x 53	
Cloth width	92''		38½''		42''		62½''	
Type of Loom	Automatic		Automatic		Automatic		Automatic	
Loom speed (ppm)	140		170		170		200	
Loom efficiency (%)	89		85		79		82	
Hours per loom/year	8664		7401		6840		7920	
Weight of yarn (gm)	335	156	140	156	138	141	229	158
Raw Materials	Per lin. yd.	Per M^2	Per lin. yd.	Per M^2	Per lin. yd.	Per M^2	Per lin. yd.	Per M^2
(i) Warp and weft	98.4	46.1	32.5	36.3	31.4	32.2 (35.5)	59.9	41.3
(ii) Size	1.7	0.8	0.9	1.0	} 23.6 (items (ii) Size to Depreciation)	} 24.2 (items (ii) Size to Depreciation)	} 24.2 (Size, Dyes and chemicals)	} 16.7 (Size, Dyes and chemicals)
(iii) Dyes and chemicals	9.4	4.4	5.1	5.7				
Labour Cost								
(i) Weaving	30.7	14.4	14.2	15.9			} 14.6 (Labour Cost to Depreciation)	} 10.0 (Labour Cost to Depreciation)
(ii) Dyeing and Finishing	12.1	5.7	2.6	2.9				
Manuf. Supplies	1.9	0.9	0.9	1.0				
Mill Overhead								
(i) Weaving	3.8	1.8	3.3	3.7				
(ii) Dyeing and Finishing	12.1	5.7	5.4	6.0				
Depreciation	3.3	1.5	2.1	2.3				
Total Manufacturing Cost	173.4	81.3	67.0	74.8	55.0	56.4 (59.7)	98.7	68.0

NOTES: 1. The figures in brackets for Akaki are the estimated costs if the yarn per M^2 was 156 gm and not the lighter weight of 141 gm.

2. The Ethiopian costs have been converted from Birr at the rate of 2 Birr = 1 US $.

14.0 LABOUR AND MACHINE PRODUCTIVITY

14.1 Spinning

Estimates of productivity are given in Table 14/1 for labour and machines.

14.1.1 Labour Productivity

The labour productivity values take into account all direct and indirect production labour from and including opening to spinning. Maintenance staff employed in those departments are also included.

Operative hours per 100 kg of yarn produced (OHK), are shown for each mill, together with the assessment of the average count produced. To provide means of comparison between the mills, and with similar indices obtained from other countries, the OHK value is also quoted for a nominal count 20^s Ne.

The OHK for nominal count 20^s varies between mills from 31 at Dire Dawa to 195 at Idget. Most of the other mills have values between 50 and 69.

The Dire Dawa OHK of 31 is better than the average for Kenya (36), and much better than the average for Pakistan (42). All the other mills performed unfavourably in comparison with the international indices quoted in the Table. Bahr Dar (50), was slightly better than the worst of the Kenya mills (51), and the Ethiopian Fabrics mill was at a similar OHK level with 51.

In the mill reports in Volume 11 a number of critical observations are made on the staffing of the Idget mill. The OHK figure of 195 is a measure of the level of overmanning in that mill.

Leaving aside the Idget mill, the general conclusion is that the N.T.C. spinning mills should aim to reduce their factory work force by an overall average of approximately 40%, to get the labour productivity up to a similar level of the average for Kenya.

Overmanning at the Idget mill is on a scale which merits special consideration by the N.T.C.

14.1.2 Machine Productivity

Machine productivity figures are given in section (B) of Table 14/1, for counts Ne 20^s and 32^s. These were chosen as common counts and for which international productivity values are available for comparison . Production per spindle per year is quoted, and the production per 1000 spindle/hours.

The production per spindle year is largely determined by the number of hours per year that the spindles are operated. Hence, for count 20^s a figure of 202.3 kg is achieved at Dire Dawa against 104.5 kg, at the Asmara Textile Mills. Of the various reasons for the difference the major one is hours worked, i.e. 7920 p.a. at Dire Dawa against 5865 at Asmara Textile Mills.

The figure for Bahr Dar is an estimate based upon the spindle rate of output of count Ne 21^s, adjusted to count 20^s.

In terms of production rates per 1000 spindle hours the figures for the Ethiopian Mills compare favourably with the international figures quoted. The Ethiopian mill figures have been calculated upon an assumed spindle efficiency of 85 % in the absence of an accurate assessment of efficiency from the mills themselves.

14.2 Weaving

14.2.1 Weaving Labour Productivity

Labour productivity in weaving has been expressed in units of man-hours per 100,000 m of weft inserted. This is approximately the length of weft woven by a loom in ten hours.

The labour taken into the calculation are those employed in all the weaving preparation processes, weaving itself and loom-state cloth inspection. Also included are the maintenance workers employed on the equipment in weaving and weaving preparation.

Results for the five weaving mills are given in Table 14/2, which also shows labour productivity figures for Kenya and other countries.

The productivity ratios are shown separately for automatic looms and non-automatic looms. In three of the N.T.C. mills, Bahr Dar, Akaki and Dire Dawa, numbers of automatic looms are being operated as non-automatics in the sense that the replenishment of the weft supply is done manually instead of automatically. At Akaki and Bahr Dar the weft replenishment mechanism has been removed from numbers of what were originally automatic looms, partly because of a shortage of spare parts, and partly because the loom mechanics have difficulty in repairing those particular mechanisms.

At Dire Dawa considerable mechanical trouble is experienced with the shuttle change mechanism of the Toyoda looms. The management estimate that at any one time, those mechanisms are out of action on 50% of the looms, necessitating manual shuttle changing to keep the looms running. The numbers of automatics being operated manually at all three mills is indicated in the Table.

The effect is to increase the man-hours per 100,000 m of weft inserted and this should be borne in mind in interpreting the data in the Table.

As in spinning, labour productivity in weaving is low by comparison with the levels achieved in other countries. The average figure for Kenya, for example is less than a half of the best of the Ethiopian Mills, i.e. weaving labour productivity in Kenya is more than twice as good as it is in Ethiopia.

14.2.2 Weaving - Machine Productivity

Loom productivity is expressed as its percentage efficiency, i.e.

$$\frac{100 \times \text{Actual running time}}{\text{Available working time}}$$

With the fabrics in production in the N.T.C. mills, an overall efficiency figure of 90% should be standard on automatic looms, and 80% on non-automatics. The latter figure is being achieved on the Kovo looms at Dire Dawa, where approximately 362 of 398 Kovo looms are employed on one cloth, thus providing the benefits of scale and specialisation.

Loom efficiencies are generally below this level, in spite of the low numbers of looms per weaver. The average for all five weaving mills is estimated at 76.3%

Whilst a 90% efficiency level obtains in many other countries with pirn change looms on plain cotton and twills, a lower target of 85% is recommended as being more feasible for the N.T.C. mills. For non-automatic looms, efficiencies of 75-80% may be considered feasible, unless there is near specialisation on a single product as in No. 2 mill, Dire Dawa, in which case a target of 80% plus should be sought.

14.3 Productivity Targets

Productivity targets should take account of both machine and labour productivity with the aim of achieving that balance of production factors which result in maximum production of the specified quality at minimum cost.

Machine productivity as measured by machine efficiency, i.e. the ratio of machine running time to total time available for work, can be maximised by increasing the numbers of workers, e.g. if the number of spindles per spinner is reduced from 1 000 to 500 the spindle efficiency will rise because ends down will be repaired more quickly. At the same time labour costs will rise and the increase in production obtained may be purchased by an unacceptable rise in total production costs. Optimisation of these production factors is the process of striking the balance which will yield minimum production costs at an acceptable quality level.

The relative importance of the factors may vary between very different products, e.g. plain weave fabrics and jacquard fabrics. Such differences can only be determined by a detailed cost study. For this reason the targets recommended below are general, but appropriate to the bulk of the N.T.C. production.

Recommended Productivity Targets

Spinning

Count	10s	20s	30s	40
Spindle Efficiency	87	89	90	91
OHK(1)	14	24	36	50

Weaving

	Automatic looms	Non-automatic
Loom efficiency	85 - 90	75 - 80
OHP(2)	3.20	6.50

(1) Operative hours per 100 kg of yarn

(2) Operative hours per 100 000 m of weft inserted.

14.4 Manning Levels

Detailed comment on particular job manning levels is not practicable because of the lack of detailed information on the work content of each operation. The mills are clearly overmanned and an estimate of 40% overmanning has been given above; but refers to a comparison with mills in Kenya which are themselves overmanned.

If the work loads of machine tenders, such as weavers and spinners etc., are considered on the basis of numbers of machines per operative, we find that operatives have half the machines of a Kenyan operative, for example, the average number of looms per weaver in No.5 mill at Dire Dawa was 10.8. Similar fabrics are woven in the better Kenya mills at 20 looms per weaver. On the face of it, it would appear that the Ethiopian weaver is working a half as hard as the Kenyan weaver but this is not necessarily true; indeed, it is almost certainly a wrong assumption. The work load of a machine attendant is determined by the frequency of the tasks they are required to perform. Thus, the main tasks of a weaver are the repair of warp and weft breaks, and the amount of work the weaver does depends upon the numbers of warp and weft breaks they repair each hour. Hence, a weaver tending ten looms on which there is an average of four warp and weft breaks per loom per hour will have a work load roughly similar to that of a weaver with 20 looms with an average of two warp and weft breaks per loom per hour.

In spinning the work load of the spinner is largely made up of the number of ends down repaired per hour on whatever number of spindles are tended; in cone-winding it is the frequency of loading, doffing and thread breaks that matter and not the number of spindles themselves.

No mill was able to provide reliable data on the frequency of tasks carried out by the direct operatives, and without that information no good estimate of the correct manning levels can be arrived at. The general conclusion, however, as stated before is that all the mills are overmanned to some extent. Work studies are required to assess the extent of the overmanning in particular jobs.

TABLE 14/1

Spinning Productivity

(A) Labour

Mill	Average Count Ne	OHK	OHK for Nominal 20s Ne
Adei Abebe	15.7	53	68
Akaki	17.7	54	61
Kalitti	16.6	54	65
Idget	10.2	99	195
Asmara Textile Mills	22.1	76	69
Ethio-Fil.	20.2	83	83
Ethiopian Fabrics	21.2	54	51
Bahr Dar	16.0	40	50
Dire Dawa	25.0	39	31

OHK Values for average count 20^s Ne

	Kenya	U.K.	U.S.A.	W. Germany	Turkey	Pakistan
Best	24					
Average	36	17	8	10	24	42
Worst	51					

OHK: Operative hours per 100 kg of yarn. Includes direct and indirect labour for processes from and including opening to ring frames. Includes maintenance labour divided by numbers of shifts worked.

(B) Machine

Count Ne:		Production per spindle/year 20^sNe (kg)	Production per spindle/year 32^sNe (kg)	Production per spindle/year Hours per Year	Production per 1000 sp/hrs 20^s (kg)	Production per 1000 sp/hrs 32^s (kg)
Asmara Textile Mills		104.5	59.2	5865	17.8	10.1
Ethio-Fil.		118.5	69.4	5224	22.7	13.3
Bahr Dar	(Est.)	143.7	-	7667	18.7	-
Akaki		134.5	-	6840	19.7	-
Dire Dawa						
Mill 3		202.3	101.3	7920	25.5	12.8
Mill 5		-	96.7	7920	-	12.2
U.S.A.		178.2	97.5	7344	23.9	13.3
W. Germany		95.2	49.9	3900	24.4	12.8
Kenya		149.2	-	7106	21.0	-
Pakistan		138.8	80.3	7401	18.8	10.8

TABLE 14/2

Labour Productivity - Weaving - Plainsand Twills

(Operater Hours per 100,000 m of weft inserted)

Mill	Automatic Looms	Non-Automatic Looms
Asmara Textile Mills	9.01	-
Ethiopian Fabrics	7.06	
Bahr Dar	5.51 (1)	
Akaki	7.09 (2)	
Dire Dawa		
Mill 2	-	8.24
Mill 5	6.20 (3)	
Country		
Kenya, Best	1.83	5.86
Average	2.60	7.46
Worst	4.04	9.06
Turkey	3.12	6.20
U.K.	1.80	3.60
W. Germany	1.06	2.20
U.S.A.	0.60	1.50

Notes: (1) 234 of 408 automatic looms have manual shuttle change

(2) 180 of 821 automatic looms have manual shuttle change.

(3) Approximately 330 of 660 automatic looms have manual shuttle change.

15.0 NEW METHODS OF PRODUCTION

15.1 Introduction

The arguments for the introduction into the textile industry of new machinery of a higher technological level than that already installed are usually based upon lower total costs of production through a reduction in labour requirements. Thus, a Sulzer loom which has a higher capital cost per unit rate of output than a conventional automatic shuttle loom, can justify its purchase because of the savings made in the costs involved in the weft supply system, i.e. the elimination of pirn winding and battery filling costs, most of which are labour costs.

Capital cost versus labour cost is the determining factor in investment decisions in the textile industries of developed countries, which are long established industries with a skilled and stable labour force backed up by a well organised educational and technical training infrastructure.

In developing countries the textile industries are of more recent development and tend to lack skilled labour and the technical education resources. Technical managers are in short supply and industrial performance in terms of output, and quality is comparatively poor. In these circumstances consideration of the benefits of new investment may extend beyond labour cost savings to such things as ease of maintenance, easier management by virtue of fewer processes, and more easily obtainable higher quality of output.

The Ethiopian textile industry is for the most part equipped with machines of the appropriate technological level for the economic circumstances of the country, and for the cost of the labour available. No widescale changes are recommended. In two particular situations, however, there is justification for at least feasibility studies on the introduction of new technologies into N.T.C. mills. These are air jet weaving and open-end spinning at Akaki, and tufted carpet manufacture at Debre Berhan. The reasons for these recommendations have been given elsewhere in the report. The following is a brief description of the type of machines that should be considered.

15.2 <u>Air Jet Looms</u>

The advantages of air jet looms over shuttle looms are:

1. <u>Speed</u> An air jet loom is approximately twice as fast as a shuttle loom of similar width, e.g.

   60" reedspace

   Shuttleloom : 175 - 190 p.p.m.

   Air jet : 375 p.p.m.

2. <u>Economies in weft supply</u>. The weft supply to an air jet loom is a cone or cheese of up to 3 kg in weight. Hence the output package at the cone-winders is the input package of the loom. The pirn winding process is eliminated as too is battery filling. Where the weft is spun on the open-end system the spinning output package can become the input package to the loom, cutting out the need for cone-winding.

3. <u>Economy of floorspace</u>. For looms of similar reed width the air jet occupies slightly less floor space than a shuttle loom. The rate of production per square metre of floor space occupied by air jets is, thus, double that when occupied by shuttle looms.

4. <u>Working environment</u>. The noise output of air jet looms is lower than that from shuttle looms. The effect is a considerable improvement in the working environment of the weaving shed.

5. <u>Easier maintenance</u>. Two thirds of the time of a shuttle loom mechanic is spent on the repair and adjustment of the picking and and checking mechanisms. This work is eliminated by the design of the weft projection system of the air jet loom. Adjustments are required less frequently and can be carried out more easily by following the makers recommendations in the maintenance manual.

The absence of wooden and leather components, the performance of which are subject to temperature and humidity variations leads to less frequent adjustment of loom settings.

Air jet looms vary in price between different manufacturers from approximately US $ 10000 to US $ 20000 for a loom of approximately 135 cm reedspace. The lowest of those prices is similar to that of a well made modern automatic shuttle loom, and nearly twice that of the cheapest automatic shuttle loom available on the international market. The cheaper shuttle loom is, however, slower than the more expensive shuttle loom.

15.3 Open-end (Rotor) Spinning

If air jet looms are installed in the Akaki Mill in the numbers recommended the annual production will be approximately doubled. This means that spinning capacity must be increased and it has been recommended that the new equipment should be based upon open-end spinning frames.

For the efficient performance from air jet looms it is desirable that the weft yarn should be even in diameter. A feature of open-end spun yarn is the high degree of regularity obtained, and in this respect the yarn is superior to that produced on ringframes.

Two major advantages of the open-end system are, (a) the elimination of the roving process, or speed frame, and, (b) the size of the spinning output package, (up to 3 kg) compared with the 90 gram spinners bobbins from ring frames. Other advantages are:

1. High production rates

The output per rotor is three times that of a ring spindle.

2. Labour savings

Labour costs savings occur through the elimination of the speed frames, of cone-winding in many cases, and the removal of the need for doffing teams because of the large size of the output package and the reduced doffing frequency.

3. Floorspace saving

Elimination of the speed frames and cone-winding results in a lower space requirement per kg of yarn produced.

4. Improved yarn quality

The improved yarn regularity brings better weaving performance through fewer yarn breaks in the loom.

The capital costs of open-end spinning machines, together with the necessary opening and preparation machinery is higher than a ring spinning installation of similar capacity. A detailed estimate of the comparative capital costs of a suitable sized extension to the Akaki capacity is not readily available. A more general estimate of the relative capital costs of ring and open-end spinning is as follows:

Annual output of yarn; 5 000 tonnes
Hours worked per year; 7200
Average yarn count : $17\frac{1}{2}^{s}$ Ne

Capital cost of machinery from and including opening to spinning:	US $
Ring spinning	16.5 millions
Open-end spinning	22.0 "

The capital cost of the building and building services are not included in this estimate.

15.4 <u>Tufted Carpet Manufacture</u>

The production from a single Wilton loom at Debre Berhan is small and uneconomical with no visible evidence from the market study to support the continued production of this machine. Wilton carpet production and consumption throughout the world has been decreasing during the past ten years, mainly due to it becoming more uneconomical to produce when compared to other woven carpets, for example Axminster, and the unprecedented surge and growth of tufted carpets which in turn have captured the major part of the previous woven market and more important has created a new market of new consumers who could not afford to pay the price of woven carpeting. This growth in the demand for tufted carpets and the decline in woven carpet is two-fold: viz .

1. Price advantage tufted carpets have over woven as a result of output of one tufting machine compared to the output of a woven carpet loom.

2. Consumer acceptance of tufted carpets is due in no small way to the technical advances made in design and colour. These recent technical innovations has put tufted carpets in direct competition with woven carpets with regard to colour and design. Prior to these advances the tufted manufacturer could only produce carpets of a single colour or at best a carpet with a mingled effect obtained by blending two fibres of different colours. Patterned tufted carpets can be produced by two methods, printing and the use of patterning attachments on the tufting machine itself which enables floral, geometric or medallion patterns to be produced. By far the most successful has been in the printing field where traditional woven designs have been reproduced.

Although it is only in the last twenty years that tufted carpets have been commercially accepted, the technique employed is nearly a hundred years old, and was used in North America for the production of bedspreads, using a backing cloth and coarse cotton waste thread which was stitched into the backing cloth using a needle. This is the principle of the modern high speed tufting machine. The main factors which influence the quality of a tufted carpet (discounting backing) are pile yarn, the count structure, height of the pile, type of primary backing cloth and the number of stitches or tufts per linear inch.

The machines are made in various widths but the majority are manufactured in broadloom width, usually 4 meter wide, suitable allowance being made for shrinkage which is expected during finishing. The most popular finished width is 3.66 meters.

The potential market in Ethiopia for carpets is currently unknown, but as the country develops, a demand should occur in the urban areas, particularly if the product is within a price range which is acceptable. Using UK figures for 1979 the average ex works price of a woven carpet was the equivalent of 31 Birr per square meter whilst the average price for a tufted carpet ex mill in the same period was equivalent to 12 Birr per square meter. These figures are obviously based on an efficient productive carpet industry of many years, but the further advantage of tufted carpet production is the simplicity of the basic tufting machine enabling easy maintenance and less lost production due to down time, and the short training period required for operatives compared to their counterparts in weaving. These factors together indicate the attractive possibilities of serious carpet manufacturing in Ethiopia.

Machinery requirements

It is envisaged that the production of plain dyed tufted carpet would be the best starting point for a new manufactuer, and also is probably the most likely to sell in the market place in the first instance. To produce this type of carpet it is recommended that either, dyed yarn is purchased ready for tufting, or dyed fibre is purchased and then spun within the N.T.C. mills.

A single tufting machine will produce the type of carpet at the rate of approximately 160 m^2 per hour. Therefore it is important that a market already exists, and can be developed as the production rate is quite rapid.

The predominant carpet yarns used in tufting are nylon, followed by polypropylene and polyester. The primary backing cloth into which the tufts are placed is traditionally manufactured of jute, but recent technical innovations in this field, new products acceptable for tufting manufacture have been developed, and a selection of these are noted below:

(i) Polypropylene tape, warp and weft

(ii) Polypropylene tape warp, and multi filament polypropylene weft

(iii) Polypropylene tape warp and jute yarn weft

(iv) Polyester multifilament warp and weft (the multifilaments being formed into individual tapes by a special adhesive.

Typical Primary Backing Structure

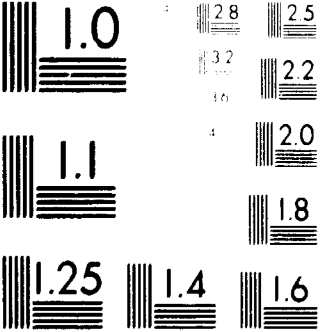
Ends per inch	Approx Weight (grams per square meter)
10 x 13	120.88
10 x 10	107.86
18 x 10	107.86
24 x 13	126.46
24 x 11	119.02

The warps are usually within the range 1,000-1150 denier, the weft 1050-1150 denier.

Loc Coat

To hold the tufted yarn in place in the primary backing cloth it is necessary to subject the carpet to a process which will achieve this end. This is known as loc coating and involves the carpet being processed through a machine which spreads on even layers of latex compound over the back of the carpet. At the same time a second backing cloth is released and firmly bonded by the latex to the carpet. This is known as secondary backing and is necessary to stop rubbing and friction on the back tufts of the carpet.

81.09.28



MICROCOPY RESOLUTION TEST CHART

Large quantities of tufted carpets are usually finished with a foam process instead of the secondary backing but this process would not be suitable for the Ethiopian climate where foam backing turns to dust as a result of heat and humidity.

The usual manufactured size of a typical tufted carpet is 12 feet wide by 100 metres in length. (the length being cut at the tufting machine and is a nominal length for handling purposes). It would be advisable to have a cutting table in the sequence of processes enabling lengths of varying size to be cut to suit individual homes.

Large quantities of second hand machinery are currently available in Western Europe and North America due to over capacity in the industry. If a decision is taken to enter tufted carpet manufacture consideration should be given to purchasing good second hand machinery.

16.0 FIBRE SUBSTITUTION

16.1 Cotton

The question of the substitution of Ethiopian cotton by a cheaper shorter staple imported variety has been considered in some technical detail in Section 7 of the report on the Asmara Textile Mill (pages H/19 -H/22, part II of volume 2).

It is concluded that the Ethiopian cottons used in the coarser counts, for which an imported shorter staple would be adequate, are of a quality which would not command an export price sufficient to justify the exchange.

More generally the widespread poor spinning conditions that exist in the N.T.C. mills would lead to a considerable drop in machine efficiency if shorter staple cottons were substituted for Ethiopian cotton. As the technical standards of spinning practice improves, together with better maintenance and more effective quality control, the case for the import/export exchange will become stronger.

16.2 Rayon

Consideration should be given to the partial substitution of cotton by rayon. The main factors in the use of rayon as a blend are, cheapness (relative to cotton) good processing characteristics in which there is a general resemblance to cotton, adequate strength and great diversity of physical forms. The disadvantages of rayon were connected with low wet strength, but in new types of rayon, wet strength is much improved and less of a problem when blended with cotton.

During the period where man-made fibres have been developing, viscose rayon producers have successfully developed, polynosic and high wet modulus fibres, which have resulted in remarkable technical improvements in respect of normal staple and are particularly suitable for blending with cotton.

The processing of viscose/cotton blends at the weaving stage does not present any special difficulties, mainly because the fibre is very similar to cotton and therefore does not suffer from the serious inconveniences deriving from the electrostatic charges present when processing synthetic fibres, though it is important that the relative humidity is not less than 70% in the weaving shed. The proportion of cotton/rayon blended yarns prior to weaving requires a slight reduction in the tension of the yarns during warping. As a sizing agent it is advisable to use products based on potato flour with the addition of resins to make the outer film less stiff, thus avoiding formation of powder, or to use products based on carboxymethyl/cellulose.

When using flour it is advisable to keep its percentage lower than when sizing 100% cotton in order to avoid a stiffening of the yarn. Also during sizing warp tension should also be lower than that required for cotton in order to avoid the formation of weak threads which will cause entanglements or breakage during dyeing. The humidity of the yarn at the outset of the drying machine should be lower than for pure cotton and therefore the speed and temperature of the cylinders must be adjusted according to the types of sizing machine. The humidity content of blended yarns should be about 7-8%.

Fabrics of cotton/viscose staple blends have a marked technical and economic interest for their use in several end uses, for example, sheets, table-cloths and linings, (growth areas in Ethiopia) and light apparel fabrics etc. In the production of these fabrics it is important to make a distinction between using blends of up to 20% viscose and blends of 50/50. It is known that the chemical behaviour of staple fibre is similar to cotton, though with a minimum resistance to alkali. As a consequence blended fabrics of this type should not undergo very akali scourings. Mercerization is not advised for ordinary viscose staple blends, but is acceptable for cotton polynosic fabrics. Fabrics with a low percentage of staple fibre do not show particular problems in dyeing and printing, but fabrics of say 50/50 blends need a selection of dyestuffs in order to get an even covering of the two fibres. It is therefore recommended that the percentage blend considered should be no more than 20% viscose with 80% cotton.

The current prices of rayon staple is approximately 80% of the price of American middling 1" staple cotton. Of the total conversion costs of 20s yarn at Dire Dawa, Akaki and Ethiofil, (Table 13/2), cotton fibre accounts for 78 - 80%. The substitution of 20% of the cotton with rayon would reduce the fibre cost by 4%, and the total yarn conversion cost by 3.2%.

17.0 BENEFITS FROM INVESTMENT RECOMMENDATIONS

17.1 General

A summary of the recommendations involving capital expenditure is given in Table 2. The Table lists the expected benefits from each recommendation in qualitative terms rather than financial terms, the calculation of which is lengthy and based in many cases on assumptions.

Many of the benefits are intangible in the sense that it is extremely difficult to measure them in financial terms because the necessary data is not available, for example, item 3, Adei Abebe, for which the recommendation is to overhaul the air conditioning plant. The benefit expected to accrue is better control of air conditions leading to an improvement in the output performance of machines, e.g. fewer ends down, higher machine efficiency. Translation of those benefits into the estimated reduction in costs is not feasible. One can calculate what the costs would be if a satisfactory production performance were achieved, but it is impracticable to assess what contribution improved air conditioning will make towards that satisfactory, or target performance level which depends upon other factors in addition to good air conditioning. One can certainly say that without an effective air conditioning system a satisfactory machine performance will not be achieved.

The value of investment recommendations resulting in better quality is another example where the benefits are difficult to evaluate. When the quality improvement is in an intermediate product such as sliver or roving, benefits will occur in spinning in the form of fewer end breaks and more regular yarn. Thus, spinning frame efficiency is improved, labour productivity increased whilst the provision of a better yarn will have beneficial effects in weaving and the quality of the cloth. The potential for these benefits is created by the investment action recommended, but their pre-determined evaluation is extremely difficult.

The only area where it is feasible to make an estimate of the financial benefits is where the provision of balancing machinery is suggested. The direct result, and a calcuable one, is an increase in production leading to an increase in revenue. Virtually all such recommendations apply to the spinning processes and they are dealt with in section 17.2 below.

17.2 Benefits from Recommendations in Spinning

An attempt has been made to evaluate the benefits which would accrue to the Ethiopian textile industry if the spinning recommendations summerized in Table 2, Executive Summary were implemented. Most of the recommendations are concerned with adjusting individual process departments in order to remove bottlenecks: improving the physical condition of existing drafting rollers, aprons, ring spindles etc. in order to achieve faster operating speeds and higher yarn quality standards; lifting machine and operative productivity by providing better and controlled working environment. However, the benefits from balancing and operating at faster speeds yield greater and more easily calculated benefits. Estimates suggest that the quite exceptional conditions at Idget factory, where a 30% reduction in manning levels was recommended, would enable labour costs there to be reduced by an amount similar to that by which sales income would increase if the projected output was achieved. In all other mills the savings in operating costs arising from improved machine and operative productivity, is small relative to the additional income expected from the improved balance and further operation of the plan.

The estimated total cost of purchasing new and renovating and rehabilitating existing machinery at the nine companies engaged in cotton spinning (excluding Debre Berhan) listed in Table 3 Executive Summary is US $ 8.892 m. For an expenditure of this sum, the mills will be able to lift their annual production (based on the prepared product mix detailed in the main body of the report), by an estimated 3500 tons a year, roughly worth an additional sales income of US $ 7.5 m annually. (The sales income is based on 1978 yarn prices). In most mills the extra investment yields an increase in annual sales income greater than itself. Exceptions to this general rule are Idget and Ethiopian Fabrics; both these mills requiring substantial investment in the 1983-84 period. In this period US $3.25m is allotted to Idget for a new factory building, and a further US $ 0.36m for moving the existing machinery into it. A large proportion of the investment in Ethiopian Fabrics in this latter period is also concerned with the improvement in the working environment, namely US $950,000 for the purchasing of air conditioning machinery and its installation. Such investment must by its nature contribute to second order benefits such as reduced absenteeism and improved productivity.

Shirley Institute

10356
(2 of 6)

Client Report

CONFIDENTIAL

SECTOR STUDY OF THE ETHIOPIAN TEXTILE INDUSTRY

FINAL REPORT

VOLUME TWO
PART 1 OF THREE PARTS

U.N.I.D.O. Contract No. 79/61
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VOLUME TWO

CONTENTS

(Vol. two - Parts I, II and III)

PART I

TABLES

INTRODUCTION VOLUME TWO

The three parts of volume Two contain the report on each plant visited, together with a set of Tables which provide the machinery register; the numbers of staff in each production department, and estimates of the output of each department.

The text of each individual mill report is followed immediately by the Tables relevant to that mill.

Machinery condition is given one of four ratings, viz.

Rating	Condition
1	In new or excellent condition.
2	Some wear but in reasonable condition with several years of useful life remaining.
3	Showing signs of considerable wear and in need of extensive overhaul or major modification.
4	Worn out or obsolete and should be replaced.

The ratings given are shown in the Tables with the machine descriptions.

ADEI ABEBE

Processes: Spinning; Blanket Weaving; Stitch Bonding; Yarn Dyeing

Spindles: 10, 720. Doubling Spindles: 360. Looms: 14.

Annual Production: Yarn: 2272 tonnes, Blankets: 358 000

1.0 MACHINE EFFICIENCY AND PRODUCTIVITY

1.1 Spinning

Adei Abeba's main product is sales yarn. The mill was originally equipped with machinery manufactured in 1961 and which is well suited to the production of this type of yarn. Since that period additional machinery has been added, notably a complete single scutcher opening and cleaning line (1979), three high production cards (1978) and drawframes, roving frames, and ringframes (1975) with a view to increasing the capacity of the mill and balancing departmental deficiencies.

The present departmental capacities, based on existing operating conditions are shown in Table A below, from which it is clear that attempts to balance the plant seem to have been largely inefficient (See Column 2).

TABLE A. Departmental Capacity: Adei Abeba (Kg/hr)

Department	Claimed Departmental Capacity	Departmental Capacity for a balanced plant	Rationalised Departmental Capacity (Balanced) Kg/hr
(1)	(2)	(3)	(4)
Ringframes	272	272	295
Roving frames	465	274	297
Drawframes	253	277	300
Cards	302	284	308
Blowing Room	434	297	322/347
Reeling	134	248	272
Winding	32	13	13
Doubling	30	13	13

using the published Waste Multuplier values for Adei Abeba the necessary departmental capacities for a balanced plant are calculated and shown in Column (3). These are based on the existing number of ringframes operating under the conditions shown in Table A/1. However, there are notable inconsistencies in this table. For example, the five RCI frames with 46 mm package sizes should be able to run faster than the larger packaged S5 frames if traveller life is any limitation. If front roller speed is the limitation, and this is more likely, then we believe that the S5's and RCI should both be able to run faster than they are doing at present. 11 000 rev/min for these frames is not exceptional.

After making these adjustments to running speeds, and re-allocating the finer count yarns to the smaller ring-diameter frames, we conclude that an output of 295 Kg/hr of yarn is a reasonable output for the mill to aim at. Production would then be:

- 170 Kg/hr of 21 Ne yarn;
- 10 Kg/hr of 16 Ne yarn;
- 13 Kg/hr of 15 Ne yarn;
- 82 Kg/hr of 10 Ne yarn;
- 20 Kg/hr of 6.5 Ne yarn.

At first glance it appears that the drawframe capacity given in Table A prevents the achievement of this output. However, the four S.20 frames are running at only 155 metres/min when we believe them capable of at least double this speed. In order to achieve this faster speed however, it will be necessary to implement better quality control and maintenance programmes than are being used at the moment, and which are discussed below.

In carding, some small increase in output is clearly necessary. Here we recommend the purchase of three more C40 high production cards, and the scrapping of eight of the older T15/2 conventional cards. This will provide the necessary additional capacity, and at the same time allow the new and existing C40 cards to be operated at 90% overall efficiency - a figure we believe the mill is more readily able to sustain. The T15/2 cards should be broken down for spare parts.

To meet the proposed new yarn capacity of 272 Kg/hr of sales yarn (21 Ne, 10 Ne, 6.5 Ne) it appears from Table A/1 to be necessary to increase reeling capacity as well. Based on the claimed performance levels it is necessary to increase the number of reelers by 16 simply to meet the new requirement for 21's Ne yarn alone. However, Table A suggests that the claimed figures are not realistic, and we calculate that reeling frames running at 200 rev/min with a 1.5 yard circumference swift, and at 50% overall efficiency will in fact produce 18 Kg/hr of 21 Ne yarn in skein form. If this larger production rate is in fact the case (as we believe) then no additional frames are necessary.

Estimated cost of balancing the plant is:

— for 4 type c40 cards: US $ 268 000.

1.2 Blanket Making

1.2.1 Woven Blankets

Weaving efficiency is an average of 65% which is reasonable taking account of the need for manual shuttle changing with the very coarse weft (count 1s Ne). The installation of 14 looms is small but operating on three shifts it produces 196 300 blankets per year. Each weaver tends a single loom and most of their work is taken up in shuttle changing. With the non-automatic looms in use there is little prospect of improving either labour or machine productivity. This can only be achieved by re-equipment with modern rapier looms which would operate at higher speeds and give economies in the system of weft supply. For the time being such re-equipment is not recommended until the general question of NTC blanket production is considered.

1.2.2 Stitchbonded Blanket Production

Three Arachne P1 machines are installed of which only two were in production at the time of the visit. Annual production in 1978 was 580,000 m^2 whilst the potential production at moderate operating efficiencies was and is 800 000 m^2. The productivity of these machines is, thus, extremely low.

The chief causes of low production are, (i) shortage of fleece, i.e. cotton waste, and (ii) carding capacity to make the fleece.

To balance the installation a third card is required. Before any decision is taken to acquire a new card, however, adequate supplies of cotton waste to keep all three machines running, must be assured.

1.3 Yarn Dyeing

The main wet processing revolves about the reclaiming of wool, acrylic and other waste from UK and other sources. The waste is firstly sorted by hand into colour categories and graded into white, medium and dark shade. Preparatory mechanical processing is plucking and shredding followed by dyeing, hydro extracting, drying and subsequent baling. White waste is normally reserved for dyeing into pastel shades, the medium and dark waste being dyed into the darker shades - this is carried out in the dyeing plant which has been in existence since the factory start-up.

The company has a second dyehouse for yarn dyeing and finishing, this unit was equipped and partly commissioned at the time of Nationalisation; but has remained dormant ever since. The stated intention is that this will be fully commissioned at a time coinciding with the spinning extension. This is unused good equipment, and in the National interest should be utilised, either on the present site or elsewhere.

2.0 BUILDINGS AND SERVICES

2.1 Buildings

The layout and construction of the buildings comprising the factory are eminently suitable for their purpose and allow adequate storage facilities. A considerable quantity of dyes and chemicals were stored in the new yarn dyehouse. This will not be a satisfactory area for storage when commissioning has been completed, apart from which, the quantity in storage represents a considerable monetary value, particularly on present day costs.

2.2 Services

2.2.1 Steam generation

The company has been reliant upon a single boiler:

Make:	Steamatic Cyclonic
Date:	1968
Working press:	5 ATM
Rating:	2 000 Kg steam/hr.

At the time of installing the new yarn dyeing equipment, a second boiler was installed, this is in the process of being commissioned, and is planned to be in use during 1979. The second boiler has a greater rating and will allow the older unit to be held in reserve, details of this are:

Make:	Steamatic Cyclonic
Date:	1974
Working press:	5 ATM
Rating:	4 000 Kg steam/hr

2.2.2 Water Supply

The company does not use large volumes of water relative to its production. Supply was stated to be satisfactory, and no problem was foreseen for the new yarn dyeing plant when this is in production.

2.2.3 Effluent

Currently, all processing effluent is discharged to the municipal sewage system. Plans are in hand to link the effluent from the factory to the settling tanks sited at Ethiopian Sewing Thread Co., if this is the case, care should be taken that these are not overloaded, particularly if expansion at the other company is contemplated.

2.2.4 Air conditioning

Mazzini unit air conditioners are installed in the main Adei Abeba plant room, that is carding through spinning to twisting. There are no partitions in the room so it is virtually impossible for the management to achieve the 45% RH at carding and 65% RH at spinning that it desires.

For this reason the plant is set at '45% to 55%'. Such a setting however, is inconsistent with the design of the machinery, and as the units on at least one occasion were not switched on when we visited the plant, we believe that the air-conditioning equipment suffers, in the same way as other machinery, from a lack of maintenance. This impression was further confirmed by the leaks which dripped onto the gangway when the water was flowing, and the generally dirty and torn condition of the air filters. In addition the water spray pump motors burn out frequently. No one in the plant has received training at Mazzini, and the last visit by a Mazzini engineer was over twelve months ago. The mill has installation instructions but unfortunately no maintenance manual.

There is then no way in which the mill can repair and maintain its existing units without obtaining assistance from outside.

We therefore recommend the mill to seek the services of a Mazzini commissioning engineer after and only after, they have recruited a suitable engineer to take responsibility for the air-conditioning units. Such an engineer is absolutely necessary for the new mill and whoever is appointed should be capable of looking after the installations in both mills. The cost of such a commissioning engineer in time and subsistence, air fares etc, for a three month stay, that is, sufficient time to maintain the existing units and familiarise the local engineer with their operation, is estimated to be US $ 68 000 (including an allowance for replacement parts for the existing 9 units).

3.0 CONDITION OF EQUIPMENT

3.1 Spinning

When rating the condition of all the machinery we have borne in mind the end-use for which the yarn is mainly intended. We do not however, go as far as the management who believe that the demand is so high that any quality of yarn can be sold. The machinery has been assessed, with a view to producing an acceptable quality of yarn for a future, more quality conscious, market.

Spare parts for the Marzotti and Muzzini air conditioning machinery have not presented management with any problems in the past. However, this is not the case for the Polish PJ31C ring frames and the blanket looms on which some spares have been difficult to obtain.

Given that there is generally speaking no problem then with the spare parts, the main reason for most of the machinery being in need of more care and attention must lie with the level of maintenance and for the competence of the mill's production supervision. As the other mills in Ethiopia, Adei Abeba has difficulties recruiting an adequate number of technically skilled personnel suitable for employment in the textile industry. Schemes for scheduled maintenance are of no value whatsoever if competent staff are not available to work them, and this is the case at Adei Abeba. Schemes are in existence but they cannot be worked. If we examine the performance of the production supervision, we find that a fine appreciation of technical matters exist; frame parts are correctly aligned, important rollers are in better condition than those less important, tapes are running true without undue vibration, cards are reground at regular intervals etc, all of which tends to confirm the fact that if more maintenance staff were available, the supervision is capable of employing it gainfully.

If more maintenance effort can be mustered then the machinery can generally be expected to perform satisfactorily until the end of the 1980's. Two exceptions to this general rule are to be found in the winding and doubling department. The 24 spindle Majed Type RZ 10-Z assembly winding unit is in a bad condition. The winding drums are heavily scored, some tensioning devices are missing, others that exist have varying weights on them. The cost of a modern non-automatic unit to replace these units is US $ 26000. The Majed Type RZ-3 post doubling winder is in even worse condition. Its replacement, if necessary (the existing unit is not working and appears not to have been so for some considerable period), would cost an estimated US $ 26000.

The Majed P17 twister has also been rated 4. Again if it is really necessary for the mill to double yarns, then we would recommend its replacement as well, at an estimated cost of US $ 81 000.

Benefits which would accrue from such a replacement policy would be mainly as a result of higher operating speeds, bette. yarn quality, and lower processing costs in subsequent non-spinning activities.

3.2 Blanket Making Equipment

The warp and weft preparation equipment is simple and robust and will last for over five years with reasonable maintenance.

The 14 Galileo looms are also robust machines and running at the slow speed of 90 p.p.m. they will give many more years of useful life. They are, however, in need of improved maintenance and tuning, a sympton of which is the frequency with which the loom is stopped by the shuttle protector mechanism. The sudden shock to the drive wheel breaks the teeth and four wheels per year require repairs for broken teeth. These looms will benefit from a thorough check on their settings, with subsequent checks at each beam change.

The Arachne stitchbending machines, and the associated cards require better maintenance. They are all in reasonable condition for their age, but that condition could deteriorate rapidly in the next two years if their maintenance is not improved. The foundations supporting the cards are becoming loose. Their repair should be carried out in the near future.

3.3. Yarn Dyeing

As evident from the inventory of equipment the general condition of this is poor and the majority of equipment is in need of major overhaul or, alternatively planned replacement during the next 1-2 years, if the quality production is to be maintained and improved in the immediate years ahead.

The present condition of equipment is due to inadequate maintenance. Assurance was given that maintenance is now a higher management priority and that scheduling schemes are in operation, unless this is a reality, equipment will deteriorate further at a very rapid rate.

4.0 WORKING ENVIRONMENT

Working conditions within production departments are reasonably good. Ventillation equipment in spinning and weaving departments, although not automatic appeared to be quite adequate for the purpose.

Health and Safety

Safe working conditions in respect of floors, machine spacing, lighting and machine guarding are at a reasonable standard.

The Company maintains a 24 hour first-aid/medical service with fully trained medical staff and in the charge of the company doctor.

Continuing the practice established in earlier years, the company operates a to and from work busing service for the benefit of all employees.

Fire Precautions

A trained fire-fight crew is employed at the factory. The trained staff give instructional training to other groups of workers, allowing a 24 hour fire fighting capability.

The Company does not possess heavy fire-fighting equipment. A minimal supply of extinguishers were evident in processing departments, none of which were suitable for electrically originated fire outbreaks.

5.0 MAINTENANCE

Lack of maintenance is a major cause of lower than expected production in the blow-room (production at current levels should have made the latest single scutcher opening line unnecessary), drawframes and roving frames (the latest BC 3 machine is unnecessary as production requirements should be met on the 4 Type P3G units).

In order to improve the level of maintenance in the factory and to reduce the apparent conflict between maintenance and production seen, we believe a department should be set up comprising the following:

1 Technical Manager. A professional engineer (mechanical or electrical) to take charge of all maintenance on the existing and expansion sites. 2 Mill Maintenance Supervisors (for existing and extension mills).

<u>Spinning Workshops</u>

2 Assistant supervisors
3 Mechanics (shift work)
4 Cot/card grinders

<u>Power Supply Installation</u>

1 Electrical Engineer
3 Chief Electricians (shift work)
6 Electricians (shift work)
4 Motor maintenance mechanics
3 Electrical station operators (shift work)

<u>Air Conditioning</u>

1 Mechanical Engineer
6 Conditioning unit mechanics (shift work)

<u>Sprinkler Plant</u> (Extension)

3 Pump Mechanics (shift work)
2 Plumbers
1 Diesel mechanic

Mechanical Workshops (Existing and Extension)

4	Lathe operators
1	Universal milling operator
1	Drill operator
3	Mechanics
3	Carpenters
2	Plumbers
2	Welders

Administration

2	Clerks (1 for safety, security, and fire protection) (1 for engineering and fire insurance)
1	Draughtsman
1	Clerk for stores and plant records
1	Maintenance and Cost Control Clerk.

6.0 PRODUCT QUALITY

6.1 Spinning

The quality of yarn produced is average for Ethiopian mills, judged visually. However, the mill does keep records of the relatively simple wrapping tests it carries out at the moment. On the basis of these records, from which we recorded only those on Machine 25, we calculate the average and standard deviation of the yarn count spun to be 20.37 ± 1.036 Ne for a nominal 21 Ne yarn. Thus if these figures are typical of the mills total production, a saving in raw material costs of roughly 300 000 Birr/annum (based on the 1978/79, first eight months consumption level) is possible. The standard deviation figure, when compared with the Uster published international standards, suggests that Adei Abeba is within the worst 10% of mills tested, or that 90 % of the mills tested achieve a deviation in counts less than Adei Abeba. This figure is probably distorted in favour of the Adei Abeba mill as it does not take into account variations between machines or short-term variations both of which would normally be expected to increase the deviation further. The sample is admittedly small so any conclusions drawn from the tests should be treated with caution. 40 readings taken over a period of twelve days in September 1979 probably does not accurately illustrate the variations in count which can occur.

Bearing in mind the end-use for which the yarn is intended we therefore recommend that at least the following quality control tests be carried out:

- For controlling the blending of bales and determining the appropriate roller settings, a Wira Fineness Metre (which the mill already has) and comb staple sorter
- Roller eccentricity tests
- Twist tests
- Blackboard tests
- Nep counts
- Yarn regulating and strength tests

No additional costs for testing equipment need be included as all of the equipment is expected to be delivered for the Adei Abeba expansion.

The recommended staff required to man the department are:

1	Quality Control Supervisor
2	Assistant Supervisors (Existing and Extension)
2	Raw Cotton Analysers
1	Twist Analyser
3	Yarn/sliver Analysers (shift work)
2	Uster Operators
Total 11	

6.2 Blanket Production

The stitch-bonded blankets are destined for the cheapest sector of the market in which weight and durability rather than quality are the prime considerations. At this level the quality of production is adequate.

The woven and raised check blankets are of reasonable quality for most minor faults are obscured by the raising process. Quality can be improved but onlyin the aesthetic sense, through the introduction of new designs and more subtle colours.

7.0 WORKFORCE

In skills the work-force in the mill (before the level of supervisors, who are rated as satisfactory), is assessed as barely satisfactory at best, but more commonly poor.

A lack of diligence arising from a failure to appreciate the importance of good maintenance/housekeeping, quality etc is the main failure of the workforce below supervisory level.

Productivity at Adei Abeba mill is amongst the lowest level found in Ethiopia. It is particularly bad in the opening and cleaning section where stack mixing is not employed (though management propose to do so). Spinners look after two or one side, depending on count (24 double siders and 4 single siders), but the mill employs 10 helpers and 25 doffers. (all figures refer to a single shift). This number of doffers implies a doffing rate of just over 50 bobbins per hour per doffer. A figure of 250 doffs/hour is being obtained in other Ethiopian Mills, and should serve as an immediate target for the workers in Adei Abeba.

The Company employs approximately 1500 persons in total. Of these, some two-thirds are female. Not surprisingly, owing to pregnancy, - the company is adversely affected by a relatively high labour turnover. It is suggested that benefit would be gained by reviewing present employment policy or alternatively, consider the introduction of more formalised training procedures to minimise the effect of the high labour turnover.

TABLE No. A.1 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - ADDIS ABEBA

Section	Machine Description	Manufacturer	Model	Year of Manufacture	No. of M/cs	No. of Del's Spindles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
BLOW-ROOM SECTION	Blending feeder	Marzoli		1961	4		14.4(1)													2
	Conveyor belt	"		1961	1		0.35(1)													2
	Hopper feeder	"		1961	1		5.88(1)													2
	Porcupine opener	"		1961	1		3.00(1)													2
	Condenser	"		1961	1		2.20(1)													2
	Feed box	"		1961	1		0.35(1)													2
	Step cleaner	"		1961	1		2.94(1)													2
	2-Way distributor	"		1961	1		-													2
	Hopper feeder	"		1961	2		11.76(1)													2
	Scutcher	"		1961	2	2	11.76(1)													2
	Lap doffer	"		1961	2		3.66(1)													2
	Blending feeder	"		1979	2		7.20(1)													2
	Conveyor belt	"		1979	1		0.35(1)													2
	Double beater	"		1979	1		6.00(1)													2
	Condenser	"		1979	1		2.20(1)													2
	Feed box	"		1979	1		0.35(1)													2
	Step cleaner	"		1979	1		2.94(1)													2
	Hopper feeder	"		1979	1		5.88(1)													2
	Scutcher	"		1979	1		5.88(1)													2
	Lap doffer	"		1979	1	1	1.83(1)													2
CARD	Cards	Marzoli	T15/2	1961	36	1	1.47	406	914	10.00		180rpm(2)	11rpm			0.13	-	7kg	90(1)	2
	High production cards	"	C40	1978	4	1	12.25	610	1016			390rpm(2)				0.13	-	20kg	95(1)	2
DRAWFRAME	Drawframe 1st Pass	Marzoli	M4	1961	1	2	3.30(1)	406	914	10.0			69m/min			0.14	-	34.9kg	70(1)	3
	"	"	S20	1975	4	2	4.87	406	914	10.0			155m/min			0.14	-	71.7kg	80(1)	2
	Drawframe 2nd Pass	"	M4	1961	1	2	3.30(1)	406	914	10.0			69m/min			0.14	-	34.9kg	70(1)	3
	"	"	S20	1975	4	2	4.87	406	914	10.0			155m/min			0.14	-	71.7kg	80(1)	2
ROVING	Roving frames	Marzoli	P3G	1961	4	110	3.6	114	305	0.750		810rpm		None	F1207 (Hungary)	0.8	0.91	1.00	85(1)	2
	"	"	BC3	1975	1	100	4.1	114	305	0.750		810rpm		None	SKF PK 1500-62	0.8	0.91	1.07	85(1)	2
RINGFRAMES	Ring frames	Marzoli	S5	1961	2	400		48(3)	254(3)	0.150		9180rpm		Yes-O/H	F1305 (Hungary)	21	17.32	0.0227	84(1)	2
	"	"	S5	1961	7	400		49(3)	254(3)	0.150		10000rpm		Yes-O/H	F1305	21	17.32	0.0247	84(1)	2
	"	"	S5	1961	6	400		49(3)	254(3)	0.150		5600rpm		Yes-O/H	F1305 (Hungary)	10	12	0.0420	84(1)	2
	"	"	S5	1961	1	400		49(3)	254(3)	0.150		9600rpm		Yes-O/H	F1305 (Hungary)	15	14.70	0.0392	84(1)	2
	"	"	S5	1961	1	400		49(3)	254(3)	0.150		8180rpm		Yes-O/H	F1305 (Hungary)	16	14.70	0.0313	84(1)	2
	"	"	S5	1961	1	344		61(3)	279(3)	0.140		4870rpm		Yes-O/H	F1305 (Hungary)	6.5	9.70	0.0695	84(1)	2
	"	Polish	PJ31C	1969	4	384		54(3)	254(3)	0.150		8700rpm		Yes	SKF PK 220	21	17.32	0.0215	84(1)	2
	"	Marzoli	RC1	1975	5	408		46(3)	254(3)	0.150		10000rpm		Yes	SKF PK 225	21	17.32	0.0247	84(1)	2
REELING	Reeling frames	Italian	-	1961 installed	1	80	1.47					200rpm				6.5		24kg	50(4)	2
	"	"	-	"	5	80	1.47					200rpm				10		25.2kg	50(4)	2
	"	"	-	"	12	80	1.47					200rpm				21		13.6kg	50(4)	2
WINDING	Cone winding machines	Tessilmeccanica	-	-	2	82	5.1	203	152	2.00			153m/min			16	-	27.8kg	10(4)	3
	"	"	-	-	1	82	5.1	203	152	2.00			153m/min			16	-	27.6kg	80(4)	3
	Assembly winder	Mated	RZ10-2	1961 installed	1	24	6.8	152	127	1.50			56m/min			7.5 (2/15)				3-4
	Twisting machine	"	P17	"	1	360	13	90(2)	330(2)			6000rpm				2/15	8.64	30.0kg	85(1)	3-4
	Winders for doubled yarns	"	RZ3	"	1	24	6.8	152	127	2.0			56m/min			2/15				3-4

Blow-room production data: During the visit one scutcher was stopped down for maintenance leaving an hourly production rate of 434 kg/hr. This hourly rate exceeds recent annual production values.

Ring frames, installed power: TOTAL INSTALLED POWER FOR RING FRAMES IS 196.[illegible] KW

NOTE Assembly winding and twisting were not working during the visit.

(1) Estimated
(2) Cylinder
(3) Full package dimensions
(4) Estimated
(5) Maximum Package size

TABLE A2

STAFFING - SPINNING DEPARTMENT - ADEI ABEBE

Doubling	Day	1	2	3	Total
Twisters	-	2	2	-	4
Total	-	2	2	-	4
Post Doubling					
Winders	-	2	2	-	4
Total	-	2	2	-	4
Opening and Cleaning					
Machinery operators	-	3	3	3	9
Feeders	-	6	6	6	18
Jobber	-	1	1	1	3
Sweeper	-	1	1	1	3
Total	-	11	11	11	33
Carding					
Jobber	-	1	1	1	3
Card operators	-	8	8	8	24
Lap carriers	-	2	2	2	6
Waste collector	-	1	1	1	3
Sweeper	-	1	1	1	3
Total	-	13	13	13	39
1st & 2nd Passage Drawing					
	-	5	5	5	15
Total	-	5	5	5	15
Roving					
Machine operators	-	5	5	5	15
Operatives' helpers	-	5	5	5	15
Sweeper	-	1	1	1	3
Jobber	-	1	1	1	3
Additional staff for cover	-	2	2	2	6
Total	-	14	14	14	42

TABLE A2 Contd.

Ring Frame	Day	1	2	3	Total
Shift leader	-	1	1	1	3
Foreman	-	1	1	1	3
Line jobbers	-	2	2	2	6
Spinners	-	29	29	29	87
Sweepers	-	2	2	2	6
Bobbin stripers/transporters	-	8	8	8	24
Bobbin carriers	-	2	2	2	6
Tape stitcher	-	1	1	1	3
Helpers	-	10	10	10	30
Doffers	-	25	25	25	75
Total	-	81	81	81	243
Reeling					
Tenders	-	72	72	72	216
Jobber	-	1	1	1	3
Assistant jobber	-	1	1	1	3
Sweeper	-	1	1	1	3
Water sprayer	-	1	1	1	3
	-	76	76	76	228
Winding					
Winders	-	10	10	10	30
Total	-	10	10	10	30
Assembly Winding					
Winders	-	2	2	-	4
Total	-	2	2	-	4
Maintenance					
Mechanics	-	3	3	3	9
Assistant mechanics	1	-	-	-	1
Total	1	3	3	3	10

Table A/3

WARPING - BLANKET DEPARTMENT - ADEI ABEBE

MACHINERY

Make	ELITEX	MAJED
Type	Direct beamer	Section warper
Age	10 years	10 years
Machine condition	2	2
Number of machines	1	1
Creel size	344 ends	1260 ends
Yarn length on beam	13,000 m	

Warp produced are for blanket weaving and stitchbonding.

Operatives

5 direct workers

Hours of work: 8 per day; 48 per week, 2400 per year.

Table A/4

COP WINDING - BLANKET DEPARTMENT - ADEI ABEBE

MACHINERY

Make	MACED (Poland)
Age	12 years
Type	Pot spinner/cop winder
Number of pots	306 (30 unused)
Machine condition	2
Count spun	1.35 Nm
Output per day	1500 kg

Operatives per shift	Total on 3 shifts
30	90

Hours of work: $22\frac{1}{2}$ per day; $157\frac{1}{2}$ per week; 6750 per year.

Table A/5

BLANKET WEAVING - ADDI ABEBE

LOOMS

Make	GALILEO
Model	M3E
Age	10 years
Width R.S.	180 cm
No. of Looms	14
Speed	90 ppm
Drive	Individual belt
Shedding	Side cam.
Boxes	4 x 4
Warp stop	None
Weft stop	Centre fork
Let-off	Negative
Change feeler	None-manual change
Picking	Underpick
Healds	Steel
Reed	Fixed
Overall efficiency	65%
Machine condition	2

LABOUR

Weaving operatives per shift		3 shift total
Supervisor	1 (day work)	1
Overlooker/fixer	1	3
Weavers	14	42
Spare Weavers	4	12
Cleaners	1	3
Oilers	1	3
Weft Carriers	2	6
Cloth Carriers	2 (day work)	2
Total	24	72

Hours of work: $22\frac{1}{2}$ per day; $157\frac{1}{2}$ per week; 6750 per year.

Table A/6

SEWING AND INSPECTION SECTION - BLANKET DEPARTMENT

ADDI ABEBE

EQUIPMENT

Locally made flat tables for inspection.

14 lockstitch sewing machines of various makes for edge binding of blankets.

Machine condition 2/3. Ages, 10+ years.

2 ORMIC baling presses.

Machine condition: 2.

ANNUAL PRODUCTION

210,000 wool type blankets

150,000 cotton blankets.

LABOUR

Operatives per shift		2 shift total
Sewing section	20	40
Inspection section	5	10
Total	25	50

Hours of work: 16 per day; 96 per week; 4852 per year.

Table A/7

WOVEN BLANKET CONSTRUCTION AND PRODUCTION

ADDI ABEBE

FABRIC

Weave	Double-faced blanket
Warp	$^2/_{15.5}$ cotton Ne.
Weft	1.35 Nm. mixed synthetic waste
Ends per cm	8.8
Picks per cm	9.0
Cloth width	1.6 m finished
Width in loom	1.72 m
Length of blanket	2.1 m

PRODUCTION

Annual production	412,230 m
	196,300 pieces

Table A/8

STITCH BONDING SECTION - BLANKET DEPARTMENT

ADDI ABEBE

MACHINES

(a) Stitch bonding machines

Make	ARACHNE
Model	P1
Age	10 years
Number	3 (2 only in production)
Width	1.85 m
Stitches per minute	350
Machine efficiency	60%
Type of fabric	Fleece consolidated by stitching through
Machine condition	2

(b) Carding

Make of card	BEFAMA
Model	C
Age	10 years
Width of card	2 m
Width of cross-layer	1.7 m
Number of cards	2
Machine condition	2

FABRIC AND PRODUCTION

Yarn	Texturised polyester DTex 167/30/1
Fleece	Cotton waste
Fabric weight	540 g per m^2
Production rate at 100% efficiency	105 m^2 per m/c hour
Actual rate of production per m/c hour	42 m^2
Annual production (1978)	580,000 m^2

LABOUR

Operatives per shift		3 shift total
Skilled	4	12
Unskilled	3	9
Total	7	21

Hours at work: 22½ per day, 157½ per week, 6750 per year.

TABLE A/9

DYEING AND FINISHING EQUIPMENT - ADEI ABEBE

Item	Equipment	No. of Units	Manufacturer	Year of Manf/Instal.	Operating Width. cms	Operating Load Kgs.	Condition	
1	Cutting and chopping M/c	1	Oreste Orlando	1969	—	—	2/3	
2	Horizontal baling press	1	—	—	—	—	3/4	Not in use. Awaiting spare parts to be manufactured on site.
3	Cage dyeing machine	1	—	—		220	2/3	
4	Centrifuge Hydro Extractor	1	Majed	1967	—	50	2/3	
5	Opening Willow	1	Majed	1967	—	—	2	
6	Lattice Drying	1	ATI Milano	1967	—	—	2/3	Used for loose stock and blanket drying
7	Tumbler washing machine	1	Majed. Poland	1967	—	—	3/4	Not in regular use
8	Raising machine	4	Serio Smit	1967	—	—	2	
9	2 Kier Dyeing machine	1	Mexxera	1973	—	400	1	Not commissioned
10	Centrifuge Hydro Extractor	1	Master Macherio	1973	—	100	1	Not commissioned
11	Continuous Drying machine	1	Alea Milano	1973	—	—	1	Not commissioned Items 9-11 inclusive all brand new. Intention is to commission at same time as new extension production commences.

AKAKI TEXTILE MILLS (including KALITI)

Processes: Spinning, Weaving, Blanket Weaving, Dyeing, Printing and Finishing

Spindles: 45 000 installed plus 4640 not yet operational. Looms: 863.

1.0 MACHINE CAPACITIES AND EFFICIENCIES

1.1 Spinning

Based on existing operating parameters and overall efficiencies the departmental capacities are calculated as follows:

Opening and cleaning	756 Kg/hr
Carding	682 Kg/hr
Combing	99 Kg/hr
Drawing	629 Kg/hr
Roving	915 Kg/hr
Ringframe	796 Kg/hr

It is clear from these values that the limitation to increasing the mills yarn output above the 1977/78 level of 633 Kg/hr average is the capacity bottleneck at drawing and carding. For a balanced plant departmental capacities require the following relationship:

Opening and cleaning	1 142
Carding	1 092
Drawing	1 048
Roving	1 025
Spinning	1 000

which if the blow-room is to run at 90% overall efficiency and produce 15 ounce/yard laps instead of the current 14 ounce per yard laps means that the revised departmental capacities which the mill should aim to produce are:

Opening and cleaning	913 Kg/hr
Carding	873 Kg/hr
Drawing	838 Kg/hr
Roving	820 Kg/hr
Ringframe	800 Kg/hr

These values correspond to a production increase above existing rates of 167 Kg/hr or 26%. It is achieved by using the existing spinning machinery spinning yarn in the count range 13s Ne to 24s Ne, (by dropping 32s Ne yarn from the present range and allocating the frames currently engaged on this count to the remaining coarser counts, roughly proportionately, the spinning capacity is increased to 876 Kg. Thus the 800 Kg/hr value identified above is still easily within the plants capacity and will allow management to be rather more selective in its choice of ring frame.

Drawing and carding however, need to have their departmental capacities increased to match the necessary throughput. In the case of the drawframes we recommend that all the existing plant be scrapped and replaced by modern high-speed two-delivery machines. Converting the existing Howa cards to high-speed units in a similar manner to that already carried out on the 2 Crosrol units is the recommended method of increasing carding capacity in the mill. If the converted cards are to operate at 90% overall efficiency producing sliver at 18 kg/hr then 48 such tandem units will be needed in addition to the existing two Crosrol units.

The cost of conversion of these cards plus the cost of new drawframes amounts to an estimated US $ 2810000. The improved yarn quality which the mill should achieve with this modified plant is expected to go a long way towards improving cloth quality and reducing weft waste which at the moment is achieved by simply inserting new pirns in the event of weft breaks. Warp and weft breakage rates are expected to drop.

At the Kaliti factory the departmental capacities are estimated to be:

Opening and blowing	314 Kg/hr
Carding	227 Kg/hr
Drawing	408 Kg/hr
Roving	256 Kg/hr
Spinning	189 Kg/hr

We do not advocate any changes in existing departmental capacities at the Kaliti factory.

1.2 Weaving Preparation and Weaving

1.2.1 Weaving preparation

Although the weaving preparation is employed on long runs with 966 beam changes per week most of the fresh warps are drawn in by hand in the drawing-in department, rather than knotted back at the loom. The consequence of this policy is low labour productivity in drawing-in, and a loss of loom efficiency in weaving, of about 2%. Both labour productivity and weaving efficiency will be improved by the substitution of machine knotting for manual drawing-in. It is recommended that three additional knotting machines and frames be purchased at an estimated total cost of US $ 60 000. The required number of employees in warp drawing-in would be reduced by 15-20 employees per shift.

There are three modern West Point sizers in the sizing department, plus five old Butterworth and Dickinson machines. The productivity of the five old machines is very low. They are running at 14 m per minute with an efficiency of 50%. The three West Point machines should be capable of fulfilling the mill's requirements for sized warps. Hence, the capacity of the sizing department is out of balance with weaving and it is recommended that four of the old machines be scrapped and their parts cannibalised for use as spare parts on the single machine to be retained. This remaining machine would provide a reserve capacity for use when the West Point machines are stopped for overhaul.

The capacity and efficiency of the pirn-winding department is satisfactory.

1.2.2 Weaving

There are 725 Sakomoto and 104 Ruti looms in the weaving shed. Eight of the Ruti are employed on terry towel weaving and the rest on a twill construction. The Sacomoto are weaving a variety of plain and twill fabrics.

The efficiencies achieved are:

Sacomoto	44"	175 p.p.m.	79.6%
"	72"	130 p.p.m.	71.0%
Ruti	52"	190 p.p.m.	75.0%

All the looms are automatic pirn changes but on 180 Sacomotos the automatic mechanism has been disconnected and the pirns are changed manually. On the rest of the Sacomotos the weft stop mechanism is connected to the pirn transfer; thus, instead of the loom stopping at a weft break the pirn is changed instead. This will reduce loom stops, increase loom efficiency, waste weft yarn and produce very bad cloth. The comparatively high efficiency of 79.6% is obtained by these means.

For the Sacomotos running as manual pirn changers an efficiency of about 75% should be expected. For all looms fitted with the automatic transfer mechanism the efficiency achieved should be 85%. Those are the target figures to be aimed at.

1.2.3 Blanket weaving

Blanket weaving is carried out on 10 Galileo looms and 24 Robt. Hall looms. The Galileo looms are used for the production of acrylic waste blankets and the Robt. Hall for cotton waste blankets.

The Galileo looms were running at 70% efficiency which is approaching the optimum which is considered to be 75%.

Of the 24 Robt. Hall looms only 10 were operating at the time of our visit. There is a shortage of condenser spun weft to keep the looms running though 16 was said to be the more usual number in operation. Their efficiency was 65%. The target efficiency should be 75%. There is clearly an imbalance between the cotton condenser weft production capacity and the weaving capacity. It is understood that two box spinning frames are on order to give the extra capacity needed.

1.3.1 Knitting and Sewing - Kaliti

The knitting department at Kaliti is equipped with 18 knitting machines of which 14 are circular and 4 flatbed. All the machines are over 20 years old and a number are stopped for lack of spare parts which are no longer available from the manufacturers. There is no skilled machine mechanic available and the performance of the machine suffers as a result. The efficiency of the department is estimated at 50% against an expected level of 85%.

Much of the sewing equipment is old and therefore inefficient. The pace of work is slow and the department is grossly under-utilized. Lay planning and cutting is extremely inefficient with cloth utilisation at a maximum of 70%, i.e. approximately 30% of cloth is cutting waste. With the types of garments in production a minimum cloth utilisation figure of 87% should be expected, and with skilful lay planning 90% can be attained.

Given replacement machines for those no longer working, together with good machine maintenance, trained designers and lay planners, and better management organization, the production of knitted garments at Akaki can be raised by 100%.

1.4 Dyeing and Printing

The rotary screen printing facilities are considerably under utilised (running $9\frac{1}{2}$ hours/week) and their continued retention would be hard to justify, particularly in the event of the decision being taken to concentrate the factory on lower qualities.

Yarn Dyeing plant is not utilised to any reasonable extent, continued retention would be difficult to justify.

2.0 BUILDINGS AND SERVICES

2.1 Buildings

The roof of the spinning mill is constructed from galvanised corrugated iron sheeting with an asbestos flat sheet ceiling. However, the roof and ceiling needs repairing and is allowing the escape of conditioned air making the likelihood of sustaining controlled conditions remote. Management are complaining that the air conditioning plants have less cooling capacity than is necessary in summer and citing temperatures of 105°F to 107°F to justify the claim. But with the ceiling/roof in the state it is, it becomes impossible to comment on this judgement without first inspecting the roof structure more thoroughly.

Lighting too has been allowed to fall below an acceptable minimum standard, and is in urgent need of renovation.

In weaving and weaving preparation the floors and ceiling are in poor condition. The metal frame and supports of the false ceiling in loom shed one are corroded rendering the structure unsafe. In the preparation department the floor is breaking up and provides a hazard to the workers. In general the building fabric of the weaving department is dirty and in need of a considerable amount of maintenance work.

2.2 Air Conditioning

A number of air conditioning plants are installed on the site, six are conventional central station units of which only the one servicing weaving mill No. 4 has additional water sprays, and a further four have plenum chambers for mixing fresh and returned air, but also individual heaters and fans at the supply end of each delivery duct. Compressed air water sprays are fitted to all delivery ducts in this latter group. Schematic layouts of the two systems are given in Figure 1 and 2 respectively.

Plants similar to that shown in Figure 1 are servicing the blow-room, cardroom, roving room, combing, weaving preparation, and weaving (Mill No.4, and linked to the combing plant using a common air washer room). Figure 2 is typical of plants servicing spinning room, and weaving mills No. 1, 2, and 3. All plants have the option of being operated in the manual or automatic mode of control, and all are in fact

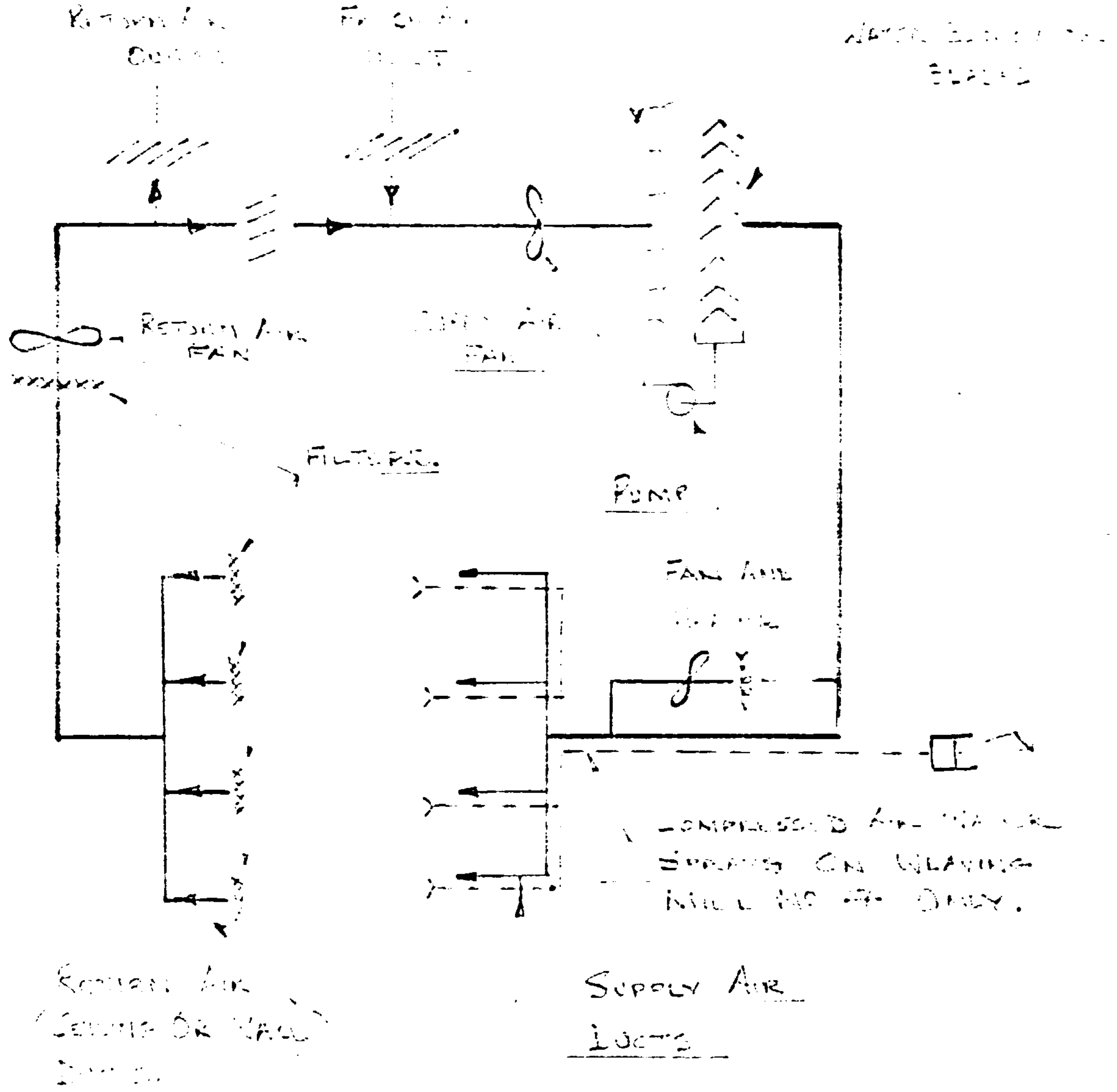

FIGURE 1.

SCHEMATIC LAYOUT A-C PLANT. AKARI M-FACT. S939

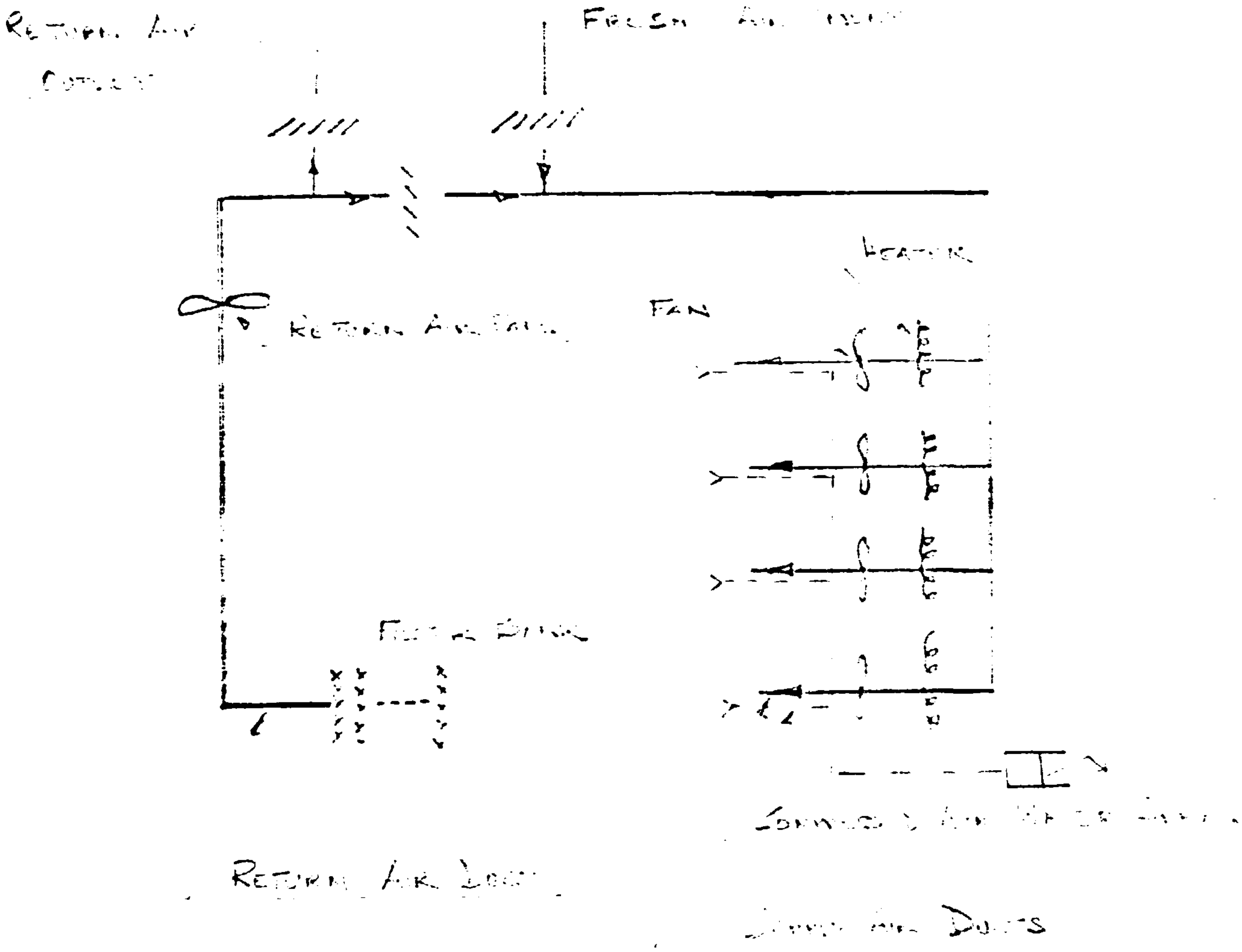

FIGURE 7.

SCHEMATIC LAYOUT A-C PLANT. AKAKI MAIN FACTORY 5939 operated in the manual mode, most having been worked in this manner for the last 10 to 12 years. The machinery was designed and supplied by Krantz.

In order to restore them to full working order management estimates that an expenditure of between US $ 70 000 and US $ 100 000 is necessary. The following faults were noted during the visit:

(a) During past winters it has been necessary to heat the supply air. This has been done by flashing live steam into the supply tank feeding the water sprays. The resulting high temperature water has allegedly caused the plastic water eliminator blades to buckle and warp. (We believe that live steam onto the blades is a more likely explanation).

(b) Water sprays appeared to be functioning correctly but the pneumatic actuators controlling the air flow louvres were not always doing so.

(c) Management did not know the designed air flow rates and had no method of checking them.

(d) Filters were generally in a bad state; always dirty, often torn, and in some instances were prevented from functioning correctly by articles which are being stored in front of them.

(e) Because the conditions required in combing and weaving are different, the linked plant could not be worked in such a way as to satisfy both sets of requirements. That part servicing the combing department is therefore shut down.

(f) The Howa cards are not fitted with individual dust extraction fans and ducting, consequently the air is heavily laden with dust and fly causing blockages to the filters and water eliminator blades. Routine maintenance is supposed to prevent these blockages but regularity and diligence with which they are cleaned is questionable. We do not believe the plant is cleaned properly every Sunday as alleged.

The Blanket Plant also has a plant similar to that shown in Figure 2.

2.3 Steam Generation

Little if any of the steam condensate is utilised in steam generation, although preparations are in hand for the collection of this from the main steam using plants in readiness for the new boilers.

Existing boilers are of various dates and manufacture. Essential instrumentation only .

New electric boilers are being installed. As this will only be the second such installation within the textile sector offering potential high energy savings, we would suggest that this is carefully monitored and the feasibility of this method of steam generation fully investigated.

2.4 Water

Source - local river. Some water shortage experienced during dry season but to no serious extent.

2.5 Effluent

Treatment - constant drip feed to the continuous mains flow(lime) and also presumably to correct pH. No attempt to monitor or control beyond this action. Main effluent passed to four settling tanks and finally returned to river - still highly coloured condition.

Complaints from downstream have resulted in the local water authority visiting the company and checking the effluent; but have not led to any specification or conditions of discharge. The local departmental management are not aware of any restrictions and assume that they are complying with any legal requirements.

3.0 WORKING ENVIRONMENT

This receives no priority, either from management or workers organisations. Physical guarding of machines is minimal, non-existent.

Weaving department and dyehouse floors are in deplorable condition and would not be tolerated in a responsible factory.

Health Care

Environmental working conditions are reasonable in the Finishing Dept. although climatic extremes are reported to affect conditions to some appreciable extent. Condensate reported to be a serious problem.

Basic protective clothing made available to persons handling dangerous chemicals. Supplementary milk ration made available to persons handling dry dyestuffs and dangerous chemicals.

4.0 ASSESSMENT OF MACHINE CONDITION

4.1 Spinning

Our main criticism of the condition of the textile machinery in both the Akaki plant; the main factory and the Kaliti unit, is the poor housekeeping which makes the machines operate in such an apparently run-down manner. It is essential that the production supervision quickly acts to improve the standard of housekeeping in all spinning departments.

Some difficulty has been experienced in the past with spare parts for the Texmaco ring frames, but since refurbishing these machines has been handed to EDERA, especially for drafting system conversions, the problem seems to have been resolved for the moment. In any event all except the few frames with the Casablancas A500 drafting system, now use SKF units and can be expected to continue giving satisfactory service until the end of the 1980's.

The only other major alterations are the replacement of the existing cards by Crosrols and the scrapping of all multi-delivery drawframes installed in both mills and their replacement by two-deliver modern high-speed units which is discussed above.

4.2 Weaving and Weaving Preparation

4.2.1 Weaving preparation

In weaving preparation the pirn winders are modern and in good condition. The Schlafhorst cone winders have a future working life of at least five years, as too have the Leesona 44 winders. The latter, however, are obsolete and labour intensive. Any programme of re-equipment in weaving preparation should cover for the replacement of the Leesona 44 machines.

The five Butterworth and Dickinson sizing machines are worn out. There is sufficient capacity in the three West Point machines. It is recommended that four of the Butterworth and Dickinson machines be scrapped, and the fifth be retained as a reserve.

In warping the Barber Colman beamer is in good condition. The six Allen machines are now 21 years old, and whilst they may last for up to another five years with good maintenance and an adequate supply of spare parts, their slow speed and increasing cost of upkeep indicates that they should be replaced within the next three years. Three modern machines would provide the capacity currently given by these six old machines. The estimated cost of three new beamers complete with magazine creels is US $ 200 000.

4.2.2 Weaving

The Ruti looms are ten years old and in reasonable condition. The Sacomotos are older, between 17 and 21 years old. On the majority of the Sacomotos the pirn change mechanism is connected to the weft fork which means that the pirn in the shuttle is changed at weft breaks and the loom continues to run. This is a policy of output at the expense of quality for cloth woven in this manner contains many serious weft-way faults. Such cloth is only acceptable to an undiscriminating rural market. The looms have no automatic warp stop, and a negative let-off mechanism, other factors which lead to poor quality fabric.

It was claimed by the technical management that 90% of the Sacomoto loom frames are cracked at the tappet shaft bearing points. This fault is being attended to in a major programme of overhaul. The loom is becoming increasingly expensive to maintain because of the high cost of the Japanese parts.

It is our recommendation that these 725 looms should be scrapped, and replaced by air-jet looms. Before they are replaced it will be necessary to renovate the weaving shed. A suitable time-table would be, 1980/81 renovation of weaving shed, 1982/83 replacement of Sacomoto looms.

At this stage only a crude estimate of the costs involved can be given, viz.

Renovation of weaving shed	US $ 500 000
Cost of 360 air-jet looms	US $ 3 600 000

The output rate of air-jet looms is about double that of the shuttle looms, hence, the number of new air-jet looms required is only half of the looms currently installed. If the present amount of floorspace occupied by Sacomotos is occupied by air-jets, the cloth output from Akaki will be doubled, i.e. 700 looms at a total cost of approximately US $ 7 000 000. This would require either an expansion in the Akaki spinning capacity, or the supply of yarn to Akaki from one of the other spinning mills in the Addis area.

In making this recommendation three important factors have been taken into consideration, viz:

1. The Sacomoto looms are technically obsolete and physically worn out.
2. Air-jet looms are easier to maintain than shuttle looms
3. The output rate of an air-jet loom is greater per unit of investment and per area of floorspace occupied than a shuttle or rapier loom.

The machine being considered is the Investa air-jet which is available at a much lower price than its competitors.

4.3 Finishing

Generally equipment in reasonable condition with some major exceptions:

Singeing machine - not run for eight years, leak in gas tanks and gas fuel unobtainable.

Open width wash range	-	In process of major overhaul and reconditioning
Small jigs	-	6 machines all in need of major overhaul
Hot flue	-	Recurring problem with internal bearing on rollers, justification for mounting these externally
4 Bay Artos stenter	-	Machine in need of major overhaul (1963)

Surplus Equipment

1	-	3 Bowl Calender, not in use
1	-	3 Bowl Schreiner Calender, not in use

General Comments

Lack of trained personnel to implement programmed maintenance and quality improvement programmes.

Insufficient open width finishing capacity means that bleaching is done on rope bleaching equipment. This method creates creases in lighter weight fabrics (160 g/m^2 and below), which persist through subsequent processes. The company has not made full use of the continuous dyeing equipment due to problems with the continuous steamer. It is thought that these had now been overcome.

4.4 Knitting and Sewing - Akaki

Much of the equipment in both knitting and sewing should be scrapped. These are the machines for which the manufacturers no longer make spare parts. It is recommended that the Kaliti plant be given an overall review with view to its re-organisation and re-equipment.

4.5 Blanket Weaving

The weaving preparation equipment is robust and has a useful life remaining of five or more years. The Galileo looms are in good condition and should last for at least another ten years. Problems are experienced in obtaining spare parts for the Robt. Hall looms and some cannibilisation is taking place. There is inadequate yarn to keep all those looms running so it makes sense to dismantle some to provide spares for others. No change is recommended.

5.0 MAINTENANCE

A complex structure and large size are the two important features of the Akaki maintenance labour force. With a total of 680 persons in the section it is clear that the maintenance department in particular has failed to gain any of the expected benefits arising from a large vertically integrated mill operating on one site. Thus it appears quite profligate to have two maintenance supervisors in the spinning department, four maintenance supervisors and shift supervisors in weaving preparation, one maintenance chief and assistant in weaving, one maintenance chief in processing and folding and a further 10 supervisors distributed around the mechanical and electrical services departments and the Kaliti mills. There are therefore, in total 19 supervisors or assistant supervisors within the organization. In addition the mill employs 34 head or chief mechanics, again the number is excessive for a mill of this nature, and this can be seen to apply to all categories throughout the mill.

6.0 QUALITY OF PRODUCTION

Under the management of its original owners the Akaki mill was organised to produce long runs of cheap fabrics with little consideration for quality. This point has been made earlier in the report in the comments on weaving. Provided that the market accepts faulty cloth, the policy may have some justification if it cuts costs and provides cheap fabric. In the case of spinning, however, lack of concern for quality, especially regularity and strength, can be a false economy because poor yarn which gives frequent breaks in weaving preparation and weaving increases costs and lowers efficiency in those departments. Whilst the Akaki mill may continue to concentrate much of its production on fabrics for an indiscriminating section of the rural market, much more attention should be paid to the needs of quality in spinning. The yarns produced are poor and irregular and weak places are the cause of many warp breaks.

The Sacomoto looms on which most of the cloth is produced are so engineered that they can only produce very faulty cloth, e.g. no warp stop mechanisms, pirn change at weft breaks, loose reed etc. The low priority given to quality has brought about an attitude of mind amongst the mill employees which, as long as those attitudes are maintained, will ensure that faulty goods will be produced. Whilst faults caused by machines can be reduced by changing the machines, those caused by carelessness or lack of awareness of good working practice will persist, and will only be eradicated by a long and vigorous programme of quality re-education.

In finishing too the process quality was poor, especially shade variation in tropical suitings as a result of jig dyeing.

From its lack of success in continuous open width processing and the lack of suitable equipment for continuous open width preparation, (whilst the unit has some O/W equipment operational this is only sufficient for the initial preparation, the only means of bleaching such fabrics is in the rope-form to the detriment of the finished fabric), there would be a strong case for eliminating the heavier and better quality fabrics from the production range, relying mainly on Kier scouring and bleaching, which is more suitable for the lighter weight fabrics, and concentrating the production of the factory on these styles.

A further serious drawback to the continued improvement in quality is the lack of technically trained staff within the department, resulting in partially experienced people controlling operations on shift.

7.0 WORKFORCE AND PERFORMANCE

7.1 Spinning

The number of operative hours required to spin 100 kilograms of yarn (OHK) is for the Akaki main factory and for the Kaliti mill in the centre and towards the bottom of the Ethiopian spinning industry spectrum respectively. In order to improve the main factory ranking we recommend the following actions:

(a) dropping combed yarn from the product range. A typical OHK value for modern mills equipped in a similar way to that of the main factory in 5.5, but the equivalent value for the main factory is 12.12. At present production through the combing department does not fully utilise all the machinery installed there, so some reduction in this figure can be expected to follow an expansion in output. Our overall impression however, is that the present management is incapable of containing its combing OHK below 9 to 10. Expansion of the combing section would therefore lead to an expansion in the labour force on a site which already has too many operatives.

(b) the changes in departmental capacity already specified above. These will have the effect of increasing the productivity of labour by introducing modern machinery with the full range of operative aids now installed on cards and drawframes. The improved quality of sliver should also yield useful benefits to the staffing levels on the roving and ring spinning frames.

(c) the introduction of work measurement. The main factory currently employs 90 doffers. There are 90 ringframes in the mill, so on average a doffer doffs 408 spindles per 7.5 hours; that is roughly 55 spindles per hour. A target of five times this value would be a reasonable starting objective. A similar though less dramatic case can be made for reducing the manning levels for the ring spinners and roving operatives. In the Kaliti factory analysis we have had to make a number of assumptions regarding staffing levels, as the information for the ring spinning department was incomplete. It is probably unfair therefore to put too much emphasis on the figures we claim. However, it can be seen that the relatively small size of plant is already showing diseconomies due to small scale operation in the opening, carding and drawing plants. In the main this machinery would be expected to yield lower OHK values than those in the main factory. That they have not done so we attribute to this scale effect and also to the bad working environment which exists in the mill.

The extent of each influence cannot be estimated however.

7.2 Weaving

The number of maintenance labour and machine operatives were excessive, and from observation of people working and of the quality of the cloth produced the degree of skill employed is lower than the level found in other N.T.C. mills.

Labour productivity in weaving was low for a mill in which most of the looms are automatic, viz: Man hours per 100 000 m of weft inserted:

Ruti: 7.25 Sacomoto: 7.00

The problem of machine and labour performance at Akaki is acute. Many of the management positions in the organization structure are vacant leading to overloading of the members of the management. There is no training or manpower department for both of which there is the greatest possible need. It has been suggested in this report that considerable investment is essential, in building renovation and new equipment, to improve the poor performance of the Akaki mill. It is further suggested that adequate levels of training and labour organization and management are essential pre-requisites to any large scale investment.

TABLE NO. B/1 - MACHINE INVENTORY

SHORT STAPLE COTTON SPINNING: AKAKI MAIN FACTORY

	Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size: Ø mm	Height mm	Capacity [illegible]	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
[illegible] - Double Scutcher Lines	Blending Hopper Bal Opener	Howa		1958/61	3															2
	Hopper Feeder	"		1958/61	3															2
	Step Cleaner (6)	"		1958/61	3															2
	Porcupine Opener	"		1958/61	3															2
	2-Way Distributor	"		1958/61	3		87kW											1354kg		2
	Reserve Box	"		1958/61	6															2
	Hopper Feeder	"		1958/61	6															2
	Double Beater Scutcher	"		1958/61	5															2
	Beater	"		1958/61	1															2
	Single Beater Scutcher	"		1958/61	1															2
[illegible] Line	Blending Hopper Bale Opener	Howa		1958/61	1															3
	Reserve Box	"		1958/61	1		15kW(1)													3
	Hopper Feeder	"		1958/61	1															3
	Double Beater Scutcher	"		1958/61	1															3
	Cards	Howa		1958/61/63	118	1	1.12	305	914			10rpm				0.136	-	5.7kg	85-90(1)	3
	Cards	Crosrol		1968	2	1	3.73	457	1067			23rpm		Yes		0.136	-	13.0kg	85-90(1)	2
	Cards	Howa		1958/61/63	18	1	1.12	305	914			10rpm				0.128	-	5.7kg	85-90(1)	3
	Precomber Drawing	Whitinaire	(India)	1970	4	2	3.0	406	1067	9			740 ft/min			0.161	-	99.3kg	80(1)	1
	Comber Lap Forming	Whitin	Super-lap	1970	1	1	5.6	381	262	4.5		60rpm						275.0kg	80(1)	1
	Comber	Whitin		1970	4	2	5.2	457	1067			220npm				0.143	-	27.7kg	90(1)	1

TABLE NO. B/1 - MACHINE INVENTORY

SHORT STAPLE COTTON SPINNING: AKAKI MAIN FACTORY

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size			Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data				Machine Condition
							Ø mm	Height mm	Capacity kg						Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	
Drawframes 1st Pass	Howa		1958	4	12	1.5	305	914	6.8			37.5m/min		4over4	0.152	-	104kg	$85^{(1)}$	4
Drawframes 1st Pass	"		1958	2	14	1.5	305	914	6.8			32.14m/min		4over4	0.152	-	104kg	$85^{(1)}$	4
Drawframe 1st Pass	"		1958	1	14	1.5	254	914	4.5			32.14m/min		4over4	0.137	-	116kg	$85^{(1)}$	4
Drawframes 2nd Pass	"		1958	4	12	1.5	305	914	6.8			37.5m/min		4over4	0.152	-	104kg	$85^{(1)}$	4
Drawframes 2nd Pass	"		1958	4	14	1.5	305	914	6.8			32.14m/min		4over4	0.152	-	104kg	$85^{(1)}$	4
Drawframe 2nd Pass	"		1958	1	14	1.5	254	914	4.5			32.14m/min		4over4	0.137	-	116kg	$85^{(1)}$	4
Roving Frames	Howa		1958/61/65	1	124	3.0	114	279	1.25		657rpm			$4over4^{(2)}$	1.21	1.24	48.8kg	$80^{(1)}$	2
Roving Frames	"		1958/61/65	4	124	3.0	114	279	1.25		657rpm			$4over4^{(2)}$	1.00	1.20	61.0kg	$77^{(1)}$	2
Roving Frames	"		1958/61/65	9	124	3.0	114	279	1.25		730rpm			$4over4^{(2)}$	1.21	1.24	54.2kg	$80^{(1)}$	2
Roving Frames	"		1958/61/65	6	124	3.0	114	279	1.25		730rpm			$4over4^{(2)}$	1.51	1.47	36.6kg	$80^{(1)}$	2
Roving Frames	"		1958/61/65	2	124	3.0	114	279	1.25		800rpm			$4over4^{(2)}$	1.51	1.54	38.3kg	$80^{(1)}$	2
Roving Frames	"		1969	2	124	3.0	114	305	1.50		800rpm			4over5	1.51	1.54	38.3kg	$80^{(1)}$	2
Ring Frames	Marzoli		1979	2	408	18.5					8500rpm		$Yes^{(3)}$ + O/H	SKF PK 225	13	13.5	17.78kg	$92^{(1)}$	2
Ring Frames	"		1979	16	408	18.5					8500rpm		"	"	14 WP	15.7	14.19kg	$92^{(1)}$	2
Ring Frames	Texmaco (WP)		1958/61/63	10	400	10.0					7200rpm		$Yes^{(3)}$	CASA's 500A	14 WP	15.7	11.79kg	$75^{(1)}$	3
Ring Frames	"		1958/61/63	1	400	10.0					8400rpm		$Yes^{(3)}$	SKF PK 211	14 WP	15.7	13.75kg	$80^{(1)}$	3
Ring Frames	Marzoli		1979	7	408	18.5		Not available			8100rpm		$Yes^{(3)}$ + O/H	SKF PK 225	14 WF	13.5	15.73kg	$92^{(1)}$	2
Ring Frames	Texmaco (WF)		1963	4	464	10.0					8400rpm		$Yes^{(3)}$	SKF PK 211	14 WF	13.5	18.55kg	$80^{(1)}$	3
Ring Frames	" (WP)		1958/61/63	2	400	10.0					8400rpm		$Yes^{(3)}$	SKF PK 225	14 WF	13.5	15.97kg	$85^{(1)}$	3
Ring Frames	" (WP)		1958/61/63	4	400	10.0					9000rpm		$Yes^{(3)}$	"	20	17.5	9.25kg	$85^{(1)}$	3

TABLE NO. B/1 - MACHINE INVENTORY

SHORT STAPLE COTTON SPINNING: AKAKI MAIN FACTORY

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size: Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Ring Frames	Texmaco (WP)		1958/ 61/63	4	400	10					9000		Yes(3)	SKF PK 211	20	17.5	9.25kg	80(1)	3
Ring Frames	" (WP)		1963	4	464	10					9000		Yes(3)	SKF PK 225	24	18.0	8.69kg	85(1)	3
Ring Frames	" (WP)		1958/ 61/63	10	400	10					9000		Yes(3)	"	24	18.0	7.49kg	85(1)	3
Ring Frames	" (WP)		1958/ 61/63	6	400	10		Not available			9000		Yes(3)	SKF PK 211	24	18.0	7.49kg	80(1)	3
Ring Frames	" (WP)		1958/ 61/63	16	400	10					9600		Yes(3)	"	32	22.6	4.77kg	80(1)	3
Ring Frames	" (WP)		1958/ 61/63	4	400	10					9600		Yes(3)	SKF PK 225	32	22.6	4.77kg	85(1)	3
Reeling Machines	P.S.B.G.I. Institute		1959	23	40	0.55		NOT RUNNING AT THE TIME OF VISIT											
Reeling Machines	"		1959	4	40	0.80													
Winding Machine	Kammatsu			2	30	2.2		USED FOR WINDING CONES FOR PIRN WINDING											
Winding Machine	Gilbos			1	100	8.8													
Assembly Winding	Kammatsu*			2	120	3.0	127	152	2.5			400m/ min			2/14 + 2/32 - 203+88			Not Spec.	3
Ring Twisters	Texmaco		1972	3	400	15	50	165			8400rpm				2/32	14.5	13.0	Not Spec.	2
Ring Twister	Alma		1958	1	396										NOT RUNNING				
Ring Twisters	Texmaco		1968	4	400	9.7		3 RUNNING ONLY. NO DETAILS SPECIFIED											
Ring Twisters	Howa		1961	4	400	15		RUNNING ON 14's NE YARN. DETAILS NOT SPECIFIED											

(1) Estimated

(2) 3 Frames fitted with SKF in 1972

(3) Pneumafil (1.5kW)

(4) Added 9/80 in response to TAM visit

* Identified as Mitsubish 520 and 852 models in assembly winding questionnaire.

TABLE No. B/2 SHORT STAPLE COTTON SPINNING : AKAKI'S KALITTI FACTORY

MACHINERY INVENTORY

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	PRODUCTION DATA Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Blending Hopper Bale Opener	Ingolstadt		1966	2[1]															2.3
Reserve boxes	"		1966	4															2
Reserve box	"		1969	1															2
Step cleaner (6)	"		1966	1		61.72 kW													2
Porcupine opener	"		1966	1															2
Scutchers (Single beater)	"		1966	2															2
Scutcher (Double beater)	"		1966	1															2
Scutcher (Single beater)	"		1969	1															2
Cards	Howa	CM.	1963	10	1	1.5	305	914			11 rpm doffer				0.14	-	7.3[2]	85[2]	2-3
Cards	"	CM.	1969	7	1	2.5	305	914			11 rpm doffer				0.14	-	7.3[2]	85[2]	2-3
Cards	Ingolstadt	KB3	1961	18	1	1.1	356	914			10 rpm doffer				0.14	-	8.0[2]	85[2]	2-3
Drawframes 1st pass	Howa		1958[2]	2	14	1.1	305	914			460 rpm	39 m/min			0.155	-	124.7 kg	80[2]	4
Drawframes 1st pass	Ingolstadt	SB5/ 450R	1966	2	4	2.2	356	914			630 rpm	59 m/min			0.128	-	65.3 kg	80[2]	4
Drawframes 2nd pass	Howa		1958[2]	2	14	1.1	305	914			426 rpm	36 m/min			0.153	-	116.6 kg	80[2]	4
Drawframes 2nd pass	Ingolstadt	S85/ 450R	1966	2	4	2.2	356	914			630 rpm	59 m/min			0.126	-	66.3 kg	80[2]	4
Roving frames	Howa		1958[2]	4	124	3.0	177	330			665				1.25	1.27	46.7 kg	80[2]	2
Roving frames	Ingolstadt	GB5/ 2202	1961	2	100	4.0	177	355			762				0.9	1.05	72.5 kg	80[2]	2
Ring frames	Ingolstadt	RB10/ 82.5	1961	5	392	14					7080 rpm		Pneumafil	Sussen Wst	10	12.33	20.2 kg	83[2]	2
Ring frames	"	"	1961	5	392	14					8000		"	"	21	18.05	7.4 kg	86[2]	2
Ring frames	Texmaco		1969	6	440	10					8800		Pneumafil	SKF PK 211	21	17.88	9.2 kg	86[2]	2
Ring frames	"		1969	4	440	10					8300		"	"	24	18.0	7.6 kg	87[2]	2
Ring frames	Texmaco (WF)		1963[2]	10	464	Ex M.FACT NOT YET OPERATIONAL								Casa A500					3
Reeling machines	Kasturi			28	40	0.55									21				1
Reeling machines		(Italian)		2	80	1.5									10				1
Reeling machines	Platts			1	80	1.5									10				1
Reeling machines				3		1.5		NOT SPECIFIED ANYWHERE							10				-
Winding machine	Leesona	Rotoconer(44)		1	40	3.7									24	- NOT SPECIFIED			2
Bundling press	NOT SPECIFIED															- NOT SPECIFIED			-

(1) One only working owing to shortage of spares

(2) Estimated

TABLE B/3

STAFFING - SPINNING DEPARTMENT - AKAKI

Opening and Cleaning	Day	1	2	3	Total
Blowroom jobber	-	1	1	1	3
Scutcher tender	-	3	3	3	9
Blowroom feeders	-	4	4	4	12
Total	-	8	8	8	24
Precomber Drawing					
	-	4	4	4	12
Total	-	4	4	4	12
Carding					
Tender	-	6	6	6	18
Jobber	-	1	1	1	3
Stripper	-	4	4	4	12
Lap carder	-	2	2	2	6
Oiler	-	1	1	1	3
Sweepers	-	3	3	3	9
Chief mechanic	1	-	-	-	1
Mechanics	6	-	-	-	6
Helpers	6	-	-	-	6
Total	13	17	17	17	64
Comber Lap Forming					
Tender	-	1	1	1	3
Total	-	1	1	1	3
Combing					
Tenders	-	2	2	2	6
Jobber	-	1	1	1	3
Reliever	-	1	1	1	3
Sweeper	-	1	1	1	3
Mechanic	1	1	1	1	4
Chief mechanic	1	-	-	-	1
Helper	1	-	-	-	1
Total	3	6	6	6	21

TABLE B/3 (continued)

1st Passage Drawing	Day	1	2	3	Total
Tenders	-	7	7	7	21
Total	-	7	7	7	21
Roving					
Tenders	-	12	12	12	36
Doffers	-	16	16	16	48
Jobbers	-	2	2	2	6
Oiler	-	1	1	1	3
Head jobber	-	1	1	1	3
Mechanic	2	1	1	1	5
Helper	2	1	1	1	5
Chief mechanic	1	-	-	-	1
Maintenance supervisor	1	-	-	-	1
Can repairers	-	2	2	2	6
Cleaners	-	7	7	7	21
Total	6	43	43	43	135
Ring Frame					
Spinner	-	22	22	22	66
Double side spinner	-	57	57	57	171
Doffers	-	90	90	90	270
Doffing jobbers	-	9	9	9	27
Head jobber	-	1	1	1	3
Line jobber	-	2	2	2	6
Bobbin carriers	-	6	6	6	18
Empty bobbin carriers	-	3	3	3	9
Bobbin cleaners	-	8	8	8	24
Shift loader	-	1	1	1	3
Supervisor	-	1	1	1	3
Mechanics	-	2	2	2	6
Helpers	-	2	2	2	6
Total	-	204	204	204	612

TABLE B/3 (continued)

Assembly Winding		Day	1	2	3	Total
Direct		-	6	6	6	18
Indirect		-	2	2	2	6
	Total	-	8	8	8	24
Reeling						
Shift supervisor		-	1	1	1	3
Tenders		-	22	22	22	66
Jobber		-	1	1	1	3
Carpenter		-	1	1	1	3
Helper		-	1	1	1	3
	Total	-	26	26	26	78
Doubling						
Tenders		-	21	21	21	63
Jobber		-	1	1	1	3
	Total	-	22	22	22	66

TABLE B/4

STAFFING - SPINNING - KALITTI

Opening and Cleaning	Day	1	2	3	Total
Feeder	-	1	1	1	3
Scutcher Tender	-	2	2	2	6
Clerk	-	1	1	1	3
Total	-	4	4	4	12
Carding					
Tenders	-	2	2	2	6
Strippers	-	2	2	2	6
Lap Carriers	-	2	2	2	6
Cleaners	-	2	2	2	6
Mechanic	-	1	1	1	3
Total	-	9	9	9	27
1st Passage Drawing					
Tenders	-	5	5	5	15
Total	-	5	5	5	15
Roving					
Tenders	-	3	3	3	9
Doffers	-	5	5	5	15
Jobber	-	1	1	1	3
Belt Joiner	-	1	1	1	3
Mechanic	-	1	1	1	3
Total	-	11	11	11	33
Winding					
Tenders	-	2	2	2	6
Helpers	-	1	1	1	3
Total	-	3	3	3	9

TABLE B/5

PIRNWINDING - AKAKI TEXTILE MILLS

Winding machinery

Make:	Scharer	Scharer
Country of origin:	Switzerland	Switzerland
Age:	1963	1979
Number of machines	10	10
Spindles per machine	10	10
Total spindles	100	100
Machine condition	2	1

Description

Magazine load		
Automatic change		
Winding speed:	4 = 11,000 rpm 6 = 12,000 rpm	12,000 rpm
Efficiency achieved:	88% to 90%	
Spindles per operative:	40	

Operatives

	per shift	Total on 3 shifts
Operatives	5	15
Others	2 + (1 single shift)	6 + (1 single shift)
	$7^1/3$	22

Hours of work: $22\frac{1}{2}$ per day. $157\frac{1}{2}$ per week. 6840 per year.

TABLE B/6

WARPING - AKAKI TEXTILE MILLS

Machinery

Make:	Barber Colman	Allen
Country of origin	U.S.A.	U.S.A.
Age	1971	1959
Number of machines	1	6
Number of creels	1	6
Creel spinning	606 ends	2 x 387 ends
		4 x 464 ends
Machine condition:	2	3
Output per machine hr	30,600 yd	15,000 yd
(Theoretical)	= 28,000 m	= 13,700 m
Efficiency	40%	53%

Yarn on beams

Ne 14	11,000 metres
	and 18,000 "

Yarn on cones

Ne 14	55,000 metres

Operatives

	per shift	Total on 3 shifts
Operators	7	21
Helpers	7	21
	14	42

Hours of work: $22\frac{1}{2}$ per day. $157\frac{1}{2}$ per week. 6840 per year.

TABLE B/7

SIZING - AKAKI TEXTILE MILLS

Machinery	3 machines	5 machines
Make:	West Point	Butterworth & Dickinson
Country of origin:	U.S.A.	England
Age:	1 m/c - 1968	1959
	1 m/c - 1977	
	1 m/c - 1979	
Machine conditions:	1	4
Operating speed:	54 m/min	14 m/min
Efficiency	55%	50%
Average length of run	11,000 metres	- sometimes 18,000 m

Operatives	per shift	Total on 3 shifts
Sizers	16	48
Mixers	2	6
Helpers	7	21
	25	75

Hours of work: $22\frac{1}{2}$ per day. $157\frac{1}{2}$ per week. 6840 per year.

TABLE B/8

DRAWING-IN AKAKI TEXTILE MILLS

Equipment

22 frames for manual warp-drawing-in

Output 966 beams per week - 157½ working hours

Operatives

	per shift	Total on 3 shifts
Drawers/reachers	44	132
Reed & heald cleaners etc	13	39
	57	171

Hours of work: 22½ per day. 157½ per week. 6840 per year.

TABLE B/9

PRODUCTION TARGET FOR 1979/1980 - AKAKI TEXTILE MILLS

	Product	Piece Dimension	Warp/weft counts Ne	Number of Looms	Loom width (inches)	Loom speed (ppm)	Reed	Picks per inch	Total ends	Annual Target (m^2)
1	Sanforized Twill	41" x 40 yds	2/32s x 13s	80	52	190	100	52	4798	2,570,000
2	Dyed Drill	41" x 40 yds	14s x 14s	16	52	190	88	40	3808	603,230
3	Dyed Drill	41" x 40 yds	14s x 14s	9	54	170	88	40	3808	287,800
4	Dyed Drill	36" x 40 yds	14s x 14s	90	44	175	80	44	3184	2,295,647
5	Dyed Drill	28" x 40 yds	14s x 14s	50	36	180	80	44	2464	1,170,724
6	Mohamudi	36" x 40 yds	14s x 14s	59	50	170	44	44	1784	1,833,222
7	Mohamudi	36" x 40 yds	14s x 14s	3	54	170	44	44	1784	9,931,532
8	Grey Sheeting	36" x 40 yds	14s x 14s	226	44	175	40	40	1604	8,400,000
9	Moradian	28" x 40 yds	20s x 20s	26	50	170	80	44	2704	640,732
10	Calico 145	42" x 40 yds	20s x 20s	5	50	170	56	56	2600	125,261
11	Calico 147	42" x 40 yds	20s x 20s	5	50	170	40	36	1864	192,576
12	Curtain Cloth	54" x 40 yds	20s x 20s	21	72	130	72	44	4416	667,046
13	Dyed Chadder	49" x 50 yds	20s x 20s	10	54	170	52	44	2676	376,419
14	Dyed Chadder	60" x 50 yds	20s x 20s	23	72	130	52	44	3508	811,731
15	Jacquard	58" x 30 yds	2/32s x 13s	4	72	130	88	46	6008	120,866
16	Dyed Poplin	36" x 40 yds	24s x 24s	160	44	175	52	44	2078	5,296,778
17	Chick Grey	36" x 40 yds	24s x 24s	21	44	175	40	40	1614	157,280
18	Sail Cloth	42" x 40 yds	2/14s x 2/14s	5	50	170	34	28	1588	259,343
19	Terry Towel	24" x 48 yds	2/32s x 13s	4	68	130	88	48	2961	45,508
	Total			817						26,547,384

TABLE B/10

LOOM SPECIFICATIONS - AKAKI TEXTILE MILLS

Type:	Automatic Pirn Change	Automatic Pirn Change
Make:	SAKAMOTO	RUTI
Country of origin:	Japan	Switzerland
Model	SO - D	BAZ
Age	1959/1963 (16-20 years)	1970 (9 years)
Machine conditions:	4	2
Width R.Sp.(cm)	92: 112: 127: 137: 183	130: 170: 180
Number of looms	50 500 100 25 50	96 4 4
Speed p.p.m.	185 170 170 170 130	190 130 130
Drive (Transmission):	Belt	Gear
Shedding:	Tappet Tappet(26 Dobby Tappet(21 Dobby (74 Tappet (29 Tappet	Tappet Terry Jacquard Dobby
Boxes:	1 x 1	1 x 1
Warp stop:	None	Mechanical
Weft stop:	Side	Side Centre Side
Let-off:	Negative	Positive
Change feeler:	Mechanical	Mechanical
Picking:	Under	Under
Healds:	Steel	Steel
Reed:	Loose	Fixed
Shuttle size (mm)	435 x 47	435 x 47
Beam flange dia (cm)	56	76

TABLE B/11

WEAVING SHED EMPLOYEES - AKAKI TEXTILE MILLS

Description		Number per shift	Total on 3 shifts
Supervisors / Foreman		3	9
Weavers	Sakamoto	161	483
	Ruti	28	84
Battery fillers	Sakamoto	14	42
	Ruti	2	6
Weft carriers		4	12
Cloth carriers		5	15
Warp carriers		6	18
Knotting machinists		2	6
" "	Asst.	2	6
Others		15	45
	Total	242	726

Hours of work: 22½ per day. 157½ per week. 6840 per year.

Note: See separate table for numbers of machine maintenance staff½

TABLE B/12

WEAVING DEPARTMENT MAINTENANCE STAFF - AKAKI TEXTILE MILLS

Shift:	Number per shift General	A	B	C	Total
Weaving preparation					
Maintenance Supervisor	1				1.
Shift Supervisor		1	1	1	3
Head mechanic	3				3
Mechanic	4	3	3	3	13
Asst. Mechanic	3	3	3	3	12
Cleaner	2	6	6	6	20
Oiler	3				3
Sub-total:	16	13	13	13	55
Loom shed					
Maintenance Chief	1				1
Asst. "	1				1
Maintenance Supervisor	4				4
Chief mechanic	9				9
Asst. "	7				7
General mechanic	3				3
Asst. "	1				1
Loom mechanic	25	11	18	20	74
Asst. "	16		16	17	49
Cleaner/oiler	26	11	6	2	45
Sub-total:	93	22	40	39	194
Grand Total	109	35	53	52	249

TABLE B/13

CLOTH INSPECTION - AKAKI TEXTILE MILLS

Inspection Tables: Made locally - No motor - manual drawing of cloth. Cloth examined in plaited form

Weekly length inspected: 512,000 metres

Operatives:

	Per shift	Total on 3 shifts
Supervisory	1	3
Direct labour	33	99
Helpers	2	6
	36	108

Hours of work: $22\frac{1}{2}$ per day. $157\frac{1}{2}$ per week$\frac{1}{2}$ 6840 per year.

TABLE B/14

WARP AND WEFT PREPARATION - BLANKET DEPARTMENT

AKAKI TEXTILE MILLS

WARPS

All cotton warps obtained from the warping department in the main plant.

WEFT

Solid cops produced on box spinners and cop winders.

Machines: 1 BEFAMA (Polish)) 1962
2 HANSEN (British))

Total spindles: 600

Output per 24 hours: 2780 kg. 1.6 Nm

Machine condition: 3

Operatives: 50 per shift

Hours of work: 22½ per day. 157½ per week. 6840 per year

TABLE B/15

WEAVING MACHINERY - BLANKET DEPARTMENT

AKAKI TEXTILE MILLS

Make of loom:	Galileo	Robt. Hall
Model	M3E	Blanket loom
Age	8 years	17 years
Width	180 cm	183 cm
Number of looms	10	24
Speed	92 ppm	115 ppm
Drive	Individual belt	Individual belt
Shedding	Side cam	Tappet
Boxes	4 x 4	1 x 1
Warp stop	None	None
Weft stop	Centre fork	Side fork
Let-off	Negative	Negative
Change feeler	None -	manual shuttle change
Picking	Underpick	Overpick
Healds	Steel	Steel
Reed	Fixed	Loose
Overall efficiency	70%	65%
Machine condition	2	3
Operatives per shift - weaving		3 shift total
Supervisor	1 (days)	1
Foreman	1	3
Weavers	30	90
Weft carriers	3	9
Cloth carriers	3	9
Total	37 1/3	112

Hours of work: 22½ per day. 157½ per week. 6840 per year.

Note: Maintenance staff for the blanket department are shown separately below

TABLE B/16

RAISING SECTION - BLANKET DEPARTMENT

AKAKI TEXTILE MILLS

MACHINES

1 Tomlinson Mark III
Speed: 10-15 m per minute
Machine condition: 2 (used on acrylic blankets only)

1 Arbach 12 cylinder machine
(Not in use - suitable for light fabrics only)
Machine condition: 2

Operatives per shift		3 shifts total
Shift leader	1	3
M/c operators	2	6
Total	3	9

Hours of work: 22½ per day. 157½ per week. 6840 per year.

Output: 422 m per 24 hours.

TABLE B/17

SEWING SECTION - BLANKET DEPARTMENT

AKAKI TEXTILE MILLS

MACHINES

6 Singer model 188 treadle lockstitch

5 Singer model 20W treadle lockstitch

Age: 25+ years

Machine condition: 4

1 Cutting table. locally produced

Operatives per shift:	General	A	B	Total
Sewing machinists:	11			11
Blanket cutters:	4			4
Inspectors	-	6	6	12
Total	15	6	6	27

Hours of work: General shift: $7\frac{1}{2}$ per day. 45 per week. 2280 per year

A and B shifts: 15 per day. 90 per week. 4560 per year

Output: 767 blankets per day

TABLE B/18

MAINTENANCE STAFF - BLANKET DEPARTMENT

AKAKI TEXTILE MILLS

	General	Shift A	Shift B	Shift C	Total
Maintenance Head	1				1
Head mechanic	3				3
Shift mechanic		3	1	2	6
Assistant shift mechanic		3	2	3	8
Mechanic	9				9
Welder				1	1
Oiler	2				2
Cleaner	1				1
Total	16	6	3	6	31

Hours of work: 22½ per day. 157½ per week. 6840 per year.

Note: Equipment serviced by the maintenance staff includes:

cutting machines
rag tearing machine
hard waste opener
blending machine
carding sets
box spinners
looms
raising machines
sewing machines

TABLE B/19

FINISHING DEPARTMENT LABOUR DEPLOYMENT - [illegible] TEXTILE MILLS

	FOREMEN/SUPERVISORS	OPERATIVES	ANCILLARY
Grey Room		-	-
Singe/Desize		-	-
Scour/Washing		3	27
Bleaching	3	-	-
Mercerising	-	3	6
Intermediate Drying	-	3	12
Continuous Dyeing	-	1	2
Pad Dyeing	-	6	12
Jigger Dyeing	3	3	30
Finishing Kitchen	-	3	3
Intermediate Drying	-	3	9
Print Machines	1	2	8
Studio and Design	-	2	-
Print Ancillary	-	3	2
Stenters	3	9	27
Calenders	-	6	2
Shrinking Machine	1	1	3
Inspection	7	47	-
Make-up	-	22	-
Baleing	-	69	7
Totals	18	126	150

Grand Total	294
Departmental Area	2507 sq. metres
Annual Production	14.72 million metres
Annual Production/Person Employed	50,068 metres
Annual Production/Unit Area	5,871 metres
Operating Days per Year	302
No of Shifts operated	3
Hours Worked per Shift per Week	47

FINISHING

Item M/c Code	Equipment	No. of units	Manufacturer	Years of Manf/Inst
1	Singeing m/c	1	Parex	1969
2	Scouring kiers	3	Warayama	1959/73
3	Rope washer	3	"	1959
4	Pad roll impregnator	1	"	-
5	Mercerising range	1	Max Goller	1966
6	Cylinder dryer (30 stack)	1	Warayama	1971
7	Cylinder dryer (20 stack)	1	"	1959
8	Open width washer	1	Italian Manufacture	-
9	Jig Dyeing M/cs	4	Ericolli	1975
10	" " "	2	Kovo	1963
11	" " "	2	Warayama	1959
12	" " "	2	Smiths	1963
13	Dye pad	1	Warayama	1969
14	Dye pad	1	J.F.Norton	1963
15	Hot flue	1	J.F.Norton	-
16	Steamer/wasn range	1	J.F.Norton	-
17	No.1 stenter-clip-4 bay	1	Artos	1963
18	No.2 stenter-clip-4 bay	1	Artos	1966
19	No.3 stenter-pin/clip-4 bay	1	Artos	1973
20	Baker	1	Artos	1971/2
21	8 colour rotary screen	1	Stork	1971/2
22	Sanforiser	1	Morrison	1975
23	Schreiner/Calender	1	Ericolli	1975
24	7-bowl calender	1	J.F.Norton	1959
25	3-bowl calender	1	" "	-
26	Making-up m/cs	5	-	-
27	Baling press	1	-	-
28	Yarn Dyeing Plant	1	Obermeir	-

TABLE B/20

EQUIPMENT - AKAKI TEXTILE MILLS

Operating Width cms	Operating Speed m/min	Condition	Remarks
150	90	2/3	Leaking supply tank - Liquid gas unobtainable. Not used in eight years
-	90	1	
-	-	1	
150	60	2	
150	20	2	Facility for operating two webs of fabric
150	-	1	Operating speed dependent on fabric weight
150	-	1/2	" " "
150	-	3	Machine is in the process of being reconditioned
150	-	1	1 metre diameter-batch machines
-	-	3	50 cms diameter-batch machines
-	-	3	" " " "
-	-	3	" " " "
-	-	2	
-	-	2	
150	-	3	Speed dependent on fabric weight. Problems with internal mounted bearings.
150	40	2	Earlier problems in attaining steam temperature stated to have been overcome.
147	-	3	Steam heated - In need of major overhaul.
127	-	2	Steam heated
160	-	1	Thermal oil heated
-	-	1	Thermal oil heated
-	-	1	Under utilised
110	-	1	
180	40	1	Not in use
180	50	2	
160	50	2/3	Not in use
-	-	2	Covering-plaiting, creasing, rolling etc.
-	-	2	
-	-	1	Infrequently used

Serial No.	Make & Type	No. of feeds		Diameter or width	RPM
1	Mayer Circular	24	14 needle/inch	30 inch	30 m/ inch
2	"	32	16 " "	26 "	16 m/ inch
3	"	32	16 " "	24 "	14 m/ inch
4	"	8	13 " "	18 "	22 m/ inch
5	"	20	18 " "	20 "	35 m/ inch
6	"	18	18 " "	18 "	40 m/ inch
7	"	16	18 " "	16 "	28 m/ inch
8	"	22	15 " "	22 "	32 m/ inch
9	"	20	15 " "	20 "	32 m/ inch
10	H.Stole Flat bed	20	10 " "	130 cm	30 stroke
11	Terrot			22 cm	
12	G.Blackburn Circular			18 cm	
13	G.Blackburn Circular			18 cm	
14	Mayer Circular			18 cm	
15	U.S.A. Circular			18 cm	
16	Rimach flat bed, Jacquard				
17 18	Rimach flat, manuel machines				

Other machines

1. Reeling machine
2. Leesona 40 spindle manual cone winder
3. 'Bari' Compressor

TABLE B/21

KNITTING EQUIPMENT - AKAKI/KALITI

Installed power per machine (kW)	Actual weight produced per machine hour	Stitch cm	Course inch	Actual Production		Wales/inch	Weight of cloth per M^2	Machine condition	Machine age (years)
				M/day	kg/day				
2.5 kW	1.29 kg	9	19	97	31	9 x 2.54	0.174 kg	2	20 +
2.2 "	1.4 kg	11	22	99	34	11 x 2.54	0.231 "	2	20 +
1.2 "	2.33 kg	11	22	197	56	11 x 2.54	0.227 "	2	20 +
1.5 "	0.71 kg	9	19	96	17	9 x 2.54	0.168 "	2	20 +
1.5 "	2.21 kg	11	26	243	53	11 x 2.54	0.241 "	2	20 +
1.5 "	1.79 kg	11	26	18	43	11 x 2.54	0.224 "	2	20 +
1.5 "	1.92 kg	10	27	227	46	10 x 2.54	0.228 "	2	20 +
1.1 "	2.5 kg	11	22	233	60	11 x 2.54	0.230 "	2	20 +
1.5 "	2.5 kg	8	16	307	60	8 x 2.54	0.190 "	2	20 +
	Produces spindle tapes and other tapes							2	20 +
Not in working order								4	20 +
Not in working order								4	20 +
Not in working order								4	20 +
Not in working order								4	20 +
Not in working order								4	20 +
Not working								2	20 +
Not working - lack of orders								4	20 +
								2	20 +
								1	5

TABLE B/22

KNITTED FABRICS PRODUCED AT KALITI

KNIT	YARN	FIBRE	END USE
Jersey	24s	Cotton	Underwear
Interlock	24s	Cotton	Underwear
Rib	60/2s	Acrylic	Sportswear
	24s	Cotton	Underwear

ANNUAL QUANTITY PRODUCED: 120 TONNES

TABLE B/23

SEWING EQUIPMENT - AKAKI TEXTILE MILLS (KALITI)

TYPE OF MACHINE	No.	MAKER	MODEL	CONDITION
Button holer	1	Durkopp		3
"	1	Juki	LA47	2
"	1	Juki	LBH-761	2
Button sewer	1	Durkopp		2
"	1	Juki	MB372	2
Single needle lockstitch	1	Singer	FE40	4
"	8	? line shaft driven		4
"	5	Durkopp		2
Twin needle lockstitch	2	Mouser		2
Overlock machines	6	Singer		2
"	6	Rowley & Kaiser		4
"	5	Yamato		2
Collar stitching machine	1	Omatex		2
Laying-up table	1	-		4
Laying-up machine	1	Durkopp	manual	2
Powered hand knives	2	Krauss & Reitchard		2
Hoffman press	1	Braithwaite		2
Steam press	1	Locally made		4
Ironing press	1	-		2

TABLE B/24

STAFFING - KNITTING AND SEWING DEPARTMENTS - AKAKI TEXTILE MILLS (KALITI)

Hours of work: General shift $7\frac{1}{2}$ per day, 45 per week, 2280 per year.
Multi-shifts $22\frac{1}{2}$ per day, 157.5 per week, 6840 per year.

	Number of operatives per shift				
Shift:	General	A	B	C	Total
Knitting	-	3	3	3	9
Cutting	3				3
Sorting	10				10
Sewing	45				45
Pressing	-	2	2	-	4
Packing & despatch	15				15
Other	6	1	1	1	9
Sub-Total	79	6	6	4	95
	Maintenance staff				
Knitting machine mechanic	1				1
Electrician		1	1	1	3
Sewing mechanic	2				2
Boiler mechanic	1				1
Supervisors	3				3
Sub-Total	7	1	1	1	10
Grand Total	86	7	7	5	105

PROGRESS COTTON FACTORY (IDGET)

Processes: Spinning and Yarn Bleaching

Output: 1394 tonnes p.a.

1.0 SPINNING CAPACITY AND EFFICIENCY

The machinery installed in Idget Cotton Factory has been manufactured by a variety of companies, and in comparison with other mills in Ethiopia, it is relatively old. However, with the three exceptions of the Whitin shortened opening and cleaning line, for which there is no requirement (the mill does not spin blends of man-made fibres), the Platt 4 delivery drawframes which are technically obsolete, and the Sario winders which are in a bad condition and of questionable value in a mill producing sales yarn only, none of the remaining machines are beyond rehabilitation or are technically obsolete.

Generally speaking the condition of the machinery ranges from poor to satisfactory. All of it could however, benefit from improved maintenance a fact confirmed by the low overall efficiency levels returned in the questionnaire. Table A summarises the departmental capacities when calculated on the basis of the present product range, operating speeds, and overall efficiencies. It illustrates the extent of the departmental imbalance. Both the Whitin opening line, and Platt drawframes mentioned above, have been disregarded in these calculations.

The first question to be asked when deciding on a future policy for the Idget mill is, is it worthwhile introducing new machinery into the mill in order to obtain a departmental balance? At present the working environment is dusty and fly-laden; there is no air-conditioning system, and the building fabric is unsuitable to support one. The whole site has a generally run-down air about it. Under these conditions new machinery can be expected to deteriorate more rapidly than it should, added to which there is an absence

TABLE A DEPARTMENTAL CAPACITIES: IDGET COTTON FACTORY

(Kg/hr)

(1) Department	(2) Claimed Capacity at existing efficiencies and operating parameters		(3) Improved Capacity at realistic operating efficiencies		(4) Recommended Capacity for a balanced plant
	Weight	Eff.(%	Weight	Eff.(%)	
Blow-room	402	85	402	85	402
Carding	214	85	226	90	370
Drawframes	261	60	326	75	368
Roving frames	310	57.5	388	72	364
Ringframes	324	60	442	82	357
Reelers	1073	28	1073	28	350

of maintenance and operating schemes to prevent this deterioration.

Thus our policy towards the mill can be summed up as one of contraction and consolidation. We believe the mill should aim to establish a more efficient plant, based on its existing machinery, which nevertheless has a capacity roughly 60% greater than its production in 1978 suggested. We cannot envisage this policy being carried through successfully unless a new building is built to house the smaller plant. The breathing space which the construction of this building will impose should be used to recruit and train, (with the assistance of the expatriate labour currently employed on the site which is technically competent and highly motivated), the necessary management and supervisory staff to achieve the full capacity of which, we believe the plant to be capable.

With the existing Hergeth opening and cleaning machinery the blow-room can produce 402 Kg/hr of cleaned and open fibre in lap form. Allowing for the wastage of fibre associated with each processing stage shown in the published Waste Multiplier for Market Yarn chart, then this capacity corresponds to 349 Kg/hr at the ringframes. With reasonable operating speeds and efficiencies and the existing yarn parameters (turns per inch, count etc) this 349 Kg/hr can be produced in the following manner:

5 Platt,	256 spindle frames on 6s Ne	=	96 Kg/hr
8 Platt	256 spindle frames on 10s Ne	=	90 Kg/hr
5 Platt	400 spindle frames on 10s Ne	=	88 Kg/hr
2 Marzoli 1965,	408 spindle frames on 10s Ne	=	36 Kg/hr
5 Marzoli 1965,	408 spindle frames on 21s Ne	=	39 Kg/hr

The aggregate output of 10s Ne yarn is 214 Kg/hr and the total for the spinning department 349 Kg/hr. In fact the sales yarn twist factors used in Idget seem marginally higher than in other mills in Ethiopia, and if this is used simply to increase the strength of the yarn rather than to meet specific market requirements, then with better maintained machinery operating in a controlled environment, management will have little difficulty increasing the output from the spinning department by an even greater margin than the above values suggest.

Based on a 288 day year and operating three shifts per day giving a total running time of 24 hours a day, this 349 Kg/hr capacity compares with the 201 Kg/hr achieved in 1978.

The present roving frame capacity, when operating at a realistic overall efficiency has sufficient capacity to match the ringframe output. In the case of the drawframes however, this is not the case. Efficiency increases alone will not be sufficient to balance the plant. Current operating speeds are marginally lower than we expected but even if they are increased to the expected speeds, capacity is still insufficient to meet the demand. We therefore recommend Idget to purchase two additional machines from Marzoli in order to provide the necessary balancing capacity. The cost of these purchases we estimate to be US $ 72 000.

In the carding department the capacity deficit is much greater than in other departments. In order to provide a balanced plant the production needs to be increased from the present rate of 214 Kg/hr to 370 Kg/hr. The Crosrol converted tandem cards are currently producing sliver at 20.6 Kg/hr when management (Mr Vuga) states that they should in fact be producing 28 Kg/hr. If this latter value is accepted as realistic, and Crosrol confirm that it is, then 15 sets would be necessary if they were all operating with an overall efficiency no lower than 90%. That is 5 sets more than are currently installed in the mill. Though the existing Whitin single cards have been rated at 3, that is they are in need of overhauling and some degree of rehabilitating, we do not recommend this action because;

(a) spare parts may not be difficult to obtain in the short-term, but could become so towards the end of the decade, and

(b) given the shortage of skilled mechanics which exists in Ethiopia, any move towards standardisation helps to off-set technical deficiencies in training programmes. The new mill will therefore be equipped with 5 additional converted Crosrol cards to add to the 10 existing units at a cost of an estimated US $ 210 000.

With these recommendations implemented, an unaltered blow-room will be able to supply the desired quality and quantity of fibre to match the subsequent machinery. We have ranked the older Whitin opening line 4, but if there is any real possibility that the mill is likely to produce blends of cotton and man-made fibre, then this machinery can be rehabilitated and transferred as well.

Estimates of the cost of such an exercise, including the cost of transfer, rehabilitation, new machinery, and new building and services are:

		US $ (000)
(i)	Cost of additional machinery specified above:	282
(ii)	Cost of transferring existing machinery including foreign supervisory labour:	360
(iii)	Cost of rehabilitating machinery:	430
(iv)	Cost of building new mill 6000 m^2 x $ 200	1 200
	plus. Air conditioning	840
	Electric	640
	Mechanical Handling	210
	Fire protection	270
	Boiler	90
	Total ('000) US $	4 322

It is emphasised that these figures are rough estimates only, and do not warrant treatment for return on investment calculations. Item (iii) includes the cost of new plant and equipment for the maintenance, and quality control departments discussed below.

2.0 SPINNING MACHINERY CONDITION

In the past it has been the firm's policy to accept twice a year a visit from the Hergeth service engineer to examine and reset the opening and cleaning machinery. Since 1976 however, this practice has stopped and in common with other departments, there are insufficient mechanics with the knowledge and ability to maintain the machinery properly. The Crosrol cards had been checked the month previous to our visit by a Crosrol engineer. Yet these cards are already showing signs of misuse with guards left off, and dust extract ductwork not operating correctly. Without any planned maintenance schedule this deterioration can be expected to accelerate. Lost output is therefore 7.4 Kg/hr/card, that is 74 Kg/hr of sliver. Over the period of a full year, this corresponds to a loss of income to the mill of at least 2.5m Birr, assuming an average selling price of 23 Birr per 4.5 Kg bundle. This costly failure to maintain the cards properly is the reason why they have been rated 2.

The drawframes are all operating with their guards up allowing the ingress for fly-laden air and the consequent collection of fly and dirt around the drafting rollers and condensing trumpet. No brakes are fitted to the motors, consequently stop motions are inoperative and when sliver breaks occur the machines continue to run with fewer than necessary slivers feeding them. Under these conditions, quality control is impossible as the supervision is not strong enough to counter the effect of this poor maintenance.

A major overhaul of the roving frames narrowly missed completion during the period of our visit. Only the Marzoti Type BC (1972) unit had not been returned to production as maintenance work on it was still in progress. With the exception of the Platt MS 1 (1950) frame all these units received a rating of 2 though at the time of the visit they were in a good condition (worthy of a 1 rating, but again owing to poor maintenance procedures can be expected to drop to 2 in a very short period). If our recommendations regarding the transfer of the plant to a new building are followed, then we would not expect the Platt M1 frame to be part of that transfer. Its capacity would be more than matched by the Marzoti unit mentioned above.

The notes which we recorded on the condition of the ringframes reproduced here in relatively detailed form and amply illustrate how the interaction between poor maintenance, poor quality control and poor supervision combine to produce low levels of poor quality yarn. On the drafting systems, roller surfaces were damaged sufficient to jeopardize controlled drafting, leading to irregular yarn with a high end-breakage rate and resulting in lower machine and operative productivity levels. Aprons were worn, cracked, in some instances torn, and where attempts had been made to replace damaged ones with new, the jointing was often bad. Again the results are low productivity. A similar example of poor supervision of that maintenance which did take place leading to a faster than necessary deterioration of the machinery is found when examining the spindle tapes. Poor jointing in some instances was causing tapes to vibrate quite violently, the inevitable result being that they jumped off the jockey pulleys, again contributing to higher down-time and lower machine productivity. Bobbins on the spindles varied in height by up to 1 inch and when this fact is combined with the eccentricity seen on some of the rings, then it is clear that it is impossible for the frames to spin packages to the size for which they were designed. Again the result is lower machine and operative productivity. Umbrella creels fitted with brakes were installed on some frames. But the brakes in most instances were incorrectly fitted, so much so, that they failed to provide any braking effect, thus causing an unecessarily high roving break-rate. Poor alignment of the 'third hand' Pneumafil system was causing roller lapping on some frames, and this must lead to excessive wear rates on the front rollers on the drafting system, plus an inevitably extended down-time for the particular spindle. The result once again contributing to the low labour and machine productivities found in the mill.

We therefore recommend that the ringframes are thoroughly overhauled before commencing production in the new building.

The estimated cost of this overhauling (for the ringframes, drawframes and opening line) is US $ 430000.

C//

3.0 YARN BLEACHING

This is a relatively small unit, badly sited and constructed and presenting extremely poor working conditions. Even so, the unit accounts for 454 000 Kg of bleached yarn per year, making a very positive contribution to the national economy.

It is understood that NTC plans to extend manufacturing capacity at the Idget site; if this is the case, existing finishing capacity will not cope with; a proportional increase in bleached yarns since it is already working at capacity within the limitation of plant and equipment.

In the event of higher production volumes of bleached yarn being required, our recommendations would be:

1. Resiting of the bleaching operation in more suitable premises

2. Acquisition of additional equipment, consistent with required production volumes

3. Acquisition of New Steam Generating Plant.

The main factor inhibiting production with the existing equipment is the boiler which has a maximum steam generating capacity of 600 Kg/hr. This quantity of steam is not sufficient to meet the demands of bleaching and drying operations with the result that process cycles are extended and efficiencies consequentially low. In the event of improved bleaching cycles, there may be a bottleneck produced in the drying operation, but in the absence of more precise information no firm recommendation is made.

4. Central authority to exercise more control over raw material deliveries, there are insufficient permanent storage facilities available on site, consequently raw materials are temporarily stored in unsuitable conditions.

5. Central assistance should be given to the factory to overcome ihe shortages of experienced technical and supervisory staff

PLANT AND EQUIPMENT

Machine	Manufacturer	Year	Condition
Bleaching unit	H.Krantz	1971	2/3
Hydro extractor	H.Krantz	1971	2/3
Dryer	H.Krantz	1971	2/3
Boiler	Wanson capacity 600 Kgs steam/hour	1971	2/3 - Low steam generating capability

PRODUCTION RATES AND CHARGES

Operation	Load/charge Kgs	Cycle Frequency per shift	Production/shift Kgs Min	Max
Bleaching	300	2.0	600	600
Hydro-extracting	75 - 130	4.5	338	585
Drying	67.5	9.0	608	608

The above production figures were obtained from two site sources on separate occasions, they demonstrate wide variation making any calculation unreliable. It is therefore essential that an accurate production survey is undertaken, before the acquisition of further equipment is contemplated.

From the above figures, the greatest potential imbalance is in hydro-extracting. A cycle time of 2.67 hours appears excessive, even allowing for hand loading/unloading, casting some doubt on the mechanical efficiency of the equipment, particularly braking efficiency.

4.0 BUILDING AND SERVICES

4.1 Building and Storage Facilities

The main manufacturing buildings for ginning, spinning and winding are of reasonable construction and suitable for intended purposes. The general factory lay-out is irregular and restricted by the site topography, particularly in respect of elevations.

Factory management would appear to have little if any, control of raw material deliveries; as a result, the main raw materials store is fully occupied and temporary stores have been erected at various locations on the factory site. This inevitably leads to mixed bales going into ginning and the mixing of different cotton qualities. Whilst the main raw material store has only an earthen floor, it is adequate for the intended purpose and until such time as circumstances permit an improved flooring. The temporary stores would be considered inadequate for the storage of raw cotton, particularly during the rain seasons, the continued use of these should be discouraged as soon as the random delivery of material has been brought under control.

Congestion on the site as a whole will only be relieved after the present spinning facility has been reorganised, and the ginning programme has been rationalised to produce sufficient fibre for the mills which the gin serves for a limited (say) three month period. A new, better quality bale store can then be built on a part of the site which will provide transport with manageable access, a condition which is not met with the existing lay-out. The estimated capacity of the two gin stands is 1800 Kg/hr or roughly two-thirds of the capacity of the press. If 90 000 quintals (the 1978 production level) is typical of ginning demand from the plant, and it is assumed that this quantity is delivered to the gin over a period of four months, then the maximum storage capacity required is for 48 600 quintals, that is for 26 000 m^3 assuming a bulk storage density of 192 Kg/m^3. Allowing an additional 40% of surface area for gangways etc. and 3.5 metres as the maximum storage height, then the total volume required is 52 000 m^3 on 10 400 m^2 of floor area. At US $ 170 per square metre this corresponds to a building cost of roughly US $ 1 800 000. Existing buildings, including the present spinning mill, would also be rationalised at this time to provide optimum storage facilities.

4.2 Air Conditioning

The plant is not equipped with a recognised air conditioning system able to give controlled temperature and relative humidity. Water sprays to provide some level of humidity are installed in the spinning department, but are not working. All doors into the mill are generally wide open to allow natural ventilation, there being no other method.

This lack of control over the working environment is seen as a major contributory factor to the general air of indifference which pervades the mill.

4.3 Steam Generator

The sole source of supply is a small package type boiler, generating 600 Kg of steam per hour. It was reported that this does not correspond with the yarn finishing demand for steam, and that as a result process and drying cycle times are extended, causing loss of production.

An improved steam supply is a pre-requisite for improving the productivity of the department; and is essential before any plans for increasing productive capacity are implemented.

5.0 WORKING CONDITIONS

Generally, the working environmental conditions within the factory fall well below those experienced in other Ethiopian Mills. It is our opinion that this is a major contributory factor to absenteeism which rises to 25% of workforce on occasions and 35% on certain shifts.

A staged programme, possibly extending over a number of years, should be drawn-up to improve general working conditions and capital allocation budgeted for its implementation.

Fire Precautions

Particularly in view of the large raw material stocks maintained at the site, the provision of more fire fighting equipment should be made as a priority. The provision of such equipment within the factory is at a low level and should be increased to a more acceptable standard.

6.0 MAINTENANCE

It is clear from the review of the processing machinery that this sector of maintenance needs to be improved greatly, and that this can occur only after sufficient well-trained technicians are recruited.

The mill has a small workshop with two existing lathes and another on order, two milling machines and an assortment of drills. Thus general maintenance, though not as comprehensively equipped as some of the larger mills in Ethiopia, is able to carry out the simple routine repair functions for which it is established. Machines are generally in a good condition and we judged the quality of the labour working in both the mechanical and electrical sections to be satisfactory, that is significantly better than that working inside the spinning departments. In view of the mills location relative to the Addis Ababa private sector repair and engineering factories, and the difficulties recruiting new staff, we do not recommend any further expansion of the general maintenance facilities.

For the size of mill and product range with which the mill is concerned, we would recommend the process machinery maintenance staffing level shown in Table B. These levels are based on the operation of planned routine maintenance schemes, sufficient only to reduce the frequency and extent of breakdown maintenance to manageable proportions, yet at the same time allowing the mill to reach the operating levels and efficiencies to produce the 349 Kg/hr of yarn discussed above. The features of Table B which differ most from the chart prepared by Mr Vuga are:

- The total of management, supervision and administration in Table B amounts to 14 persons compared with 3 in the existing structure

- Excluding boiler, pump, and air-conditioning mechanics 35 skilled workers are required in Table B compared with the 37 currently employed (this number includes 9 shift mechanics listed under the production organisation in the staff list supplied by Mr Vuga).

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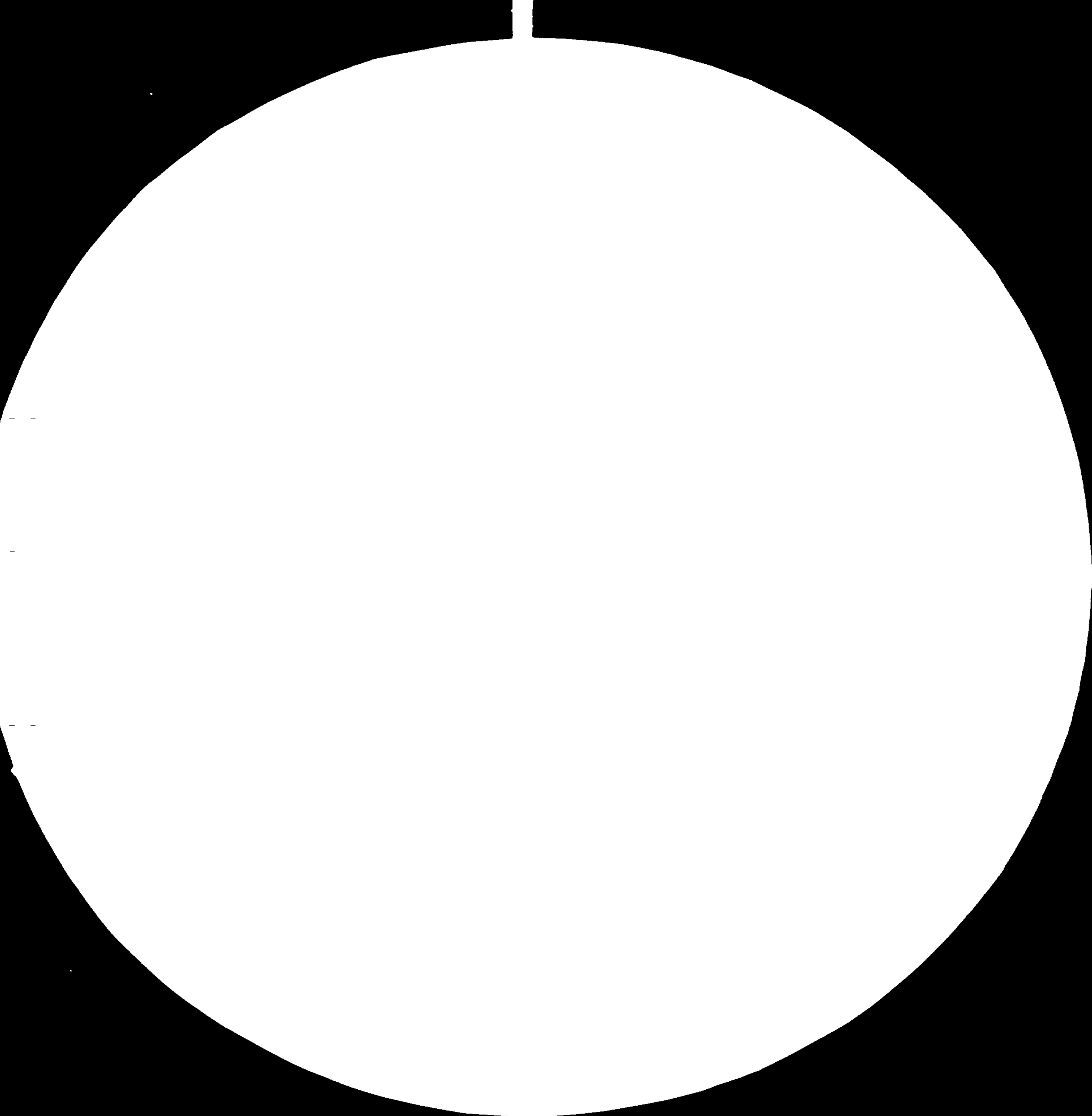

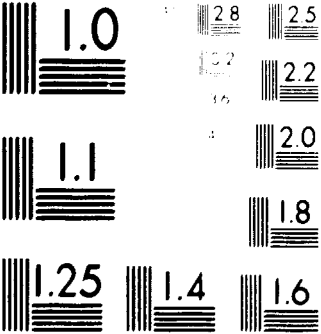

MICROCOPY RESOLUTION TEST CHART

TABLE 8: RECOMMENDED MAINTENANCE DEPARTMENT STAFFING LEVELS: IDGET

- **TECHNICAL MANAGER**
  - **ASSISTANT MANAGER (Maintenance)**
    - **FOREMAN (Workshops)**
      - EXISTING WORKSHOP (16 in total) LABOUR FORCE & SUPERVISORS (Mech.+Elect.)**
        PLUS
        - 1 Welder (days)
        - 2 Carpenters (days)
        - 2 Plumbers (days)
      - AND IF RECOMMENDED NEW BUILDING GOES AHEAD, PLUS
        - 1 Boiler mechanic (days)*
        - 1 Pump mechanic (days)*
        - 1 Air-conditioning Engineer (days)*
        - 3 A-C mechanics (Shift)*
    - **FOREMAN (Process machinery)**
      - 2 Mechanics in charge of ginning/yarn dyeing etc.
      - 1 Mechanic in charge of Hergeth and Crosrol (days)
      - 1 Mechanic in charge of Drawframes/Roving frames (days)
      - 1 Mechanic in charge of Ring frames and Reelers (days)
      - 6 Shift mechanics
      - 1 Cot grinder/Apron repairer (days)
      - 1 Card grinder (days)
      - 1 Card covering mechanic (days)
      - 6 Cleaners (Scouring team, days)
  - **ASSISTANT MANAGER (Administration)**
    - 1 Draughtsman
    - 1 Maintenance control and planning clerk
    - 1 Cost control clerk
    - 2 Stores clerks
    - 1 Clerk: Plant records, and Engineering and Fire insurance
    - 1 Clerk: Safety, Security and Fire protection

TOTAL APPROX: 59 + Labourers to suit

NOTES

* TO BE RECRUITED BEFORE BUILDING PROGRAMME/MACHINERY INSTALLATION IS COMPLETED

** IT IS ASSUMED THAT THE ELECTRICAL WORKSHOP STAFF INCLUDES 3 SHIFT ELECTRICIANS. IF THIS IS NOT THE CASE THEN 3 SUCH ELECTRICIANS ARE TO BE ADDED TO THE FOREMAN (PROCESS MACHINERY) COLUMN.

We have not followed the management structure recommended by the existing acting general manager, which required the technical manager to be responsible for both a maintenance manager and a production manager. Our reason for not doing so is that we believe that in the past in Ethiopia maintenance has been treated as a secondary requirement to production. Yet one of the most important needs of the industry at the moment is to increase its output to a level consistent with its machine capacity. In order to do this we believe it is essential for production and maintenance objectives (which in some instances are bound to conflict) are reconciled and agreed at the highest level. If production managers are to be increasingly occupied with optimising their labour manning levels and developing realistic cost control and incentive schemes, and technical managers with introducing planned maintenance programmes and cost control systems, then they both need to be represented on the higher echelons of the management heirarchy, so as to ensure fully integrated decision making.

7.0 LABOUR PRODUCTIVITY

The OHK value, for the labour employed from opening and cleaning through spinning is 84.65 which on a corrected basis (the average count is 10.16 Ne) for 20 Ne increases to 195.0 and is very high. It remains so even if the plant produces the 349 Kg/hr which we believe it is capable of doing.

There is empirical evidence to suggest that once the OHK values reach this level in a spinning mill, then the number of employees engaged on the work is the prime cause of inefficiency in itself. High manning levels (at this level) do not result from poor machinery, poor training, poor operating conditions etc. rather these qualities are caused directly by the high labour allocation which removes from individual operations the need to accomplish a range of tasks for which they are responsible and accountable.

Indifference then persists at all levels of labour, and marginal changes of the number tackling a particular task do not alter the attitude of the staff working on that task.

Instead a rigorous cut-back in the manning level is required. Perhaps, in the case of Idget, as many as 450 to 550 need to be withdrawn from the production departments. Only then will the mill be in a position to introduce into the mill a worthwhile job content for each operative, and at the same time raise its quality and efficiency to more acceptable levels.

The key areas which can be expected to provide the largest shake-out of labour are:

(a) the blow-room. In the blow-room it is the indirect labour which causes the unacceptable manning levels. 15 day workers are described as bale transporters or blenders, and these are employed in addition to the 3 (per shift) tending machines. Each of these day-workers are consequently handling no more than 480 Kg/day of fibre.

(b) in the ring-room. The prime cause of the large OHK value here, is the number of spinners (even allowing for relatively high end-breakage rates and small diameter rings for the counts spun), doffers, and the quite exceptional number of helpers. Spinners look after only one side per frame, doffers doff 93.26 packages per hour each, and the 10 reserve (on each shift) means that the reserve is, after the machine operators and doffing teams, the largest category of labour employed.

8.0 SKILL LEVELS

Concern was expressed by senior management regarding the difficulty of obtaining suitable people for technical and supervisory positions. Generally, existing supervisory staff were lacking in the training and experience necessary to be competent in the present positions. Particular obstacles in improving the situation were:

1. Existing work-force would not accept outsiders in positions of authority.

2. Graduate staff engaged, had to gain acceptance by the work-force and in so doing lost their potential effectiveness as supervisors.

Given the above situation, it is difficult to envisage effective training being extended to the work-force in general.

TABLE NO. [illegible] - INVENTORY OF SPINNING MACHINERY

[illegible]

Section	Machine Description	Manufacturer	Model	Year of Manufacture	No. of M/cs	No. of Del./Spindles	Installed Power kW	Can, Bobbin or Tube Size: D mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Rate: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
BLOW-ROOM SECTION	Blending Feeder	Hergeth	MB	1965	1		[illegible]				[illegible]									2
	Conveyor Belt	"		1965	1		1,75				[illegible]									2
	Condenser	"	KD	1965	1		[illegible]													2
	Feed Box	"	[illegible]	1965	1		1,35				[illegible]									2
	Giant (step) Cleaner	"	[illegible]	1965	1		[illegible]				[illegible]									2
	Porcupine Opener	"	YO	1965	1		3,70				[illegible]									2
	2-Way Distributor	"	MV	1972	1		-													2
	Dust Cage Filter	"		1965			0,25													2
	Dust Cage Filter	"		1972			0,25													2
	Hopper Feeder	"	KS	1965	1		5,29				1000									2
	Hopper Feeder	"	KS	1972	1		5,29				1000									2
	Scutcher	"	SW	1965	1		5,98				1000									2
	Scutcher	"	SW	1972	1		5,98				1000									2
	Auto. Lap Duffer	"	AZ	1965	1	1	1,83				914/1016		9,9m/min			0,0012		244kg	85	2
	" " "	"	AZ	1972	1	1	1,83				"		"			0,00135		230kg	85	
	Blending Feeder (2)	Whitin																		4
	Opener (2)	Whitin			1	1	18,3				1016									4
	Hopper Feeder (2)	The accuracy of the list of machines needs checking																		4
	Scutcher (2)																			4
CARDS	Single Cards	Whitin			[illegible]	1	[illegible]	457	[illegible]	[illegible]	1016	[illegible] rpm	Doffer)			[illegible]		6,6kg	85	3
	Tandem Cards	Crosrol	MK-1	1972	10	1	9,8	[illegible]	[illegible]	[illegible]	1016	[illegible] rpm	"			[illegible]		[illegible] kg	85	2
	Rotary Filter	"	Cross-clean	1972	2		30,2 (1)													2
DRAWFRAMES	Drawframe 1st Pass (2)	Platts			1	4														4
	Drawframe 1st Pass (2)	Marzoli	[illegible] 20	1972	[illegible]	2	[illegible]	457	914	[illegible]			[illegible] m/min		Lovere	[illegible]		[illegible]	60%	2
	Drawframe 2nd Pass (2)	Platts			1	4														4
	Drawframe 2nd Pass	Marzoli	[illegible] 20	1966/1968	4	[illegible]	[illegible]	457	914	[illegible]			[illegible] m/min		Lovere	0,125		[illegible]	60%	2
ROVING FRAMES	Roving Frames (2)	Platts	[illegible]	1950	[illegible]		[illegible] (1)													[illegible] 4
	Roving Frames	"	MS2	1955	[illegible]	100	6,00 (1)	[illegible]	305	[illegible]		600rpm			SKF,PK, 421	0,9	0,87	0,775	50%	2
	Roving Frames	Marzoli	F3G	1965	2	100	7,15	48	340	0,9[illegible]		800rpm			Sussen [illegible]	0,6	0,78	1,538	65	2
	Roving Frames	"	F3G	1966	1	100	7,15	48	340	0,9[illegible]		850rpm			SKF PK 421/1	0,8	0,87	1,029	65	2
	Roving Frames	"	BC	1972	1	100	7,35	48	340	0,9[illegible]		850rpm			SKF PK 521/1-F					2
RING FRAMES	Ring Frames	Platts	M1	1955	6	356	7,35	48	250	0,110		6500rpm		Yes	Casa's x 3	10,0	11,75	0,050	55	3
	Ring Frames	"	M1	1955	2	356	7,35	48	250	0,110		6000rpm		Yes	SKF PK 2[illegible]	6,0	9,5	0,095	50	3
	Ring Frames	"	M23	1958	5	400	18,40	48	280	0,110		7000rpm		Yes	SKF PK 2[illegible]	10,0	11,75	0,054	60	3
	Ring Frames	Marzoli	RC	1965	7	408	14,70	48	280	0,120		8500rpm		Yes	Sussen [illegible] 200	21,0	19,0	0,019	65	3
	Ring Frames	"	RC	1972	6	408	14,70	48	280	0,120		8250rpm		Yes	SKF PK [illegible]	10,0	11,75	0,063	63	3
	Ring Frame*																			
REELING	Reeling Frames	Bertone	20	1967	14	80	1,5					[illegible] rpm				21,0		0,066	55 (1)	
	Reeling Frames	Tessiltecnica			[illegible]	80	1,5 (1)					[illegible] rpm				10,0		[illegible]	58 (1)	
	Reeling Frames	Unknown			14	80	1,5 (1)					250rpm				6,0		[illegible]	60 (1)	
WINDING	Cone Winder (2)	Savio			1	48														4
	Cone Winder (2)	"			1	50														4
WASTE PROCESSING	Soft Waste Opener (2)	Fitson	[illegible]	1958	1		7,5				660									2
	Hard Waste Opener	Tatham		1958	1		[illegible]				640									2
	Willow (2)	Polando	[illegible]/240	1971	1		[illegible]				[illegible]									2

(1) Estimated

(2) Not working during visit

(3) Added in response to [illegible] visit - no details

* Ring Frame (3) Platts [illegible] No further information.

TABLE C/2

STAFFING - IDGET

Blowroom Section	Day	1	2	3	Total
Machine operator	-	3	3	3	9
Doffing team	-	3	3	3	9
Sweeper	-	1	1	1	3
Total	-	7	7	7	21
Cardroom Section					
Machine operator	-	3	3	3	9
Feeders	-	5	5	5	15
Transporters	-	1	1	1	3
Tube cleaner	-	1	1	1	3
Oiler	-	1	1	1	3
Reserve	-	1	1	1	3
Total	-	12	12	12	36
Draw Frame Section					
Machine operator	-	8	8	8	24
Mechanic	-	1	1	1	3
Total	-	9	9	9	27
Speed Frame Section					
Machine operator	-	4	4	4	12
Machine operator helper	-	2	2	2	6
Doffing team	-	5	5	5	15
Feeders	-	4	4	4	12
Transporters	-	1	1	1	3
Line head	-	1	1	1	3
Reserve	-	3	3	3	9
Total	-	20	20	20	60

TABLE C/2 (continued)

Ring Frame Section	Day	1	2	3	Total
Machine operator	-	62	62	62	186
Doffing team	-	30	30	30	90
Tube cleaner	-	6	6	6	18
Sweeper	-	6	6	6	18
Tape repairer	-	1	1	1	3
Apron repairer	-	1	1	1	3
Mechanic	-	1	1	1	3
Oiler	-	1	1	1	3
Line head	-	5	5	5	15
Reserve	-	10	10	10	30
Total	-	123	123	123	369
Reeling and Packing					
Machine operator	-	64	64	64	192
Transporters	-	2	2	2	6
Packers	-	13	13	13	39
Tube cleaner	-	2	2	2	6
Mechanic	-	1	1	1	3
Production control	-	1	1	1	3
Production clerk	-	1	1	1	3
Line head	-	1	1	1	3
Total	-	85	85	85	255
Shift Crew					
Sweeper	-	1	1	1	3
Supervisor	-	1	1	1	3
Assistant Supervisor	-	1	1	1	3
Total	-	3	3	3	9
Total, Spinning Department	-	259	259	259	777

TABLE C/2 (continued)

Ginning Department	Day	1	2	3	Total
Machine operator	-	4	4	4	12
Machine operator helper	-	4	4	4	12
Doffing team	-	6	6	6	18
Feeder	-	13	13	13	39
Transporters	-	4	4	4	12
Production control	-	1	1	1	3
Production clerk	-	1	1	1	3
Reserve	-	1	1	1	3
Total	-	34	34	34	102
Bleaching					
Machine operator	-	1	1	-	2
Machine operator helper	-	1	1	-	2
Doffing team	-	8	8	-	16
Supervisor	-	1	1	-	2
Total	-	11	11	-	22
Grand Total, All Production	-	304	304	293	901
Seasonal Workers in Ginning	77				
Maintenance					
Foreman	2	-	-	-	2
Fitters	5	-	-	-	5
Mechanics	9	-	-	-	9
Machine operator	6	-	-	-	6
Electricians	5	-	-	-	5
Electric motor winders	1	-	-	-	1
Plumbers/carpenters	13	-	-	-	13
Rubber cylinder grinder	1	-	-	-	1
Cleaners	13	-	-	-	13
Helpers	12	-	-	-	12
Labourers	3	-	-	-	3
Total Maintenance	70	-	-	-	70

TABLE C/2 (continued)

Management	
Acting general manager	1
Secretary	1
Others	73
Office girls	1
Total	76

TABLE C/2 (continued)

Administration	
Office girls	5
Drivers' helpers	3
Guards	34
Dresser helpers	3
Workers' club	10
Time keepers	4
Office clerk	3
Secretary	1
Transportation chief	1
Chief of clinic	1
Dresser	4
Driver	14
Chief of administration	1
Total	84
Accounts Department	
Office girls	4
Office clerk	2
Sales clerk	1
Payroll clerk	5
Accounting clerk	4
Accountant	2
Chief accountant	1
Total	19
Property Purchasing	
Office girls	3
Warehouse workers	11
Tailor	1
Secretary	1
Store clerk	5
Bank transit clerk	1
Lint cotton supervisor	1
Chief of property purchasing	1
Total	24

ETHIOPIAN SEWING THREAD CO.

Processes: Twisting and Doubling of Sewing Threads, Yarn Dyeing and Bleaching. Output: Approximately 300 tonnes p.a.

1.0 MACHINERY AND CONDITION

1.1 Winding, Twisting and Doubling

The processing sequence for the mill is:

a) assembly winding of bought-in singles yarn

b) twisting of assembly-wound packages

c) gassing

d) reeling

e) scouring

f) hydro-extracting — g[1]) dyeing and bleaching

g) mercerizing — h[1]) hydro-extracting

h) acidizing — i[1]) drying

i) hank stretching ←

j) hank to cone winding

k) bobbin winding, k[1]) ball winding, k[11]) cone winding

l) folding and bundling.

Bobbin winding onto a spool and ball winding are used for domestic sewing threads, cone winding for industrial sewing threads.

Table D/1 shows our assessment of the machinery condition. Most would benefit from an improved level of maintenance, but the plant, at the time of our visit, was being intensively operated and this was being done at the expense of some maintenance. Exceptions to this general rule are:

a) the Model 210M Technomechanica Lombarda (1967) cone winder for which it is proving difficult to obtain a regular supply of spare parts, sufficient to keep the machine adequately maintained. This problem is not apparent on the other more recent models.

b) the Model D14 P/3 Carniti twisters. These machines are in a poor state with the free-running feed rollers out of alignment with the driven roller, the conditions of the yarn guides are in some instances damaged and often out of alignment and the bobbins were not always running true. The number of ends down was higher than the labour force manning the frames warranted.

These cone winding machines can be maintained in Western Europe, but it is possible that difficulties with communications between suppliers may make their replacement in Ethiopia a more attractive option. If they were replaced, then we estimate the cost to be roughly US $81 000. The cost of rehabilitating the twisters is an estimated US $ 105000, which includes replacement spindles, rings, feed rollers, etc.

1.2 Dyeing and Finishing

With some notable exceptions, the condition of the plant and equipment is good and providing that improved maintenance attention can be given, will have a continued service life in excess of five years. The main items of equipment in a deteriorated condition and requiring major overhaul are:-

Drying Machine	-	Officine Minutta - (3)
	-	machines are not externally vented, cabinets and insulation panels damaged.
Yarn Singeing Machine	-	S.A. Figli Di Mettler - (1)
	-	winding units in need of major overhaul/replacement.
Beck Dyeing Unit	-	The machine is not fully utilised, but is used for specialised dyeings.

It is recommended that the above matters are attended to if future production and quality is to be maintained.

2.0 BUILDINGS AND SERVICES

2.1 Buildings

In the main, the main production building is of good design and construction - a particular problem is that the factory is built on unstable sub-soil and a section of flooring is prone to subsidence; this is causing difficulties with winding equipment sited in this area.

The factory occupies approximately one half of a rectangular site, with adequate space for further building expansion.

Storage accommodation is at a premium, various non-perishable items - chemicals, production materials, etc., are stored in the open; more delicate materials are stored in small adjacent buildings to the rear of the factory.

2.2 Services

2.2.1 Steam generation

Currently steam is generated by a single package boiler -

Make	-	Shand Kessel, Duisburg.
Model	-	Monarch
Year	-	1973
Rating	-	1,200 kg/hour.

From discussions it was apparent that this unit satisfied current steam demands. This situation may be questionable in view of the steam shortages at IDGET which has a boiler of half this capacity, but proportionally less equipment.

The Company has a second boiler sited, which, although completely fitted, has not been commissioned -

Make	-	Shand Kessel, Duisburg
Model	-	Monarch
Year	-	1979
Rating	-	2,000 kg/hour.

This additional capacity would be sufficient to satisfy the steam demand of a sizeable production expansion.

2.2.2 Water supply

The Company maintains its own artisian well which has a daily supply capacity of 340,000 litres against a current daily demand of 150,000 litres. Some water shortages are experienced during the dry season when it is necessary to augment the well supply with municipal mains water.

A small water treatment plant processes 80 - 100,000 litres of water daily - mainly for boiler feed water and dyeing processes. Site water storage capacity is 30,000 litres. An appreciable expansion of yarn finishing would call for additional supply and storage facilities.

2.2.3 Effluent

Effluent is treated on site in concrete settling tanks prior to discharge. Current capacity is 250,000 litres per day - assuming a 24-hour period of settlement.

2.2.4 Air conditioning

The mill does not have any air conditioning machinery to control the working environment. The machines are, however, grouped tightly together and steam and water drifts into the winding and doubling areas, making working conditions unpleasant. In order to overcome this, we recommend the installation of extractor hoods and duct-work leading from the dye vessels and driers directly outside the building. We believe this to be well within the capabilities of local engineering firms.

If this factory should be expanded at any time in the future, then a new building will be necessary, and it is this building, with a more logical lay-out of the equipment, which we recommend is air conditioned.

3.0 WORKING ENVIRONMENT

Generally good, although there is a degree of physical congestion due to the close spacing of machines and localised hot conditions of working as a result of the drying machines venting directly to the working atmosphere.

Basic conditions - floors, machine guarding and the provision of protective clothing were to a reasonable standard.

The general welfare of the employees was provided for in that the Company maintained the following facilities -

Canteen	-	provision of hot water, cooking and eating facilities.
Showers	-	available for all shift workers.
Rest Room	-	used mainly by stranded night-shift workers.
Medical Centre	-	for first-aid treatment.
Sports Group	-	provision of equipment and facilities.

4.0 FIRE PRECAUTIONS

Internal water hose reels and wet and dry extinguishers are sited in the factory, improved cover would be provided by increasing the latter, particularly in higher risk areas.

No scheduled maintenance programmes have been drawn-up for the mill so far, but clearly if the mill is to continue operating satisfactorily then at least the rudiments of such a scheme should be developed as quickly as possible. It is probably sufficient at this stage in the mill's life, to organise routine cleaning, lubrication and setting of the machines, which allied to a scheme for the control of spare parts, will enable the mill to continue operating the rehabilitated machines for the next five years. Thereafter we expect a new mill to be built and to be operational with sufficient capacity to allow the present mill to close down.

5.0 PRODUCT QUALITY

Ethiopian sewing thread is able to sell all the sewing thread it produces. Quality at the moment is not a problem for the company. It does carry out fairly simple tests on the bought-in yarns and its own produce, for example, wrapping and twist tests, but in the main there is little advantage to the company lifting the quality of its thread above its present level. By confining the bulk of its purchases of singles yarn to Dire Dawa, the company has effectively assured itself of the supply of best quality yarn from within the country.

6.0 PRODUCTIVITY

6.1 Winding, Twisting and Doubling

No detailed analysis of the operative productivity has been made for the following reasons:

- the product range of the mill is wide, thus preventing the continuous operation of much of the machinery.

- the product is of a specialised nature and not in the main stream of textile technology in Ethiopia.
- insufficient information is available in the returned questionnaire to show the correct machinery utilization for specific end-uses.

6.2 Yarn Dyeing

Whilst not strictly comparable with other yarn processing units, owing to the specialised and varied nature of the products, with consequential higher added value, the operating efficiencies would be considered acceptable within the limitations of the equipment. Respective production per operative per annum being:

Dire Dawa	9411 Kg
Ethiopian Sewing Thread	10363 Kg
Asmara Textile Mills	17143 Kg

the main factors having a bearing on the above figures, other than operating efficiency are, complexity of processing, batch size and equipment.

7.0 LABOUR FORCE AND SKILLS

The company did not operate a formal training programme for its workers. Comment was made that a more formal approach to training would be of benefit in improving efficiencies and in training operatives for multi-skill operations. It is understood that a Personnel Manager is to be appointed and will be responsible for training within the factory, and that training programmes are already in course of preparation.

Senior and supervisory management are very capable and progressive in attitude to furthering the Company's interests, this should be positively encouraged and supported by central resources where appropriate.

8.0 OTHER METHODS OF PRODUCTION

If another factory is built to replace the existing unit, two different processing methods, should be examined to test their feasibility both from a marketing and economic standpoint. The use of ring twisting machines for doubling or plying yarns is now generally accepted as uneconomic compared with two-for-one and stage twisting, and core-spun polyester filament/cotton yarns have been found to be successful on industrial sewing applications, particularly with fancy goods, and shoes.

TABLE No. D/1 ETHIOPIAN SEWING THREAD

MACHINERY INVENTORY-

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	PRODUCTION DATA Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Assembly winder	Technomechnica Lombarda	210 B	1967	1	54	6kW		150	1.2-1.5			450 m/min			Various				2
Twisters	Carniti/DMAB	D14	1967	4	400	14.7	55 (1)	280	0.150		8100 rpm			Production assigned to specific machines	2/30	18			3
		P3	1975	1	128	11.0	65 (1)	280	0.150		6300 rpm				6/30	7			3
															2/34	19			
															3/34	12			
															3/50	17			
															2/16	12			
															3/16	8			
															2/9	7 (2)			
															9/9	N.S.			
															5/16	N.S. (2)			
Reeling machines	Giacomo Bertona	R4	1967	2	40	1.5					120 rpm								1
Cone winders	Technomechanica Lombarda	210M	1967	1	72	6.75	160	150	1-1.2			250 m/min		PRODUCTION NOT ASSIGNED TO SPECIFIC MACHINES					3
		415/M/	1973	4	3	0.87	160	150	1-1.2			400 m/min							2
		150	1975	2	3	0.87	160	150	1-1.2			400 m/min							2
Ball winders	Redalhi Lugi	49-RL	1967	2	15	1.47	45		0.010									45	1
		UNIDENTIFIED		1	12	0.75	87		0.030									50	1
Bobbin winders	Technomechanica Lombarda	50/3	1967	4	3x6	0.75			0.020(30's)			54 m/min			2/30			70	2
		50/3	1973	1	3x6	0.75			0.017(34's)			94 m/min			2/34 only			70	2
		50/3	1974	2	3x6	0.55						94 m/min						70	2
Industrial cone winders	Technomechnica Lombarda	50	1967	1	6		87.5 (m)	115	0.350			94 m/min			3/50; 3/34; 5/16			75	2
		50	1967	1	6		87.5 (m)	115	0.350			94 m/min						75	2
Gassing machine	Mettlers	GSK	1967	1	48	10.03	160	148	0.8-1									75	2

(1) Ring diameter

(2) Not specified

TABLE D/2

STAFFING - SPINNING - ETHIOPIAN SEWING THREAD

Reeling	Day	1	2	3	Total
Reeler	-	4	4	4	12
Cone Winding					
Winder	-	23	23	23	69
Hank Stretcher	-	1	1	1	3
Total	-	24	24	24	72
Ball Winding					
Winder	-	6	6	-	12
Industrial Cone Winding					
Winder	-	2	2	-	4
Bobbin Winding					
Winder	-	7	7	7	21
Assembly Winding					
Winder	-	3	3	2	8
Twisting					
Operative	-	10	10	10	30
Gassing					
Operatives	-	5	5	5	15

TABLE D/3

DYEING AND FINISHING EQUIPMENT - ETHIOPIAN SEWING THREAD COMPANY

Item No.	Equipment	No. of Units	Manufacturers	Year of Manf. or Instal.	Operating Load	Percentage Utilisation	Condition
1	Hank Dyeing M/c	1	Mezzera Vopa	1973	145	78	2
2	Hank Dyeing M/c	2	Mezzera VE	1967	60	83	2
3	Hank Mercerising M/c	1	Meccano Tessile	1967	60	94	2
4	Hank Neutralising	1	Meccano Tessile	1967	-	30	2
5	Centrifuge	1	Officine Minotta	1967	160	94	2
6	Centrifuge	1	Officine Minotta	1967	70	94	2
7	Drying Machine	2	Officine Minotta	1967	35	94	3
8	Drying Machine	1	Officine Minotta	1973	35	94	3
9	Drying Machine	1	Obermeir	1973	70	94	2
10	Yarn Singeing M/c	1	S.A. Figli Di	1967	-	-	3
11	Beck Dyeing M/c	2	-	-	70	25	3

Notes:

Item No.	Remarks
7 and 8	Machines are not vented, moisture to the immediate working environment.
9	Externally vented.
10	Winding units in need of overall.

Table D/4

YARN DYEING AND BLEACHING - LABOUR DEPLOYMENT -

ETHIOPIAN SEWING THREAD

Management	1
Supervisors	2
Operatives	20
Ancillary	6
Departmental Total	29

The above figure excludes persons employed on the Yarn gassing operation.

Annual Production	-	300,515 kgs
Production Area	-	N.A.
Annual Production/Person Employed	-	10,363 kgs
Annual Production/Unit Area		N.A.
Operating Days Per Year	-	300
No. of Shifts Operated	-	3 - on gassing & mercerising
		2 - all other sections
Hours Worked Per Shift Per Week	-	45

GENERAL TEXTILE AND GARMENT FACTORY - ADDIS ABABA

INTRODUCTION

The Company has two branches, the main factory on the outskirts of Addis Ababa and a small plant in Addis Ababa.

The first part of this report refers to the main factory.

1.0 BUILDING

The Company is housed in two main buildings plus a further small building which is used as a canteen.

The main building which contains the production unit and the offices was built in two stages, the first stage being completed in December 1970 and the second stage in November 1971. Total area allocated for production purposes is calculated at 2606 square metres.

Construction is from stone block, level cemented with a pitched corrogated iron roof.

Internally, the premises have a false ceiling and stone floor. Decoration is adequate, well illuminated, resulting in a good working environment.

The second building is constructed with similar materials and has a total area of 1129 square metres. The premises house both the raw material and finished goods store. The building was completed in 1971.

1.1 Production Area

Production is carried out in two areas of approximately equal proportion. Most of the female operatives work in one half, and approximately 50 male operatives work in the other half. The segregation is a result of the method of payment for the work completed, the females are paid their wages based on the time spent at the factory, recorded from clock cards, whilst the male operatives are paid no basic wage, but piece work rate only, based on the number of garments completed.

It is understood that the 75 new sewing machines are to be installed in the second area which will give a more acceptable spread of labour over the two areas, and will still leave scope for further expansion when required.

1.2 Raw Material Store

The total area of 777 square metres is adequate for a factory of this size.

Racking is provided for storing sewing thread, buttons and other various making-up consumables. Fabric is stored on the floor with no systematic plan or location. New deliveries are accepted and stored in the nearest convenient space. It is our opinion that racking be erected for the storage of fabric and that a location system is introduced enabling the store-keeper to extract fabric required for production without having to establish the whereabouts of the cloth in question. Once fabric has been removed from the floor into racking, the visual disorganisation will disappear.

1.3 Finished Goods Store

The finished goods store is approximately 352 square metres which again appeared to be adequate for the amount of finished garments requiring storage.

There is no racking for finished goods, which are stored in size order on the floor. The current product range is mainly Military tunics and trousers which are collected for distribution at regular intervals. This method of storage appears acceptable at the present time considering the type of garment produced, but would not be acceptable for the storage of more delicate fabric type garments. It is our opinion that racking should be installed in preparation for a change in the product range whenever that occurs.

2.0 MACHINE REGISTER

The machine register was checked for accuracy, and found to be correct. It was difficult in some cases to identify the machines by their number as the plates containing the numbers have become detached.

A total of 75 new Juki sewing machines have arrived in the factory and are in the process of being assembled prior to installation. These have not been included in the machine register, see Table E/1.

2.1 Machinery Condition

Out of a total of 259 production machines installed in the factory, nearly half of this total were installed in 1971 and although they have been well maintained, some doubt as to their future efficiency must br raised. The product range of the factory has changed during the past three years, with more drill fabric for military uniforms being used. The older machinery cannot always cope with the demand made on them and breakdown. Spare parts are becoming increasingly more difficult to obtain as the Japanese manufacturer has updated his current sewing machine range and has discontinued manufacturing spare parts for the older machines. An example of the difficulty in obtaining spare parts is apparent at this mill where two Mitsubish DF200 Perforated Pico needle machines are being stripped of parts to maintain two other machines of the same make.

The Table E/ 'Machine Inventory' shows which machines have now become obsolete.

3.0 HEALTH CARE

Since nationalisation of the factory a state scheme exists for the payment of employees' wages during a period off work due to ill health. To quality for benefit, an employee must first obtain a certificate of 'unfitness for work' from the factory nurse. On this basis the company will pay 70% of the basic wage for normal sickness and 100% if the illness or accident is a result of working at the factory.

3.1 Fire Precautions

Fire fighting equipment consists of extinguishers which are mounted at strategic points throughout the factory, although adequate for containing small internal fires, the absence of any hydrants make the buildings a hazard. It is recommended that at least four hydrants are installed in the main factory and two in the material stores.

No fire drill or training has taken place in case of fire and this should be rectified as a matter of urgency.

3.2 Inflammables

No inflammable materials other than fabric are stored on the premises.

3.3 Machine Guards

There are no protective guards on some of the older sewing machines, which have exposed pulley belts. Guards should be purchased even if these machines have a short operating life expectancy, due to the seriousness of accidents which could occur with these machines.

3.4 Protective Clothing

Employees are not issued with protective clothing. It is recommended that consideration is given to the issue of overalls for all operatives.

4.0 ELECTRICAL

It was claimed that all the wiring had been inspected during August 1979, by the company's electrician and found to be in good order. An inspection of all the electrical gear including switchgear and control boxes confirmed that all the equipment is well maintained and in good condition. Fluorescent lights provided the artificial lighting, illumination being of an acceptable level.

5.0 COMPRESSED AIR

Compressed air is supplied for the cleaning of machines and the supplying of an air/water mixture for the steam irons by 4 Meiji compressors rated at 5 HP each. Only two compressors are required at any one time, the other two being held in reserve. All four compressors appeared to be well maintained and in good condition.

6.0 AIR CONDITIONING

There is no air conditioning requirement at this factory.

7.0 STEAM

The only steam requirement is for the presses which is supplied by electrically heated mini boilers.

8.0 PROCESS WATER

There is no requirement for process water, only domestic. Water is drawn from an outside well by an electric pump. It is planned to clean the well in the near future as it has not been cleaned for eight years.

9.0 EFFLUENT

No effluent is discharged from this factory.

10.0 MAINTENANCE

Fourteen mechanics and three elctricians respond to a foreman. All except the foreman work a three shift system.

No regular routine maintenance is carried out, the maintenance staff preferring to wait until a machine becomes inoperative.

The service area at the rear of the factory is small and unsuitable for the purpose of machine repair. Consequently maintenance staff endeavour to repair machines where they stand, causing some further interruption to production.

It is our opinion that a suitable area is found for machinery repair. Machines could then be removed from the line quickly, minimising production loss.

No training takes place, apart from staff having to gain their knowledge undertaking actual repairs on production machinery.

11.0 QUALITY CONTROL

No set standard quality control system is in operation, although there is a final inspection, consisting of two groups of girls. The first group pick loose threads from the finished garment, and the second group perform an actual inspection looking for faults. Management consider that this is acceptable for the heavy military type garments. An inspection of a small selection of inspected garments revealed a reasonable standard of quality.

12.0 WAGES

The major part of the workforce are paid on an hourly basis, the exception being the 50 male operatives who are paid no basic wage, only a bonus depending on the number of garments finished each day.

This two tier system results in high productivity but low quality by the male machinists and low productivity and higher quality by the female labour who are paid hourly.

13.0 INVENTORY CONTROL

The raw materials and finished goods store employ a stock card system which although simple, appears to work effectively. The main criticism of the system is that the location of stored goods are not recorded, mainly because stock is stored in a random fashion on the floor.

A recommendation that racking is installed in both warehouses has already been made in this report, a location system could be introduced on completion of the racking installation.

14.0 PRODUCTION PLANNING

The production plan is decided by the General Manager and the Production/ Technical Manager. Current requirement are dictated by the requirements of the military authorities, as 95% of production is for army uniforms. No reference is made to the annual agreed budget or to the sales department. The 5% balance of output is made up of towels and bed sheets, and plans to increase output in the two latter products are in hand. Documentation is poor, but it is understood that the NTC auditos have insisted on an improved system. Copies of the documentation for the new system were not available for inspection.

14.1 Production Control

A similar situation to production planning exists, no effective control in operation, causing concern to the NTC auditors, who it is understood are preparing a new system.

It is accepted that the move to a three shift system has resulted in difficulties for management, causing neglect to control systems, but it is our opinion that the factory should introduce effective production control at the earliest opportunity. This will be possible when the proposed daily record by operative is introduced enabling the information on completed work to be extracted and recorded on daily control sheets, similar to those proposed for the Augusta Shirt Company.

15.0 MAKING UP

The company is engaged in manufacturing military uniforms, both men's and women's, bed sheets, towels and a small amount of other men's wear.

The target for the last year was set at 1.8 million pieces and actual output was 0.67 million pieces. The high target was based on the assumption that three-shift working would be fully operational for most of the operating year. Difficulty in recruiting trained staff resulted in the company having to recruit a large number of inexperienced operatives who required training. This situation drastically restricted production during the past year.

As the operatives gain experience output will increase and the original 1978 target could be achievable if the planned product range does not involve the older, obsolete machinery being used on the heavy drill fabric.

GENERAL TEXTILE AND GARMENT FACTORY - ADDIS ABABA

This section of the report refers to the small subsidiary factory in Addis Ababa.

16.0 INTRODUCTION

The main products manufactured are emblems, insignia, flags, badges and caps.

16.1 BUILDING

The Section is housed in a stone block and brick single storey building which is in very poor condition. The roof, of corrugated iron, is also in need of repair. The premises are totally unsuitable for the purpose of manufacturing.

MACHINERY

A total of 36 sewing machines are employed in an area approximately 200 square metres. Sixteen of these machines, viz

Adder	9
Texima	4
Juki	3

are electrically powered and in reasonable condition. The balance of twenty machines, viz

Pfaff	11
Singer	5
Husgvarna	3
Necci	1

are foot controlled machines, which are not acceptable for modern production requirements and should be sold.

The only other machinery are two six head embroidery machines which are not fully utilised, the production rate being up to 300 badges per machine per day depending on the type of embroidered badge required.

16.3 SERVICES

Lighting levels are very poor, only reaching an acceptable level on a sunny day with the doors open wide. Electric switches and control gear are in poor condition, not secured to the walls in a safe manner. This could result in a serious accident to employees and increase the risk of fire for which there is no adequate fire fighting equipment.

16.4 CONCLUSION

It is our opinion that this factory should cease production and transfer the sixteen sewing machines and two embroidery machines to the main General Textile and Garment Factory without delay.

TABLE 5/1

Sewing Equipment - General Textile and Garment Factory

Type of Machinery	No.	Maker	Model	Condition
Cutting Table	2	Not Identified	-	2
Laying Up Machine	1	" "	-	2
Powered Straight Knives	1	Light	151-T	3
" " "	1	Mitaka	MC-A	3
" " "	5	Eastman	625	3
" " "	1	Lewis	150-5	3
Loop Cutter	1	Ace	C75	3
Collar Cutter	1	Minami	81-6	3
Lable Cutter	3	Lieether	ED5	3
Sewing Room				
Single Needle	44	Juki	DDL-555	4
" "	21	Juki	DDL-555	3
" "	34	Juki	DDL-555	2
" "	4	Juki	MH-38	4
" "	1	Juki	MH-38	3
" "	15	Juki	DLN-415	3
" "	12	Textima	-	2
Twin Needle	7	Juki	LH-51	4
" "	2	Juki	LH-51	2
" "	1	Clean	FW-327	4
" "	1	Durkopp	238N 25	3
Lockstitch	8	Juki	MD-352	4
" "	1	Juki	DLM-52	4
" "	14	Pffaff	485-03-87	3

continued

continued

Type of Machinery	No.	Maker	Model	Condition
Twin Needle Chain Stitch	6	Juki	MS-19	4
" " " "	2	Juki	MS-19	2
Lock and Chain Stitch	7	Pegosus	U32-36	4
" " " "	6	Pegosus	U32-36	3
Band Loop Twin Needle	1	Watanuki	SCB 200	4
Backtacking	4	Juki	LK 232	4
Pico Needle	4	Mitsubish	DF 200	4
Button Holer	5	Juki	LBH 761	4
" "	4	Juki	LBH 771	3
" "	4	Juki	MB 372	4
" "	4	Juki	MB 372	3

Presses

Roll Iron	1	F.C.H.	150	4
Electric Press	1	Kobe	YPS	3
" "	1	Kobe	YP-SK	3
" "	3	Kobe	YP-CDN	3
" "	2	Kobe	YP-CR	3
" "	3	Kobe	HC-FP	3
Fuse Press	1	Takaoka	00152	3
" "	4	Taisei	-	3
" "	5	Taisei	-	2
" "	1	Sakata	ALP 3	4
" "	4	Sanko	11-41321	3
" "	2	Sanko	11-41321	4
" "	1	Satito	00115	3
" "	1	Hor	-	3

Other Equipment

Glove Knitting	1	Matuya	-	4
Compressors	4	Meiji	-	2

TABLE E/2

Staffing - Sewing Department - General Textile and Garment Factory

Staff	Number
Design and Pattern Cutting	4
Cutting and Bundle Forming	11
Sewing Room	
Supervisors	30
Machine Mechanics	14
Electricians	3
Sewing Machinists	858
Service Operatives	15
Press Operators	20
Unskilled Workers	7
Sub Total Sewing	962
Folding and Packing	19
Warehouse and Despatch	27
Grand Total	1008

AUGUSTA SHIRT FACTORY - ADDIS ABABA

1.0 BUILDING

The company is housed in a modern, split level building constructed in 1966, from concrete. The material used in the construction of the roof could not be identified, but appeared to be of a strong lightweight material.

Windows, running the length of the factory, are small and restrict the amount of natural light available to the operatives. There is scope for increasing the size of these windows, and it is recommended that this should be undertaken, resulting in more natural light being available for operatives, involved in close needle work. A reduction in artificial light requirement will also reduce power costs.

The building has been maintained to a high standard resulting in a good working environment.

The main factory areas are:

Production	583	square	metres
Raw material store	184	"	"
Finished goods store	85	"	"
Offices/canteen/ workshop	488	"	"

1.1 Production Area

The size of the area allocated for production is more than adequate, allowing for expansion when required. Space is mainly to be found at the top end of the factory and a recommendation later in the report, suggests that some of this area should be designated for expansion of the finished goods store.

Machinery has been installed in a logical order, with adequate space between each machinist.

The area is maintained in a clean condition, and good decorative order, resulting in good working conditions.

1.2 Raw Material Store

The store, sited below the main factory, is used for the storage of fabric, buttons, labels, needles and other small items of consumables and spare parts.

The area totalling 183 square metres is more than adequate for a factory of this size. The lack of space currently being experienced is due to the high fabric stocks of 150,000 square metres, caused by the introduction of the new products requiring raw material servicing.

Fabric is stores in wooden racks, suitable for the purpose. Buttons, and other small items of haberdashery are stored in a small area at the rear of the main store, the racking being of a general box type, and though not custom built, adequate for the purpose. Needles and small spare parts are neatly stored in wooden drawers.

1.3 Finished Goods Store

The position of this store is at the top end of the production area, above the raw material store. The area is small for the storage of finished goods. The size being less than half of the raw goods storage. Goods are moved in and outthrough one small door, causing congestion at certain times of the day. This is usually when goods are being transferred into store from production, and outgoing goods are being extracted for loading prior to delivery in Addis.

Extension to this area is strongly recommended, with the racking being re-arranged, for easier access to the goods. A further access should also be planned, at the production office end of the store, so that new production from the factory can be received without contributing to congestion at the loading bay door.

Working conditions for the Stock Controller are poor and consideration should be given to the provision of more space and facilities for the function of this important job.

It is claimed by Management that the 'storage of finished goods' is only for a short period, but an inspection of the garments showed that some have been in the store for long periods of time. A critical analysis of all goods which have been in stock for more than three months should be made, as the number of finished pieces being produced, and requiring storage have risen from 17,000 per month in July 1978 to 30,000 in June 1979. Slow sales, which have been experienced with some lines will ultimately fill the warehouse, if allowed.

2.0 MACHINE REGISTER

A full inventory check was made of the machine register which revealed a small number of discrepancies. A portable rotary blade cutting machine, Model Aurora CY 12T and a Rimoldi overlocking machine, Model type No. 329-00-2CD 05 could not be traced. One extra sewing machine, a Necchi Model 830-103 was found to be additional to the machine register.

A total of 15 new Necchi sewing machines which had been on order for 2 years, have arrived in Ethiopia, but have not been included in the register as the company is still awaiting delivery to the factory.

A full inventory is shown in Table F/1.

2.1 Machinery Condition

All the machinery inspected appeared to be in good working order, although with regular planned maintenance some improvement to their condition would result, reducing the number of breakdowns and consequent loss of production. Two exceptions to this are a Necchi automatic collar stitching machine and and Adler automatic pocket stitching machine, which have been out of service since nationalisation. The faults in both machines should be identified, spare parts obtained, and the machines repaired. Both are capable of producing large quantities of stitched collars and pockets daily, thereby releasing machinists currently engaged on this work for other sewing duties.

A Zappas domestic washing machine located in the main factory has no valid use and should be sold.

The majority of the machinery was purchased by the former Italian owners. On nationalisation all company records on plant and equipment disappeared, causing maintenance personnel difficulty in establishing the date machiney was installed.

An efficiency assessment of all production machinery should be undertaken at regular intervu!-, and where machinery efficiency has dropped, a replacement obtained. At the present time, management at Augusta consider the machinery to be in good order causing no major problems or regular loss of production.

3.0 HEALTH CARE

Since nationalisation, health care is provided by the state. If an employee is absent from work sick (certified) rate of normal wage is paid by the company. If the illness or accident is caused as a result of work, 100% wage is paid. Health care payment is calculated on average wage.

3.1 Fire Fighting

Basic fire fighting equipment in the form of extinguishers have been installed in the factory and appear to be satisfactory. It is understood that employees have been instructed in the use of these extinguishers, but no training in fire drill has taken place. It is recommended fire drill practice is instigated as soon as possible and that consideration be given to the installation of at least two hose pipes, one at each end of the factory.

3.2 Inflammable Materials

No inflammable materials are stored on the premises.

3.3 Machine Guards

There are no large process machinery at Augusta and therefore the question of machine guards does not arise. The sewing machines are of Western European manufacture incorporating the usual safety points.

3.4 Protective Clothing

Protective clothing is issued to machinists in the form of dark green cotton button through overalls. The mechanic wears a full boiler suit. No other operatives are issued with protective clothing, i.e. cutters, stores, personnel. Consideration should be given to the provision of protective clothing for all manual workers. It is suggested that two overalls per employee are issued, enabling a change to be made each week. Staff should be made responsible for the washing and care of the overalls.

4.0 ELECTRICAL

An inspection of the elctrical system confirmed that the wiring, control boxes and switchgear are all in good condition and well maintained.

Lighting by flourescent tube is adequare for the close needle work of the machinist and other manufacturing and clerical functions.

5.0 COMPRESSED AIR

Compressed air is supplied to the pressing machines and button-holer by a 7.5 kW (10 hp) compressor, working at 150 psi. The machine is well maintained with regular filter changes and servicing. The size of the machine is suitable for the amount of compressed air required.

6.0 AIR CONDITIONING

The factory does not have air conditioning installed and no process carried out at the factory would require an air conditioning plant.

7.0 STEAM

There is no steam requirement at Augusta, the presses being electrically heated. No advantage would be gained by changing the system.

8.0 PROCESS WATER

The only water requirement is a small amount for the presses and for domestic use. No difficulties have been experienced in obtaining the required daily amount.

9.0 EFFLUENT

No effluent treatment is carried out at Augusta.

10.0 MAINTENANCE

The maintenance section consists of a foreman and two mechanics. Training of these personnel has been restricted to a 3 month course at the Ethiopian National Productivity Centre.

There is no set programme of routine maintenance. It is claimed by the maintenance staff that there is a general inspection of all machinery, but it is our considered opinion that this inspection is only visual inspection rather than maintenance.

A small workshop under the main factory was inspected, but it is doubful if any spare parts could be manufactured. A number of parts are carried in the raw materials store, but the range was not comprehensive.

11.0 QUALITY CONTROL

There is no standard quality control procedure in operation at Augusta, inspection is carried out by individual supervisors in each of the sectors for which they are responsible, using their experience and judgement to make quality decisions. Management consider that the present system is adequate and fulfills the necessary quality requirement of the Ethiopian consumer. A random inspection of the current product range showed a good standard of quality. This was further confirmed by inspection of fabric samples for sewing faults at the collar section. Some of the faults were of a minor nature, but had been rejected, and although not conclusive, gave some indication of the standards set. One part of the system which could be improved is final inspection which is not as thorough, management claiming that the various quality checks made during a garments progress through production was sufficient, and whilst this statement has some foundation, a final quality check would ensure each garment is up to a uniform standard of quality, with the same inspection team setting the final standard. This would be achieved with training by the Senior Supervisors who already set a good standard of quality.

12.0 WAGES

The operatives in the factory, cutters, sewing machinists, pressers, packers, warehousemen and maintenance personnel are paid wages every 15 days, based on a flat rate, dependent on the number of hours worked which is recorded on clock cards by time machines. Each employee records the time he or she commences and finishes work. A normal working day is 7.5 hours, with single shift working in operation. No bonus or incentive schemes are employed. Differentials in wage scales are calculated by service and experience. For example, a young trained machinist with little experience will probably earn approximately 80 Birr per month. A more experienced operative would earn about 100 Birr per month. Any scope for increased earnings, once the top rate has been achieved, is only attainable by promotion, for example, if a machinist is promoted to Supervisor, her initial salary will remain at about 100 Birr per month until supervisory experience has been gained, at which point wage increases are made at management discretion to a maximum of approximately 150 Birr per month.

A similar wage structure for all shop floor operatives who are paid on the 15 day cycle, is in operation.

13.0 PRODUCTION CONTROL

No effective daily production control system operates within this factory. Management being content to check the production order in which shortages have been noted, after the production completion date has expired. This involves reporting to the General Manager, after completion of an investigation to establish the cause of the shortage.

It is claimed by the Management that the main criteria for production is to achieve the overall daily production targets set through the National Textile Corporation, and that daily production control is not critical. It is our opinion that control is an essential part of the production function, making available on a daily basis, information of work in progress, thereby enabling management to identify areas of over/underloading of sections. Decisions can quickly be taken for priorities resulting in an organised workload with maximum production being achieved. A regular 'feed back' to the sales office on the progression of all orders placed with the factory can be maintained.

The basic information for a production control system is already available to the production department. Each operative records hourly work completed in a personnel 'daily production book'. This record is submitted at regular intervals during each working day to the production department, who extract and analyse the information for the overall daily target, both for individual operatives and factory.

With the introduction of control documents, one for each section, and a master factory document, it would not be difficult to maintain effective control of all production.

Each process would have a set target for the completion of each order through that particular section.

14.0 INVENTORY CONTROL

Both raw materials and finished goods stores operate a simple efficient stock card system. Each product is allocated its own card, which records details of the product, date, stock movement and balance. The cards are stored in product number order. Storekeepers ensure that the records are strictly maintained with up-to-date information, no goods being accepted or extracted without the relevant information being recorded. The system appears to work efficiently.

15.0 PRODUCTION PLANNING

The sales and production departments, making a joint decision, decide on which products should be manufactured each week. The planned production is usually in line with annual budget, which has been agreed between the factory and the National Textiles Corporation.

Documentation consists of a production order sheet, containing all the necessary instructions for raw material supply, cutting, sewing and finishing. One copy each is issued to sales and accounts, one copy is retained by production and one copy is issued to the factory foreman to activate the order. This latter copy, is issued as a batch card, passing through each section with the garments. On completion of the order, the batch card is returned to the production office, duly completed by each section, for analysis.

The system is sound with no apparent loss of cards, reflecting shop floor discipline.

16.0 MAKING-UP

Augusta shirt factory manufactures ready to wear men's and women's wear and has recently introduced bed sheets and pillow cases, to the product range. Up to 1978 the factory had concentrated on producing two main types of garment, shirts and overalls. Since Octobor 1978, at intervals, pyjamas and ladies' dresses have also been introduced into the Augusta range. Customer acceptance has still to be finally decided, if the new products are to remain in the production range. Sales are made through the Augusta shop in Addis. A small made-to-measure department for shirts, is also functioning.

The production area in the factory is well laid out with the machinery arranged in a logical order for maximum production.

The cutting staff, who have one cutting machine and a laying-up machine have no difficulty in supplying the sewing machinists with sufficient cut cloth, at all times.

The sewing section has been split into four main groups; sleeves, collars cuffs and bodies. Each section completes in turn, the sewing operation for which it is responsible. Each section is controlled by a supervisor, usually a mature person with wide experience in sewing and making-up. The system operates effectively enabling daily targets of 450 overalls or 950 shirts to be achieved without any difficulty. This applies mainly to the two main products in the range, shirts and overalls. The introduction of new products of a different nature may cause an inbalance in the present set up.

A total of 18 presses, 14 being electric and 4 hand, complete the production cycle.

The factory is well organised and controlled meeting daily targets without any difficulty. Targets should be raised in line with current production, i.e. 1,000 shirts per day, or 475 overalls which should be achievable without recourse to any re-organisation of the factory layout.

TABLE NO. F/1

SEWING EQUIPMENT - AUGUSTA SHIRT FACTORY

Type of Machine	No.	Maker	Model	Condition
Cutting Room				
Cutting rable	1	Local	Unidentified	3
Laying up machine	1	Local	Unidentified	2
" " "	1	Imported	Unidentified	2
Power straight knives	2	Aurora	AY4T	2
Band knives	2	Aurora	SC100	2
Press cutting machine	1	Saspol	T20/60	2
Portable rotary blades	1	Hoggs		2
Sewing Room				
Single needle lockstitch m/c	15	Necchi	830-103	2
" " " "	5	Necchi	831-130	2
" " " "	21	Necchi	600-100	2
" " " "	13	Necchi	835-103	2
" " " "	1	Necchi	830-102	2
" " " "	1	Necchi	921-144	2
" " " "	1	Necchi	810-100	2
" " " "	1	Necchi	830-100	2
" " " "	2	Necchi	832-100	2
" " " "	4	PFAFF	467-2-05	2
" " " "	1	Union Special	1400C	2
" " " "	2	Rimoldi	164-00-02	2
" " " "	1	Rimoldi	164-00-10	2
Twin needle lockstitch m/c	1	Necchi	460-100	2
" " " "	1	Union Special	35700AK	2
" " " "	1	Union Special		3
Overlock machine	4	Rimoldi	329-7	2
	2	Rimoldi	329-00-2CD-05	2

TABIE NO. F/1 (contd.)

Type of Machine	No.	Maker	Model	Condition
Blindstitch machine	1	US Blindstitch	Model 718	2
Button stitching machine	3	Necchi	440-100	2
Collar stitching machine	1	Necchi	803-100	3
Pocket stitching machine	1	Adler		3
Button holers	2	Necchi	401-100	2
" "	2	Necchi	405-100	2
" "	1	Necchi	400-101	2
Button cover machine	1	Necchi	700-18	2
Presses				
Electric press	1	Kanne Giesser	VDH411	2
" "	1	Kanne Giesser	XVK	2
" "	3	Caron	TC6	2
" "	3	Caron	RC	2
" "	1	Caron		2
" "	3	ATI		2
" "	1	Franchi		2
" "	1	Unidentified		2
Hand Press	3	ATI		2
" "	1	Markier-Wunder		2
Other equipment				
Washing machine	1	Zoppas		3
Stapling machine	1	Speckbotel	33	2
Size labelling machine	1	Rejafix	D26	2
Compressors	1	Emac		2

TABLE No. F/2

STAFFING - SEWING DEPARTMENT - AUGUSTA FACTORY

Staff	Number
Design and pattern cutting	2
Cutting and bundle forming	10
Sewing room	
Supervisors	8
Machine mechanics	3
Sewing machinists	97
Service workers	7
Inspectors and trimmers	27
Press operators	19
Clerks	2
Unskilled workers	24
Sub total sewing:	199
Folding and packing	6
Warehouse and despatch	4
GRAND TOTAL:	209

TABLE No. F/3 1978/1979

SEWING DEPARTMENT PRODUCTION - AUGUSTA SHIRT FACTORY

Garment Month	Shirts	Overalls Overcoats	Pyjamas	Bed Sheets	Pillow Cases	Ladies Aprons	Dresses	Twill sheets and pants
July 1978	16,267	1,001	-	-	-	-	-	-
August 1978	20,232	1,173	-	-	-	-	-	-
September 1978	7,784	2,232	-	-	-	3	-	-
October 1978	2,223	8,434	729	-	-	-	-	-
November 1978	177	9,812	1,005	-	-	13	-	-
December 1978	4,321	5,486	241	-	-	-	-	-
January 1979	15,274	1,087	124	272	272	-	-	-
February 1979	17,572	839	-	368	368	-	-	-
March 1979	22,181	2,186	90	517	517	-	7	-
April 1979	22,186	1,193	-	-		404	36	457
May 1979	22,694	3,730	-	272	272	-	64	432
June 1979	23,000	3,298	-	3,357	3,357	-	103	133
TOTALS:	171,860	41,271	2,189	4,786	4,786	420	210	1,022

Units = pieces.

GULELE FACTORY — (ADDIS ABABA)

1.0 INTRODUCTION

The Gulele factory was opened approximately ten years ago to weave and finish fine woollen and worsted type fabrics in wool and man-made fibres. The enterprise was completely unsuccessful and was placed in the hands of the Receiver after two years trading. For the last eight years the factory with its equipment has been standing idle.

The purpose of our visit was to make a register of the equipment, assess its condition, and suggest to what use the machinery could be put if the factory was put back into operation.

2.0 MACHINERY

The heart of the plant is an installation of 48 Hattersley woollen and worsted looms. In addition there is warp preparation equipment (excluding sizing), and some pirn winders. A quantity of finishing equipment is installed also. A complete list of the equipment is given in Table G/1 (Weaving) and Table G/2 (Finishing).

2.1 Weaving Preparation

This equipment comprises 2 warping machines, 2 creels and a 28 spindle pirn winder. Technologically these are all of obsolete design but adequate for the purpose of serving the 48 looms. They are in good condition but will need some cleaning up and checking before they go back into production. They have been given a rating of 2.

2.2 Looms

The looms are Hattersley 'Standard' models, semi-automatic, with a $78\frac{1}{2}$ inch nominal reedspace. 16 are 4 x 1 boxing, and the rest 4 x 4. All have dobbies, 8 with 16 shafts, and 40 with 8 shafts.

During their period of standing the looms have been regularly maintained and are well greased. There is little sign of rust. The only parts which have deteriorated are the leather accessories which is to be expected. These are excellent looms in nearly new condition for they have had little use. They have been given a rating of 1.

2.3 Finishing Equipment

This is made up of various items of machinery which, so far as we can judge, were second-hand when originally installed. Most have been given ratings of 3 or 4 for they are in a generally poor condition.

3.0 BUILDING

The building was newly erected to house the machinery. Lack of maintenance has led to minor deterioration of the fabric, particularly to the cement rendering. The roof has been kept in good condition over the weaving area but there are signs of leaks elsewhere though they are not considered to be serious.

4.0 SERVICES

4.1 Electrics

The electrical installations, wiring, cables, and switchgear are in excellent condition.

4.2 Boiler

The boiler is an obsolete Lancashire type made in India. No opinion on its condition can be given without an internal inspection which we did not carry out.

5.0 FUTURE USE OF THE FACTORY

5.1 Worsted Weaving

Weaving of worsted or fine woollen fabrics is a skilled process if the essential high quality in the finished cloth is to be obtained. Such fabrics are expensive and design is an important factor in successful marketing.

In our opinion the Gulele plant is unsuitable for that kind of production. It is too small to produce the wide variety of designs the market demands without operating on production runs so short as to be quite uneconomic. Nor are the skills currently available to meet the very high quality standards expected in this selective and competitive market.

5.2 Blanket Weaving

Our recommendation is that the 48 looms should be used to weave the acrylic blankets for which there is a large and growing demand in Ethiopia. The shuttle size will take a solid cop of count 1.5 nm sufficient to give $1\frac{1}{2}$ to 2 minutes weaving. This is shorter than one would like but with one loom per weaver it is feasible. Alternatively the looms could be modified to take a much larger shuttle with at least double the weft capacity. The loom makers have provided an estimate of the cost of parts for such a conversion, viz.

4 x 4 box loom, £2094
4 x 1 box loom, £1424

i.e. 32 at £2094
16 at £1424
= £89792 or 404000 Birr approx.

To put this figure into perspective we estimate the current replacement cost of these 48 near new looms at approximately 2.2 million Birr. Labour costs must be added to the cost of the conversion parts.

Additional costs would be incurred for shuttles, reeds, heald wires and possibly drop pins.

Operating on three shifts at 70% efficiency we estimate the production would be 1.26 million linear metres per year, or approximately 600000 blankets.

Equipment for the spinning and winding of weft, (1550 tonnes p.a.), is estimated at £774000 or approximately 3.5 million Birr.

Investment in blanket weaving on this scale can only be considered in the context of an overall review of blanket production within the N.T.C. One form of rationalisation which the N.T.C. may wish to consider would be as follows:

1. Acrylic blanket production concentrated at two factories only, i.e. Gulele and Debre Berhan.

2. The blanket looms already on acrylic blankets in the other mills to be transferred to Debre Berhan, provided that they are in good condition

3. The production of cotton blankets to be confined to stitch bonding, i.e. cease weaving cotton blankets. Thus, all cotton blankets produced within N.T.C. will originate from Adei Abebe.

4. Cotton waste from all N.T.C. plants to be supplied to Adei Abebe for the manufacture of fleece for stitch bonding, (except that needed to produce cotton wool and sanitary towels).

5. Sorting, carding, and spinning of acrylic waste for use as weft at Gulele, to be concentrated at Adei Abebe and transported in cone form to Gulele.

6. Cotton yarn for warp (probably 2/14s) to be supplied to Gulele from Akaki.

We recommend that a feasibility study of these proposals be conducted as soon as possible.

TABLE G/1

WEAVING EQUIPMENT — GULELE MILL

16 - "STANDARD MODEL" HIGH-BUILT SEMI AUTOMATIC LOOMS, Fast Re
REEDSPACE. 78½ Inches nominal
BOXES Four shuttle Rising Box at one side only.
SHEDDING. 8 Shaft 5/8 coarse pitch (in 20 shafts frame) Possitive Dobby, our No. 345 Model)
PACKING Underpick system
Checking motion with 'Leader' Hydraulic Shuttle control.
DRIVE. Individual electricj motor drive by the friction place, including 1½ H.P. Motor with Prentice Push-button starter to suit normal voltage A.C. and with 4-Rope 'V' rope drive.

TAKE-UP. Positive worm take-up and reversing motion.
Cloth Beam controlled by R ck and Pinion motion.
LET-OFF. Positive worm let-off (pump rod) motion to one warp beam in middle position, with light alloy warp beam fitted with light alloy flanges 24" dia.
WEFT FORK. Twin Micro-setting Centre Weft Fork Motion
Automatic Pick Finder motion.
WEFT FEELER. Multi-Box Electric Weft Feeler motion.
WARP STOP. 6-row mechanical Warp Stop motion.
SIGNALLING LIGHTS (3)
Including the following Accessories with each Loom:
10 Shuttles, 150 pirns.,
Steel Wire Shuttle Guard, 1 Set Strapping & Plastic Pickers, 1 Pair 6-ring Taper Barrel Temples with double-floted grate type fixings and socks,
50 plastic lags for Dobby.
100 Nylong Pegs for box motion.
8 All-metal Heald Frames,
6000 Steel Wire Healds for-do-
1 Double-shift Pick Counter
½ spare Warp Beam with 24" flanges
¼ spare Cloth Beam, and
1 set Spare Parts for renewals, etc.

24 "STANDARD MOREL" HIGH-BUILT SEMI AUTOMATIC LOOMS
REEDSPACE. 78½ inches nominal BOXES Four Shuttle Rising Boxes at each side.
SHEDDING. 8 Shaft 5/8" coarse pitch positive Dobby
In all other respects as foregoing specification, and including the foregoing accessories.

....../2

ALL-ELECTRIC 4-SPEED PERCHING MACHINE.

Strongly constructed of 2¼" angle iron framing, with all rollers 75" in length. Measuring roller 36" in circumference, covered with oil-resistant rubber strip to prevent "lip" of smooth fabrics.

Fitted with measuring counter recording to 999 7/8 yards, with hand re-set, which can be read from either inside or front of machine.

Motor is 4-speed, to which is fitted a solenoid brake, and cloth speeds are as follows:-

No.1 12 yards per minute.
No. 2 19 yards per minute.
No. 3 28 yards per minute.
No. 4 38 yards per mimute.

The four speeds "Forward" and "Reverse" are available at the movement of a gear, similar to a car, but much easier to operate. Change to any gear instantaneously both "Forward"or "Reverse". "On-off" forward control is by foot-operated treadle, from any position in front or inside of machine, a push-button inching devise is provided for reversing control. A "Forward" and "Reverse"push-button station is fitted on rear pillar for control from back of machine. The machine is fitted with a "Cuttle" opener and self-flyping attachment for folding cloth in the centre of the machine after inspection. Inspection of cloth can be made from platform inside machine or from any position in front.

1 - SHUTTLE RECTIFYING MACHINE.

Complete with accessories and spare blade cutter. With grinding and polishing wheels for removing shuttle tips. Comprehensive model, mounted on stand.

1 - HYDRAULIC BEAM TROLLEY

To Lift complete warps upto 2 tons direct from floor level, or from beaming headstock in Warping machine.

TABLE G/1 (Continued)

8 - "STANDARD MODEL" HIGH-BUILT SEMI AUTOMATICE LOOMS.
REEDSPACE. 78½ inches nominal.
BOXES. Four shuttle Rising Boxes at each side
SHEDDING. 16 Shaft 5/8" Coarse pitch positive Dobby.
In all other respects as foregoing specificatinns, and including Accessories as foregoing, but with 16 Heald Frames.

2 - "RW4" WARPING & BEAMING MACHINES

Nominal Clacs 78. DRIVE. Vee Belt Drive, with 7½ H.P. motor and starter. REEL. Totally enclosed Reel 12'-6" circumference. BEAMING. Maximum distance between flanges 72". Maximum flange diameter. 32"
Williams - Hattersley tension guage, with Trumeter Measuring counter. Saddle 12" section head with Trumeter Measuring Counter.
MISCELLANEOUS
Electro-mechanical starting notion. Electro mechnical stopping motion. Including spares for 2 years' running.

2 - CONE WRAPING CREELS. Special designed for Truck loading. Freel to have provision for 304 packages, 152 each side, arranged 8 high, 19 packages in length, with 9" centres. Creel complete with individual tension devices of the disc type, Universal package received suitable for 5/16" minimum 3/4" maximum bore for parallel tubes and standard 8° cones.
Universal detector arms for electric stop motion, with indicator lamps, Annuniciator controller for indicator lamps.
Creel mounted on wheels running on steel rails. Automatic creel traversing mechanism, Set of deterctor arm supports plus wiring ductings and cable glands, etc. Creel designed so that loading of packages can be carried out away from the creels. This is achieved by using three trucks for holding packages, which are then pushed inside the centre of the Creel. Spare set of Trucks for efficient operation of unit

2 - 6 rows 8 high, on casters
1 - 7 rows 8 high, on casters

1 - AUTOMATICE PIRN MINDERS - 28 spindles, latest construction totally enclosed oil lubricated spindle gear box, four spindles per box, independent automatic pirn changing mechanism, individual thread breakage mechanism, with special front tip-end release mechansm, super-sentive diameter control mechanism and quick-acting brake, Equiped to wind by drawing over-end from suitable supply packages on to pirns. Machine equiped with bunch builders and "New Look" guarding Machine fitted with dead weight rotary type tension, vertical creel, yarn takeup mechanism, anti-rust black finish, set of allen Keys & spanners Mechanie finished in green collulose paint including motor and drive.

Table G/2

DYEING AND FINISHING EQUIPMENT - GULELE MILL

ITEM	EQUIPMENT	NO. OF UNITS	MANUFACTURER	YEAR OF MANF/INSTAL	OPERATING WIDTH CMS	OPERATING SPEED	CONDITION	REMARKS
1	Cylinder Pressing M/c	1	A. Heaton & Co. Ltd	-	160	-	3	
2	Filling & Padding M/c	1	Jas. Bailey	-	160	-	3	M/c No. 8863
3	Gerber Pressure M/c	1	Maschinenball Schotz & Co.	-	150	-	3	M/c No. 19747
4	Singeing M/c	1	Walter Osthoff	1954	180	-	3	M/c No. 5014
5	Winch Dyeing/Scouring M/c	1	-	-	-	-	3	
6	Inspection M/c	1	-	-	-	-	4	Drive mechanism missing.
7	Stenter	1	G. Whitley	-	-	-	4	M/c has a 2 mt drying chamber - too short for practical purposes. (PIN/CLIP)
8	Rope Washing/Scouring M/c	1	-	-	-	-	3/4	
9	Double Bowl Crawling M/c	1	-	-	-	-	4	
10	Opening Scutcher	1	-	-	180	-	4	
11	Centrifuge Hydro Extractor	1	-	-	-	-	3/4	
12	Single Knife Shearing M/c	1	-	-	150	-	3/4	
13	Grinding M/c for (12) above	1	-	-	-	-	3/4	
14	Single Cylinder Blowing M/c	1	-	-	-	-	4	
15	Creasing-Rolling/Plaiting M/c	1	-	-	-	-	2	
16	Piece End Sewing M/c (Hand)	1	-	-	-	-	4	
17	Piece End Sewing M/c (Electric)	1	-	-	-	-	4	
18	Screwclamp Baling Press (Electric)	1	-	-	-	-	3/4	
19	Screw Baling Press (Hand)	1	-	-	-	-	4	

All the above equipment was second-hand when purchased in 1966 and has deteriorated over the years.
There is no conceivable future use for this equipment - apart from the crease/rolling M/c.

Shirley Institute

10356
(3 of 6)

Client Report

CONFIDENTIAL

SECTOR STUDY OF THE ETHIOPIAN TEXTILE INDUSTRY

FINAL REPORT

VOLUME TWO

PART 11 OF THREE PARTS

U.N.I.D.O. Contract No. 79/61
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VOLUME TWO

PART II

CONTENTS

ASMARA TEXTILE MILLS - ASMARA

Processes: Spinning; Weaving; Dyeing and Finishing; Knitting; Garment Making; Blanket Weaving.

Spindles: 25 384 Doubling spindles 3 224 Looms:426

1. MACHINE CAPACITIES AND PRODUCTIVITY

1.1 Spinning

1.1.1 Carding and Preparation

For all processes, from carding through roving production, ATM has a relatively low labour productivity. The main reason for this is of course the shortened operating day caused by power cuts which prohibit the machinery producing the quality of product which it would otherwise do, yet still requires staffing whether it is producing or not. This is not the only reason however. In combing for example 5 tenders are required to operate 9 combing machines compared with 2 tenders to operate 6 combing machines at Dire Dawa (Mill No.5, Productive capacity at Dire Dawa being 125 kg/hr and at ATM, 106 kg/hr, both at 85% effeciency). A similar picture emerges at the drawframes where both companies have the older 4 delivery machines but Dire Dawa requires 6 tenders to look after 16machines, and ATM requires 15 tenders for 28 machines. This latter ratio is achieved when half the frames are modern 2-delivery high speed units. Clearly then some reduction in manning levels is necessary at ATM. We believe a reasonable initial target, to be achieved over the next two to three years would be a reduction of 30% in current levels.

1.1.2 Spinning

In the spinning sector, the OHK values appear to indicate a low level of operative productivity. However in this instance the reduction is seen to be mainly due to a high number of 'other' category workers, which other mills employ but,for one reason or another,have not either identified them or allocated them to the spinning department. Given the absence of any work study personnel, the management achieves a manning level in this department averaging two sides/spinner, which is typical of the levels in Ethiopia, but some way behind satisfactory standards (for example 6 sides/operative in Mill 5, Dire Dawa).

We recommend that the management draws-up plans to introduce a measured work based incentive scheme as soon as possible. During our visits we were informed that it is management's intention to introduce a bonus payment scheme for operating an additional side. At present all spinners work two sides no matter what count is being spun on the frame. We strongly recommend ATM to drop this scheme and proceed no further with this bonus. In our opinion the scheme is essentially unfair and will be rewarding some operatives by paying them for a lower work rate than others who are already relatively over-worked.

Even if work study teams are not available in Ethiopia at present, management can still calculate theoretical loadings, based on international clement times, giving a more logical work allocation to its labour force.

1.2 Weaving

The abnormal conditions under which the Asmara mills are operating prevent them from achieving anything approaching normal levels of productivity, either machine productivity or labour productivity. Until more normal conditions return the Asmara plants will continue to operate at less than a half of their capacity.

At the time of the visit to the Asmara Textile Mills much of the machinery was idle for lack of electrical power which is rationed to industrial users. This situation is expected to improve during the early part of 1980. Another complication is the curfew. This operates from 7.30 p.m. to 6 a.m., thus preventing what would be the normal shift change at about 10 p.m. Hence, whilst the labour force is made up of three shifts only two of those shifts are working in a 24 hour period.

In these circumstances the present productivity levels of the Asmara Textile Mills are meaningless.

With the current product mix the equipment in weaving preparation is in balance with loom capacity, but if there is a shift to finer counts, cone winding capacity may become inadequate.

1.3 Knitting and Sewing

The knitting department is operating at approximately 50% of its capacity. Some machines are stopped because of yarn shortages particularly in counts 22s, 32, and 2/60s. There is a general shortage of knitting expertise within the department, both nechanically and in design. Hence, machines are not easily repaired and style changes do not take place because nobody knows how to make the necessary changes to the machines.

The equipment in the sewing is adequate in type and quantity to cope with the potential output from the knitting section. The sewing department is on day work whilst knitting is on two shifts; the two sections are approximately in balance with this arrangement. When the knitting department gets into full production a double shift system will become necessary in sewing.

1.4 Blanket Weaving

The blanket department consists of 14 looms over 60 years old, a 40 drum conewinder on which only 20 drums are working, a 20 spindle pirn winder on which only ten spindles are running, and one raising machine. The weft is provided by an adjacent condenser spinning unit utilizing cotton waste generated within the mill.

A recommendation is made elsewhere in the report that NTC cotton blanket production be confined to the stitch bonded process and that it be concentrated at Adei Abebe. Cotton waste would be sent to Adei Abebe from the other NTC mills for use as the fleece. If the recommendation is implemented the blanket department at Asmara Textile Mills would be closed down.

1.5 Finishing

The finishing department would seem to be working at reasonable efficiency levels, the restriction on volume being physical rather than other considerations. The existing equipment is somewhat out of balance in that there is a lack of capacity for the intermediate and finished drying of fabric. Rectification of this imbalance would allow an increase in the total volume processed within the department at improved efficiency levels. Essentially, this would involve:

(i) The introduction of high efficiency mangle units in front of drying cylinders.

(ii) Increasing by addition/replacement, the evaporation capacities of the existing drying cylinder ranges.

(iii) The replacement/reconditioning of the Sir J.F. Norton stenter- with high evaporation rate units.

(iv) Additional jigger machine capacity.

It was understood that as far as print goods are concerned, the current market demand is against pigment prints and insistence on reactive or vat dyed products. With existing facilities, the unit can only produce pigment prints in any appreciable volume. It should therefore be company policy to sell only pigment prints, until such time that market factors overrule this policy. On the production from two automatic flat screen printing machines, it would be difficult to economically justify the acquisition of post printing ancillary equipment necessary for the production of other than pigment prints - unless such an acquisition was part of the re-equipment programme designed to substantially increase the total volume produced by the department. Alternatively the printing operation could be concentrated (with other) in one locality in the area.

The department is established to process a proportion of the total mill production, the balance being sold direct to the market as grey cloth. Currently that processed by the finishing department amounts to approximately 30% of total production. From discussions it is evident that all production can be sold without undue difficulty - and that this situation will continue into the near future. However, the time will come - assuming reasonable economic growth, when this situation will no longer appertain, and it will be becessary to enlarge the finishing capacity if the company is to continue selling the whole of its production. Since the lead time in the implementation of such plans is likely to be 12 - 18 months minimum, the whole matter should be kept under regular periodic review, so that the changed situation is recognised earlier rather than later.

1. Given a suitable product mix, current capacity - based on 2 shift working and 302 days per year is 3.0 million metres of woven goods per annum. When circumstances permit three shift working, the annual capacity is increased to 4.5 million metres. Similarly, the capacity for processing yarn and knitted fabric is:

	Current 2 Shift Working	3 Shift Working
Weft Knit Goods	270,000	410,000 metres
Yarn Dyeing and Bleaching	120,000	181,000 Kgs

Clearly there is advantage in re-introducing three shift working as soon as this is practical.

2. Intermediate and finished drying capacity is a restriction on increased volume production - consideration should be given to overcoming this by the acquisition of additional equipment.

3. Items of equipment are in urgent need of attention if production volumes are to be maintained in the near future.

4. To ensure that the boiler plant is operated as efficiently as possible, we would advise that further instrumentation be fitted.

5. The company was undertaking trial orders for the production of medical bandage cloths. In our opinion, the finishing department is not equipped to process such fabrics economically - and to attempt to do so will merely be a dilution of management effort in more essential areas.

6. During the visit, it was suggested to team members that there would be a requirement for the company to expand its dyeing and finishing capability. Whilst this would naturally depend upon the product nature of such expansion; assuming that this was an expansion of volume only, the types of additional equipment required would be:

   (i) Continuous preparation and bleaching equipment - integrating with existing (refurbished) equipment.

   (ii) Continuous dyeing and washing equipment - the latter also suitable for the washing off of print process.

   (iii) Additional stenter finishing equipment.

   (iv) Additional inspection and make-up equipment.

2. BUILDING AND BUILDING SERVICES

2.1 Buildings

The general factory buildings are well designed and constructed, eminently suited to textile manufacture and processing.

Owing to a corrugated metal roof, some condensation was experienced in the Dyehouse during colder periods; but this was not considered sufficiently serious to warrant remedial action.

Serious roof leaks were reported in the weaving shed causing water to run into electric cable ducts and consequential shorting in circuits. Early attention to the roof covering is strongly recommended.

2.2 Storage Areas

Ge ,erally stores areas were well sited in relation to the various production units, and suited to their purpose.

It was noted that immediate dyehouse raw materials were stored in close proximity to the wet processing and that some containers were showing obvious signs of corrosion. It would be advantageous if such materials as dyestuffs were isolated from such atmospheres.

2.3 Fire Precautions

Generally good. Fire hydrants are strategically sited throughout the factory and extinguishers plus sand buckets are available within departments. The number of these latter in the immediate areas to the singer and stenter machines could be increased for greater security.

2.4 Water Supply

Process water was abstracted from own artesian wells, that required for boiler feed was supplied by the Municipality. All water was filtered and chemically treated for appropriate uses.

No shortages of water were reported - even during the dry season. Current demand (18 hours/day) is 356 m^3, assurance was given that the supply is sufficient to cope with 24 hour working and foreseeable expansion. Two of the five available wells are sufficient to meet current demand.

2.5 Steam Generation

Steam is generated from five Oreste Luciano package type boiler operating at 4 kg/cm^2. Steam demand is such that normal requirements are met by using three of the five boilers - fou occasionally. Apart from individual pressure gauges there is no additional instrumentation fitted - therefore further information as to steam usage and boiler efficiencies is not available. In view of increasing fuel costs, and the necessity of efficient usage, it would be recommended that instrumentation for adequate control is fitted, e.g. time clock; steam output recorder; thermostat; condensate temperature gauge; fuel tank gauge; flue gas gauge.

All boilers are subjected to annual insurance inspection; but only in respect of working pressure and automatic flame cut-out. In its own interests, the company should extend this to a more comprehensive boiler survey - so avoiding inevitable breakdowns or worse at unscheduled times. Similarly, the regular chemical monitoring of boiler water conditions should be introduced.

2.6 Effluent Disposal

Domestic effluent is passed direct to the main municipal drains. All process effluent, is passed via a works main to settling fields outside the factory perimeter, from where it is channelled to the local river system. There was no knowledge of local bye laws governing effluent discharges - nor had any complaints been received on this matter.

2.7 Air Conditioning

Asmara Textile Mills uses a combination of Central Station and Unit Air Conditioners. Table A below summarises the present installations:

Table A - Air Conditioning Installations (Mazzini)

Area	No. Central Station A-C	No. Unit A-C
Blow-room		4
Carding/Combing		5
Spinning	2	2
Weaving	4	
Knitting		2
Sewing	Extractor fans only	

No information is available about the technical performance or the capacities of the plants.

Few of the installations can be working correctly. The two central stations are operating in the manual mode of control; the fans are working but the louvres controlling proportion of fresh or recycled air are not connected to their respective pneumatic activators, the pneumatic controls themselves are not functioning and the water eliminators have not been cleared recently. All of which leads us to believe that when the air conditioning is switched on, it does very little other than introduce a proportion of fresh air into the mill. Certainly humidity can not be controlled - a fact which unfortunately cannot be confirmed in all areas because the recording units 'have not worked for 10 years'.

In other mills this mode of control, without adequate maintenance to ensure that the air is cleaned either by the spray units or the filteres, leads to high levels of airborne fly and dust. This is not the case in ATM owing to the very high standard of housekeeping within the mill, and the associated machine cleaning programmes. Power failures and the exceptional working hours no doubt assist the management in preserving this standard of cleanliness, but we are left with the impression that this is only part of the explanation. Staff are undoubtedly better supervised in the Asmara mills, better motivated, and generally their work is to a higher standard than that found in the other parts of Ethiopia.

In order to return the air conditioning installations to full working order, as quickly as possible, we recommend the mill to contact Mazzini and obtain the services of one of their commissioning engineers. His brief should include obtaining the necessary spare parts (the mill has difficulty obtaining parts for the control equipment), installing them , and recommissioning the plant. We believe the cost to ATM, to restore the plant to full working order, and to restock with all the necessary spare parts, to be in the order of US $ 325,000. This sum includes cost of the engineer's travel and subsistence for a stay in Asmara of 10 weeks.

3. ASSESSMENT OF MACHINE CONDITION

3.1 Short Staple Spinning

3.1.1 Opening and Cleaning Machinery

The four opening and cleaning lines installed at ATM have a combined total capacity of roughly 900 kg/hr. This capacity exceeds the current operating requirement by 376 kg/hr. One line has been reserved for man-made fibres (171 kg/hr at 100% efficiency) but current production does not require man-made fibres. Generally the condition of the plant is satisfactory, though in order to ensure a satisfactory operating life until 1985, for the oldest (1956) opening line, we recommend that it be thoroughly overhauled as early as possible. The remaining three lines should have a satisfactory operating life span until the end of the 1980's.

On the basis of the present production schedule we believe it is unnecessary to introduce any other improvements or replacements to these lines.

The cost of carrying out the overhaul advocated above would be roughly US $ 20,000.

3.1.2 Carding

Discussion with the management at ATM revealed that the carding section (and the ringframes) is believed to cause a bottleneck in production sufficiently narrow to prevent further expansion of production. Table H/3 Spin Plan: Asmara Textile Mills does not support this argument. There is in the carding sector, with present processing speeds, 68 kg/hr of spare capacity. Even this figure is probably an underestimate as it is based on an assumed efficiency of only 80%, which we believe can be improved.

Generally, the condition of the cards is satisfactory, and that of the C20 cards good. The company does not work a scheduled maintenance scheme in all departments, but does operate a scheme to regrind the cards at regular intervals. The 2 rating given to the older cards arises from the high nep count (believed to be caused by poor grinding) and the unnecessary high level of dust and fly being generated by the cards. More attention to covers is expected to improve the latter problem.

Given the surplus capacity and generally satisfactory condition of this section, we do not believe any replacements or additions are necessary.

3.1.3 Combing

The combing equipment from pre-comber drawframes through combers is operating well within the speed limits imposed either by the machines themselves, or by the quality of the raw fibres. Even so there is 30 kg/hr to spare, a figure which could probably be increased by 50% by simply increasing the operating speed of the combers, lap former and pre-comber drawframes.

In order to ensure a satisfactory operating life to the end of the 1980's, the machines should be maintained on a more regular basis.

3.1.4 Drawing

Six-, four- and two-delivery drawframes are used in the mill. Existing trends throughout the world are towards the two-delivery drawframe which, though it is generally accepted to offer only a relatively low return on the investment cost of replacing the older four- and six-delivery units, nonetheless is attractive because of the improved quality of sliver produced, especially when the first passage units are fitted with autolevellers. The quality of yarn spun by ATM is sufficiently high to warrant the introduction of the two-delivery units; so rather than renovate the older machines, they are rated 4, with the recommendation that they be replaced where necessary. The S20 frames should continue to operate satisfactorily beyond the end of the 1980's providing some form of planned maintenance is introduced. Table H/3 shows that present demand can be met by replacing the 14 older units by only 2 modern units, at a current cost of US $ 70 000.

3.1.5 Roving Frames

It appears from the returned questionnaire that at least one 130 spindle (1956 or 1960) and one 110 (1964 or 1974) frame are surplus to current requirements, equivalent to 15% spare capacity. From Table H/3 Spin Plan, additional spare capacity arising from under-utilization of the frames probably accounts for a further 5%, giving a total surplus of approximately 20%. Operating speeds are disappointingly low, probably as a result of the management's attempt to balance the production in the mill. The two newer types of frames (BC and BC3) should be capable of 1000 rpm rather than the 800-850 at which they are currently operating.

The 4 Marzoli Type 4C roving frames are rated 3 even though their production is confined to market yarns for which the quality requirements are obviously lower. We believe that the overhaul of these machines, with the replacement of 4-roller drafting system by a double apron top arm drafting system, is a necessary prerequisite if they are to continue operating beyond 1985.

The estimated cost of rehabilitating these four machines is US $ 150,000. The work can be carried out by a Marzoli commissioning engineer who can supervise the rehabilitation programme on these machines plus any work on the other roving frames at the same time.

3.1.6 Ringframes

Management at ATM were unable to give overall operating efficiencies for the ring frames. It is therefore impossible to state categorically the known capacity of this sector. However, from Table H/1 it is clear that any limitation to increasing the rotational speed of the spindles must arise from:

(a) an unacceptable end-breaking rate;

(b) an unacceptable traveller replacement programme; or

(c) mechanical considerations, rather than any front roller speed limitation.

The recommendations made above regarding drawframe and roving frame improvements should help management to reduce the end-breakage rate at the ringframe, or alternatively, to increase the rotational speed of the spindles with no increase in the end-breakage rate.

An acceptable traveller life cannot be specified without a more detailed examination of costs at the mill, but the evidence we have suggests that the frames are operating more slowly than optimum economic considerations would dictate.

Finally, there is no mechanical reason why the 1960 and younger frames (which, with the exception of the eighteen 1967 units, are all equipped with SKF or WST top arm drafting systems) cannot operate at speeds up to 11,000 rev/min, spinning yarn between 14 Ne and 24 Ne, and up to 12,000 rev/min for counts above 24 Ne.

We believe, therefore that the spinning sector can be run with greater productivity, and that this increase in productivity could amount to between 5% and 10% plus any additions from improved overall operating efficiency. If the power failures are ignored the total annual capacity is therefore an estimated 3625 tonnes/annum for 308 twenty-four hour days. This estimated capacity roughly corresponds to 70% of the mill's 1973 production or 250% of 1978 production.

1973 production however, is reported to have spun yarns with an average count of 18's Ne. Based on the breakdown of yarn counts given in the completed questionnaire, the present average count is 22.13 Ne (the management quoted 22.4 Ne), so the present capacity of 3625 tonnes a year at 22.13 Ne corresponds to 4950 tonnes at 18's count which is 95% of 1973 production.

The 1956 frames have been rated 3. The main reason for this low rating is the need to replace the existing 4-line drafting system with a double-apron system. This recommendation should only be followed however, after the current end-breakage rate has been examined on these frames, and the economic case made.

3.1.8 Winding

If an average overall operating efficiency of 65% is assumed for each of the winders, then the present capacity of this sector is:

(a) For winding and clearing singles yarn : 128 kg/hr, or 50 kg/hr more than is required by the present demand for yarn based on spinning department figures given in Table

(b) For assembly winding double and three-ply yarns; 75 kg/hr which is equivalent to 55 kg/hr more than present demand requires (as measured in (a) above).

(c) For gassed yarns : no information regarding the count of yarns which are gassed is given in the completed questionnaire.

The condition of the machinery in this sector has been rated 3. In common with other mills, the clearers are set too open and the tensioning devices are set irregularly. The net effect of setting the machines incorrectly is to increase the warp breaks at weaving whilst achieving relatively better machine and labour productivity figures in winding. As these warp breaks can account for about 2% (or more) loom efficiency reduction for four-loom working, the incorrect operation of the winders can be seen to be bad practice.

We therefore recommend that these winding machines be thoroughly overhauled and that operative supervision be increased to ensure the proper future operation of the winders.

Subject to the overhauling of the machines, we believe they are capable of operating satisfactorily until 1985. The cost of the overhaul is expected to be about US $ 100,000.

3.1.9 Twisters

The Marzoli TS5 and TRC ring twisting machines should continue to give a satisfactory performance until the end of the 1980's. Under present operating practice they have a capacity of 31 kg/hr of 2/26 Ne, 18 kg/hr of 2/28 Ne, 16 kg/hr of 2/34 Ne, and 3.5 kg/hr of 2/60 Ne yarn. This 68.5 kg/hr capacity is roughly 350% of present prequirements and is based on an overall operating efficiency of 90% and the demand profile deduced from Table H/1.

3.1.10 Reeling

34 reeling machines are installed in the mill to handle the 21 Ne and 40 Ne yarns. The total demand (as measured by Table H/1) is, for 21 Ne and 40 Ne yarns, 154 kg/hr and 20.5 kg/hr respectively. At 30% efficiency this calls for 14 frames to run on 21 Ne yarn and 4 frames to run on 40's. Thus the total spare capacity in the reeling sector (excluding the eight frames which are not being used at this moment) is roughly 40%. The frames though old, are simple to maintain and are expected to continue operating satisfactorily until the end of the 1980's.

3.2 Weaving Preparation and Weaving

Equipment in weaving preparation is in good condition. With reasonable maintenance it will last well beyond 1985.

The technical management have a number of problems with the Northrop looms which are between 17 and 20 years old. Most of the problems are related to the picking and checking mechanisms. Whilst these two parts of the loom usually do take up most of a loom mechanic's time, the failure to overcome the problems of their adjustment at the Asmara Textile Mills is attributed mainly to the lack of training of the loom mechanics. The age of the looms with theirconsequent wear is a factor, but not the important one.

Broken pirns and broken picking sticks are more frequent than is normal for this type of loom and this is a clear indication of poor maintenance and incorrect loom adjustment. Shuttle checking is a constant problem and this is attributed to rapid wear of the check strap. A possibility is that the straps are of inferior quality. If these looms are properly maintained and correctly adjusted they should be capable of several more years of useful life. It is recommended that a skilled Northrop loom mechanic be put into the mill for three months for the purpose of checking all the loom settings and making adjustments where necessary, whilst at the same time he should train the weaving technical management in the correct procedures and settings.

Twenty new Northrop Sensomatic looms are installed in the weaving shed in various stages of assembly. They have been there for several years. It is recommended that action be taken to commission these machines as quickly as possible.

3.3 Blanket Weaving

The machinery in this department is very old and long since obsolete. Given a supply of spare parts this old but robust machinery will run for many more years. It is used to produce cheap cotton blankets from the cotton waste generated within the other processes of the mill. The blankets are of low quality but adequate for the market for which they are intended. As long as this department continues to be profitable it should be allowed to continue. New investment is not recommended.

3.4 Knitting and Sewing

The machines in these two sections are in good condition generally, in spite of the fact that there is a lack of skilled knitting machine mechanics. Sufficient maintenance is carried out to keep the machines in working order, but the skills available are insufficient to enable style changes to be made on most of the knitting machines. A knitting machine mechanic with some knowledge of knitted fabric design and construction is an urgent requirement. It is recommended that an engineer from the manufacturers (Fouquet), be brought in to check the machines, and to instruct the machine mechanics on the adjustments necessary to produce new styles.

A few of the sewing machines are out of action awaiting spare parts. Apart from this the sewing equipment is in good condition.

3.5 Finishing

Comment on individual items of equipment is included with the plant register. There are however, certain items requiring senior management attention if production is not to be jeopardized in the near future. These are:

Mercerised Wash Unit	in need of major overhaul, rollers missing, main squeeze rollers worn etc.

Cylinder Drying Units	Steam joints leaking badly, condensate return valves not functioning - further reducing the efficiency of these machines, which at their best are low production machines.
Drying Mangle Units	Rollers badly worn, impairing their efficiency. This type of machine would not be recommended due to its low efficiency in mechanically extracting water from the fabric.
Impregnation unit - Kuster Type Mangle	This unit is not functioning owing to mechanical problems - this is impairing the efficiency of the bleaching operation.
No 2 Stenter (Camerio Ericole)	Only two of the three burners are functioning - reducing the drying efficiency by 33%.
Jigger Machines	Automatic controls not functioning.

4. WORKING ENVIRONMENT

4.1 Spinning

Generally satisfactory to good, but probably reflecting the relatively high standard of housekeeping in the mill arising from the exceptional working hours and power cuts. Given full availability of power, then the condition is expected to deteriorate rapidly unless maintenance of the air-conditioning plants can be improved. Recommend the use of face masks in the blending department.

4.2 Weaving

Air conditioning ventillation is to a reasonable standard, although some atmospheric dust was evident. The lighting conditions however, are poor - down to 20 Lux in the daytime, the light sources are mercury vapour lamps which give poor light consumming much of the power in the generation of heat. The company would be advised to replace these with fluorescent lighting designed to give a standard of 100 Lux on the warp sheets in the looms. The estimated cost of the change is US $ 40,000.

4.3 Knitting and Sewing

Environment conditions satisfactory in all respects.

4.4 Finishing

Working conditions satisfactory being commensurate with those normally experienced in such processing departments.

4.5 Health and Safety

It was reported that induction safety training was given to each new employee - this is the only incidence of such training being given; but is a practice that should be recommended to other units within the organisation.

Generally, attention to the provision of safe working conditions was reasonable - further attention to the safe-guarding of machinery, particularly in the finishing department would improve matters further.

Comment was made that more attention could be given by senior management to the provision of more appropriate protective clothing than is supplied at present - this being exampled by inferior (and unusable) rubber gloves, boots, aprons, for persons handling dangerous chemicals.

A daily milk allocation is provided to all persons handling or using dangerous chemicals.

5. MAINTENANCE

The general condition of the machinery on the site is satisfactory. Management is clearly helped by the frequent power cuts which enable operatives to spend more time than is normally allowed for cleaning their machines. In addition, the daytime power shut-down is used to maintain some items of opening, cleaning and spinning machinery.

No complete scheduled or planned maintenance programmes for processing are yet recorded, but the cards are claimed to receive regular grinding, and the knitting and sewing machines to receive scneduled maintenance. However, the frequency and duration of the maintenance time spent on the knitting and sewing machines - two hours every Saturday afternoon, suggests that this is routine cleaning and oiling rather than a full planned maintenance programme.

No planned maintenance is carried out on the mechanical service machinery either. The boilers are maintained every 3 to 4 months, but not to a regular schedule. They are inspected on behalf of the management by the Ethiopian Insurance Corporation whose engineer simply checks that the boiler burner cuts out when the steam reached the designed boiler temperature, and that the steam pressure at this temperature is not in excess of the designed pressure. The engineer does not inspect the boiler cold. Water from the municipal supply is used to feed the boiler, without recourse to any additional softening plant.

The air conditioning plants and water distribution networks are subjected to breakdown maintenance.

The mill has a comprehensive range of workshop machinery which includes a heat-treatment oven (though it has not been used for the past four years). Any shortages or gaps in the range of machine tools are easily filled by recourse to either other NTC mills in the area or to one of the two reputable engineering firms (private sector) in the city. In the electrical workshop there are four testing stations equipped with power points and ammeters on which to test the rewound electric motors which are held in stock for immediately replacing damaged motors on the cards, spinning machines and looms. A hand former is used when rewinding larger motors, and consequently it can take up to 3 days to complete the rewinding. A powered unit is used for the smaller motors. Mechanics complained of a shortage of portable instruments - particularly Clippon ammeters; the mill has two at present but six would be a more appropriate number for a site of this size.

A stock control scheme is worked. Each department (spinning, weaving, electrical, and mechanical services) has its own store and ordering procedures which is unnecessarily labour intensive. Except for the control instruments fitted on the air-conditioning equipment, no shortages of spare parts are reported. Communication with, and delivery time for spare parts from, Marzolli do present a problem.

Only the weaving department, which is short of assistant mechanics, is claimed to have any shortage of suitably skilled labour. Otherwise labour is said to be good, with an adequate stock within the city boundaries should replacements be necessary. Many of the labour force in the maintenance department are said to have been employed at the mill for between 15 and 20 years, and by now are considered skilled artisans - a fact which our observations tended to confirm.

The severest criticism we have for the operation of the maintenance department, whether it be in the processing departments or the workshops, is the complete failure to keep any record of the work carried out, or the cost of this work. It is therefore impossible for management to judge whether machinery ownership costs (including maintenance costs) are greater than replacement costs for particular machines. Investment decision making is thereby limited to technical obsolescence rather than including economic obsolescence.

6. QUALITY OF PRODUCTION

Only the simplest quality control techniques are practiced in the spinning department. Sliver wrappings, nep counts and yarn strength measurements are made. Management's attitude is that the company can sell everything they manufacture and consequently quality is not an important consideration in the market place. This attitude however is inconsistent with produce range which includes such comparatively high quality products as twill fabrics woven from fine count doubled yarns, and knitted fabrics. Market considerations are not the only reason for improving the quality control in the mill. Our visit reports notes the relatively high number of ends down in the weaving department so loom efficiencies will improve if quality standards are lifted.

We therefore recommend that ATM increase the staffing of its quality control department to the following levels:

Table B - Recommended Quality Control Staffing Levels

(a) Spinning:	,Supervisor (recruited)	1
	Calculator	1
	Yarn analysers	3
	Raw cotton analysers	2
	Twist analyser	1
	Uster operator	2
	Yarn appearance	1
(b) Weaving:	Supervisor	1
	Slub catcher setter	2
	Size analyser	2
	Cloth inspectors	5
(c) Finishing:	Supervisor	1
	Laboratory technicians	4
	Chemist	1
		27

The above staffing levels reflect the wide divergence of yarn and fabric types processed in the mill. If this product range were to be rationalised then, the recommended numbers would be reduced.

Equipment costs for such a department, are at present day costs, roughly US $ 120,000. This does not include a Uster Evenness Installation as the company already ownes one. However, it is inoperative owing to lack of maintenance at the moment, as the company needs to quickly obtain the service of a Uster's maintenance engineer.

7. COTTON AND COTTON BLENDING

In the blowing room, management operates a stack mixing system. Instead of opening bales close to the feeder lattices on the bale openers, thereby relying on the correct selection of bales and a controlled regular manual loading of the lattices, ATM mixes in a pile (or stack) a large quantity of fibre from a given number of bales (usually a day's supply) and then manually loads the lattices from this stack. Thus blending is improved at the expense of the additional cost of the labour working on the stack.

At ATM some of this additional cost is off-set by using cheaper blends of fibre for the coarser count yarns. Table H/22 gives details. Two points are clear from this Table:

* Raw material costs (excluding waste) are only two percent cheaper for sales yarn than for combed yarns for high quality twill fabrics and sewing threads.

* The weighted average staple length of fibre used to spin 6s Ne is only 0.072 ins shorter than that used to spin combed 60s Ne yarns.

We have examined the prices of raw cotton in Ethiopia and compared it with the prices of other varieties. The results are presented in Tables H/23 and H24 and show the Ethiopian price variance from the base value, for equivalent qualities of cotton, lie within the range obtained for Memphis and Mexican varieties (see Table H 23). When compared with El Paso variety however, the range of Ethiopian cotton for different staple lengths is much smaller at the Good Middling end of the spectrum and roughly similar at the Low Middling end (See Table H/24). These variances are of course subject to variations caused by fluctuating base prices and as they are taken from data prepared at different times, then some adjustment to the figures is necessary to compare them at identical dates. However, the magnitude of this adjustment does not affect these general conclusions.

With regard to the variance from base price with quality, the Ethiopian cotton values get progressively larger as the average staple length increases whereas for the other cottons the values are much more stable with variance in staple length.

We conclude then that though there are some differences between the price structure of the cotton used in Ethiopia and the structure of that used outside the country, these differences are only marginal.

However, if we examine the average staple length of cottons used to spin different counts of yarn, we find that Ethiopian practice is different from that in other countries. Outside Ethiopia it is often found that carded yarns up to 20s Ne are spun from fibre with an average staple length of $^7/8$ ins or below, and combed yarns of 60s Ne from fibre with an average staple length of approximately $1\frac{1}{4}$ ins. However, the $1^{1}/8$ ins average staple length fibre is suitable for combed yarns up to 40s Ne, so it is only the 50s Ne and 60s Ne yarns, of which there are relatively small amounts spun, that are outside normally accepted practice.

At the coarse end of the range however, the 1 ins fibre is typically used outside Ethiopia for counts be, veen 24s Ne and 30s Ne. It is then the coarse yarns which are consuming longer than necessary fibre rather than fine yarns consuming inferior fibre, that is seen to be a noticeable characteristic of the Ethiopian spinning industry.

Ideally it would be in the interest of the Ethiopian cotton growers to sell some of their shorter staple length fibre abroad, and for the industry to make up the deficit with even shorter fibre. But the exisiting quality problems besetting the growers, and the transportation difficulties (reliability and delays) across Ethiopian borders, make it unrealistic to recommend this practice at the moment.

Instead we suggest that the industry, at the same time that it lifts the standards of its cotton crop, and mill maintenance and quality control procedures and practices; derives as much benefit as it can from 'over spinning' by operating its machinery faster. ATM is a good example of a company with the potential to do just this. With improved quality control and air-conditioning maintenance, the company should easily attain the additional output from its existing spindles which has been discussed above (See Section 3.1.6).

Though the difference in raw material prices over the full range of counts that is to be found with the selective blending of fibres, is not to be taken advantage of in Ethiopia owing to the relatively narrow range of fibre lengths apparently available, the practice is still to be recommended as it is only in this way that the mills can:

- Control the fibre length distribution of a blend sufficient to keep machinery adjustments to a minimum. In this connection the machinery adjustments to control comber noils are particularly sensitive to changes in fibre length distribution and short fibre content. Also the uniformity of slivers and rovings is dependent mainly on fibre properties and machinery adjustments; thus the most uniform products can only be produced by controlling and establishing pre-determined fibre property levels.

- Reduce to a minimum the twist variation in yarns, thereby achieving better control over yarn strength, and end breakage levels and variations not only in spinning but also in warping, winding and weaving.

8. WORK FORCE AND SKILLS

8.1 Spinning

Recently a formal training programme has been introduced for operatives, but no special educational qualities are required for the manual staff. The training programme will therefore familiarise operatives with the tasks necessary to progress from sweeper, through bobbin carrier and doffers to spinners. It will do little to improve the operative's appreciation of the finer points of spinning - for example the importance of roller surfaces, the advantages which accrue both to the company and to the operative if a high standard of housekeeping is achieved, and the benefits gained from consistent machine adjustment.

8.2 Weaving

Compared with other N.T.C. mills the numbers employed in the various occupations tend to be lower in relation to the work to be done. In assessing the work force, however, the unusual working conditions in Asmara have to be borne in mind. The whole picture is distorted by these conditions.

The skills of most operatives are lower than would be expected. This is almost entirely due to inexperience,for this mill, with the others in Asmara has been open for a little over a year after being shut-down for a year.

Many of the operatives recruited for the re-opening were inexperienced. The most important skill deficiences are amongst the mechanics employed on loom maintenance and knitting machine maintenance. Machine performance suffers on that account.

The institution of formal training is recommended for all machine tenders, e.g. spinners, weavers, winding operatives etc, and for the more skilled occupations such as production machine mechanics and general maintenance mechanics. The provision of maintenance manuals or instruction sheets in Amharic is also recommended.

8.3 Finishing

Production per capita per annum is lower than at other units within the organisation. To some extent this can be attributable to the facts that products are in a higher quality bracket - and therefore have a higher added value content, and that the Company is restricted to two shift working. This latter point is borne out by the appreciably lower production per unit area of floor space - compared to other production units - coupled to the fact that there is a generous spacing of equipment within the department.

As in other units visited, comment was passed regarding the shortage of skilled and fully trained technicians and operatives. This is such a general need that appropriate action will only be possible with central (NTC) participation.

Whilst departmental management appeared to be quite competent - technically, such expertise was not evident in lower levels of management and supervision.

SHORT STAPLE SPINNING - ASMARA TEXTILE MILLS

BLOW - ROOM 4 LINES

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size			Working Width mm	Operating Speed	livery Speed	Waste Removal System	Drafting System	Production Data				Machine Condition
							Ø mm	Height mm	Capacity kg						Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	
Bale openers	Marzoli		1956	2						760									3
Hopper feeder	"			1															3
Beater	"			1															3
Reserve box	"			1															3
Cage	"			1	22												213		3
Hopper feeder	"			1															3
3-Blade beater	"			1															3
Kirschner beater	"			1															3
Lap former	"			1						925									3
Bale openers	"	B16	1960/ 1963	3															2
Feeder	"			1															2
Cage	"			1															2
Step cleaner	"		1960	1															2
Hopper feeder	"			1	35.3												240		2
3-Blade beater	"			1															2
Reserve box	"			1															2
Kirschner beater	"			1															2
Lap former	"			1						965									2
Bale openers	"	B16	1964	3															2
Feeder	"			1															2
Cage	"			1															2
Step cleaners	"	B22	1964	2	39.7												392		2
Hopper feeders	"	B24	1964	2															2
3-Blade beaters	"			2															2
Lap formers	"			2						1000									2
Bale openers	"	B10/1	1975	2						1000									2
Crighton opener	"		1956	1															2
Hopper feeder	"		1964	1	20.9												171		2
3-Blade beater	"			1															2
Lap former	"		1964							1000									2

TABLE No. H/1 (continued) - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - ASMARA TEXTILE MILLS

	Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
	Cards	Marzoli	T15	1956	30	1	1.47	235	890	3	940	9.7rpm	(doffer)			0.15		5.01		
	"	"	T15N	1960	40	1	1.47	300	900	4.3	940	9.7rpm	(doffer)			0.15		5.01		2
	"	"	C20	1964/5	21	1	4.05	445	1025	9.0	1000	16.2rpm	(doffer)			0.15		16.20		1
	Pre-comber drawframe	Marzoli	S20	1968	1	2	4.05	360	880	5.0			124 m/min							2
	"	"	S20	1975	1	2	4.05	360	880	5.0			"							2
	Lap former	Marzoli	SR3	1964	1															2
	Combers	Marzoli	C8	1964	6	2	4.05	350	885	5		132rpm	26.5m/min			0.15		12.54		2
	"	"	P1	1972	3	2	4.05	350	885	5		156rpm	34.5m/min			0.15		16.32		2
DRAWFRAMES	Drawframes 1st pass.	Marzoli	4C	1955	4	6	1.47	245	880	3.0			36m/min		4 over 4	0.15		51kg		4
	"	"	M4		3	4	1.47	300	890	4.3			71m/min		3 over 4	0.15		67kg		4
	"	"	S20	1964	6	2	4.05	340	880	5 0			131m/min		3 over 4	0.15		64kg		2
	"	"	S20	1975	1	2	4.05	340	880	5.0			136m/min		3 over 4	0.15		64kg		2
	" 2nd pass.	"	4C	1955	4	6	1.47	245	880	3.0			35m/min		4 over 4	0.15		49.6kg		4
	"	"	M4		3	4	1.47	300	890	4.3			70m/min		3 over 4	0.15		66kg		4
	"	"	S20	1964	6	2	4.05	340	880	5.0			130 m/min		3 over 4	0.15		61.4kg		2
	"	"	S20	1975	1	2	4.05	340	880	5.0			135 m/min		3 over 4	0.15		63.7kg		2
ROVING FRAMES	Roving frames	Marzoli	4C	1956	4	130	4.0	120	230			830rpm		None	2 and 4 line	1.35	1.34	53.6kg	70	3
	"	"	P3	1960	2	130	5.5	120	280			725rpm		None	WST	0.90	1.06	91.9kg	70	2
	"	"	P3G	1964	6	110	7.36	125	280			810rpm		None	WST	0.9 - 1.5	1.17(1)	64.4kg(1)	70	2
	"	"	BC	1968	1	40	5.15	135	260			850rpm		None	PK421	2.0	1.73	19.5kg	70	2
	"	"	BC3	1974	1	110	12.14	125	280			800rpm		Broken end	PK321	1.0	1.08	73.3kg	70	2
RING FRAMES	Ring frame	Marzoli	RC	1972	1	96	-	50(2)	210			5885rpm	649(3)	B-end	PK220	6 P	9.06	9.35kg		2
	"	"	S5	1960	8	400	17.38	54(2)	230	120		7607rpm	462(3)	B-end + O/H	WST	14 P	16.46	11.88kg		2
	"	"	RC	1964	1	408	17.7	50(2)	195			8618rpm	523(3)	B-end + O/H	WST	14 P	16.46	13.73kg		2
	"	"	S5	1960	4	400	17.38	54(2)	230	106		9164rpm	465(3)	B-end + O/H	WST	20 XB	19.68	8.38kg		2

TABLE No. II/1 (continued) - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - ASMARA TEXTILE MILLS

	Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
RING FRAMES	Ring frames	Marzoli		1956	9	384	7.36/ 11.2	51(2)	215	92		9443rpm	448(3)		4-line, weight	21 N	21.08	7.37kg		3
	"	"		1956	9	384	7.36/ 11.2	51(2)	215	88		9443rpm	448(3)		4-line, weight	21 N	21.08	7.37kg		3
	"	"	RC751	1974	3	456	22	51(2)	230	111		10445rpm	602(3)	B-end + O/H	PK225	22 XB	17.36	11.22kg		1
	"	"	RC	1964	3	408	17.7	50(2)	195	116		9435rpm	427(3)	B-end + O/H	WST	24 XB	22.05	6.55kg		2
	"	"	RC	1964	3	408	17.7	50(2)	195	96		9260rpm	403(3)	B-end + O/H	WST	26 XB	22.95	5.70kg		2
	"	"	RC	1964	3	408	17.7	50(2)	195	126		9789rpm	430(3)	B-end + O/H	WST	28 XAC	22.75	5.64kg		-
	"	"	RC751	1974	4	456	22	51(2)	230	96		10055rpm	423(3)	B-end + O/H	PK225	32 XA	23.76	5.42kg		1
	"	"	RC	1964	5	408	17.7	50(2)	195	96		10380rpm	378(3)	B-end + O/H	WST	34 XAC	27.41	4.09kg		2
	"	"	RC	1964	2	408	17.7	50(2)	195	82		10486rpm	364(3)	B-end + O/H	WST	36 XA	28.80	3.71kg		2
	"	"	S5	1960	1	400	17.38	54(2)	230	70		9106rpm	334(3)	B-end + O/H	WST	40 XB	27.20	3.01kg		2
	"	"	RC	1964	3	408	17.7	50(2)	195			10202rpm	375(3)	B-end + O/H	WST	40 XB	27.20	3.44kg		2
	"	"	RC751	1974	2	456	22	51(2)	230	74		9688rpm	356(3)	B-end + O/H	PK225	40 XB	27.20	3.65kg		1
	"	"	RC751	1974	1	456	22	51(2)	230			8148rpm	240(3)	B-end + O/H	PK225	50 XAC	33.94	1.97kg		1
	"	"	RC751	1974	1	456	22	51(2)	230	94		10830rpm	291(3)	B-end + O/H	PK225	60 XAC	37.18	1.99kg		1
WINDERS	Winders (Single)	Savio		1963	2	88	7.5	200	140(4)				590m/min							3
	" (Assembly 4)	"		1964	2	48	8.2	160	155(4)				325							3
	Winder (Single	Bernardi		1964	1	48			125(4)	Out of Use			280							3
	" (Assembly 4)	Savio		1967	1	64	8.2	160	155(4)				340							3
	" (Single	Lettretes		1968	1	24	4.0	250	145(4)	Used for Gassing			-							3

SHORT STAPLE SPINNING - ASMARA TEXTILE MILLS

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit, per hr	Overall Efficiency %	Machine Condition
Ring twisters	Marzoli	TS5	1965	3	400	18.4					7800				13, 2/26	18.35	19.4 kg		1
"	"	TRC	1967	2	408						8900				17, 2/34	21.10	17.0 kg		1
"	"	TS5	1965	2	400						7800				14, 2/28	19.10	18.0 kg		1
"	"	TRC	1967	1	408						8100				30, 2/60	22.11	8.7 kg		1
Reeling machines	None specified	-	-	4	80	0.92					210			20 frames	21	-	36.88		1
"	Platts	-	-	6	80	1.47	Machines Not Assigned to Production				210			6 frames	40	-	19.36		1
"	Guiseppe Grespi	-	-	24	80	0.92					210								1

(1) Average (Mathematical)

(2) Ring diameter

(3) inches/min

(4) Traverse

TABLE No. H/2 CONDENSER SPINNING - ASMARA TEXTILE MILLS

	Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
OPENING CLEANING BLENDING	Opener	Oreste Rolando	3153/110	1968	1		7.5													
	Opener/cleaner	Autefa	C 1211	1957	1		87.6													
	Opener/cleaner	Oreste Rolando		1963	1		9.2													
	Cleaner	Mario Gosta		1959	1		10.0													
	Blender	-	-	-	1		11.5													
	Scutcher	Aquila			1		3.8 (1)													
	Scutcher	Duesberg Bosson			1		3 (1)													
	Breaker Card 1.	Aquila					3.5 (1)						NOT IN PRODUCTION							
	Finisher Card 1.	Aquila				72	4.5 (1)													
	Breaker Card 2.	Officine E Fondere					3.5 (1)													
	Finisher Card 2.	Gini				72	4.5 (1)									NOT KNOWN				
	Ring Frame	Perfect		1958	1	384	18.8	74.5 (2)	210	0.150		2150rpm		Broken-end	3 over 3					

(1) Estimated

(2) Ring diameter

SPIN PLA

Process	Count	End into one	Draft	Twist X	TPI	Processing speed
Spinning	6	1	6.67	3.7	9.06	5885 r.p.m
	14	1	15.56	4.4	16.46	7721 r.p.m.
	20	1	20.00	4.4	19.68	9164 r.p.m.
	22	1	22.00	3.7	17.36	10445 r.p.m.
	24	1	24.00	4.5	22.05	9435 r.p.m
	26	1	26.00	4.5	22.95	9260 r.p.m.
	40	1	40.00	4.3	27.20	9843 r.p.m.
	21	1	15.56	4.6	21.08	9443 r.p.m.
	32	1	21.33	4.2	23.76	10055 r.p.m
	36	1	24.00	4.8	28.80	10486 r.p.m.
	28	1	24.35	4.3	22.75	9789 r.p.m.
	34	1	29.56	4.7	27.41	10380 r.p.m.
	50	1	25.00	4.8	33.94	8149 r.p.m.
	60	1	30.00	4.8	37.18	10830 r.p.m.
Roving	0.9	1	6.00	1.1	1.06	768 r.p.m
	1.0	1	6.67	1.08	1.08	750 r.p.m
	1.35	1	9.00	1.15	1.34	830 r.p.m.
	1.50	1	10.00	1.13	1.38	810 r.p.m
	1.15	1	7.67	1.13	1.21	810 r.p.m.
	2.00	1	13.33	1.22	1.73	850 r.p.m.
Drawing	0.15	6	6	–	–	135 m/min
	0.15	6	6	–	–	130 m/min
	0.15	8	8	–	–	70 m/min
	0.15	6	6	–	–	136 m/min
	0.15	6	6	–	–	131 m/min
	0.15	8	8	–	–	71 m/min
Comb.	0.15					34.5 m/min
Lap Former	0.012			–	–	130 yd/min
Draw	0.15	6	6	–	–	124 m/min
	0.15	6	6	–	–	124 m/min
Card	0.15	–	–	–	–	16.2 doffer r.p.m.
	0.15	–	–	–	–	9.7 doffer r.p.m.
	0.15	–	–	–	–	9.7 doffer r.p.m.
Blow-room						

TABLE H 3

N: ASMARA TEXTILE MILLS

Production at 100% efficiency	Production required	Number of spindles/ deliveries	Number of Machines required		Remarks
0.0974	9.35 Kg/hr	96	1		P. Blend
0.0301	108.77	3608	9		P Blend. Average speed used. 8 x 400 + 1 x 408 spindles
0.0210	33.52	1600	4		XB Blend.
0.0246	33.60	1368	3		XB Blend. 3 x 456 spindles
0.0160	19.65	1224	3		XB Blend. 3 x 408 spindles
0.0140	17.10	1224	3		XB Blend. 3 x 408 spindles
0.0081	20.63	2536	6		XB Blend. 1 x 400 +3 x 408 + 2 x 456 spindles average speed
0.0192	132.66	6912	18		N Blend. 18 x 384 spindles
0.0119	21.68	1824	4		XA Blend. 4 x 456 spindles
0.0091	7.42	816	2		XA Blend 2 x 408 spindles
0.0138	16.92	1224	3		XAC Blend. 3 x 408 spindles
0.0100	20.45	2040	5		XAC Blend. 5 x 408 spindles
0.0043	1.97	456	1		XAC Blend.
0.0044	1.99	456	1		XAC Blend.
0.7244	119.89	236	2	70	P Blend. Requires 1 x 130 + 1 x 110 . . 1 x 130 Spare capacity
0.6249	130.17	290	3	70	X3 Blend. " 3 x 110 spindles . . Surplus capacity ≃ 10%
0.4129	134.65	466	4	70	N Blend. 4 x 130 spindles . . Surplus capacity 11%
0.3521	30.41	124	1	70	XA Blend. 1 x 130 spindle . . Under capacity = (110 spindle used) 11%
0.5238	39.02	106	1	70	XAC Blend. 1 x 110 . . Surplus capacity 1 x 110 spindle frame
0.2211	4.13	26	1	70	XAC Blend. 1 x 110 . . Surplus capacity = 320%
63.7674	467.95	1 (10)	1	75	10 Required but only 1 available
61.4057	404.19	6 (9)	6	75	9 Required but only 6 available
66.1292	35.76	1 (1)	1	75	1 Required and 3 available + 4 x 6 -delivering machines. Spare capacity = 140%
64.2398	467.95	1 (10)	1	75	10 Required only 1 available.
61.8780	403.71	6 (9)	6	75	9 Required 6 available
67.0739	32.44	1 (1)	1	75	1 Required 3 available + 4 x 6 - delivery machines. Spare capacity = 140%
16.32	44.02	3 (3)	3	70	Spare capacity = 6 x 12.54 = 75 Kg/hr.
309.0	52.00	1	1	88	Spare capacity = 219 Kg/hr
58.57	52.00	1 (2)	1	75	
58.57	11.00	1 (1)	1	75	Spare capacity 30 Kg/hr. = 57%
16.20	482.00	21 (38)	21	80	38 required 21 available
5.01	209.84	40 (53)	40	80	53 required 40 available
5.01	49.52	13 (13)	13	80	13 required 30 available: spare capacity = 68 Kg/hr 14%
240	134.07	1	1	90	P. Blend. 38% spare capacity = 91
342)	156.45	1	1	90)	A and B Blends. spare capacity 20% = 68
)	92.26	1	1	90)	
213	150.57	1	1	90	N Blend. spare capacity = 22% = 46
171		—	—	—	171 Kg/hr spare capacity = 171
	533.35				376

TABLE II/4

STAFFING - SHORT STAPLE SPINNING - ASMARA TEXTILES MILLS

Blowroom	Day	1	2	3	Total
Mechanic	1	-	-	-	1
Reserve mechanic	1	-	-	-	1
Mechanic helper	1	-	-	-	1
Feeder	-	8	8	8	24
Operator	-	5	5	5	15
Sweeper	-	1	1	1	3
Foreman labourer	1	-	-	-	1
General labour	23	-	-	-	23
Tea foreman	-	1	1	1	3
Tea distributor	-	2	2	2	6
Toilet cleaner	-	1	1	1	3
Total	27	18	18	18	81
Carding					
Supervisor	-	2	2	2	6
Mechanic	2	-	-	-	2
Operators	-	11	11	11	33
Reserve	-	2	2	2	6
Lap transporters	-	3	3	3	9
Can transporters	-	3	3	3	9
Waste collector	-	1	1	1	3
Sweeper	-	3	3	3	9
Helper machine cleaner	-	-	-	2	2
Oiler	-	1	1	1	3
Total	2	26	26	28	82
Combing					
Sliver lap operator	-	1	1	1	3
Comber operator	-	5	5	5	15
Mechanic	1	-	-	-	1
Total	1	6	6	6	19

TABLE [illegible] Cont.

	Day	1	2	3	Total
Drawing					
Mechanic	1	-	-	-	1
Operators	-	15	15	15	45
Reserve	-	1	1	1	3
Total	1	16	16	16	49
Speed Frames					
Foreman	-	1	1	1	3
Operator	-	14	14	14	42
Doffer	-	7	7	7	21
Reserve	-	2	2	2	6
Sweeper	-	1	1	1	3
Foreman mechanic	1	-	-	-	1
Asst. foreman mechanic	1	-	-	-	1
Mechanic	-	1	1	1	3
Machine cleaner	5	-	-	-	5
Total	7	26	26	26	85
Ring Frames					
Supervisor	-	8	8	8	24
Operator	-	63	63	63	189
Reserve	-	8	8	8	24
Doffer	-	34	34	34	102
Sweeper	-	6	6	6	18
Tube sorter	-	7	7	7	21
Tube arranger	-	2	2	2	6
Roving distributor	-	2	2	2	6
Tape bonder	-	3	3	3	9
Roller cleaner	-	4	4	4	12
Mechanic/oiler	-	3	3	3	9
Foreman mechanic	1	-	-	-	1
Asst. foreman mechanic	1	-	-	-	1
Mechanic	5	-	-	-	5
Machine cleaner	5	-	-	-	5
Foreman cleaner	1	-	-	-	1
Yarn transporters	-	4	4	4	12
Total	13	144	144	144	445

Doubling		Day	1	2	3	Total
Supervisor		1	1	1	1	4
Doubler		-	10	10	10	30
Piecer		-	7	7	7	21
Doffer		-	4	4	4	12
Sweeper		-	1	1	1	3
	Total	1	23	23	23	70
Reeling						
Supervisor		-	2	2	2	6
Reeler		-	52	52	52	156
Hank twister		-	2	2	2	6
Yarn conditioning		-	2	2	2	6
Sweeper		-	1	1	1	3
Mechanics		1	-	-	-	1
Helper		1	-	-	-	1
	Total	2	59	59	59	179
Packing						
Supervisor		-	1	1	1	3
Packer		-	10	10	10	30
Bonder		2	-	-	-	2
	Total	2	11	11	11	35
Control						
Shift leader		-	1	1	1	3
Asst. Shift leader		-	2	2	2	6
		-	3	3	3	9
Cone Winding						
Supervisor		-	1	1	1	3
Winders		-	10	10	10	30
Tube arrangers		-	1	1	1	3
Sweeper		-	1	1	1	3
Cone distributor		-	1	1	1	3
	Total	-	14	14	14	42

General Service	Day	1	2	3	Total
Repairer	2	-	-	-	2
Helper	1	-	-	-	1
Air conditioning mechanic	1	-	-	-	1
Foreman cleaner	1	-	-	-	1
Duct cleaner	3	-	-	-	3
Foreman tube cleaner	1	-	-	-	1
Tube cleaner	17	-	-	-	17
Chief puffer	1	-	-	-	1
Helper	2	-	-	-	2
Waste transport	1	-	-	-	1
Roof cleaner	2	-	-	-	2
Pneumafil maintenance	1	-	-	-	1
Total	33	-	-	-	33
Office					
Departmental head	1	-	-	-	1
Asst. departmental head	1	-	-	-	1
Maintenance head	1	-	-	-	1
Departmental clerk	1	-	-	-	1
Production clerk	1	-	-	-	1
Quality inspector	2	-	-	-	2
Yarn tester	2	-	-	-	2
Total	9	-	-	-	9
Grand Total	98	346	346	348	1138

TABLE H/4a

STAFFING - CONDENSER SPINNING

Opening, Cleaning and Blending	Day	1	2	3	Total
Supervisors	-	1	-	-	1
Assistant supervisors	-	1	-	-	1
Machine operator	-	3	2	-	5
Helpers	-	1	1	-	2
Hand openers	-	16	1	-	17
Total	-	22	4	-	26
Carding					
Machine operators	-	4	4	-	8
Total	-	4	4	-	8
Spinning					
Machine operators	-	8	8	-	16
Total	-	8	8	-	16
Grand Total Condenser Spinning	-	34	16	-	50

TABLE [illegible]

ASMARA TEXTILE MILLS - WEAVING PRODUCTION PROGRAMME - 1979

PRODUCTS	COUNT Ne	DAILY LOOM	LOOM R.P.M.	ENDS	DENSITY cm.	DENSITY inch	REEDS Ne	REED-SPACE cm.	REED-SPACE inch	TARGET LOOM/DAY % PROD.	DAILY ACTUAL PROD. %	DAILY ACTUAL PROD. YD.	WEIGHT/YD. GM. WARP	WEIGHT/YD. GM. WEFT	WEIGHT/YD. GM. TOTAL	TAPE LENGTH YDS.	WEIGHT GRAMS	REMARK
ABUJADID 333	14 x 14	150	180	1.688	15	38	42/2	99	39.5	109	65%	10650	81.9	58.6	140.4	30 yd	4.212 gm	
GAUZE 66	36 x 36	30	180	904	8	20	48/1	95	37.5	206	65%	3990	14	11.1	25.1	100 "	25.10 "	
POPLIN 2420	24 x 20	40	180	2.410	17	43	59/2	102	40	96	65%	2480	63	46.2	109.2	30 "	3.276 "	
PRINTED POPLIN	24 x 20	48	180	3.420	20	51	59/2	100	39.5	82	60%	2352	88	58	146	30 "	4.380 "	
TWILL 75200	34/2 x 28/2	37	180	4.790	20	51	55/2	113	44.5	82	65%	1961	174.5	85	259.5	40 "	10.380 "	
BLUE JEANS 9 x 9	9 x 9	11	180	2.688	16	41	40/3	112	44	102	60%	671	193.1	97	290.1	40 "	11.640 "	
FRENCH TWILL	26/2 x 26/2	28	180	2.115	17	43	48/2	112	44	96	65%	1736	96	77.5	173.4	25 "	4.335 "	
BEDSHEET 160 cm.	20 x 20	19	138	3.600	20	51	50/2	180	70	62	50%	589	111.5	96.2	207.7	(160x253cm)	574 "	
" 180 cm.	20 x 20	1	110	4.100	20	51	50/2	217	80	50		25	131	119.8	250.8	(180x253cm)	692 "	
UPPER	14 x 14			1.410														
TOWELS 125 x 65	20/1	5	146	3.098	16	41	56/2	136	53.5	83	50%	210	296.9	61.3	258.2	(125x65")		
LOWER	14 x 14			1.688														
		341									60%	24664						

Daily yarn requirements from Spinning Department

Ne	14	1,500 kg
"	36	200 "
"	26/2	300 "
"	24	340 "
"	20	400 "
"	9	190 "
"	34/2	300 "
"	28/2	200 "
"	6	25 "
		3,455 kg

N.B. 20 Sensamatic Looms are not included in production.
According to given target of 1979, there are 341 Looms assigned in the target. 406 - 341 = 65.
Those 65 looms are assigned 20 looms to abujadid.
30 looms to gauze 15 looms to dyed poplin. Total 406

TABLE H/6

ASMARA TEXTILE MILLS

(FIRN WINDING)

Winding machinery:

Make:	Spoliera Fiore
Country of origin:	Italy
Age:	5 machines - 22 years; 1 machine - 9 years
Number of machines:	6
Spindles per machine:	30
Total spindles:	180

Description:

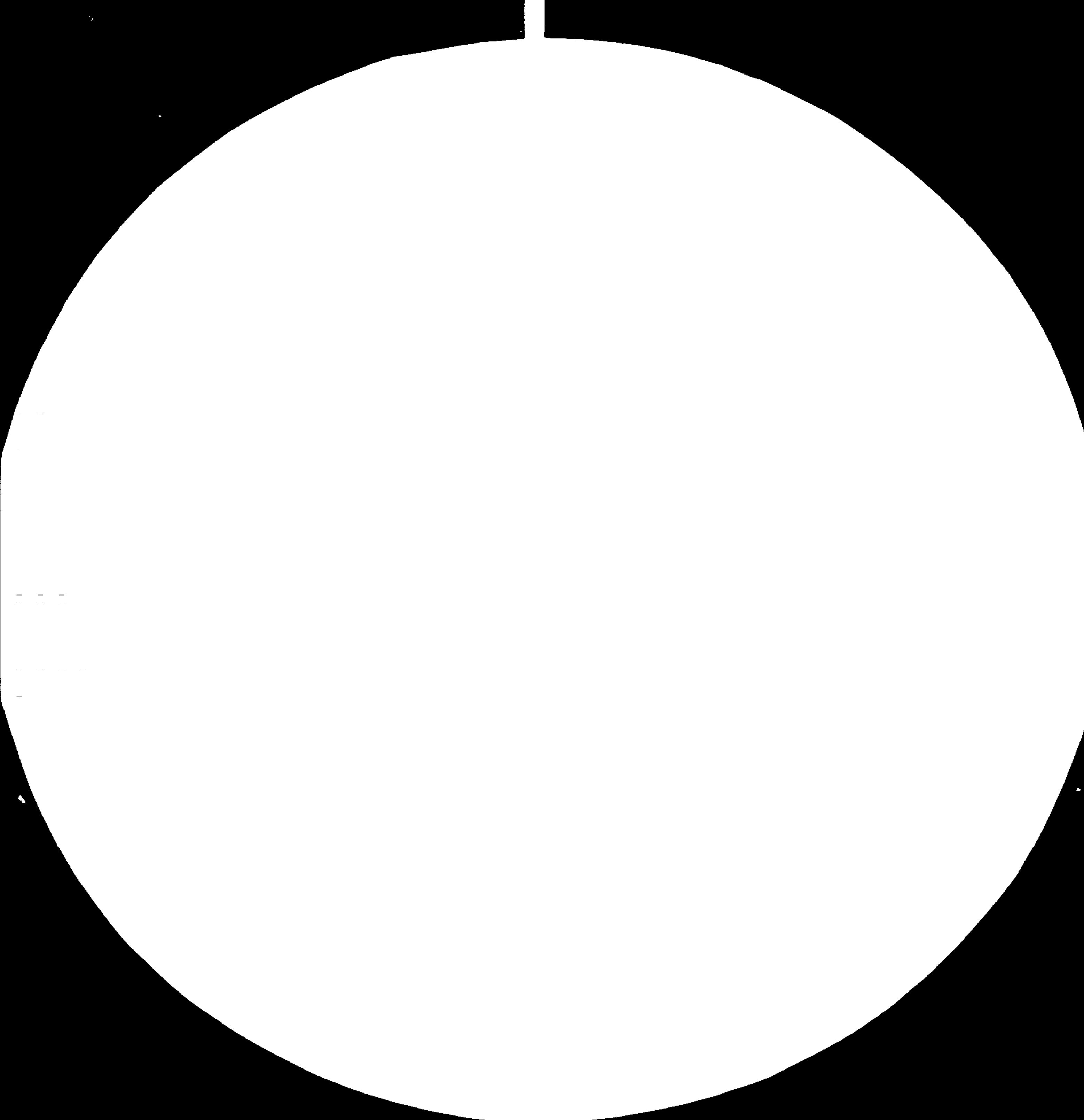
Model: -SP-SPV-CO 30 (1957 and 1970 models)

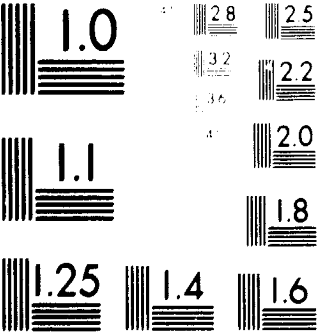
Semi-automatic

Winding speed:	700 metres per minute
Efficiency achieved:	-
Machine conditions:	2
Spindles per operative:	15
Annual output 1978/79:	285,029 kg.

Operatives per shift		Total on 3 shifts
Winding operator:	15	45
Mechanic:	1 (+ 1 day)	4
Overlooker:	1	3
Bobbin Transporters and Firn Cleaners:	[illegible]	24
Supervisor:	(1 day)	1
Total:	2[illegible] (+2)	77

Hours of work: 1[illegible] per day, 14[illegible] per week, [illegible] per year.





MICROCOPY RESOLUTION TEST CHART

TABLE H/7

ASMARA TEXTILE MILLS

(Beaming)

Machinery

Make	1 Off - Pietro Muzzi O.F.	2 Off - Leesona Holt Ltd
Country of Origin	Italy	England
Age	4 years (1975 model)	18 years (1961 model)
Machine Condition	2	2

Creel Capacity 2 Off - 512 ends; 2 Off - 443 ends.

Output per machine hour 6000 m/hr (at 33% Eff - 300 m/min)

Yarn on Cones	metres		Yarn on beam metres	ends	Fabric
Counts Ne 9 -	25,000	-	8,200	448	Jeans
14 -	37,700	-	9,100	442	Abujadid
20 -	60,500	-	7,300	452	Sheets
26/2 -	44,000	-	8,200	423	F. Twill
34/2 -	47,500	-	9,100	479	Twill
36 -	77,300	-	36,500	452	Gauze
24 -	68,700	-	68,700		Poplin
28/2 -	35,500	-	35,500		Towels

Annual output 1978/79: 15,797,921 metres

Operatives

	per shift	Total 3 shifts
Operators	3	9
Helpers	3	9
Total	6	18

Hours of work; 19 per day, 133 per week, 6555 per year.

TABLE H/8

ASMARA TEXTILE MILLS

(Sizing)

MACHINERY:

Make	1 Off - Leesona Holt Ltd	1 Off Maschinen Fabric Zell
Country of Origin	England Multi-cylinder	West Germany Multi-cylinder
Age	22 years (1957 model)	12 years (1967 model)
Machine Condition	2	2
Operating Speed	30 ~ 40 m/min	30 ~ 40 m/min
Average Length of Run	13,000 m	
Annual Output	1978/79 - 5,289,356 m	

OPERATIVES:

	per shift	Total 3 shifts
Sizers	2	6
Helpers	2	6
Total	4	12

Hours of work; 19 per day, 133 per week, 6555 per year.

TABLE H/9

ASMARA TEXTILE MILLS

(Drawing-In)

Equipment

4 Manual drawing-in frames
1 Egelhaaf (West Germany) reed repairing machine
Machine Condition: 2

Output — per week of 45 hours

Twill beams	4790 ends	- 10 beams
F. Twill beams	2115 ends	- 5 beams
Abugedid beams	1688 ends	- 4 beams
Jeans bemas	2688 ends	- 6 beams
Bedsheets beams	3640 ends	- 8 beams
Gauze beams	904 ends	- 2 beams
Towels beams	2098 ends	- 4 beams
		39 beams

Operatives

	per shift	Total on 3 shifts
Drawers	8	Day shift only
Connectors	1	
Reserve	1	
Reed repair	1	
Reed adjuster	1	
Total	12	

Hours of work: 7.5 per day, 45 per week, 2265 per year.

TABLE H/10

[illegible] TEXTILE MILLS

(Description of Looms)

Type:	NORTHROP AUTOMATIC pirn change	NORTHROP AUTOMATIC pirn change	NORTHROP AUTOMATIC pirn change	PICANOL AUTOMATIC
Number of looms:	140	20+5	235	6
Specification				
Country of origin	England	England	England	Belgium
Model	LF	LF	LF	CC-C/P T112
Age	1960	1961	1963	1970
Width R.S.	112cm(44")	190cm(75")	112cm(44")	112cm(44")
Number of looms	140	20+5	235	6
Speed p.p.m.	180	138/146	180	180
Drive (transmission)	Belt	Belt	Belt	Gear
Shedding	25 Dobby 115 Tappet	5 Tervel Looms with Dobby 20 Tappet	55 Dobby 180 Tappet	Tappet
Boxes	1 x 1	1 x 1	1 x 1	1 x 1
Warp stop	Mechanical	Mechanical	Mechanical	Mechanical
Weft stop	side	side	side	side
Let-off	Positive	Positive	Positive	Positive
Change feeler	Mechanical	Mechanical	Mechanical	Mechanical
Picking	Under	Under	Under	Under
Healds	Steel	Steel	Steel	Steel
Reed	Fixed	Fixed	Fixed	Fixed
Machine condition:	2	2	2	2
Beam flange dia.	66cm(26in)	66cm(26in)	66cm(26in)	66cm(26in)

Note: In addition to the looms listed above there are 20 Northrop Sensamatic Mark III automatic pirn change looms, (1975), which have not yet been commissioned.

TABLE H/11

ASMARA TEXTILE MILLS

(WEAVING SHED EMPLOYEES)

Description	Number per shift	Total on 3 shifts
Supervisors/Asst.	2 (Dayshift)	2
Shift Leader	1	3
Assistant Shift Leader	1	3
Foremen	2 (Dayshift only)	2
Overlocker/fixers	1 (Tech. day shift)	1
Loom Mech.	9	27
Weavers	75	225
Spare Weavers	-	-
Battery fillers	16	48
Cleaners	9	27
Oilers	6 (Dayshift only)	6
Weft carriers	3	9
Cloth carriers	2	6
Warp carriers	9	27
Knotting machinists	2	6
Knotting machinists Asst.	2	6
Others	[illegible] (Dayshift)	[illegible]
Total	148	406

Hours of work: per day 17, per week 11[illegible], per year: 5865.

Note: The figures quoted refer to the length of the period when there is power available to run all the looms.

TABLE H/12

ASMARA TEXTILE MILLS

(Loomstate cloth inspection)

Inspection Tables: 1

Description: Slanted table work with undertable light and controllable cloth speed

Weekly length inspected: 165,677 yards

Operatives per shift		Total on 3 shifts
Supervisors	2 (dayshift)	2
Inspectors/Correctors	3	9
Folders/Trimmers	6	18
Weighers/Transporters	8	24
Cleaners	1	3
Total	20	56

Hours of work: 19 per day, 133 per week, 6555 per year.

TABLE H/13

WARP AND WEFT PREPARATION - BLANKET DEPARTMENT

ASMARA TEXTILE MILLS

WARP

Cotton warps prepared in the warping department of the main plant.

WEFT - CONE-WINDING

Make:	CRIPPESPIANI
Age:	20+ Years
Number:	2 machines/40 drums (20 not running)
Machine Condition:	4
Output:	50 kg per hour

Operatives per shift		3 shift total
Direct	2	6
Indirect	1	3
Total	3	9

WEFT - PIRN-WINDING

Make:	Brugger
Type:	Manual
Age:	20+ Years
Number:	1 machine/20 spindles (10 not running)
Machine Condition:	4
Output:	50 kg per hour

Operatives per shift		3 shift total
Direct	2	6
Indirect	1	3
Total	3	9

Hours of work: 19 per day; 133 per week; 6555 per year.

TABLE H/14

WEAVING - BLANKET DEPARTMENT

ASHARA TEXTILE MILLS

LOOMS

Make:	Lantex
Model:	N7 L25
Age:	50+ Years
Number:	14
Weft Change:	Manual
Weft Stop	None
Warp Stop	None
Boxes:	4 x 4 but used as 1 x 1
Let-off:	Negative
Reed:	Loose
Picking:	Under
Healds:	Steel
Loom Speed:	100 ppm
Working Width:	152 cm
Estimated Efficiency:	57%

Production: 1144 lin. metres per 19 hour day.

LABOUR

Operatives per shift		3 shift total
Supervisor	1	3
Weavers	14	42
Mechanic	1	3
Others	3	9
Total	19	57

Hours of work: 19 per day; 133 per week; 6555 per year.

TABLE H/15

SEWING AND FINISHING - BLANKET DEPARTMENT

ASMARA TEXTILE MILLS

RAISING MACHINE

Make:	Mario Cresta
Model:	GZ 30
Number:	1
Age:	16 Years
Machine Condition:	2

SEWING MACHINES

Make:	Necchi
Model:	Lockstitch
Number:	2
Age:	16 Years
Machine Condition:	2

Possible production: 545 blankets per 19 hour day.

LABOUR

Operatives per shift		3 shift total
Blanket inspecters	1	3
Raising machine operatives	2	6
Sewing machinists	2	6
Folders and cutters	7	21
Others	2	6
Total	14	42

Hours of work: 19 per day; 133 per week; 6555 per year.

TABLE

Asmara Textile Mills - [illegible]

	MACHINERY/EQUIPMENT	UNITS	MANUFACTURERS	DATE ACQUIRED/ DATE [illegible]	MAXIMUM [illegible]
1	Continuous [illegible] Impregnation with Reaction Caravans	1 6	CAMERIO ERICOLI " "	1960 1960	150 150
2	Chain [illegible] & Rinsing Unit	1	CAMERIO ERICOLI	1960/ 1967	150
3	Singe Machine	1	JAS. FARMER NORTON	1963	150
4	Pressure Jig	1	JAS. FARMER NORTON	1957	[illegible]
5	Automatic Jigs	4	[illegible]	1957	[illegible]
6	Padding Mangle	1	CONRAD PETERS	1964	150
7	Hot Flue	1	ATI-MILANO	1964	150
8	No. 1 Flat Screen Print Machine	1	MECCANO TESSILE	1960	105
9	No. 2 Flat Screen Print Machine	1	MECCANO TESSILE	1965	150
10	No. 1.8. Cylinder Drying Machine	1	JAS. FARMER NORTON	1960	100
11	No. 2.12. Cylinder Drying Machine	1	JAS. FARMER NORTON	1960	100
12	No. 1 Stenter (Clip)	1	JAS. FARMER NORTON	1960	150
13	No. 2 Stenter (Clip)	1	CAMERIO ERICOLI	1966	160
14	Seven Bowl Calender	1	JAS. FARMER NORTON	1960	180
15	Raising Machine	1	BUSTOARISIZIO	1971	200
	KNIT GOODS				
16	Impregnator - Pad Unit	1	JAS. FARMER NORTON	1963	
17	Winches	2	" "	1965/71	NA
18	Centrifuge Hydro Extractive	1	-	1962	NA
19	Drying Machine	1	ALEA	1971	NA

No. [illegible]

Finishing Equipment

RATED OUTPUT M/HR.	PERCENTAGE UTILISATION	CONDITION OF EQUIPMENT	REMARKS
20	•	2 2	KÜSTER Type mangle unit - not functioning impairing bleaching efficiency.* Restricted by subsequent process.
2	•	2/3	Rinsing unit requires extensive overhaul.* Utilisation affected by other processing capacities.
20	NIL	2	Not used - This operation not deemed essential in servicing market, percentage of production combed yarn fabrics.
NA	NIL	3	Tension control is inadequate - causing fabric extension. Not in use.
NA	100	2/3	Automatic controls not functioning.
-	-	1	Units are not worked to capacity - Limited by preparation, washing & drying capacities.
-	-	2	
-	40	2	Market pressures are for reactive prints; but due to lack of facilities, the plant is restricted to pigment prints for volume production.
-	40	2	
-	-	3	Machines have high utilisation, but owing to low working steam pressures, inadequate mechanical water expression and general condition - very low operating efficiencies.
-	-	3	
-	-	4	Not in use. Small capacity machine - refurbish only if this can be done locally. Steam heated.
-	-	2	Oil heated stenter. 4 Metre drying chambers - Low production capacity, which could be increased by lengthening. (One burner unit taken out of service - impairing drying efficiency drastically).
-	70	2	Bowls - 3 steel, 4 paper composite.
NA	-	2	Not in use.
		2	All-in bleach system in use. Goods are processed in tubular form. Also used for yarn processing.
-	-	1/2	
-	-	2	
-	-	1	

	MACHINERY/EQUIPMENT	UNITS	MANUFACTURERS	DATE ACQUIRED/ DATE MAN.
20	Calender	1	FERIM	1971
21	Plaiting Machine	1	FERRARO	1971
22	Plaiting Machine	1	MONTI	1965
23	Slitting Machine	1	SPERATTO	1971
	[illegible]			
24	Crease-[illegible] Machine	1	[illegible]	[illegible]
25	Plaiting Machine	1	[illegible]	[illegible]
26	Stamping Machine	1	STONE-[illegible]	[illegible]
27	Bale Press	1	ORMIC-MILANO	1960
	YARN PROCESSING			
28	No. 1 Bleaching Machine	1	[illegible]RINI	1961
29	No. 2 Bleaching Machine	1	BELLINI	1961
30	Yarn Drying Machines	3	ATI-MILANO	1961
31	Yarn Drying Machine	1	POZZI MILANO	1961
	SCREEN ENGRAVING EQUIP.			
32	Silk Stretching Machine	1	ROBUSTELLI	1970
33	Photo Copying Machine	1	ALLIEVI	1970

[illegible] 8/16 Cont.

[illegible]	RATED OUTPUT M/MIN.	PERCENTAGE UTILISATION	CONDITION OF EQUIPMENT	REMARKS
NA	-	-	1	
NA	-	-	2	
NA	-	-	3/4	The above machine was stated to be able of meeting the production requirements.
NA	-	-	1	
[illegible]	-	-	2	
[illegible]	-	-	2	
NA	-	-	2	
NA	-	-	1	
NA	-	100		All process machines in this section are fully utilised for the hours worked.
NA	-	100		
NA	-	100		
NA	-	100		

TABLE H17

FINISHING DEPARTMENT - LABOUR DEPLOYMENT - ASMARA TEXTILE MILLS

	Foremen/Supervisors	Operatives	Ancillary
Cloth and Chemical Transport	—	—	4
Scouring/Bleaching	4	6	—
Pad-roll	—	3	3
Mercerising	—	1	1
Intermediate Drying	—	6	—
Cont-Dyein g	—	1	1
Batch/Bieach (Knitwear)	—	1	4
Bleaching (Knitwear)	—	10	11
Colour Kitchen	1	6	—
Pad Mangles	—	3	2
Printing	2	6	4
Studio/Designers	2	1	1
Stenters	—	4	3
Calenders	—	3	—
Make-up, parcelling etc.	2	13	8
Yarn Dye and Bleach	—	4	3
Cleaners	—	—	2
Mechanics	4	—	—
Clerical	—	1	—
Management	2	—	—
	17	69	47
Total	133		

Annual Production - Woven Goods 3,250,000 mts
Knitted Goods 360,000 Kgs
Yarn 120,000 Kgs

Woven piece goods:
Annual roduction/person employed (133 - 33)
= 32,250 metres

Annual Production/Unit Area = 1083 (assessed on basis of 3000 sq. mts production area)

Knitted piece goods:

Annual Production/Person Employed
= 13,846 Kgs

Annual Production/Unit Area
= 1412 Kgs (assessed on basis of 255 sq. mts production area)

Yarn Production

Annual Production/Person Employed
= 17,143 Kgs

Annual Production/Unit area 667 Kgs (assessed on basis of 180 sq. mts production area)

TABLE H/17 (continued)

Operating days per year	-	250
No. shifts Operated	-	3*
Hours per shift per Week	-	70*

* Three shifts are employed; but only two of the three are working in any one week.

The company is in a position to revert to three shift working when circumstances permit.

TABLE H/18

Knitting Equipment - Asmara Textile Mills

	For RIB Knit & Jersey							For Interlocks						For Jersey & Plush			For Nets
Type	Circular Gauge 12	Circular Gauge 14	Circular Gauge 16	Circular Gauge 18	Circular Gauge 20	Circular Gauge 22	Circular Gauge 30	Circular Gauge 14	Circular Gauge 16	Circular Gauge 18	Circular Gauge 20	Circular Gauge 22	Circular Gauge 30	Circular Gauge 30	Circular Gauge 30	Circular Gauge 30	Warp Knitting Machine
Make	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	W.Germany	Italy	Italy	Italy	W.Germany
Model	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Fouquet	Paolo Orizie JRSO	Paolo Orizie JRSO	Paolo Orizie J59C	W.Barfuss [illegible]
Number of M/cs	1	2	4	4	4	2	1	1	2	2	2	1	4	4	2	2	2
No. of cones per mach.														44	72	90	
Width	12"	14"	16"	18"	20"	22"	30"	14"	16"	18"	20"	22"	30"	30"	30"	30"	[illegible]
Courses/Min.	47.5 at posn 5	21.5 at posn 7	32.5 at posn 7	32.5 at posn 7	27.5 at posn 7	27 at posn 7	[illegible] at posn 5	31.5 at posn 7	33.5 at posn 7	32 at posn 7	26 at posn 7	27 at posn 7	16 at posn 7	13.5	12.5	12.5	[illegible] cm/min.
Efficiency	≈80%	≈80%	≈80%	≈80%	≈[illegible]%	≈80%	≈80%	≈80%	≈89%	≈89%	≈89%	≈89%	≈89%	≈89%	≈80%	≈89%	≈[illegible]
Installed KW/hp	1.1KW	1.5KW	1.5KW	1.5KW	1.5KW	1.5KW	2.5KW	1.5KW	1.5KW	1.5KW	1.5KW	1.5KW	2.2KW	2.2KW	3HP	(2.2+0.42)KW	[illegible]
Actual Production per mach/hr	2.7Kg	3.3Kg	3.4Kg	3.6Kg	3.9Kg	4.1Kg	4.3Kg	1.9Kg	2.1Kg	2.4Kg	2.6Kg	2.0Kg	3.[illegible]Kg	3.1Kg	6.3Kg	5.7Kg	[illegible]
Yarn Counts (Ne)	22,24,26, 28,30	22,24,26, 28,30	22,24,26, 28,30	22,24,26, 28,30	22,24,26, 28,30	22,24,26, 28,30	22,24,26, 28,30	22,26,30, 32,36	22,26,30, 32,36	22,26,30, 32,36	22,26,30, 32,36	22,26,30, 32,36	22,26,30, 32,36	60/2	22,30	9,14	[illegible]

NOTE:

- data on age of machines not available.
- Warp Knitting machine has an auxiliary warping machine

  Make : Italy
  Model : Rostoni R68C
  Width : 35 cm
  Installed KW : 0.59
  Efficiency : 79%

- Other Machines are:

  1. Elastic band making machine

     Make : Italy
     Model : Comez EL600
     Installed Powers : 0.5HP

  2. Machines for making ribbons

     Model : Comez PB800
     Installed : 0.5HP

TABLE NO. H/19

Sewing Equipment - Asmara Textile Mills

Type of Machine	No.	Maker	Model	Condition
Cutting Room				
Cutting Tables	2	Rimoldi		1
Laying-up Machines	2	Rimoldi	72535 7253	2
Powered Straight Knives	4	Wolf	Pacer	2
Band Knives	2	Rimoldi	850-1	2
Bias Slitting Machine	2	Rimoldi	962-M3 TMF 160	2
Roll Maker for TMF 160	1	Rimoldi	SMF 160	2
Cotton Tape Cutter	1	Rimoldi	TPS	2
Sewing Room				
Single needle lockstitch	20	Adler	396-161	2
"	2	Adler	396-161	3
"	2	Neechi	600-100	2
"	2	Letia	510	2
"	1	Singer	331-K4	2
"	2	Singer	331-K4	3
"	2	Singer	196-K5	3
Overlock Machines	57	Rimoldi	Series 227	2
"	4	Rimoldi	Series 327	2
"	1	Union Spec.		4
Chainstitch Machines	9	Rimoldi	Series 164	2
"	4	Rimoldi	Series 163	2
"	28	Rimoldi	Series 063	2
"	4	Rimoldi	Series 065	2
"	1	Rimoldi	Series 066	2
"	1	Rimoldi	Series 264	2
"	2	Mauser	1280 KSP	2
"	2	Mauser Lock	46411 HE	2
Blindstitch Machine	1	U.S. Blindstitch		2
Button Holers	4	Reece	S2-BH	2
"	5	Reece	S2-ED	2
"	2	Reece	S2-LSZN	2

TABLE H/19 Cont.

Type of Machine	No.	Maker	Model	Condition
Button Sewers	3	Adamson	136/16A	2
Air Punch Buttoners	7			2
Thread Trimmers	5	Rimoldi	780/1	2
Inspection Machines	5	Miraliex	A	1
Presses				
Steam	1	Mentasti	MSR 755	2
"	4	Mentasti	MSM 2/V	2
Electric	1	Camptel	DL 70	1
Collar Fusing Press	3	A.T.I.		1
Other Equipment				
Plastic Bag Maker	1	Andrea Crespi	1639	1
Plastic Bag Sealer	2	Conformatic		1
Compressors	2	Ceccato	4388	1
Floor Scales (200kg)	1	Macchi		1

TABLE NO.H/20

Staffing - Sewing Department - Asmara Textile Mills

Hours of work, per day 7.5; per week 45; per year 2280

Staff	Number
Design and Pattern Cutting	2
Cutting and Bundle Forming	30
Sewing Room	
Supervisors	2
Foreladies	6
Chargehands	13
Machine Mechanics	3
Sewing Machinists	110
Service Workers	3
Inspectors and Trimmers	10
Press Operators	26
Clerks	3
Messengers	2
Cleaners	5
Sub Total Sewing	183
Folding and Packing	10
Sewing Thread Store	1
Grand Total	226

TABLE NO. H/21

Sewing Department Production - Asmara Textile Mills

GARMENT:	T.Shirt	Vest	Shirt	Underpants
Month				
March 1979	72,240	47,184	2,360	4,800
April 1979	90,324	46,960	1,680	2,880
May 1979	113,393	73,610	360	-
June 1979	103,680	51,960	1,000	960

All Knitted Fabrics

TABLE H/22

FIBRE BLENDS AT A.T.M. (%)

Data based on Cotton Prices, delivered Dire Dawa, 1976/77.

Cotton Staple Length (ms)			$1^{1}/8$	$1^{3}/32$	$1^{1}/16$	$1^{1}/32$	1	Counts Spin (ne)[1]
Price/100 Kg. Av. Grade M.*			310.4	309.7	308.5	302.8	297.1	
Blend and Average Cost Birr/100 Kg.								
	Cents per lb	Birr						
Extra A	68.18	310.1	50	50				28, 34, 50, 60 (all combed)
Extra B	68.03	309.4	25	31.25	43.75			20, 22, 24, 26, 32, 36, 40 (carded)
Perla	66.79	303.8			43.5	30.4	26.1	6, 9, 14 (carded)
Normal	66.71	303.4			30	50	20	21's (carded)

Note:[1] End uses for different count yarns

6, Blanket quality	24, Poplin	36, Gauze
9, Jeans	26, French Twill (doubled)	40, Market
14, Abujedid	28, Twill (doubled, weft)	50, Sewing Thread (3-fold)
20, Bed sheets, Poplin	32, Knitwear	60, Knitwear, Shirting (doubled)
22, Knitwear	34, Twill (doubled, warp)	

* Costs include Turnover Tax + Transport (to Dire Dawa)

TABLE H/23

COMPARISON OF COST VERSUS STAPLE LENGTH

Data based on Ethiopian Cotton Prices, delivered Dire Dawa

Staple Length	Grade	GM Cent Points per lb	SM Cent Points per lb	M Cent Points per lb	SLM Cent Points per lb	Range
	E	-65	-125	-250	-375	310
1 in	M					
	X	-175	-275	-375	-615	440
	E	+60	0	-125	-250	190
1 1/32 ins	M	+200	+100	-50	-225	425
	X	+125	+25	-75	-315	440
	E	+190	+125	B	-125	315
1 1/16 ins	M	+250	+150	B	-175	425
	X	+200	+100	B	-240	440
	E	+220	+150	+25	-100	320
1 3/32 ins	M	+275	+175	+25	-150	425
	X	+250	+150	+50	-190	440
	E	+235	+165	+40	-85	320
1 1/8 ins	M	+350	+250	+100	-75	425
	X	+330	+230	+130	-110	440
Range 1 1/32-1 1/8		175/150/205	165/150/205	165/150/205	165/150/205	

Notes: E: Ethiopian Cotton. Variation from base cost 1 1/16 ins, M.
M: Memphis Cotton. " " " " 1 1/16 ins, M.
X: Mexican Cotton. " " " " 1 1/16 ins, M.
Price of Ethiopian standard 67.84 ¢/lb. Year 1976-77.
Memphis standard 83.25 ¢/lb. 2nd Jan. 1980.
Mexican standard 83.00 ¢/lb. 2nd Jan. 1980.

TABLE H/24

COMPARISON OF COST VERSUS STAPLE LENGTH

Staple Length	Grade	GM Cent Points per lb	SM Cent Points per lb	M Cent Points per lb	SLM Cent Points per lb	LM Cent Points per lb	Range
1 1/16	E	20	-40	-165	-290	-480	500
	P	-75	-150	-250	-515	-545	470
1 3/32	E	55	-15	-140	-270	-455	510
	P	-25	-100	-160	-475	-510	485
1 1/8	E	70	B	-125	-250	-440	510
	P	100	B	-60	-375	-495	595
1 5/32	E	90	20	-105	-230	-420	510
	P	150	50	-15	-345	-490	640
1 3/16	E	115	45	-80	-205	-395	510
	P	275	150	55	-270	-470	745
1 7/32	E	150	90	-50	-175	-360	510
	P	425	325	225	-140	-445	890
1 1/4	E	180	115	-15	-140	-330	510
	P	575	475	350	-15	-420	995
Range 1 1/16 - 1 1/4	E	160	155	150	150	150	
	P	650	625	600	500	125	

Notes: E: Ethiopian Cotton. Variation from base cost 1 1/8 ins, M.
P: El Paso Cotton. " " " " " " "

ETHIOPIAN SPINNING PLANT — ASMARA (ETHIO-FIL)

Processes: Spinning and Doubling.

Ring spindles: 7992. Output: 550 tonnes p.a.

1.0 MACHINE REGISTER

Table I/1 gives the machine inventory for the mill. In the main the equipment in use has been manufactured by Ingolstadt; the only exception being the reeling machine of unknown manufacture and the Schlafhorst winder. Two items of equipment, the Croon and Lucke reeling machine and the TML (Milano) winder are no longer used.

2.0 BUILDINGS AND SERVICES

2.1 Buildings

The building is in good condition but too small to permit an optimum layout of the equipment. Expansion of production facilities must involve expansion of the building also and there is room on the site for this.

2.2 Air Conditioning

The air conditioning plants are manufactured by Weissner (Bayreuth) and are of good design and construction. Two central plants of 63 000 m^3/hr and 31 000 m^3/hr capacity are installed but as with other plants elsewhere in Ethiopia, they are both running in the manual rather than automatic mode of control. The mill is therefore unlikely to derive the maximum benefit from the installation.

A shortage of spare parts for the control equipment is alleged to be the main cause of the control equipment failure but no instruction manuals exist for the plant, though management has written to the suppliers for them. Management also suggests that the services of a Weissner Commissioning engineer would be useful as the quickest way of returning the plant to full operation, and we concur with this suggestion. The cost of such a service, including the necessary parts, is estimated at U.S.$50 000.

3.0 MACHINERY ASSESSMENT

3.1 Blow-Room

An extremely versatile opening and cleaning line has been installed in the mill. It contains 6 cleaning points and 3 by-passes which enables the plant to handle the dirtiest or relatively clean cotton depending on the blend required. However, the company is at present ordering only $1^{3}/32$ ins and $1^{1}/16$ ins Tendaho varieties which should require little cleaning

Originally the company spun yarns for the knitting department of Ethiopian Textile Industries, but because of a recent fall-off in demand for locally manufactured knitwear, it has now changed its product range to that shown in Table A below.

TABLE A. Yarn Production (Kg/annum)

Count Ne	Quantity per annum/Kg	End Use
8	1 000	Stitching yarn in knitting
16	73 000	Knitting yarn
20	198 000	Knitting yarn
21	176 000	Market yarn
24	79 540	Knitting yarn
2/20	17 740	Spindle tape for ETI
4/60	4 241	Stitching yarn for ETI
	549 521	

This level of production corresponds to roughly 150 Kg/hr at the blow-room, or a 6.88 minute doffing cycle (for a 17.2 Kg lap). Thus one scutcher is fully utilised, but the preceding machinery not so. Two scutchers would therefore increase the production of laps from the blow-room and allow the present high weight/yard in the lap to be reduced. The additional scutcher can also be justified on the grounds of good practice. If the present single machine is stopped for maintenance or as the result of a breakdown, then the opening line must be halted at the same time.

However, doubling the number of scutchers will not double the output of the mill. Limitations in other departments mean that the demand for laps cannot be increased by more than 20%, that is a total rate of production equal to 180 Kg/hr at the blow-room.

The cost of an additional two-beater scutcher and lap former is U.S.$140000, installed in Asmara.

A rating of 2 has been given to the opening and cleaning machinery. Until recently no spare parts have been ordered for 4 years. Now however, the mill is expecting spare parts sufficient to rehabilitate the equipment and restock the stores, so there should be no problem to increasing the rating to 1 in the near future.

3.2 Carding

Ten high production cards capable of processing local cotton at 22 Kg/hr at 100% efficiency are installed in the mill. These units are of modern design and are expected to continue giving a satisfactory performance until the end of the 1980's.

Current production from the cards is governed by the product mix and the limitations in the blow-room already discussed. The additional scutcher will permit the carding rate to increase to 22 Kg/hr giving a departmental capacity of 180 Kg/hr at 85% efficiency.

3.3 Drawframes

The Type S4104 drawframes are able to produce good quality sliver, and are in good condition with an anticipated life well beyond 1985. The only reservation we have about this single delivery unit is that to our knowledge only relatively few have been sold throughout the world. Single delivery units were introduced in the 1960's with the intention of facilitating the use of autolevellers on drawframes. However, the technology used to ensure their high production was quickly transferred to existing double delivery units and no great economic advantage to the single delivery unit materialised. Autolevellers can now be fitted to double delivery units anyway. In order to ensure the continuing use of these machines it is therefore essential that the firm maintains a reasonable spare parts stock control system.

Capacity of these units is such that the three units at present installed can easily match the anticipated additional output arising from the introduction of a second scutcher.

3.4 **Roving Frames**

With improved attention to detail in their routine maintenance, the roving frames are expected to continue producing satisfactorily until the end of the 1980's. The machines are in good condition and operating at a reasonable speed. Their existing capacity, at 300 Kg/hr (total) is well in excess of current demands.

3.5 **Ringframes**

Worn top and bottom aprons, variably lubricated roller bearings, and worn spindle bearings were in evidence in the spinning department. This situation probably reflects the recent difficulty with spare parts, and can be expected to improve when supplies become available again.

Current production in the ringframes is roughly 150 Kg/hr, and if the additional scutcher is introduced then this ringframe capacity needs to be increased in order to achieve a balance. This can normally be done by increasing spinning speeds, but owing to the end-use for which the bulk of the yarn is intended (mainly knitting) this is not possible at Ethio-fil, so an alternative method is to reduce the average count spun. Assuming an average count of 30s is spun on the three machines now engaged spinning 40s and 60s, then an additional 10 Kg/hr production can be achieved. Further, if the distribution of counts were to be changed from that shown in the questionnaire and in Table I/1, to that shown in Table A above (excluding 40's and 60's) then an additional 15% production can be achieved equal to 22 Kg/hr. The plant would then be operating closer to the manner for which it was designed than it is at present.

The ringframes are expected to perform satisfactorily through the 1980's.

3.6 Reeling, Winding and Twisting Machines

All machines in these departments have abundant capacity, are generally in a satisfactory condition, and should continue to perform satisfactorily until the end of the 1980's providing the adequate supply of spare parts is forthcoming.

3.7 General

Once the power supply to Ethio-fil is available on demand and the procedures and practices we have recommended are introduced then the annual target output for the mill (based on the modified spin-plan suggested above to bring the spinning sector into balance with preparatory sectors) will be 1300 tonnes.

Unfortunately the N.T.C. Production Report does not give a target figure for total yarn production with which to compare this output; it merely concentrates on DIK and MAG production.

4.0 MAINTENANCE

Scheduled maintenance schemes have been tried on the site in the past but have always failed from an inadequate supply of skilled technicians to man the schemes. None of the established maintenance staff have had any formal training (including the chief mechanic), though two recent acquisitions, a technical and an electrical graduate, have both spent three months on a textile familiarisation course at Akaki.

Apart from a lathe and a small drilling machine, the mill has no repair workshop or electrical testing workshop.

Stock control of spare parts is not practical; the mill simply reorders against use.

The mill, with just under 8000 spindles, is not a large one. Its markets are closely linked with production at Ethiopian Textile Industries and it was suggested to us that ETI could take over some of the administration of Ethio-fil, for example, the cost control scheme and maintenance control. However, the maintenance requirements of knitting and sewing machines are different from those of spinning machinery and we believe it essential that maintenance staff should be administered at Ethio-fil. The number of staff necessary for such a small plant would only be 21 to cover all spinning, mechanical and electrical requirements necessary for two shift operation. The addition of a further shift will increase the number to 24. Details are given in Table B. Priorities have been allocated on the understanding that there are machine-shop facilities close to the mill which can be used to augment initial shortages. The number of staff is higher than one would initially expect for such a small mill. However, 8000 spindles is not the most economic size of plant but it is felt that the need for planned maintenance will grow once the plant gets back into full production.

5.0 QUALITY AND QUALITY CONTROL

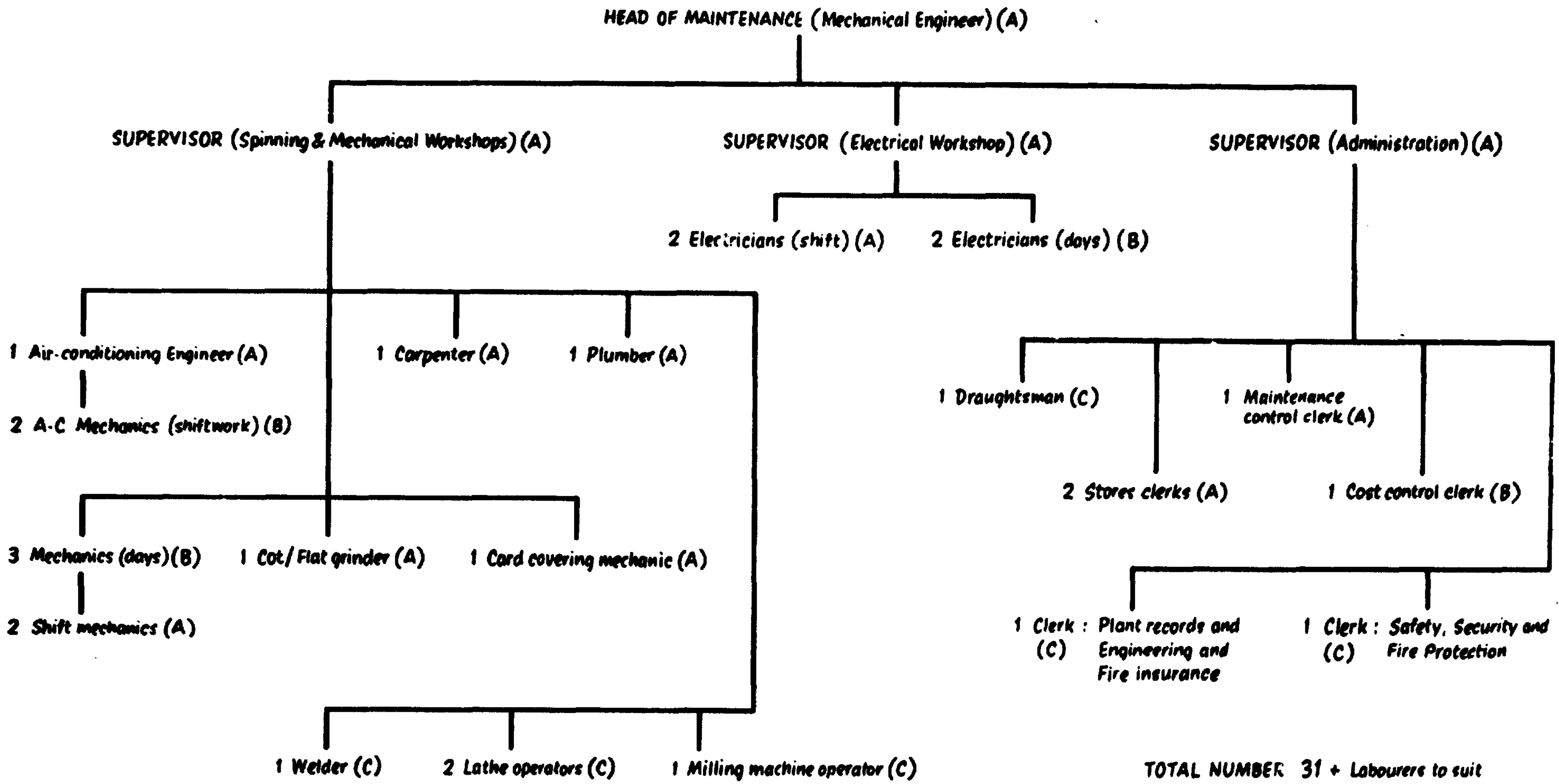
The requirements for knitting yarns are:

- Good regularity
- Relatively low twist
- Knot-free package and freedom from thick places

In order to achieve these characteristics many spinners comb their sliver prior to spinning. No combing facilities are available at Ethio-fil so the need to use good quality raw material, and then to ensure high quality standards and controls at each process is imperative. These additional controls, which are generally reflected in higher count-for-count knitting yarn prices, are necessary if the knitting (and sewing) machines are to achieve the operating efficiencies and quality standards for which they were designed.

At Ethio-fil the quality control schemes are operated at a minimal level. No pre-spinning fibre tests, no regularity tests of sliver or yarns, and no black-board or sample knitting tests are carried out. Only sliver and yarn count wrapping, and single yarn strength tests are done at present, and these in our view are inadequate.

TABLE 8 : RECOMMENDED MAINTENANCE DEPARTMENT STAFFING LEVELS : ETHIOFIL



TOTAL NUMBER 31 + Labourers to suit
1st. Priority (A) 16
2nd Priority (B) 8
3rd Priority (C) 7

We therefore recommend that the following tests be introduced as soon as staff can be made available:

(a) For yarn testing

- Regularity of slivers and yarns
- Blackboard wrapping on tapered boards
- Twist testing on a 10 ins twist tester
- Knitting performance tests on a small diameter (6 ins) electrically powered, tubular knitting machine.

(b) For fibre testing

- Cotton fineness testing
- Immaturity count test
- Microscopy
- Comb sorter tests
- Shirley Analyser tests

Staff to carry out these tests number 6 (1 supervisor, 2 yarn analysers, 1 twist analyser, and 2 fibre analysers) and the cost of machinery on which to carry out the tests is, at current prices, roughly U.S.$ 65 000.

6.0 LABOUR PRODUCTIVITY

Reasons for the relatively low productivity at the mill are:

- The need to employ three shifts whilst only effectively working two.
- Stock mixing is employed in the blending area.
- The mill is not the most economic size so indirect labour in carding, drawing and roving production is relatively high.
- Spinners look after only one side of a frame. When the mill spins 16s Ne and 60s Ne with the same ring diameter, then the spinner working the frame spinning 60s Ne, must be under-employed compared to those spinners working the frames spinning 16s Ne, unless the end-breakage rate with 60s is exceptionally (and therefore uneconomically) high. There is no evidence to suggest that this is the case.

One feature of the figures submitted in the questionnaire is that the totals in the departments do not agree with the numbers specifically identified by their duties.

Nevertheless, the labour productivity is still too low and in order to increase it to more acceptable levels, we recommend that management introduce a programme of rational work allocation (based initially on theoretical calculations but subsequently on work study techniques) with the objective of reducing the number of spinners and other direct operatives by 25%. Such a programme cannot, it is emphasised, be carried out independently of the maintenance and quality control recommendations made above.

7.0 LABOUR SKILLS

In common with other mills throughout Ethiopia, Ethio-fil suffers from a shortage of trained staff which manifests itself by understaffing in all technician grades. Without these trained technicians, supervision finds itself spending too much time trouble-shooting when it should be devoting a larger proportion of its time to organising, planning, and setting standards. Once the shortage of technicians is resolved, then it is possible that training at operative level can also be improved.

At present operatives receive on the job training. This is based on a natural progression from the simplest of duties to the more complex, that is from sweeping through creeling, doffing and piecing. However, little effort is made to emphasise the importance of maintenance and quality control, which is perhaps understandable given the shortage of technicians to explain their importance.

Clearly then, the key to improved performance at all levels of the labour force is an adequate supply of well-trained technicians. We do not believe that this necessary training can be given by any but the largest mills in the NTC organisation. In order that the training be completed as quickly as possible, with the minimum disruption to present production, we believe it will best be carried out by NTC working in collaboration with the mills.

8.0 NEW METHODS OF PRODUCTION

No new processing techniques are recommended for the mill. Rather the mill would benefit from some contraction of its existing count range. The demand for 60s yarn throughout Ethiopia is not great and production could easily be concentrated on mills which already have combing facilities.

TABLE No. V1 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - ETHIOPIAN SPINNING PLANT (ETHIO-FIL)

	Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size: Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
BLOW - ROOM	Cotton feeders	Ingolstadt		1968	3		31.62													2
	Waste feeder	"		1968	1															2
	Step cleaners	"		1968	2									See filters below						2
	2-Bar striker beater	"		1968	2															2
	1-Bar striker beater	"		1968	1															2
	Kirschner beater	"		1968	1															2
	Lap Former	"		1968	1			Lap Weight = 14 ounces/yd x 43.5 yds = 38 lbs (17.2 kg)												2
	Filter units	"		1968	2		11.07													1
	Cards	Ingolstadt	K400S/KBS	1968	1	1	3.3	810	1050	30		cylinder 400/420	21rpm			0.12	-	17.8	87.5	2
	Drawframes 1st pass	Ingolstadt	S4104	1969	2	1	5.21	810	1050	27.5			290 mpm		3 over 4	0.125	-	82.2	75	1
	"	"	S4104	1971	1	1	5.21	810	1050	27.5			290 mpm		3 over 4	0.125	-	82.2	75	1
	Drawframes 2nd pass	Ingolstadt	S4104	1969	2	1	5.21	505	1050	11.6			290 mpm		3 over 4	0.125	-	82.2	75	1
	"	"	S4104	1971	1	1	5.21	505	1050	11.6			290 mpm		3 over 4	0.125	-	82.2	75	1
	Roving frames	Ingolstadt	F4301	1968	2	96	5.5	135	290	0.82		1000rpm			SKF PK421	0.75	0.85	135.5	60	1
	"	"	F4301	1971	1	96	5.5	135	290	0.82		1000rpm			SKF PK421	1.60	1.52	35.5	68	1
	Ring frames	Ingolstadt	R4407/RB10	1969	7	444	16.33	50	210	.065		9800rpm		Jacobi patrolling cleaners	SKF PK220	20	16.5	11.85	89	2
	"	"	R4407/RB10	1969	4	444	16.33	50	210	.065		9800rpm			SKF PK220	21	17.0	10.96	89	2
	"	"	R4407/RB10	1969	2	444	16.33	50	210	.075		9800rpm			SKF PK220	24	18.0	9.06	89	2
	"	"	R4407/RB10	1973	2	444	16.33	50	210	.070		9800rpm			SKF PK220	30	20.0	6.53	89	2
	"	"	R4407/RB10	1973	2	444	16.33	50	210	.060		9800rpm			SKF PK220	40	28.0	3.49	92	2
	"	"	R4407/RB10	1973	1	444	16.33	50	210	.053		8500rpm			SKF PK220	60	40.0	1.41	92	2
	Reeling machines	Unknown	-	1969	5	80	1.5					225rpm				21	-	41.60		1
	"	"	-	1969	2	90	1.5					225rpm				40	-	21,84		1
	Winding machine	Schlafhorst	BKF	1968	1	24	3.0	250 max	125	2.0			600 m/min			60	-	4.25		2
								300 max	125	2.0			"			4/60	-	17.00		2
	Twisting	Ingolstadt	R24501	1969	1	144	11	57	230	0.092		5000rpm				4/60	17.8	2.43	40	1

NOTE Additional Machines Not Engaged on Production:

Machine	Manufacturer	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Remark
Reeling machine	Croon & Lucke	1	30		Not In Use
Cone Winder	TML Milano	1	40	2.2	Not In Use
Bundling presses					
Baling press					

TABLE I/2

STAFFING - SPINNING DEPARTMENT - ETHIOFIL

Opening and Cleaning	Day	1	2	3	Total
Operators	-	2	2	-	4
Feeders	-	2	2	-	4
Manual	-	-	-	-	11
Others (unaccounted for)	-	-	-	-	4
Total	-	4	4	-	23
Carding					
Mechanic	-	1	1	-	2
Helper	-	1	1	-	2
Operators	-	2	2	-	4
Feeders	-	2	2	-	4
Sweepers	-	2	2	-	4
Others (unaccounted for)	-	-	-	-	4
Total	-	8	8	-	20
1st & 2nd Passage Drawing					
Mechanic	-	1	1	-	2
Helper	-	1	1	-	2
Jobber	-	1	1	-	2
Operator	-	3	3	-	6
Helper	-	1	1	-	2
Others (unaccounted for)	-	-	-	-	3
Total	-	7	7	-	17
Roving					
Operators	-	3	3	-	6
Helpers	-	3	3	-	6
Bobbin carrier	-	2	2	-	4
Total	-	8	8	-	16

TABLE I/2 (Continued)

Ring Frame	Day	1	2	3	Total
Mechanic	-	1	1	-	2
Helper	-	9	9	-	18
Jobber	-	1	1	-	2
Spinners	-	33	33	-	66
Doffers	-	14	14	-	28
Bobbin carrier	-	3	3	-	6
Sweeper	-	2	2	-	4
Others (unaccounted for)	-	-	-	-	43
Total	-	63	63	-	169
Reeling					
Jobber	-	1	1	-	2
Operative	-	14	14	-	28
Others (unaccounted for)	-	-	-	-	15
Total	-	15	15	-	45
Winding					
Operative	-	2	2	-	4
Others (unaccounted for)	-	-	-	-	2
Total	-	2	2	-	6
Assembly Winding					
Operatives	-	2	2	-	4
Others (unaccounted for)	-	-	-	-	2
Total	-	2	2	-	6
Doubling					
Operatives	-	2	2	-	4
Others (unaccounted for)	-	-	-	-	2
Total	-	2	2	-	6

ETHIOPIAN TEXTILE INDUSTRY

Processes: Knitting; Garment Making; Dyeing and Printing; Cotton Wool Making.

1.0 MACHINE CAPACITIES AND EFFICIENCIES

1.1 Winding

The winding section was composed of six machines with a total of 360 spindles. Output was up to 120 Kg per hour in the range of counts 20s-30s Ne. Four of the machines were operating at 80% efficiency and the remaining two at 75%. The efficiencies of these machines may be considered to be reasonably satisfactory.

1.2 Knitting

The number of circular and flat-bed knitting machines was 66. Of these 41 were stopped, six awaiting spare parts to complete repairs, and 35 because there was no market for the fabrics the machines were designed to produce. Thus, 25 machines only were actually in production. Average machine efficiency was low at 65%. It should be noted that the winding section was fully employed whilst the knitting department was operating at a mere 25% of its maximum theoretical output. The implication is that the winding capacity is too small to satisfy the knitting requirements when that department is operating at any level above its present low level.

1.3 Sewing Operations

The sewing department is barely able to keep up with the output from knitting. Much of the available space in the sewing room was being used as a temporary storage for work in progress between dyeing and printing and sewing. This situation is dependent upon the garment styles in production and the conditions prevailing at the time of the visit may not be typical. But the fact that the knitting department is currently operating well below capacity suggests that there is a lack of balance between knitting and sewing. A double shift system in sewing instead of the present single shift would, of course, ease the problem.

1.4 Cotton Wool and Sanitary Towel Manufacture

Manufacture is based on own and bought in cotton waste from other textile units in the area.

Processing Equipment:

Much of the equipment in this section was secondhand when installed, after fifteen years of use with mediocre maintenance, its continued life expectancy is very limited. Working conditions in the opening section and immediate areas are extreme and are probably the worse observed in Ethiopia. That sanitary and medical products are prepared in the vicinity, is completely contrary to good practice in the manufacture of such products.

Depending on the commercial viability of this section - no information was made available on this issue, the whole operation should be either revived or scrapped. In the event of the former, it would be recommended that a new production line was established, isolating the dust creating opening operation from subsequent processing and that the final products were prepared and packaged in a suitable hygenic environment. Further, that new management was brought in to organise and control the operation in an efficient manner.

1.5 Knitted Piece Goods — Dyeing and Finishing

General comments and recommendations

This did not present the outward appearance of being a healthy production unit — management and staff being severely depressed that there was no stimulating demand for their products — and whilst recognising some of the reasons for this, realised that the more positive corrective actions may be beyond their authority.

The general layout of plant within the department is such that there is severe overcrowding of equipment, allowing little room for the passage/intermediate stortage of work in progress. There would be a strong case for the rationalising of activities within the department, particularly as comparable facilities exist in the immediate locality. As example — the bulk of yarn and material is dyed using direct dyeing systems, which over a period of time has not been satisfactory in meeting the technical marketing demands of the trade — the further use of more suitable dye systems is restricted by the plant available.

The company supports a small hand printing operation which, in bulk marketing terms, can barely be justified and could in all probability be done more economically on automatic flat screen machines based elsewhere in the near vicinity.

It was understood that the services of a specialist were being sought to update the products being manufactured, and to ensure that these more fully met the market requirements. It is suggested that this would be a good opportunity to rationalise production — discarding redundant equipment and creating improved product flow patterns on a reduced variety of product.

Knitted cotton products are manufactured from bought in cotton yarn. A reported market objection to some of the company's apparel garments was that they had a 'grinning' or 'speckled' appearance. As this appearance is in all probability due to yarn irregularities, it is recommended that trials using combed yarns are undertaken, particularly for the higher quality garments.

In view of the nature of intermediate and finished products, more attention should be given to reducing the potential hazards of an outbreak of fire. To this end, the number of extinguishers available should be brought to more acceptable levels, and water hydrant/s strategically sited.

2.0 BUILDINGS AND SERVICES

2.1 Buildings

The general factory buildings in terms of construction and layout are good and suitable for their intended purpose. In the finishing and making-up sections, there is congestion caused by location of equipment and work stations — probably to the point of diminishing returns.

2.2 Storage Areas

In the main, storage facilities are adequate for the current production activities. A possible exception to this is the area allocated to the storage of dyestuffs — being in the close proximity to the wet processing department, there is a danger of air-borne dye powder contaminating wet fabric in processing.

This danger could be avoided by physically isolating the storage area and introducing a positive ventilation of the dispensing area.

It was noted that the facilities for storing finished products was severely overloaded — a factor no doubt due to the downturn in market demand.

2.3 Steam Raising

There are three steam generating boilers on site:

	Type	Manufacture	Year	Generating Capacity Kgs/hr	Condition
(i)	Economic Package	Cyclonic (Milano)	1965	1150	Good
(ii)	Small Package Boiler	Officina Mecanica Carladaria	1958	15	Poor condition
(iii)	Horizontal Boiler	Luigi Endfiliegh B. Pelucchi and Figlio	1905	?	Not in use

Short of conducting a complete energy audit, we believe that the Cyclonic Boiler would be capable of generating sufficient steam to meet requirements and that in the interests of energy conservation, items (ii) and (iii) above should be discarded, or replaced if further capacity is required.

Water for the Cyclonic Boiler is chemically treated before being fed into the boiler.

2.4 Water Supply

The main water supply was from own artesian well, augmented by municipal supply. Some reduced supply was experienced during the dry season; but not so severe that it proved to be a hinderance to production.

Water for processing was not chemically treated other than by addition of sequestring agent to the dye/chemical bath. If the company is to improve the quality of its products, a requirement will be a higher percentage of goods dyed with reactive or vat dyestuffs — this being the case, the use of chemically softened water would be a recommendation, affording a saving in dyestuff consumption, and as a quality aid.

2.5 **Fire Precautions**

Knitting and winding

Whilst there were some fire extinguishers in evidence — these were insufficient in number to give adequate cover in the event of a localised fire.

There was no indication of a water hydrant being available in the event of a major outbreak of fire.

Finishing and making up

There did not appear to be sufficient numbers of extinguishers available — particularly in more vunerable areas. As in other sections, there does not appear to be adequate provision of means for combating a major outbreak of fire.

3.0 WORKING ENVIRONMENT

Knitting and winding

Working conditions were reasonable in terms of machine spacing, lighting and ventilation.

Cotton waste/wool department

Excess dust in the atmosphere with no adequate ventilation — this is at a level that it constitutes a health hazard to workers operating in the immediate area. The main contributory factor is the age and condition of the opening and carding engines.

Finishing and making up

Apart from the normal conditions of heat and water — normally experienced in finishing plants, working conditions are aggravated by the congestion of machinery and equipment.

Congestion of work stations and storage areas is also a problem in the making-up section.

Resolution of these problems would be afforded by the rationalisation of products and production, when redundant equipment could be discarded and further space created.

4.0 HEALTH AND SAFETY

Comment has been made elsewhere regarding the dust conditions in the cotton waste processing section.

Generally electrical fittings and wiring are in good condition — conforming to accepted practice. A common failing in the departments was the safeguarding of drive units and moving parts of machinery as potential causes of personal injury.

It is our opinion that a more active stance by management in improving safe working conditions would be an important factor in improving morale within the unit.

5.0 PRODUCT QUALITY

There was strong evidence that the company was finding difficulty in selling the whole of its production. What was not made clear during our visit, was to what extent this was a result of fashion acceptance/change or a rejection on quality grounds. On the one hand, garments were seen where the quality was suspect for the intended market, and on the other hand — pile fabrics were shown which made up into quality garments.

In E.T.I. interests it would seem appropriate that a thorough market survey was undertaken to establish amongst other factors — the exact quality demands for products in their intended market. Such a study would be the only sound basis for rationalisation at the factory.

6.0 SKILL LEVELS

From the diversity of products and operations, there is evidently a wide range of skills available in the factory. One comment is, that these are possibly so diverse and of low magnitude that it is a very difficult task to improve the overall skill levels.

Since the unit is relatively small, a possible solution to improving specific skill levels would be to allow such persons temporary secondment to other units in the locality where that particular skill is practised on a larger and more organised scale. In the same manner, it would be advantageous to the company to expose middle management to external experience — particularly those persons who have had experience solely at E.T.I.

TABLE J/1

Package Winding - Ethiopian Textile Industry

Make of Machine	TECHNOMECCANICA LOMBARDIA				FADIS SOBILATE
Model	49			48T	AVA
No. of Machines	1	1	1	1	2
Spindles per Machine	96	68	96	40	30
Winding Speed (M. per min.)	640	640	640	615	125
Age of Machine (Years)	15	15	15	17	16
Efficiency (%)	80	80	80	80	75
Type of Clearer	MECHANICAL				MECH.
Weight Input Package (gms)	64	65	68	64	68
Weight Output Package (kg)	0.65	0.71	0.77		
Machine Condition:	2	2	2	2	2

Counts: 20s Ne; 24s Ne; 30s Ne.

Hours of Work: 15 per day, 90 per week, 4560 per year.

Production: Up to 120kg per hour.

Operatives per Shift		2 Shift Total
Foreman	1	2
Winders	22	44
Transporters	3	6
Sweepers	1	2
Others	8	16
Total	35	70

TABLE J/2

Knitting Equipment - Ethiopian Textile Industry

Make & Type	Model	No. of M/cs	Age of M/cs	Width (diam)/gauge	No. of Needles	Production per machine/hour	Installed Power	Remarks
Circular								
1. Fouquetwerk - Fraus France	Fouquet	4		16/20	1008	2.67 kg/hr.	1.1 KW.	Production figures are just indicative and not precise enough as there has not been proper record for Individual machines.
				16/20	1008	"	"	
				16/14	702	"	"	
				16/16	756	"	"	
		4		18/20	1126	"	"	
				18/10	1126	"	"	
				18/14	792	"	"	
				18/16	906	"	"	
		3		20/20	1126	"	"	Figures are obtained from the shift Leader and some operatives as well.
				20/14	852	"	"	
				20/14	1008	"	"	
		1		30/16	1788	"	"	
2. Jovani Marchise & C. Torino		2		14/14	612	2 kgs./hr.	1.5 HP	
		2		16/14	696	"	"	
		1		16/16	804	"	"	
		2		18/14	792	"	"	
		1		18/16	900	"	"	
		2		20/14	876	"	"	
		1		20/16	996	"	"	
		3		20/20	1008			
					1128			
					1260	"	"	
		1		22/14	972	"	"	
3. Nishe Knitting Machine Works Japan		1		17/14	1452	2 kgs./hr.	0.4 KW	
		2		18/14	1452	"	"	
4. Wildman U.S.A.	Wildman	3		16/14	996	2 kgs./hr.	0.75 KW	
		2		18/14	792	"	"	
		2		20/14	876	"	"	
5. Singer U.S.A.	Singer 828	4		30/42	6058	6.4 kg/hr.	2 HP	
				30/30	2000		"	
					1980		1 HP	
		2		15/20	1760	1.2 kg/hr.	"	
					800	"		
		1		14/20	504	"	"	
		1		13/20	480	"	"	
		1		9/20	400	"	"	
		1		8/20	400	"	"	
		1		7/20	400	"	"	
6. Scott and Williams U.S.A.	1865	1		15/14	792		"	
Flat bed M/cs								
1. Porti Automatica Type 14	P457	1		183/12			0.37 KW	
2. Socomar Firense Italy	-	1		125/12			0.2 HP	
3. W. Barfuss & Co. FRG	HR5	2		4 x 36"/1.41			3.75 KW	One is slightly faster.
4. " " (W/K)	R53	1	1966	210 cm			1.1 KW	
5. " " (W/K)	R52	2	1951	200 cm			0.55 KW	
6. Meyer, Milano (Warpknitting)	-	4	over 20 years	240 cm			1.25 KW	
7. Rimoldi Comez, Milano	EL600	4					0.37	Used to produce narrow elastic bands & spindle tapes.
Beamers								
1. W. Barfuss FRG	SM 48	1	1966			3 kg/min.	1.1 KW	
2. Lartionfale		2	1954					

TABLE J/3

STAFFING - KNITTING DEPARTMENT

ETHIOPIAN TEXTILE INDUSTRIES

Hours of work: 15 per day. 90 per week. 4125 per year.

Staff per shift		2 shift total
Supervisor	1 (days)	1
Foreman	1	2
M/c operators	31	62
Needle makers	1	2
Oilers	1	2
Sweepers	1	2
Others	1	2
	$36\frac{1}{2}$	73

TABLE J/4

Cotton Wool Making and Fabric Finishing Equipment — Ethiopian Textile Industry

Item	Equipment	No.	Manufacturer	Year Manf.	Operating width cms.	Load Kgs.	Condition	Remarks
1 *	Scouring tank and cage	1	-	-	-	175	3/4	Cage and loading facilities in poor condition
2 *	Bleaching and washing m/c.	1	-	-	-	-	3/4	Requires full recondition/renewal
3 *	Centrifuge - hydro extractor	1	Courozet	-	-	75	3	Low load m/c. - too small
4 *	Opener machine	1	Hoffman	-	-	-	3/4	
5 *	Drying machine	1	Hoffman	-	-	-	3/4	Capacity too small - 6 Kgs/2 hours
6 *	Dryer opener	1	Hoffman	-	-	-	3/4	Capacity too small - 6 Kgs/2 hours
7 *	Carding engines	2	Lavino Caldirolli	-	-	-	4	Low production cards - total output 7.5Kgs/hour
	* All above equipment was second-hand when installed. It is old, worn out equipment which is out of balance as a production unit. Replacement should be considered.							
8	Rolling m/c (cotton wool)	1	Lavino Caldirolli	-	75	-	2	
9	Cutting m/c	1	" "	-	75	-	2	
10	Zigzag parallel cutter	2	" "	-	-	-	2	
11	Circular knitting m/c	1	" "	-	-	-	2	
12	Dyeing vessels	2	Fratelli Pozzi	1967	-	1140/day	2	
13	Centrifuge - hydro extractor	1	" "	1967	-	810/day	2	
14	Drying m/c	1	Haas	1967	-	874/day	2/3	
15	Drying m/c	1	Fratelli Pozzi	1967	-	686/day	2/3	

Item	Equipment	No.	Manufacturer
16	Dyeing winches	5	Fratelli Pozzi
17	Centrifuge - hydro extractor	2	" "
18	Bleach/padding m/c	1	M. Goller
19	Drying machine	1	Ati. Milano
20	Calendering m/cs	3	Fratelli Feraro
21	Plaiter/opener	1	-
22	Tumbler m/c	1	-
23	Auxiliary cutting m/c	1	-
24	Shearing m/c	1	-
25	Raising m/c	1	-

TABLE J/4 (Continued)

Year Manf.	Operating width cms.	Load Kgs.	Condition	Remarks
-	-	-	2/3	
-	-	-	2/3	
1967	-	-	3	Bowls req. attention and general overhaul
1967	-	-	2	
-	-	-	2	
1967	-	-	2	
1974	-	-	1	
1974	-	-	1	
1974	-	-	1	
-	-	-	4	Carding badly worn - no grinding equipment, try other NTC units in area

Table 1/5

FINISHING DEPARTMENT - LABOUR DEPLOYMENT -
ETHIOPIAN TEXTILE INDUSTRIES

	Foremen/Supervisor	Operative	Ancillary
Grey Room		2	
Bleaching		3	4
Dyeing	1	10	-
Colour Kitchen	-	2	-
Printing Machine		2	3
Studio 1 Design	1	-	-
Dryers		4	8
Calendar		4	
Centrifuge		2	
Boilers		3	
Cleaning			1
Management	2		
	4	32	16

TOTAL 52

Annual Production

Knitwear Garments	-	136,300 dozen
Sanitary Towels	-	4,200 kgs
Cotton Wool	-	7,000 kgs
Plastic Bags	-	4,500 kgs
Laces	-	4,800 kgs

A comparative break-down on production efficiencies is not possible in view of the varied nature of the products and the inability to associate resources against these.

Operating days per year - 304

Number of shifts operated - 2

Hours per shift - 45

TABLE NO. J/6

Sewing Equipment - Ethiopian Textile Industries

Type of Machine	No.	Maker	Model	Condition
Cutting Room				
Laying-up Tables	3	Rimoldi		2
Laying-up Machines (Manual)	1	Rimoldi	71-5	2
Laying-up Machines (Automatic)	2	Rimoldi	72-0	2
Band Knives	2	Rimoldi	840/1	2
Powered Straight Knives	2	Wolf	L/NG	2
"	1	Wolf	L/N	2
Bias Binding Cutters	5	Rimoldi	96-2	2
"	2	Rimoldi	TMF110	2
Sewing Room				
Overlock Machines	88	Rimoldi	B27	2
"	11	Rimoldi	B27	3
Coverstitch Machines	9	Mauser Spec.	CS46411	2
Lockstitch Machines	1	Union Spec.	36200A	2
"	1	Union Spec.	81200A	2
Bartacker	3	Reece	S2-ED	2
"	1	Durkopp	560-8	2
Chainstitch Machines	43	Rimoldi	B6325	2
"	5	Rimoldi	B6325	3
"	8	Mauser	1280KSP	2
"	3	Mauser	10148	2
"	21	Necchi	486R20	2
Button Holers	2	Durkopp	557-340	2
"	1	Durkopp	555-W2	2
Button Sewers	2	Durkopp	566-101	2
"	1	Durkopp	566-102	2
Portable Bag Stitcher	1	Union Spec.	2100 AA	2
Miscellaneous				
Thread Trimmers	2	Rimoldi	780	2
Plastic Bag Sealer	1	Lavine Caldireli		2

TABLE 1/6 (Continued)

Type of Machine	No.	Maker	Model	Condition
Presses				
Steam	1	Mentasti	MSM/V	2
"	1	Mentasti	MSM/V	3
"	1	Mentasti	MSR	2
"	1	Monti	104	2
"	1	Fratelli Ferare	SA439	2

TABLE J/7

Staffing - Sewing Department - Ethiopian Textile Industries

Hours of work, per day, 7.5; per week, 45; per year 2280

Staff	Number
Cutting room and bundle making	27
Sewing room	
Supervisor	1
Foreladies	7
Machine Mechanic	1
Asst. Mechanic	2
Sewing Machinists	96
Service Workers	7
Inspectors and Trimmers	17
Press Operators	4
Others	5
Sub Total Sewing	140
Folding and Packing	49
Grand Total	216

TABLE J/8

ETHIOPIAN TEXTILE INDUSTRY – ASMARA

SANITARY TOWEL AND COTTON WOOL UNIT

Ethiopian Textile Industry Factory makes sanitary towels and medical cotton wool. There is also a small plastic bag making unit for the factory's own use. These two units are located at different places in the factory premises.

(1) Cotton Wool and Sanitary Towel Section

A. Preparing Waste Cotton

(a)	Scouring tank	10.5 kW	
(b)	Bleaching and	4.4 kW	
(c)	Washing basins	3 kW	
(d)	Hydro extractor courozet	(cr) 3 kW	
(e)	Opener m/c	3 kW	Hoffman
(f)	Dryer m/c	3.15 kW	"
(g)	Dryer opener m/c	(2.2 kW)	"

B. Carding

2 cards make the continuous thick web on rolls

- Roller top machines
- 5.5 HP each
- Production is about 15 rolls/day, i.e. 15 x 10 Kg/day
- Two shift system, 8 and 12 hrs per day
- Make: Lavino Caldirolli

C. Rolling, Cutting and Packing

1 Roller m/c (rolls with paper cover)

- Width 75 cm
- Power 1 HP
- Make: Lavino Caldirolli
- 1 Cutter
- Make: Lavino Caldirolli
- 2.5 HP

TABLE J/8 (Continued)

- 2 Zigzag parallel cutters for sanitary towels in 50 gm wt.
- Make: Lavino Caldirolli
- Power 1 HP each
- Production 2500 pcs/day (50 packs of 50 gm pcs)
- Knitting m/c for sanitary towels use. 2 Cutting m/cs
- Power: 2.4 HP Power: 4.5 HP
- Make: Lavino Caldirolli
- Production 10 Kg/shift/mi

Operatives

Day shift operators 6 Two shift operators 20/shift

Floor area = 7 x 25 + 25 x 20
= 175 + 500
= 675 sq. metres

- working area is affected by fibres and fly
- no suction system has been installed

Production Report

Oct/78 - June/79		Target for 1979/80	Working Days
Sanitary towels	13 432 Kg	4 200 Kg	301
Medical cotton wool	7 110 Kg	7 000 Kg	301
Plastic bags	9 234 Kg	4 500 Kg	275

D. Plastic Bags

Machinery:

1 Plastic melting (moulding m/c) with control panel

Make: Andrea Crespi, 1969

1 Roller machine (21 - 44 cm wide)

Make: Andrea Crespi

1 Cutting and sealing m/c

Make: Andrea Crespi

Installed power = 20.8 HP

Floor area: 4 x 6 = 24 sq.m.

Operative: 3 day shift only

Production: 60 Kg per day (1 shift)

ETHIOPIAN FABRICS - ASMARA

Processes: Spinning; Weaving; Dyeing, Printing and Finishing.
Spindles: 7568 ; Looms: 136 ; Annual Production: 1.9 million m^2.

1. MACHINE EFFICIENCY AND PRODUCTIVITY

1.1 Spinning

Ethiopian Fabrics is one of the few mills to give machine efficiencies about which we can be reasonably confident. Other mills have given estimated efficiencies without knowing for example, the end-breakage rates at the ring-frames. Estimated values in the latter cases need to be treated with caution.

Table A (below) is prepared from data supplied in the questionnaire. It shows the required production at each processing sector based on the claimed present production level (for a 22 hour day) at the ringframes.

Ringframe operating speeds are, for the 9, 12, 24 and 30's Ne yarns, consistent with front roller and/or traveller life limitations; only the 16's Ne yarn appears to be spun relatively slowly. Based on this ringframe performance, the annual capacity of the mill is at present (for 22 hours per 305 day-year) 1220 tonnes. For a full 24 hour day this capacity increases to 1340 tonnes. However, these at present are only theoretical values, and some adjustments to present operating conditions are necessary if they are to be achieved.

At current operating speeds and efficiencies the roving frames produce only 79% of that needed to match the spinning frames at full capacity. The count spun on these roving frames (0.8 Ne) is coarse compared with normal practice, so the only remaining variables which can be altered to increase output are operating speed and efficiency. In our view neither of these variables can be improved by the necessary margin. We therefore advocate the replacement of the two M4 units by 96 spindle Rovematic FB frames. These frames running at 70% efficiency and 1000 rev/min (maximum 1200 rev/min) will produce 79.5 Kg/hr each, or 30 Kg/hr each more than the present units, and increase the capacity of this processing sector from its present 147.6 Kg/hr to 207 Kg/hr.

At first glance the drawframe capacity also appears to prevent the mill achieving its full (ringframe) capacity. However, correctly maintained machines should easily reach the increased running speeds (+53%) necessary to enable drawframe sliver production to match spun yarn production. Processing speeds on the four 1965 and two 1972 units would then be 168 and 190 metres/min respectively. The services of a Platt commissioning engineer would assist management with the selection of the necessary replacement parts to achieve these speeds.

Some adjustment to the carding department is also needed to balance capacity. The Type 600 cards are producing at the rate of 21 Kg/hr and it is unlikely that this figure can be increased. A better way of increasing the carding output would be to increase the number of the 1964 cards. These are however reconditioned units, and though they would be obtainable from the U.K., additional staff would be necessary to man them. If however some of these older units were replaced with an equal number of high production cards, then the additional output is achieved without the need for more space or staff. Three new Type 600 cards would provide an additional 30 Kg/hr capacity. Normally the replacement of reconditioned cards by new high production units is not considered an economic proposition. However, the additional capacity which is achieved with these units must make these proposed changes worthwhile.

TABLE A. Production Requirements by Processing Department (Kg/hr at operating efficiency)

Department	Required Production Rate	Claimed Capacity
Blow-room	200	197
Carding	188	172
Drawing	186	122
Roving	185	147.6
Spinning	181.5	181.5

Current production from the opening and cleaning line is 197 Kg/hr. Table B summarises Platt's claimed production rates for the units comprising the line.

TABLE B. Production Rates: Opening and Cleaning Machines (Kg/hr at 100% efficiency)

Machine		Production Rate	No. Available
Blending Hopper Bale Opener	Type 452	136 Kg/hr	4
Ultra (Strip) Cleaner	Type 521	590 Kg/hr	1
Porcupine Opener	-	500 Kg/hr	1
Hopper Feeder	Type 462	450 Kg/hr	1
Beater	Type 496	500 Kg/hr	1
Air-Stream Cleaner	-	499 Kg/hr	1
Hopper Feeder	Type 462	450 Kg/hr	1
Scutcher (15 ounces/yd)	Type 560	202 Kg/hr	1

Clearly the scutcher is the limitation, and with only one such machine, breakdowns or maintenance stoppages will critically affect the remainder of the plant. We therefore recommend that a two-way distributor followed by a new hopper feeder and scutcher unit to operate in parallel with the existing unit, is purchased and installed.

The estimated cost of this additional equipment is:

Scutcher	U.S.$	103 000
Hopper feeder		36 000
Two-way distributor		7 500
Cards (3)		201 000
Roving frames (2)		311 000
	U.S.$	658 500

Based on reasonable assumptions regarding average cloth weight, these purchases will enable the mill to return to its 1973 (24 hour/day) level of fabric output.

1.2 Weaving

Average loom efficiency is 65%. With the fabrics in production a loom efficiency figure of 85% should be attainable without difficulty.

Causes of low loom efficiency are high warp and weft breaks and poor loom maintenance. Currently, warp breaks are 4 per hour, and weft breaks $2\frac{1}{2}$ per hour. These high breakage rates are attributed by the weaving management to poor yarn, which is said to have many weak places. A reasonable level of breakage rates would be a half of the present rates.

Down-time for mechanical repairs is high and much of this is caused by or aggravated by the inexperience of the loom mechanics and other maintenance labour.

The productivity of the weaving department is estimated at 40%, productivity being defined as the ratio of actual production to potential production. Main causes of low productivity are low loom efficiencies as dealt with above; working time lost due to interruptions of the power supply; loss of working time necessitated by the curfew, and the inexperience of the labour generally.
The equipment in all weaving departments is basically in good condition and should require no unusual expenditure for the next five years.

If the various problems, listed above, can be overcome, the mill will have a potential annual production of 5 million square metres.

1.3 Finishing

In recent times, many of the main production machines have been overhauled and refurbished - where spares and accessories have been available. The department has a clean and orderly appearance, confirming an impression of a competently managed unit.

Common to such other units, the department is short of technically trained staff and operatives.

Operative productivity within the department appears to be reasonable in comparison to other units - bearing in mind that the average value added, is probably greater than those units showing a higher production per capita.

At the time of survey, a major restricting factor to the production of flannelette fabric was the shortage of raising capacity. This situation could be corrected by the relocation of such surplus equipment from within N.T.C.

2. BUILDINGS AND SERVICES

2.1 Buildings

In general the factory buildings are of good design and construction, with a site lay-out ideal for vertical textile manufacture.

Storage areas are well organised and adequate for maintaining a high volume production. The central stores appeared to be well provided and administered.

2.2 Service Installations

2.2.1 Air conditioning

The spinning mill is equipped with ventilators only, and the weaving mill with 98 spray units in the weaving shed. Thus air conditioning is inadequate for normal good quality production and for providing a satisfactory working environment in the spinning and spinning preparation areas.

If full air conditioning is to be provided in all operating areas in spinning, and in the weaving shed, the cost is likely to be U.S.$ 950 000, excluding civil engineering work.

2.2.2 Steam generation

Generating plant:

Type	Make	Year of Manufacture	Capacity Kgs/hr
3-Pass Package Boiler	Duisborg	1965	4 000
3-Pass Package Boiler	Duisborg	1973	6 000

These are standard type package boilers, in general good condition and having standard instrumentation relative to their operation. The steam demand is such that it is possible to run one of the two boilers at any one time, allowing regular maintenance on the one not in use.

All boiler feed water was filtered and chemically treated; there was no facility for the regular testing of boiler water, although boilers were subjected to annual inspection by the insurers.

2.2.3 Compressed àir

Used for fire ventilation, air conditioning, and some items of equipment air is supplied from a central compressed air unit on a ring main. This unit originally consisted of two compressors (of different manufacture), one of which is now out of commission, as spares are no longer available. This leaves the company completely reliant on the single compressor which, in the event of breakdown or failure would deprive the factory of compressed air - with disastrous results to production and quality.

2.2.4 Electricity supply

The situation has improved in recent times, but continues to be a determining factor in optimising production in the company. All wiring and switchgear is in good condition.

2.2.5 Water supply

Total factory consumption is at a rate of 300-350m^3 per day. This volume is supplied by nineteen artesian wells, augmented by municipal supply for specific purposes. The team was assured that potential water supply was considerably in excess of current requirements and that the month of June was the only period in which there was any restriction to the volume abstracted.

The main feed pumps were reported to be in poor condition and due for replacement, but at the time of the survey visit, no provision had been made for this in the expenditure budget.

2.2.6 Process effluent

Average process effluent amounts to approximately 270m^3 per day. This is discharged direct to a nearby river. The management were not aware of there being any restrictions on the quality of effluent so discharged.

2.2.7 Storage areas

The various stores and storage areas were ample for their purpose and secure where used for valuable or small portable items.

3.0 CONDITION OF EQUIPMENT

3.1 Spinning

When the mill was inspected some of the spinning machinery was running, but nothing was actually processing fibre. Apparently the mill had been shut down for a full week prior to the visit. Maintenance work was being done on some of the machines, so accurate assessment of the machinery under normal working conditions was impossible.

(1) Opening and cleaning machinery

Secured in satisfactory working order. Guards are in place and there is no evidence of any critical shortage of spare parts. Machinery should continue to function well into the 1980s providing it is maintained satisfactorily.

(2) Cards

Some evidence was recorded of the need to regrind the card flats and to make adjustments to the machine settings. Card wire was damaged on some units sufficient to justify replacement. We have rated both types of card the same (2) on the grounds that the standard of maintenance of one type is unlikely to be very different from the other.

(3) Drawframes

A relatively low rating was given to these machines because of their low operating speed. Essentially nothing appeared wrong with the machines, so there is unlikely to be any problem lifting the operating speed once a Platt engineer has reset the machines.

(4) Roving frames

The steel rollers are in a satisfactory working condition and the other drafting components were not in need of replacements. None of the gears looked worn, though it was noted that some were incorrectly meshed. Generally the machines should, with adequate maintenance, continue performing satisfactorily until 1985. The only reason we have recommended the replacement of the 1965 units is simply to balance the production with faster and a greater number of spindles.

(5) Ring frames

Some of the oldest of the ringframes had replacement parts fitted in 1977. But both these M4 and the Type 800 units had not been set up correctly. There were for example many instances of spindle/ring/tappet eccentricity and the spindles on some of the machines were worn very badly. The bobbins fitted on some of the spindles were so loose as to prompt us to question the possibility of their spinning any yarn at all. However, it seems likely that the mill visit had not been arranged at the best time and that some attempt may have been made to 'dress up' the mill especially for the visit.

(6) Doubling

Mainly spindles and rings which need attention if the mill is to spin and double quality yarns.

(7) General

Possible cost of rehabilitating the cards, drawframes, ringframes, and doublers is an estimated U.S.$ 480000. This includes for replacement of spindles on all ringframes and doublers and a complete overhaul for each frame, reconditioning the Globe drawframes and re-clothing 30% of the cards.

3.2 Weaving

The condition of machinery in weaving and weaving preparation is generally satisfactory and in every case it has a useful life expectancy in excess of five years, with the proviso that adequate standards of maintenance are provided and spare parts continue to be available. Two minor problems exist, both in sizing, viz.

(1) The electronic automatic controls on the Sucker machine are not working because the electrician does not have the experience necessary to maintain and repair sophisticated electronic equipment. Running adjustments are made manually.

(2) On the older of the two machines the steam pipes in the size bath are corroding and must be replaced. This is within the capabilities of the mill maintenance staff.

3.3 Finishing

Mercerising The existing plant has a maximum width capacity of 95 cms due to the restricting width of the guide rollers and the deteriorated condition of the internal rollers. Capital appropriation should be made for the complete refurbishing of this machine if the Company is to stay in the production of higher quality fabrics - particularly in respect of width. Estimated cost: US $ 85,000.

Intermediate drying is currently carried out on machines designed for other and more productive purposes (i.e. Hot Flue and Stenters), the existing intermediate drying ranges are inadequate for the purpose and should be replaced or increased in capacity, for improved overall efficiency. Estimated cost: US $ 65,000.

Certain machines require major overhauls and refurbishing - tasks which are possibly beyond the capability of plant resources. Main items are - Hot Flue machine, Screen Print machine. Estimated cost: US $ 130,000.

For a large proportion of throughput, the factory is reliant upon an all-in desizing, scouring and bleaching operation. Whilst this method would be regarded as satisfactory for light-weight/lower quality goods, it would not be a recommended procedure for heavier/higher quality goods - particularly where these were to be continuously dyed or printed. If it was the Company's intention to concentrate more on the latter, additional open-width preparation capacity would be required.

The factory possess a well equipped yarn dyeing and bleaching section which is not in commission. Since there is an overall shortage of such facilities action should be taken to fully utilise the plant or relocate it.

3.4 General

There is sufficient floorspace within the existing factory to permit a 25% increase in the quantity of equipment at present installed. It is suggested, however, that the immediate task in this plant is to restore output levels to those achieved five years ago, i.e. 5.5 million M^2 per year. To accomplish this aim will require expenditure for the rehabilitation of certain equipment in spinning and finishing, followed by further investment in spinning equipment and air conditioning.

At the same time the skills of the work-force must be built up, particularly those of technical maintenance workers and technical management.

The following time-table is recommended:

1980/1981:

(i) Rehabilitation of spinning equipment (Section 3.1)

(ii) Rehabilitation of finishing equipment (Section 3.3)

(iii) Training and stabilisation of work-force

Estimated cost of items (i) and (ii): US $ 760,000.

1982/1983:

(i) Installing of new spinning equipment (Section 1.1)

(ii) Installation of air conditioning equipment (Section 2.2.1)

Estimated cost of items (i) and (ii): US $ 1,608,000

1984

Feasibility study for mill expansion by 25%.

4. WORKING ENVIRONMENT

4.1 Health and Safety

From the point of view of safety the factory was generally satisfactory except for certain machines in the finishing department which were not fitted with adequate guards. These were the raising machine from which the drive covers were missing, and the dye jiggers from which the control panels had been removed.

Fire precautions and fire fighting equipment were to a high standard throughout the factory which was fitted with numerous hydrant points, extinguishers and sand buckets placed at strategic places. Emergency exits were clearly marked.

Little of the machinery was running at the time of the visit, hence the atmosphere was not typical of normal operating conditions. It is judged, however, that lack of proper air conditioning in spinning would lead to an excessively dusty atmosphere when the machines are running.

The spacing of machines was good with adequate alley-ways for movement between machines.

Absenteeism due to sickness was said to be running at an overall average of 15%. For the month of August it rose to 21%. We have no means of checking whether sickness was the only cause of these very high rates of absenteeism. It was claimed that the high rates were due to the effects of excessive fatigue, brought about by the long working hours spent in the factory by the night shift, and inadequate diet. Certainly, the curfew imposes burdens upon night shift workers and it is possible that this and other local factors may be contributing causes to the high absenteeism.

Complaints were made about the effects of noise upon workers in the weaving department. Ear plugs or muffs (pads), are not provided and it is recommended that they should be.

5. MAINTENANCE

The mill employs a general maintenance labour force of some 19-20 persons split evenly between the mechanical and electrical workshops. The staff are a blend of experienced, untrained (without formal mechanical/electrical training) and inexperienced, trained staff who we believe have not yet had time to make a significant impact on the general condition of the machinery.

With regard to textile maintenance, there is a claimed shortage of suitable personnel (though the training is different, the characteristics required for textile and general site maintenance are similar) which is preventing the introduction of planned sheduled maintenance. For example a comprehensive 51 - point check-list covering setting adjustments, replacement of worn parts, and lubrication requirements, exists for the looms, and cannot be implemented owing to the aforementioned shortage. But after one week of an enforced shut-down in which staff had been redeployed on maintenance work, the spinning equipment should have benefited from better housekeeping, better lubrication, and improved alignment of machinery parts, all of which would have played a significant part in achieving a reduction in current end-breakage rates.

The spare parts store was well arranged and layed out with the parts apparently in good condition even though there was no temperature control in the room. The only specific item about which the mill has re-ordering problems is the printed circuits needed for the sizer.

Our recommendations for the mill are therefore confined to the steps which need to be taken in order to ensure a higher level of maintenance than is achieved at present with existing resources. Firstly we believe that the responsibility for the maintenance of all machinery should be solely that of the Technical Manager/Chief Engineer. In this way disputes between maintenance and production are sorted out by senior management each on an equal footing. In too many mills in Ethiopia we find the maintenance personnel are effectively responsible to the production management, and as a consequence it is the maintenance aspect of this work which often receives inadequate support. The next important step is for the Technical Manager to determine and obtain agreement for his scheduled maintenance programme which must be based on a realistic balance of resources committed to both breakdown and scheduled maintenance.

At present it is common practice for operatives to hold regular political meetings during normal working hours. Whilst this practice continues we suggest that a discussion forum is established under the Chairmanship of the General Manager for the purpose of analysing and making recommendations on how to improve communications between the departments on the subject of the interaction between quality maintenance and production. All management and supervisory staff should attend. A secondary objective is to establish working limits for such performance characteristics as:

- machine hours worked/machine hours possible
- end-breakage levels
- warp yarn breaks
- finished fabric rejects, etc.

A more general treatment of this subject is included in the section the report - Maintenance.

6. PRODUCT QUALITY

6.1 Spinning

No assessment of the yarn quality can be made as the plant was not spinning on the day of the visit. However, from what was seen it is likely to be good. It is the mills policyto carry out sliver and yarn wrappings only, and for this work they employ one quality controller on each shift. This we to be inadequate both for the size of the mill, and for the end-uses for which the yarns are intended. If the mill were to change from the manufacture of cotton yarns to cotton/polyester yarns, then it is imperative that management first recruit and train an adequate quality control department. We believe that the minimum staffing level necessary to meet present commitments in the spinning department is:

1.	Quality Control Supervisor	days only
1.	Calculator	days only
3.	Yarn and twist analysers	shifts
2.	Uster and blackboard operators	days only
2.	Fibre analysers	days only
9		

Though this number is relatively high it is recommended in the light of current absenteeism rates in Ethiopia, and the knowledge that the mill is below the normal economic size of plant. Such a staffing level would be suitable for the mill if it is producting cotton or cotton/polyester blends. Cost of essential testing equipment for the mill (say) US $ 40,000.

6.2 Weaving

The quality of cloth is good by the standards obtained in most of the N.T.C. mills. Most of the faults are due to yarn, particularly irregularity and weak places. These latter yarn faults are the cause of many warp breaks in weaving, almost all of which leave a fault in the cloth.

Faults which may be attributed to weaving practice were thick and thin places caused by defective let-off mechanisms; broken picks caused by careless repair of weft breaks, and lashings-in due to selvedge cutters not working at the pirn change.

All these faults can be reduced by better loom maintenance and by more care and attention from the weaver. The labour force is inexperienced and will improve with time, but the improvement can be expedited by the introduction of constructive instruction into the day-to-day supervision of loom mechanics and weavers.

6.3 Finishing

There is little opportunity for an extensive examination of the quality of goods produced; but from the evidence of the goods seen during the visit, the standard of quality appeared to be reasonably good, particularly in view of the limitations in existing equipment.

Although goods were not processed to meet a specification, departmental management was well aware of quality requirements and confident in their ability to satisfy this.

One possible failing of the plant in the future could be the inadequacy of the all-in preparation system for high quality print and dyed goods, too wide for processing on the mercerising range.

7. WORK FORCE

7.1 General

Like most of the Asmara plants conditions at Ethiopian Fabrics are abnormal. The work force is relatively inexperienced and output is less than a half of full potential. In these unusual and temporary circumstances it is not possible to make any definitive judgements on the present staffing.

7.2 Spinning

From returns to the questionnaire it is clear that Ethiopian fabrics has a labour productivity better than the average for the industry generally. The OHK value (22.75 corrected to 20s Ne) is, in the spinning department alone, better owing to a lower than normal number of spinners and doffers. Spinners look after two sides of a frame and the doffers handle an estimated 1780 packages per hour or roughly 250/hr each. It is mainly because of these two factors that the mill achieves its improved rating.

Unskilled labour for work in textile mills in Asmara is freely available.

7.3 Weaving

The numbers of looms per loom mechanic, per weaver and per battery filler are roughly similar to the numbers found in the less efficient mills of East Africa, i.e. 27 looms per mechanic, 5 per weaver, and 25 per battery filler. In terms of output achieved the staffing numbers are even more unfavourable, but in the present local situation this is unavoidable.

7.4 Finishing

On the current volume of production, the output per operative is exceptionally low. This situation is aggravated by the fact that three working shifts are maintained, whereas only two shifts are worked per day. There is no doubt that three-shift working will be resumed as soon as circumstances permit, and that as a result the output per operative will improve; even so, and taking the average value added into account, productivity in the unit will be low relative to other sites within the organisation. This situation is to some extent accounted for by the diversity of work undertaken on a relatively low volume of total production - e.g. screen printing, running at 50% ultilisation on two shifts with staff compliments for three shifts. As productivity becomes a more urgent concern, there is clearly scope for rationalisation, either in the product-mix or in the better utilisation of resources elsewhere.

8. SKILL LEVELS

8.1 Spinning

No special problems are experienced except with skilled maintenance personnel which has been mentioned elsewhere in this report.

8.2 Weaving

Loom mechanics need more experience. Theirs is a skilled job and the effectiveness with which they carry it out has an important bearing upon loom efficiencies and cloth quality. Shift supervisors give some 'on the job' training during the scheduled maintenance of looms but their other duties are constraints upon sufficient time being allowed for this purpose.

The looms are Picanols for which there are good maintenance manuals available from the manufacturers, usually in English and French. It is recommended that abridged translations into Amharic be made for use by the loom mechanics. This is a recommendation which applies to all maintenance manuals for all machines throughout the N.T.C. factories.

8.3 Finishing

In common with other plants, one of the main problems experienced at the factory was the shortage of skilled operatives.

In the absence of formal training techniques, training was by experience and working with others deemed to have acquired the necessary skills. The point was expressed that the Company having passed through a transitional phase during which there was a high labour turnover, had only recently settled down with a more stable work-foce - which in itself was a positive asset in imparting further skills and experience in the work-force.

9. FEASIBILITY OF USING OTHER METHODS OF PRODUCTION

The equipment in all departments is reasonably modern and suitable for the yarns, fabrics and finishes produced. No alternative method of production is recommended.

SHORT STAPLE COTTON SPINNING - ETHIOPIAN FABRICS

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Spindles	Installed power per unit kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working width mm	Operating speed	Delivery speed	Waste removal system	Drafting system	PRODUCTION DATA Output Count Ne	Turns per inch	Prod'n per unit per hr	Over-all effic-iency %	Machine condi-tion
Blending openers	Platts		1964	4															1
Ultra (step) cleaner	"		1964	1															1
Porcupine opener	"		1964	1															1
Hopper feeder	"		1964	1		42.3													1
Beater	"		1964	1															1
Air-stream cleaner	"		1964	1															1
Hopper feeder	"		1964	1															1
Scutcher	"		1964	1															1
Roving waste opener	"		1964	1															1
Filter unit	"		1964	1		18.4													1
Cards	"	RF.	1964	11		2.4	457	1067	13		240 Cylinder 22 doffer				0.14	-	11.5 kg	90%	2
Cards	"	600-111	1972	3		8.0	457	1067	13		300 Cylinder 40 doffer				0.14	-	21.0 kg	92%	2
Drawframes 1st Pass	"	740	1965	2	2	3.6	457	1067	12			110m/min			0.14	-	55.6 kg	70	2
Drawframes 1st Pass	"	740	1972	1	2	3.6	457	1067	12			125m/min			0.14	-	63.2 kg	70	2
Drawframes 2nd Pass	"	740	1965	2	2	3.6	457	1067	12			110m/min			0.14	-	55.6 kg	70	2
Drawframe 1st Pass	"	740	1972	1	2	3.6	457	1067	12			125m/min			0.14	-	63.2 kg	70	2
Roving frames	"	M4	1965	2	80	7.5	145	305	.947		800			SKF PK 528 (1971)	0.8	0.95	75.7 kg	65	1
Roving frames	"	S2	1972	1	80	7.5	145	305	.947		800		Pneumafil	SKF PK 528/1	0.8	0.95	75.7 kg	65	1
Ring frames	"	MR4	1965	12	400	15.4	PRODUCTION NOT ASSIGNED TO MACHINES				7400			2PK 220, 1977 10/PK211, 1965	9	9.5	31.1/28.6kg	72	2
Ring frames	"	800	1970	1	400/368	15.4					8200			PK 220	12	11.3	21.7 kg	75	2
Ring frames	"	800	1971	1	368/400	15.4					8200			PK 220	16	13	14.1 kg	80	2
Ring frames	"	800	1972	5	400	15.4					10500			PK 220	24	18	8.7 kg	81	2
											10500				30	20	6.2 kg	83	2
Doubling frames	"	MD3	1965	3	360	15.0	PRODUCTION NOT ASSIGNED TO MACHINES				8200				2/24	14			2
Doubling frames	"	MD3	1968	1	360	15.0					8200				2/30	15			2
Doubling frames	"	MD3	1972	2	360	15.0													2

TABLE K/2

STAFFING - SPINNING - ETHIOPIAN FABRICS

Opening and Cleaning	Day	1	2	3	Total
Attendants	—	2	2	2	6
Maintenance mechanic	1	-	-	-	1
Maintenance worker	1	-	-	-	1
Total	2	2	2	2	8
Carding					
Attendants	-	3	3	3	9
Mechanic	1	-	-	-	1
Helper	1	-	-	-	1
Sweeper	-	1	1	1	3
Total	2	4	4	4	14
Drawing					
Attendants	-	2	2	2	6
Reserve	-	1	1	1	3
Maintenance Worker	1	-	-	-	1
Scourer	1	-	-	-	1
Total	2	3	3	3	11
Roving					
Attendants	-	3	3	3	9
Helper	-	1	1	1	3
Mechanic	1	-	-	-	1
Maintenance	1	-	-	-	1
Sweeper	-	1	1	1	3
Total	2	5	5	5	17
Ringframe					
Spinners	-	19	19	19	57
Helpers	-	4	4	4	12
Doffers	-	7	7	7	21
Filler	-	3	3	3	9
Reserve	-	4	4	4	12
Mechanic	4	-	-	-	4
Maintenance worker	2	-	-	-	2
Tape repairer	1	-	-	-	1
Sweepers	-	2	2	2	6
Total	7	39	39	39	124

TABLE K/2 (continued).

STAFFING - SPINNING - ETHIOPIAN FABRICS

	Day	1	2	3	Total
Doubling					
Operators	-	7	7	7	21
Reserve	-	2	2	2	6
Sweeper	-	1	1	1	3
Total	-	10	10	10	30

TABLE K3

FABRIC CONSTRUCTIONS AND PRODUCTION - ETHIOPIAN FABRICS

Serial	Looms alloc.	Sort.	Ref.	Weave	Fibre Warp	Fibre Weft	Warp Count Ne	Weft Count Ne	Ends/cm	Picks/cm	Cloth Width cms	Loom type/ Width	Square metres (Sept. 13/78 - July 7/79)
1	11	poplin	f10	plain	cotton	cotton	24	16	36	16	107	1c/122	175,135
2	15	lining	f11	3/1	cotton	cotton	24	12	23	20	100	1c/122	148,323
3	6	shirting	f14	plain	cotton	cotton	30	24	35	22	105	1c/122	239,882
4	33	twill	a18	3/1	cotton	cotton	30/2	30/2	44	19	112	1c/122	484,456
5	9	gaber	a18s	2/1	cotton	cotton	30/2	30/2	44	17	112	1c/122	20,407
6	9	flannel	f21	plain	cotton	cotton	24	12	22	17	105	1c/163	53,434
7	16	Fr. tw.	d26	dobby	cotton	cotton	16	16	27	15	111	1c/163	373,651
8	12	dobby	d27	dobby	cotton	cotton	24	16	36	19	107	1c/122	39,249
9	11	jeans	j38	3/1	cotton	cotton	9	9	25	16	114	1c/122	259,528
10	3	suiting	pv40	plain	poly/visc	poly/visc	30/2	40/2	28	18	161	1c/163	43,556
11	11	trop. suit	f43	plain	cotton	cotton	30/2	24/2	22	16	160	8 - 4c/163	41,557
	136											3 - 1c/163	
12		sateen	f9	3/1	cotton	cotton	24	12	50	19	73.4		15,209
13		drill	f16	3/1	cotton	cotton	12	12	35	16	109.5		26,064
14		sateen	f20	3/1	cotton	cotton	30	30	37	26	107		7,046
													1,923,637

Notes: 1. Loom allocation changed in May 1979 in line with targets for 1979/80.

2. 66% polyester 34% viscose yarn imported.

3. Ends per cm obtained by dividing total ends by cloth width and result rounded off.

4. Production figures are indicative only.

5. Other production figures:

July 75 to June 76	4,017,790 lin. metres
July 76 to June 77	2,309,392
July 77 to Nov. 77	368,662
Sept. 76 to June 79	1,741,429

6. Weaving Manager's estimate: warp breaks per loom per hour 4 for all sorts except shirting - 5.
weft 2/3 breaks per loom per hour.

TABLE K/4

Pirnwinding - Ethiopian Fabrics

Machinery

Make	Hacoba SSA	Hacoba SSA
Country of Origin	Germany	Germany
Age	1965 (24 yr)	1974 (5 yr)
Number of Machines	12	10
Spindles per Machine	4	4
Total Spindles	48	40
Machine Condition	2	2

Description

Magazine Load

Automatic Pirn Change

Winding Speed 400 m per minute

Efficiency Achieved 62.5%

Spindles per Operative: 20

Annual Output 1978/79: -

Operatives

	Per Shift	Total on 3 Shifts
Winding Operators	6 + 1 General Shift	18
Tube Fillers	3	9
Pirn Strippers	1	3
Pirn Transporters	1	3
Other	1	1
Total	12 1/3	35

Hours of work: 21.5 per day, 129 per week, 6536 per year (1979/80)

TABLE K5

Warping - Ethiopian Fabrics

Machinery	1 - Direct Warper	1 - Direct Warper	1 - Section Warper
Make	Hacoba Type UZN	Benninger Type ZFR	Benninger
Country of Origin	Germany	Switzerland	Switzerland
Age	1973 (6 years)	1967 (12 years)	1964 (15 years)
Creel Capacity	1 - Creel (576 ends)	1 - Creel (57 ends)	1 - Creel (576 ends)
Machine Speeds (m per min)	350	300	400
Output per machine hour	6900 metres	6900 metres	6900 metres
Machine Condition	2	2	2

Yarn on beams: Average - 510 ends; 8300 metres length

Yarn on Cone: Average 53,000 metres

Annual Output (1978/79): 13,000,000 metres (1975/76): 31,800,000 m.

Operatives	Per Shift	Total on 3 Shifts
Beamers	3 + 1 on general shift	9 + 1 on general shift

Hours of work: 21.5 per day, 129 per week, 6536 per year.

TABLE K/6

Sizing - Ethiopian Fabrics

Machines

Make	1 Sucker Type ZTC (1964)	1 Sucker Type DL (1973)
Country of Origin	Germany	Germany
Age	15 years	6 years
Machine Conditions	2	1

Operating Speeds:

9 Ne - 13 metres/min
30/2 Ne - 20 " "
30 Ne - 42 " "

Average length of run: 8,300 metres

Annual Output (1978/79): 1,800,00 metres

Operatives	Per Shift	Total on 3 Shifts
Chief Sizer	1	One general shift only
Sizers	2	
Mechanic	1	
Helpers	4	
	8	

TABLE K/7

Drawing-In Ethiopian Fabrics

Equipment:	3 beam stands for manual drawing. 1 Knotex portable Knotter (Model F2642 A+B 730-410 (1973)) also 1 Uster Knotter damaged and out of use.
Output:	12 beams per week; average ends 3562 per beam.
Operatives:	One shift only - 48 hours per week.
Drawers:	3
Reachers:	3
	6

TABLE K/8

Looms - Ethiopian Fabrics

TYPE	PICANOL	PICANOL	PICANOL	PICANOL	PICANOL
SPECIFICATION					
Country of Origin	Belgium	Belgium	Belgium	Belgium	Belgium
Model	President	President	President	President	President
Age (years)	14	14	6	6	6
Width R.S. (cm)	122	122	163	163	163
No. of Loans	72	24	30	2	8
Speed Picks pm	210	200	180	170	170
Drive (Transmission)	← Motor Pinion →				
Shedding	Tappet	2 - Tappet 22 - Dobby	Tappet	Dobby	Tappet
Boxes	1 x 1	1 x 1	1 x 1	1 x 1	1 x 1
Warp Stop	← Mechanical →				Electrical
Weft Stop	Side	Side	26 Side 4 Centre	Centre	Centre
Let-Off	← Positive →				
Change Feeler	← Loepfe electric →				
Picking	← Under →				
Healds	← Steel →				
Reed	← Fixed →				
Beam Flange dia (cm)	← 71 →				
H.P. of Motor	1.25	1.50	1.75	1.75	1.75
Machine Condition	2	2	2	2	2

TABLE K/9

Weaving Labour - Ethiopian Fabrics

Description	Number per Shift	Total on 3 Shifts
Supervisory	1	3
" (General)	4	4
Foremen	3	9
" (General)	1	1
Overlookers/Fixers	5	15
" (General)	4	4
Weavers	25	75
Spare Weavers	6	18
Battery Fillers	5	15
Cleaners	3	9
" (General)	2	2
Oilers	1	3
Weft Carriers	(Included under pirn staff)	
Cloth Carriers	1	3
Warp Carriers	2	6
Knotting M/C Operatives	1	3
" " (Assistants)	2	6
Others (General)	7	7
	73	183

TABLE K/10

Cloth Inspection - Ethiopian Fabrics

Inspection Tables:	10
Model:	No information
Desciption:	Inclined Tables with illuminated panels; manual pulling-down of fabric. Cloth inspected in both roll and plaited forms.
Weekly length inspected:	No data

Operatives: One shift only - 48 hours per week

Supervisor	1
Piece examiners/repairers	10
Sweepers	2
	13

TABLE K11

FINISHING EQUIPMENT -

Serial No.	Machine	Number	Machine condition	Maker
1	inspection machine	1	2	Muzzi Gessener
2	Inspection machine	1	2	Muzzi Gessener
3	Inspection machine	1	2	Made in Ethiopia
4	Raising machine	1	1	Mario Crosta
5	Shearing and Cropping	1	1/2	Platt Bros
6	Singeing	1	1/2	Louis Julien
7	Singeing	1	1/2	Louis Julien
8	Three bowl padding mangle	1	2	Farmer Norton
9	Automatic dye jiggers	5	2	Farmer Norton
10	Automatic dye jiggers	2	2	Mezzers
11	Caustic soda refrigeration	1	2	Frigerex
12	Chainless mercerizer	1		Benninger
13	Open width counterflow washing	1	2/1.5	Artos
14	Beam piece dyeing machine	1	2	Obermaier
15	Package yarn dyeing machine	1	2	Obermaier
16	Six cylinder vertical dryer	1	2	Farmer Norton
17	Two bowl squeezing mangle	1	2	Farmer Norton
18	Screen printing machine	1	2/3	Stork
19	Hot flue	1	2	Farmer Norton
20	Hot air stenter	1	2	Farmer Norton
21	Stentering and heat-setting	1	1	Artos
22	Three bowl calender	1	1	Farmer Norton
23	Palmer calender	1	1	Farmer Norton
24	Folding and measuring	1	2	Farmer Norton
25	Folding and measuring	1	2	Muzzi Gessener
26	Doubling and measuring	2	2	Muzzi Gessener
27	Baling press	1	2	Farmer Norton

Maximum capcity potential 24,000 wts/day

ETHIOPIAN FABRICS

Origin	Width	Year	Remarks
Italy	1600	1965	
Italy	1300	1965	
	1300	1966	
Italy	1900	1968	
England		1965	
Belgium	1300	1965	with 2 carbonatic burners
Belgium	1800	1973	with 2 carbonatic burners
England	1300	1965	pneumatic pressure
England	1300	1965	
Italy	1600	1968	
Italy		1973	(machine only capable of running
Switzerland	1300	1965	(90 cms cloth - deteriorating (internal rollers and faulty guides
W.Germany	1800	1973	
W Germany		1973	Not in use
W.Germany		1973	horizontal capacity 250 kg
England		1965	vertical capacity 250 kg
England		1965	
Holland	1000	1965	8 colour
England		1968	
England	1300	1965	clip
W.Germany	1800	1973	oil heating pin/clip
England	1300	1965	hydraulic friction swizzing
England	1720	1973	
England		1965	
Italy		1973	
Italy		1968	
Bale weight 130 kg			bale dimensions 104 x 36 x 36 cms

TABLE K/12

FINISHING DEPARTMENT - LABOUR DEPLOYMENT - ETHIOPIAN FABRICS

	FOREMEN/SUPERVISORS	OPERATIVES	ANCILLARY
Grey Room	1	6	-
Singe/Desize		2	-
Mercerising	1	7	-
Intermediate Drying	-	9	-
Pad Mangle	-	2	-
Colour Kitchen	1	9	-
Mangling/Extracting	-	3	-
Printing Machines	1	9	1
Studio/Designers	1	1	-
Stenters	4	12	-
Calenders	-	2	-
Inspection	-	6	-
Make-up	-	15	-
Raising and Shearing	-	3	-
Clerical	-	2	-
Jigger Dyeing	3	12	-
Cont. Washer	-	6	-
Mechanics	-	4	-
Cleaners	-	-	3
Laboratory	-	1	-
Management	3	-	-
	15	113	4

Departmental Total 132

Annual Production	2,400,000 mtrs -Current product
Production Area	3,265 sq. metres
Annual Production/Person Employed	18,180mtrs
Annual Production/Unit Area	735mtrs
Operating Days per Year	304
No of Shifts Operated	2*
Hours Worked Per Shift Per Week	44*

*There are three shifts operating; but only two shifts working in any one week. The factory is therefore capable of reverting to three full shift working when circumstances permit.

ASMARA SWEATER FACTORY

Processes: Knitting and making up of sweaters.

Powered knitting machines: 10. Manual knitting machines: 78,

Sewing machines: 42. Annual output: 156 000 sweaters.

1.0 MACHINE CAPACITY AND PRODUCTIVITY

All sections of this factory are employed on day work of 7½ hours per day excluding meal break. Of the ten powered machines only four are in production, and ten of the 78 manual machines are stopped awaiting spare parts. Thus, the potential capacity of the factory is very much under-utilised.

Like the other Asmara textile plants the sweater factory has experienced many difficulties in recent years, the most serious of which has been and still is the absence of a knitting machine technologist, and a knitted garmet designer. Thus, six of the powered machines (V bed), are unused because there is nobody on the staff with the knowledge and skills necessary to run them. The flat bed Scheller machines are in production but much of what they make cannot be easily sold because the styles are five years out of date, and there is nobody available to adjust the machines to produce new styles. Nor is there a designer available to specify what new styles should be produced.

Most of the manual machines are in production on styles which tend not to sell well; again due to the absence of a designer.

In these circumstances the factory is considerably under-utilised and both machine and labour productivity is, at best, a half of what is attainable.

2.0 BUILDING AND SERVICES

The building is in excellent condition and is well lit and airy. There is no air conditioning system but it is not necessary for the processes carried on. Space is adequate in the production area but not in the finished goods store which is too small for the quantities of stock carried.

Steam is provided by a small oil fired boiler which has been maintained in good condition, viz.:

AHENA fire tube boiler	
Date of manufacture:	1969
Capacity:	700 Kg/hr
Steam consumption:	600 Kg/hr
Fuel:	Oil, 'Total' SG at 60°
Operating pressure:	4 Kg

Process effluent is confined to 200 litres per hour of garment wash water which is discharged into the public drainage system.

3.0 MACHINE CONDITION

When the original owners of the factory departed, all maintenance manuals were removed. In spite of this the machines have been kept in reasonable condition, and have been left stopped where it was recognised that the skills available were inadequate to carry out a competent repair when a repair was required. A major problem has been the lack of spare parts, particularly for the vertical spindle winders. In this case it has been necessary to cannabilise one machine to keep the others running. The make of these machines is unknown for the manufacturer's name plates have been removed from the machines.

All the ten Dubied hand knitting machines which are out of production are stopped for lack of spare parts. Some have been dismantled to provide parts to keep other machines running.

In the sewing section the equipment is generally in good condition except for the Hoffman press. It is in poor condition and should be scrapped.

4.0 WORKING ENVIRONMENT

The working environment is good with no health or safety hazards. Fire precautions are adequate.

5.0 REPAIR AND MAINTENANCE

There are no skilled employees capable of competent repair and maintenance work, i.e. there are no mechanics for any of the production machines, nor is there an electrician. Hence maintenance work is confined to cleaning and oiling the machines, whilst only the simplest repair may be carried out and that by a machine operator.

6.0 QUALITY

The hand knitters work on a piece rate system of payment and there is no effective check upon the quality of their work. Because of this the quality of the sweaters produced is acknowledged to be poor, and compares unfavourably with the standards achieved by hand knitters in the cottage knitting industry.

Poor quality coupled with out of date styles makes the products of the factory uncompetitive with the output of the cottage knitters.

7.0 RECOMMENDATIONS

From what has been written above it will be clear that the Asmara Sweater Factory is operating under difficult conditions which put its viability as a production unit in doubt. Its failure to compete successfully with the cottage knitters has been mentioned, and this is a failure on grounds of styling, quality and price. One result is a growing stock of unsold garments, which in September 1979 had reached 50 000 in number, or the equivalent of four months production.

It is recommended that the N.T.C. should consider whether to continue to keep the Asmara Sweater Factory in operation. If it is decided to do so, then it is suggested that the factory should concentrate on the production of non-fashion sweaters, e.g., roll and v-necked sleeved and sleeveless sweaters in plain knitted fabrics without any radical styling, or decorative patterned knitting. It is felt that the production of patterned fashion sweaters, which involve short runs, is best left to the cottage industry.

There is a market in Ethiopia for a medium quality utilitarian type of sweater that is durable, made from acrylic fibres, and reasonably priced. This is the sort of garment which can be made cheaply on the powered knitting machines already installed. With the right sort of design the sewing component of the garment can be reduced, and with the potential long runs sewing productivity would increase substantially.

Acceptance of this suggestion implies that the labour intensive hand knitting machines will cease production and the machines disposed of to the cottage industry. It also implies the recruitment of at least one skilled knitting machine technologist who is capable of exploiting the full output potential of the powered knitting machines. He should also have sufficient knowledge of design to get the optimum balance between garment design and knitting machine output.

Other technical staff are required also, e.g., a sewing machine mechanic, a knitting machine mechanic, and a general mechanic to maintain the other types of machines installed.

TABLE I/1

WINDING EQUIPMENT - ASMARA SWEATER FACTORY

DOUBLING

1	-	Calvani Ring Dry Doubler	
		Number of spindles	4 all in operation
		Probable age	15 years
		Inside ring diameter	81.5 mm
		Left	260 mm
		Length of ring tube (paper)	300 mm
		Yarn contents	106 Cm

Used to double one end of cotton yarn	Ne	21/1
and one end of acrylic yarn	Nm	24/2

Supply packages cone or large wooden bobbin with conical base.

Installed power	0.37 kW

Machine conditions: 2

WINDING

1	-	HIRSCHBURG Rotary Traverse Drum Winder.	Type FKS
		Number of positions	12 of which 9 available for winding
		Probable age	15/20 years

Hank to cone winding at 205 metres per minute.

Acrylic yarn	Nm	24/2
Hank circumference		1.3 metres

Mechanical slot clears and waxing with locally prepared candle wax.

Output package		Cone centre 180 mm x 70 mm dia.
Cones	Traverse	150 mm
	Large dia;	270 mm
	Small dia.	200 mm
	Net yarn weight	1385 gms

Installed power

Machine conditions: 2

TABLE L/1 (Continued)

4	-	EDCO Vertical Spindle Winder	
		each with 6 spindles	
		Total available spindles	18
		Probable age	15/20 years

Hank to bobbin winding Acrylic yarn Nm 24/2

Mechanical slot clearers and waxing with locally prepared candle wax

Traverse movement progressed by Feeler disc

Output package

Former: Wooden bobbin with conical base and slotted at base end

Length	240 mm
Parallel part	160 mm
Dia: top	38 mm
middle	37 mm
base	78 mm
Net yarn weight	127 gms
Lift	200 mm
Dia. of full package	80 mm
Installed power	0.5 HP = 0.373 kW

Machine condition: 2

7	-	Italian make Verticle Spindle Winder	
		each with 12 spindles	
		1 machine unserviceable owing to lack of spares.	
		Total available spindles	54 (out of 84)
		Probable age	15/20 years

Hank to bobbin winding Acrylic yarn Nm 24/2

Mechanical slot clearers and waxing with locally prepared candle wax.

Traverse movement progressed by Feeler disc

Output package As for EDCO winder

Winding speed	65 metres per minute
Installed power	0.5 HP = 0.373 kW

Machine condition: 4

TABLE L/1 (Continued)

1	-	Schweiter Drum Winder Type MC 660/63	
		Reciprocating traverse.	
		Number of Winding positions 12 of which 9 available for winding.	
		Probable age	15/20 years

Hank to cone winding at 265 metres per minute

Slot clearers and waxing

Acrylic yarn Nm 24/2

Output package

Cones:	Traverse	160 mm
	Large dia	220 mm
	Small dia	145 mm
	Net yarn weight	904 gms

Installed power 1.5 HP = 1.12 kW

Machine condition: 2

TABLE 1/2

KNITTING MACHINES - ASMARA SWEATER FACTORY

Powered Machines								
Type of machine	V bed	V bed	V bed	V bed	V bed	Flat bed	Flat bed	Flat bed
Make	Calvani	Calvani	Protti	Universal	Universal	Scheller	Scheller	Scheller
Model	Patter Z.C.Z.	APE	P457 T/A	MC I	Suprafix SG	BS	BFS	BS
Number of machines	1	1	1	2	1	2	1	1
Age	1970	1970	1970			1970	1972	1970
Gauge						21gg	12gg	21gg
Width	12/200cms	8/183cms	12/183cms	14/183cms	12/40cms	32"/4	36"/4	32"/4
Courses per minute						70	60	70
						1- Polyester 1- Polyester or Acrylic	Acrylic Yarn only	Polyester Yarn only
Production						20 - 25 Adult garments or 30 - 35 Child's garments per shift		
Use	Idle	Idle	Idle	Idle	Idle	Operating	Operating	Operating
Installed kw	Unknown	Unknown	0.4kw	0.44kw	0.45kw	3kw DC*	2.7kw DC*	4kw DC*
Manual Machines								
Type of machine	V bed	V bed	V bed	V bed	V bed	V bed	V bed	V bed
Make	Dubied	Dubied	Dubied	Dubied	Dubied	Dubied	Dubied	Dubied
Model	free standing	Fs.	Fs.	Fs.	Fs.	Fs.	Fs.	Fs.
Number of machines	1	6	1	13	28	4	19	6
Age	20 Years	20 years	20 years	20 years	20 years	20 years	25 years	20 years
Gauge (Needle size)	3	5	8	8	10	12	12	14
Width	100cms	100cms	90cms	100cms	100cms	90cms	100cms	100cms
Courses per minute	80 - 120	80 - 120	80 - 120	80 - 120	80 - 120	80 - 120	80 - 120	80 - 120
Production	Patterned - 3 to 5 garments per shift				Plain 10 to 20 Adult garments or 15 Child's garments per shift			
Use	Most are in operation							

* Note above: Each machines fitted with converter each marked 4.75 and 5.7kw.

TABLE I/3

SEWING EQUIPMENT - ASMARA SWEATER FACTORY

Type	No.	Maker	Model	Age	Condition
Single needle lockstitch	4	Platt	134/0/6	12 yrs	2
"	1	Necchi		9 yrs	2
Overlock	1	Rimoldi	153-00-03	8 yrs	2
Chainstitch	8	Rimoldi	163-10-12	9 yrs	2
F.O.A.Felling	8	Rimoldi		11 yrs	2
Button holers	2	Durkopp	551-202	7 yrs	1
Button sewers	2	Durkopp	566-104	7 yrs	1
Embroidery machine	1	Zang	7000	7 yrs	1
Circular stitching	14	Exacta		9 yrs	1
Label sewer	1	Lewis	160-20	9 yrs	1
Cutting tables	2				
Hoffman press	1	Braithwaite			4
Electric press	7	Monti	103/NF/5504	7 yrs	1

TABLE I/4

PRODUCTION EMPLOYEES - ASMARA SWEATER FACTORY

Winding Section

Hours of work:	per day	7.5
	per week	45
	per year	2280
Operatives		
Chargehand:		1
Winders/Doublers:		13
	Total	14

Knitting Section

Hours of work:	as for winding	
Staff and Operatives		
Technical Supervisor		1
Knitting Supervisor		1
Knitting Foreman		3
Knitters powered machines		10
Knitters manual machines		70
Cleaners		3
		88

Sewing Section

Hours per work:	as for winding	
Staff and Operatives		
Supervisors		6
Cutting room		14
Sewing machinists		52
Service operatives		44
Inspectors and trimmers		11
Press operators		9
Others		2
	Total	138
Folding and packing		4
Warehouse and despatch		5
Total production employees:		249

TABLE I/5

PRODUCTION - ASMARA SWEATER FACTORY

(For period 5.9.78 - 7.6.79.)

YARN CONSUMPTION

Nm 24/2 Acrylic	25,136 kg.
135/3 den. Polyester	2,049 kg.
Palanza wool 24s, 12/2, 48/2.)) Shetland wool 15/2)	1,899 kg.

PRODUCTION

Men's, women's, children's sweaters :	117,100
Average weight per garment:	250 grms.

Approximate hours of work during the period: 1800

Shirley Institute

10356
(4 of 6)

Client Report

CONFIDENTIAL

SECTOR STUDY OF THE ETHIOPIAN TEXTILE INDUSTRY

FINAL REPORT

VOLUME TWO
PART 111 OF THREE PARTS

U.N.I.D.O. Contract No. 79/61
Project No. DP/ETH/78/006
Activity Code 317

February 1981

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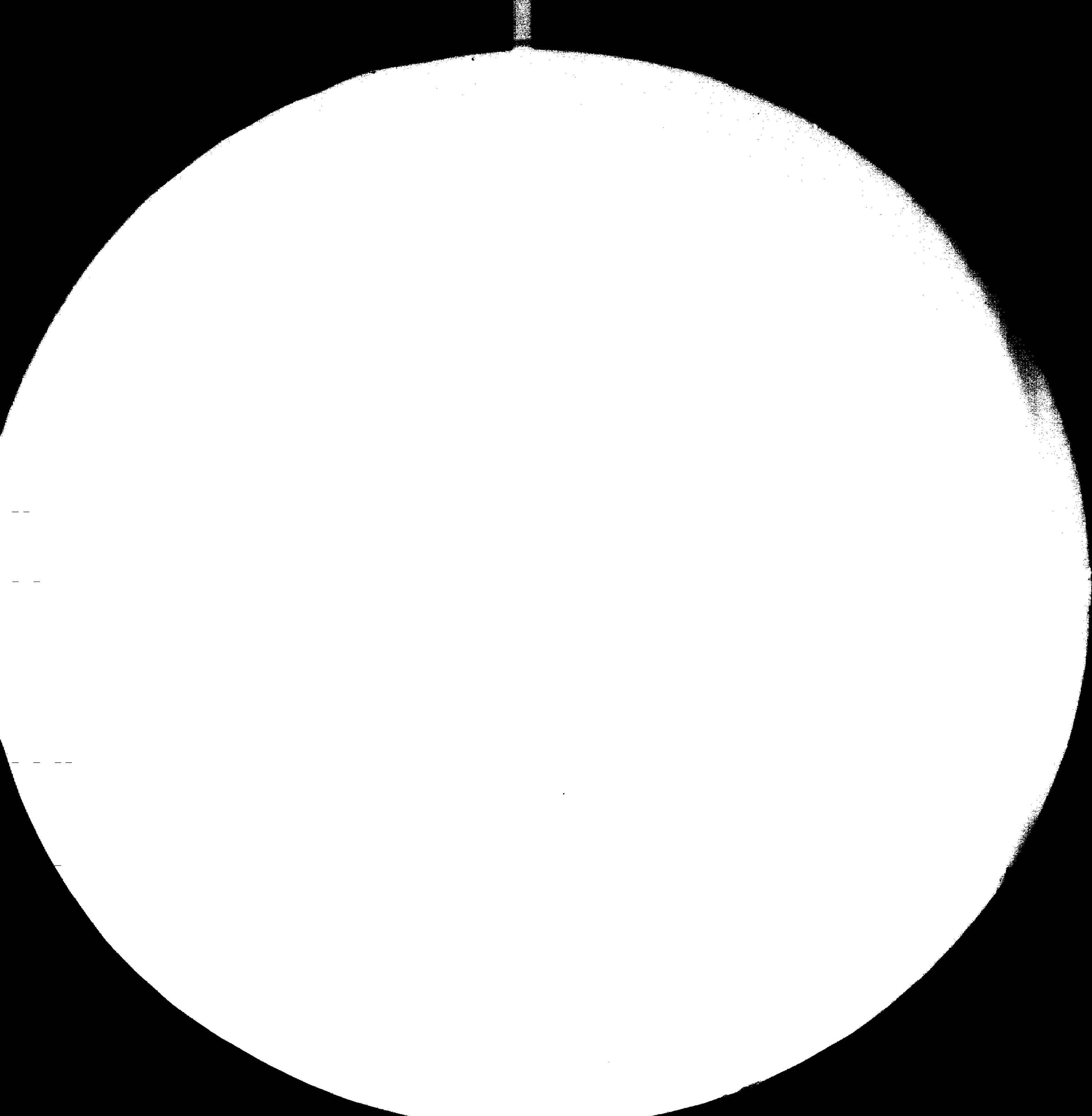
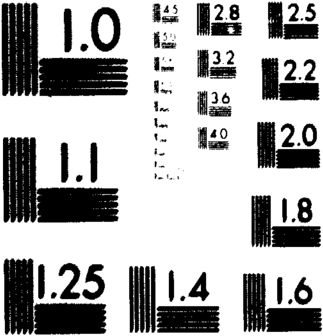
VOLUME TWO

PART III

CONTENTS





MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS 1963 A

BAHR DAR TEXTILE MILLS

Processes: Spinning; Weaving; Dyeing; Printing; Finishing

Spindles: 20000 Looms: 408 Annual production: 19 million m^2

1.0 MACHINE CAPACITY AND PRODUCTIVITY

1.1 Spinning

1.1.1 Blow-room

Two Marzoli opening and cleaning lines, manufactured in 1961 have a combined capacity of 609 Kg/hr. This capacity corresponds to a surplus of 60 Kg/hr more than is required if the ringframes are to be fully occupied in their present mode of operation, and all the spinning machinery; cards, draw-frames etc are to remain in balance. During our visit however, management advised us of their request to NTC to purchase a more modern pair of lines from Marzoli. The main justification for this new machinery is that the existing machines are obsolete, which added to the difficulty obtaining spare parts, makes the machines uneconomic to operate.

We do not concur with this suggestion. Rehabilitation and maintenance of the existing opening line is probably well within the capacity of the engineering workshops on the site and is certainly so if augmented by facilities elsewhere in Bahr Dar or Addis Ababa.

Present blow-room practice is to use three blends; coded red, for 21's (mill use), 28's and 34's Ne yarn; green, for 9s and 16's Ne yarn and, blue for 10's, 16's, and 21's Ne (market) yarn. From the questionnaire we deduce that very roughly 100 - 120 Kg/hr of blue, 170-220 Kg/hr of red and 240 - 280 Kg/hr of green are mixed. Thus each blend can be mixed for a single, double-scutcher opening and cleaning line, but the green blend can be seen to be approaching its limiting capacity. However, a further reserve can be built into this line by producing coarser laps (16 ounces, 454 grains per yard) and coarser sliver at the cards and drawframes (say 0.13 Ne). There is therefore no need for additional blow-room capacity.

This does not mean that the mill lacks opportunity to increase its output. With $2^{1}/8$ ins diam. rings we believe it is possible to run the spindles spinning the finer counts more quickly and that an additional 42 Kg/hr of spun yarn is possible with existing facilities.

Table A below, summarizes the existing and proposed departmental capacities.

TABLE A. Departmental Capacities (Kg/hr). Bahr Dar.

Department	Capacity on a departmental basis		Requirements for a balanced plant	
	Current	Proposed	Current	Proposed
Blow-room	609	609	549	598
Cards	639	639	522	569
Drawframes	683	683	500	546
Roving frames	760	760	496	541
Ringframes	471	513	471	513

1.1.2 Carding, Drawframes and Roving Frames

Of the three categories of machine considered in this group only cards can be considered to be operating near to their maximum capacity. In view of the Spinning Master's expressed belief that he can increase the output from the cards by 50% without any loss in quality, then even this category can be seen to be relatively under-utilised. However, this statement could, no doubt, only be justified after fibre quality has improved. At present picking at the farms tends to be carried out to varying standards and there is often an exceptional amount of dirt and trash in the fibre. Dry storage is often an additional problem. Once the quality of the fibre improves to its pre-1975 level, then the cards can be expected to perform with an adequate margin for contingencies.

Modern drawframes are able to operate at speeds well in excess of the 200 metres/min being used at the Bahr Dar mill. Allowing for the difficulties associated with the raw fibre which have already been discussed above, a speed of 270 metres/min is the minimum we would expect with the latest models. Such a speed would then increase the production capacity of this department by roughly 30% after allowing some slight adjustment in overall operating efficiency.

The roving frames too are operating well within their design limits and can be expected to meet the demand for roving under any foreseeable conditions. Table A illustrates the extent of the surplus capacity which exists in this department, so with five frames apparently in storage the mill has no worries in this department for some time to come. However, it is obviously an undesirable situation to allow capital to remain inert, so we have examined the other mills using Marzoli roving frames to see if any outlet exists there. Similar units are installed in Adei Abeba, Asmara Textile Mills, and Idget, but in none of these mills is there a shortage of roving capacity. We therefore reluctantly conclude that they should remain in storage for the moment.

1.1.3 Ringframes

In our discussion of the blow-room machinery we stated our belief that the ringframes are able to produce a greater output than they are presently doing. This statement is based on the following two assumptions:

(a) The ringframes are equipped with 2 1/8 ins. diameter rings. In our opinion Bahr Dar do not obtain the maximum advantage from their finer count rings; the extent of this deficit being illustrated in Table B below.

TABLE B. Calculated Actual and Proposed (Shirley) spindle speeds (r.p.m.)

Count Ne	Actual Speed	Proposed Speed
34	10430	11300
28	9615	11300
21	8720	10100
16	8110	10000
13	7670	7500
10	7080	5800
9	6470	4800

This is not to say that these proposed speeds can be achieved overnight. Necessary pre-requisites are the improved quality of fibre already discussed, more suitable processing parameters in the preparatory stages, especially with regard to counts, and the improvement in maintenance and quality control which we anticipated once the recently introduced procedures become accepted practice throughout the mill.

(b) With careful selection of fibre at the blending stage, then more accurate control of twist variation and machine settings necessary to give stronger and more regular yarns is readily achieved.

There is obviously some overlap or interaction between both (a) and (b) above, but the nett result should be that output from the ring-room should increase from its present 471 Kg/hr to 513 Kg/hr.

1.1.4 Reeling, winding and twisting

In the financial year 1978/9 Bahr Dar produced 815.2 tonnes of sales yarn. Assuming half this weight was 10's Ne yarn and the other half was distributed evenly betwem 16's and 21's Ne yarn, then the existing reelers have a spare capacity of 20%, based on an overall operating efficiency of between 45 and 50%. If the mill is to produce at the rate of 559 Kg/hr then additional reeling capacity is required and this we believe should be obtained from one of the other mills in Ethiopia.

One side of the Savio winder is used as an assembly winder for the doubled yarns. The other half and the remainder of the machines are employed simply cone winding the yarn prior to weaving preparation. Cone winding speeds at the mill are by modern standards slow, and should easily be increased providing the machines are maintained correctly. We do not believe that the present quality of the yarn is so poor as to justify this slow speed, rather that the present speed is selected in order to fully utilise the plant. Consequently there is at present adequate winding facilities to match any foreseeable demand.

The Barmag twister is incongruous amongst the other machinery at Bahr Dar; it is a modern, relatively high technology unit whereas the other machinery is more mundane. This in itself is not a criticism but diversification by mills from a range of utility products into higher quality goods in order to achieve a broader market base is, we believe, unnecessary in Ethiopia and counter-productive. Greater specialisation must be to the industry's advantage when it off-sets the disadvantages of a low level of literacy, poor technical education, and an overstretched management work-force. If on the other hand a policy of diversification is followed in order to achieve greater profitability; then it is the pricing structure, over which NTC has considerable control, to which the manufacturing firms should turn for respite - not the markets. We therefore recommend that Bahr Dar ceases doubling and twisting yarns, and that the Barmag machine be installed at Dire Dawa whenever it is needed there.

1.2 Weaving Preparation and Weaving

1.2.1 Preparation machinery

The production capacity of the weaving preparation department is in balance with weaving requirements, but only just. Sizing is the critical area. Of the three machines two Muzzi sizers, 17 and 19 years old, are in need of extensive overhaul. Their operating speeds are slow at 20m per minute and the combined output of all three machines is only just sufficient to satisfy the warp needs of the looms. Loom efficiency is 70% which

leaves room for improvement, which it achieved would mean that the present sizing capacity would be inadequate. It is recommended that a fourth sizing machine be installed at an estimated cost of US $ 250000.
This would allow time for the two old machines to be completely overhauled, thus extending their working life and providing the extra sizing capacity needed for increased weaving output.

The pirn winding speeds are slow at 200 m/min. At present they are able to satisfy the weft consumption requirements of weaving but increased speeds of up to 300 m/min will become necessary with improved weaving efficiency. The pirn winders are capable of this increase.

1.2.2 Weaving

234 of the looms are non-automatic, i.e. manual pirn change, whilst the remaining 174 are automatics of which 52 are fitted with Unifil. Overall loom efficiency is 70% which is considered to be low. With these looms and the types of fabrics in production an efficiency of 83-85% should be expected.

All the looms were originally automatics but the pirn change mechanisms were removed from the 360 Galileos because the loom mechanics had difficulty in maintaining the mechanical pirn changing feeler and its linkage to the battery. The battery has been restored on 74 looms but a Loepfe photo-cell change detector is now used in place of the original mechanical feeler. This eases the task of the loom mechanic in maintaining the change mechanism in running condition. Unfortunately the Loepfe device costs US $ 500 per loom and cannot be fitted to the remaining looms until funds are available. An alternative is an electric pirn feeler which can be fitted at an approximate cost of US $ 50-100 per loom. This feeler requires a pirn with a metal sleeve on the butt and is slightly more expensive than the normal wooden pirn in current use. It is suggested that the management consider the feasibility of this proposal, and possibly convert a small number of looms as a trial. The restoration of the looms to their automatic state will bring an improvement in efficiency of up to 6% depending upon the coarseness of the weft, i.e. the coarser the weft the greater the improvement in efficiency.

Warp beam changes occur at the rate of 420 per week, or roughly one per loom per week. This can result in a loom stop lasting several hours if the new beam is not immediately available or the knotting machine to attach it to the old warp. Weavers beams are in short supply and this may lead to delays in the supply of warps. The number of knotting machine operators is low and it is suspected that they may be overloaded in coping with 420 warp changes per week. It is recommended that, the down-time at warp changes be investigated to locate any cause of avoidable lost time. This could amount to half a shift per loom per week.

1.3 Finishing

Within its limitations the unit appears to be an efficient and well organised operation, producing finished fabrics to reasonable standard with an efficiency in terms of labour and occupation - above that of other comparable units.

Whilst the department is well run and shows good productivity results; this situation will not hold for the future if certain key areas do not receive some attention, or if quality demand standards are increased:

Consideration should be given to the refurbishing /replacement of certain items of equipment - see accompanying notes.

In the face of continuing problems concerning printed goods-expert advice should be sought from the main colour supplying companies.

Several items of equipment were stated to be in poor condition on account of the shortage of spare parts. It is probable that this situation arises not from a shortage of spares; but rather from the lead time required for the delivery of such spares, and the fact that insufficient foresight had been exercised in identifying parts that were most likely to wear/fail with the passage of time. A maintenance scheme which identified the likely call for spares -

would have much to recommend for itself.

Provision should be made for the acquisition of intermediate drying facilities.

The pad-jig dye systems in use cause a relatively high percentage of seconds. In considering remedial action, serious consideration should be given to providing continuous equipment, both for dyeing and preparation.

Production delays are experienced due to malfunctioning of the Artos Stenter. Since this situation has existed for sometime, an Artos Engineer should be brought in to diagnose and rectify the faults.

Production delays are also occasioned by the shortage of batching rollers. The fuller utilisation of these by optimising the batch/order size should be examined and provision made for the acquisition of additional units if still required.

Lighter weight fabrics are prepared by the 'all in' desize and bleaching method. Heavier and higher quality goods are similarly treated and subsequently scoured and bleached on the jig machines - even so, it would be our opinion that such a preparation system is inadequate for prints and goods to be continuously dyed, particularly in the event of quality becoming a more dominant factor. To this extent, there is an imbalance in production capacity - in that there is no continuous preparation, or intermediate drying facility.

2.0 BUILDING AND BUILDING SERVICES

2.1 Buildings

The fabric of the buildings is in good condition but it suffers from the lack of under-drawn ceilings. Some attempt has been made in weaving to ameliorate the adverse conditions that result, by making a false ceiling from fabric. It is not wholly satisfactory. This point is dealt with more fully under the comments on air conditioning given below.

2.2 Storage Facilities

Generally, these are well sited and eminently suited to their purpose. Control proceedings appeared to be adequate.

2.3 Fire Precautions

The site facilities for fire-fighting are very good. So much so that they would provide a suitable model for other units within the NTC organization. Basically these consist of:

(a) Central, automatic fire alarm system which signals the zone in which a fire outbreak has occurred.

(b) A central fire fighting unit with mobile equipment and trained staff available, affording 24 hour coverage.

(c) Provision of immediate fire fighting equipment to hand in each department.

Whilst the latter were in evidence within departments, the siting and concentration of these relative to higher risk activities could perhaps be improved.

2.4 Effluent Disposal

Processing effluent was discharged direct - down stream, to the Blue Nile River. As far as could be ascertained, there is no legislation restricting discharge, in respect of either quality or volume.

2.5 Steam Generation

The basic plant is housed in excellent, purpose built premises and appears to be very well maintained. The plant consists of:

1.	Eclipse Scorch Boiler.	Oil fired (No.6 oil fuel). Max working pressure 125 lb/sq, ins. Input 4 200 000 BTLU/Hr. Date of manufacture-1976. Capacity 100 H.P. This unit provides steam supply to the West Point Sizing Machine Only.
1.	Wanson Steam Block Boiler.	Oil fired (No.6 oil fuel). Type 400. Date of manufacture-1967. Capacity 400 Kg/hr Rating 300 H.P. - 2 560 000 Cals/hr.
4.	Mascarini Electric Boilers	Type 800- date of manufacture-1961. Operating pressure 16 Kg/cm^2. Input Energy 1250 KN @ 380 Volts. Dry steam system operating @ 190^{o}C. Incoming hot water temperature - 167^{o}C. Outgoing hot water temperature - 187^{o}C Utilisation - 2860 000 Kg steam/month

Of the four units three are in use, the fourth is in the maintenance care and is available as a spare unit.

2.6 Water Supply

Water is abstracted from the Blue Nile River at a rate of approximately 1750 m^3 per day, of this, 600 m^3 is consumed in the Finishing Department after filtering and chemically softening. The water processing equipment is in good condition with adequate storage facilities. There was no report that water supply was a hinderance to production at anytime of the year.

2.7 Electricity Supply

Power is supplied to the factory from the hydro-electric power station on the Blue Nile River. During the dry season between March and June the water level goes down and there is a reduction in the power generated. Thus, power supplied to the factory is reduced and some machines are stopped in consequence. For example, of the three electric boilers in normal use two are shut down for about three months when the power supply is reduced. This situation is clearly a constraint on any plans for mill expansion.

2.8 Air Conditioning

Full air conditioning systems with automatic control are installed in the ring-room and the Ruti loom weaving shed. Both systems are reportedly running correctly and the evidence of the control charts is that they are functioning perfectly. The large weaving shed equipped with Galileo looms has a partial air-conditioning system augmented with humidifier water sprays to provide the desired humidity. These sprays are manually controlled (switched on and off) but fail to give controlled conditions. The systems are manufactured by Hall and Kay.

We believe it is a desirable feature to have fully controlled air-conditioning equipment installed in Ethiopian mills in order to protect the workforce from the debilitating effects of textile environments (thereby helping to overcome the high levels of absenteeism) and to provide stable working conditions so as to minimise the amount of machinery adjustment necessary to ensure high machine productivity.

Given these objectives, then there is little advantuge on either account to installing new air-conditioning plants for the drawframes and roving frames alone, as suggested by the Bahr Dar management. Of the work areas yet to be air-conditioned, the worst from a health hazard point of view, both in terms of the level of airborne dust, and the number working in the area; are the mixing room and the card room. Thus we recommend the installation of full air-conditioning throughout the spinning and weaving departments of the mill.

Based on the following areas and volumes for each department, we estimate the cost for the new air-conditioning equipment to be US $ 550 000;

Department	Area (m^2)	Volume (m^3)
Opening and cleaning	1920	13340
Carding	1296	9072
Drawing	700	4900
Roving	500	3500
Winding (cone)	880	6160
Winding (pirn)	400	2800
Weaving (Galileo)	3900	27300

However, the building at Bahr Dar has a relatively high pitched roof so in addition to the above cost we believe it is necessary for the mill to build under-drawn (or false) ceilings. These will need to be carefully selected in order to avoid the dew-point falling inside the working areas causing, as it does at present, the formation of drops of condensation which the fabric sheets do little to alleviate. The construction of the ceiling will also depend on the availability of materials and upon the strength of the present roof structure, but a reasonable estimate of the cost of such a ceiling is US $ 280 000.

3.0 MACHINERY CONDITION

3.1 Spinning

In one important aspect the condition of the machinery at Bahr Dar was different to that in other mills in Ethiopia. The mill has recently introduced a number of maintenance schedules and management control systems, the benefits of which are manifested partly in the generally high rating (1 and 2) of the machines' condition. The spinning machinery is expected to offer a reliable and satisfactory performance for the rest of the decade. Nonetheless, during our visit we found ample evidence of poor attention to detail in maintenance work which does not threaten the reliability of the machines so much as their ability to perform to a satisfactory standard of quality and at an economic operating efficiency. It should be remembered that the present apparently satisfactory operating efficiencies are achieved in departments running machines at relatively slow speeds. (See the discussion on machine capacity above). Thus the assisted rehabilitation programmes we have recommended in most other mills form no part of our recommendations to Bahr Dar.

3.1.1 Spinning preparation

Opening and cleaning machinery is for the most part relatively simple to maintain. Only the control sequences providing the 'single process' facility is likely to raise problems and there is no evidence to suggest that this is the case at Bahr Dar. We therefore believe that the difficulties the company is reported to experience with spare parts for the opening and cleaning line reflect communication and transportation conditions in Ethiopia rather than the obsolescence of the machinery. Similar difficulties were reported on spare parts for the Crosrol cards and they are only three years old. Twenty years is not an exceptional period over which to operate blow-room machinery, and we have no hesitation in recommending its use for a further 10 years.

Both the cards and drawframes were in good condition; some 36 of the cards having new wire recently ordered for them and this should complete the refurnishing of the set. The old Marzoli MH drawframes are obsolete but already withdrawn from service leaving the modern S 20's to handle all the production. The drawframes were in good condition and should easily last for a further 10 years.

3.1.2 Spinning

Machinery was functioning satisfactorily if slowly, but it was common to find patrolling cleaners fitted with their nozzles wrongly aligned, drafting rollers running skew, lappets mounted eccentrically, the spacing of drafting rollers varying on the same frame, scored and pitted drafting rollers; all of which makes the achievement of high machine productivity and a satisfactory yarn performance in weaving impossible. Management therefore needs to impose more diligent supervision before re-equipping the roving and spinning frames with new rings, drafting rollers, aprons, lappets etc. After which the mill is expected to achieve an improvement in its productivity. It is wrong to believe that rectifying these faults will raise the rate of production to the 513 Kg/hr mentioned earlier; it will not. But unless these faults are substantially reduced Bahr Dar has no hope of achieving the improved yarn regularity and strength necessary to spin at speeds we have indicated in Table B above. We estimate the cost of spare parts to refurbish the machinery in this section to be roughly US $ 400 000.

3.1.3 Post spinning machinery

Reeling machines are eas'ly maintained machines, and should the mill eventually experience some diffic ..y obtaining spare parts then we are confident that they can be manufactured and supplied from within the country.

As in the case with the ringframes, the winders show considerable evidence of not being set correctly and consequently failing to produce good quality yarn for the weaving department. Research in India has shown that the reduction in warp breaks in some fabrics is as much as 40% arising from an increase of only 8% in the winding breaks. These figures are exceptional but they are indicative of the advantages in terms of increased weaving efficiencies which are available to mills which set their machinery correctly. At Bahr Dar, however, the comb slub catchers and mechanical clearers were not set consistently, and tensioning devices were also set variably. Our rating of 3 was therefore too slow to allow the firm to refurbish its winders with new tensioning, guide, mechanical clearing and other similar devices. We estimate the cost of parts to do this to be roughly US $ 35 000.

Our view of the Barmag twister has already been made clear in the section dealing with machine capacity.

3.2 Weaving Preparation and Weaving

3.2.1 Weaving preparation

The pirn winding machines are in reasonable condition with some occasionally out of action awaiting spare parts. They have been given the low rating of 3. This is because of their need of modification to enable them to produce pirns with a reserve bunch. A number of frames have already been so modified. If the programme of restoring the automatic pirn changing mechanisms on the looms is to continue then the pirn winding modification is a pre-requisite. The estimated cost is US $ 30 000.

In the sizing department the fairly new West Point machine is in excellent condition but there are problems with its electronic control instrument. This is due to the inability of the mill's electrician to cope with sophisticated electronics. A suitable expert should be brought in to repair the instrument and to give the electrician some basic instruction in its day-to-day maintenance and adjustment.

The two Muzzi machines are in need of a major overhaul which cannot be undertaken because there is no spare sizing capacity. All three machines in the department are working overtime to keep up with the needs of weaving. It is recommended elsewhere in this report that a new machine be installed to give the spare capacity needed. If this is not done within the next 18 months, the delays to the overhaul of the Muzzi machine must inevitably lead to their increasingly rapid deterioration.

Also in the sizing department the two wooden size kettles with their home-made stirrers are leaking. They should be replaced with a modern size-cooking installation at an estimated cost of US $ 10 000.

The warping machines have been given a rating of 2. They are in need of attention to their brakes and should be fitted with adequate stop mechanisms. These two deficiencies are causing missing ends in the beams which lead to stops in sizing and in weaving and to faulty cloth. The cost of the parts required is estimated at US $ 7 000.

3.2.2 Looms

48 of the 408 looms are modern Ruti and 360 are 18 years old Galileo. The Ruti are in excellent condition for which they have been given a rating of 1. The older Galileo looms are in reasonable condition for their age, and

provided spare parts are available they should give useful service for a further five years or more. Comment has been made under section 1.2.2 above upon the pirn changing mechanisms fitted to the looms. The condition of the non-automatic looms is good enough to justify the mill's policy of restoring their automatic pirn changing mechanisms. Using the Loepfe photo-cell weft detectors the estimated cost of restoration of the remaining 234 non-automatic looms is US $ 120 000. If simpler electrical weft change detectors can be used instead of the Loepfe device, the cost of the conversion will be reduced to US $ 12 000 - US $ 25 000, depending upon the cost of the parts required.

52 of the Galileo looms are fitted with Unifil loom pirn-winders. As a weft supply system they are completely uneconomic in developing countries with low labour costs. They also impose heavy demands upon maintenance resources. It is strongly recommended that no further Unifils should be purchased.

3.3 Finishing

The main plant was commissioned in 1962 - with additional equipment being added at later dates. Considering its age, the equipment with some exceptions, is in good condition, indicating that a reasonable standard of maintenance has been the practice over these years.

Certain items of equipment are in urgent need of attention if future production is not to be jeopardized. In our opinion, these are:

(i) Hot Flue Range

Heat circulation fans do not function properly - resulting in low efficiency running.

(ii) Mercerizing Range

The machine is prone to constant break-downs when run at recommended speeds.

(iii) No. 1 Stenter-Camerio Bricole

It was reported that owing to excessive wear of parts - the machine is constantly breaking down and production lost.

(iv) Washing Range

Again, constant break-downs owing to wear and tear - and the difficulty of obtaining/holding sufficient spare parts.

(v) Bleaching Range

It was noted that this unit had only two reaction chambers available. Further enquiry should be made to quantify the improved quality of preparation and bleaching afforded by the acquisition of further chambers.

Serious consideration should be given to the refurbishing/replacement of above equipment if production is to be maintained at current levels in the immediate succeeding years.

4.0 WORKING ENVIRONMENT

4.1 Health and Safety

Spinning and weaving

The machines are well spaced, and floors are maintained in good condition. All machines are guarded, eliminating most of the machinery hazards.

Finishing

Where machine guards have been provided these are in position and have been maintained over the years. There are however, several examples where these were not provided and have remained so ever since.

Whilst there does not appear to be legislation covering such matters, it would be in managements self enlightened interests to improve on the situation - where such omissions exist.

4.2 Working Environment

Spinning

Inadequate dust control in spinning is probably a contribution factor in the high incidence of sickness due to chest complaints. An average of 8% of employees are off sick leading to insufficient labour to run all the machines. As many as 15% of spindles can be stopped for lack of labour.

Weaving

The lighting conditions are seriously impaired by the fact that 25% of fluorescent tubes are missing - the provision of adequate lighting is essential, not only for safety, but for the maintenance of quality standards.

Atmospheric dust would appear to be a problem in the department, casting some doubt on the efficiency of the ventillation and air-conditioning systems. This is further confirmed on enquiry - when it was revealed that a considerable number of workers are affected by Asthmatic sicknesses. In weaving preparation, weaving and Grey-room, it was claimed that one hundred people are off sick each day - and a further 65 persons on light duties, mainly because of asthma related sickness.

A positive step to reduce the incidence of this sickness, would be to provide face masks and educational talks by the medical staff on the necessity of wearing these.

Similarly the provision of ear-plugs would be beneficial in avoiding permanent ear-damage to persons working in the weaving sheds.

5.0 MAINTENANCE

Scheduled maintenance programmes for the opening and cleaning lines, cards, looms and finishing department machinery, are already in existence. Though in all instances they are not complete, they do illustrate how much further towards implementing a regular maintenance programme the mill at Bahr Dar has progressed when it is compared with other mills in Ethiopia. Unfortunately, the existence of these schedules is in itself insufficient to ensure the reliable operation of the machines. We know that the looms, for example, at the time of the visit were not receiving regular maintenance checks in accordance with the programme; the explanation for this failure is that insufficient qualified staff are available.

However, the mill clearly knows the frequency with which it needs to withdraw some of its machines from service and we have every reason to believe this policy will soon be expanded to encompass all the necessary machinery.

The frequency at which critical parts of the machines need to be checked are listed for each of the blowing-room machines, the cards, the finishing machines and the looms. In the case of the latter, an additional inspection sheet has been drawn up which enables the overlooker to enter the option of:

— finding to be in order
— adjusting or re-setting a part
— replacing a part.

A sheet for each machine inspected is issued on the day of the inspection and the overlooker completes the checks listed on it and records whichever of the three actions is taken. However, there is no record kept of the cost of any action, so as is the case in other mills in Ethiopia, the management at Bahr Dar is unable to bring to bear on their machine replacement decision making any feeling for economic obsolescence.

One hundred and seventy people make up the maintenance labour force at the mill, and this figure excludes mechanics and maintenance workers attached to the production departments. The number is consistent with our expectations for mills in Ethiopia which are adequately staffed.

6.0 PRODUCT QUALITY

6.1 Spinning

When discussing the condition of the machinery, we draw attention to the inconsistent machine settings which have been recorded during the visit. Under these conditions the quality of the yarn cannot be good. The management and quality control staff with whom we discussed the matter confirmed that this was indeed the case; the quality is poor. The Process Quality Sheet for the fortnight 1.8.79 illustrates the situation, and some of the returns are recorded in Table C below. They show that in all spinning departments the quality of the fibre, web, sliver, yarn etc is worse than the mill's standard except in end-breakage rate and yarn strength.

Success in these factors is however being bought expensively. The twist inserted into the yarn ranges from 99% of the standard to 123% with an average of 109% and of course the strength is achieved partly by this additional twist and partly as a result of using better quality cotton (in terms of basic physical properties) than the range of counts spun in the mill would normally warrant.

TABLE C Quality Control Parameters. Bahr Dar

Parameter		Standard	Actual
Lap variation		3%	5.3%
Nep count:	Green mix	19	22
	Red mix	16	52
	Blue mix	23	31
	Tandem red mix	10	—
Simplex Breaks/1000 spindle hours		—	—
Ringframe Breaks/1000 spindle hours		120	108
Lea Strength	16's Ne	75.0 Kg	70.9 Kg
	21's Ne	55.0 Kg	55.1 Kg
	28's Ne	40.0 Kg	40.6 Kg
	34's Ne	35.0 Kg	33.5 Kg
Lea Strength CV%	16's Me	—	9.6
	21's Ne	—	7.8
	28's Ne	—	9.2
	34's Ne	—	16.0

The standards for the lea strength correspond to LSCP values of 2500 and above, which should provide very good yarn performance in weaving. The warp breakage rate in weaving however, suggests that this performance is not achieved and consequently the conclusion must be drawn that the average strength may be acceptable but the regularity of the yarn is such that the variation in strength which would be expected on a single thread tester is much higher than even the lea strength CV% figures in Table C suggest.

The mill's Quality Control Department is currently equipped with:

- Lea strength tester
- Warp wheel
- Twist tester
- Taper Black-board
- Single thread tester (not working)
- Uster Evenness Tester
- Scales etc.

One particular project which the mills Q-C department has just commenced in the Amharic translation from English of the causes of common yarn faults. This information sheet is the first step in the textile education of the work-force and is absolutely essential if this and other mills in Ethiopia are to eventually reach quality standards good enough to displace some imported products.

6.2 Weaving

The general level of cloth quality produced at Bahr Dar is poor but not signficantly below the level achieved in several of the N.T.C. weaving mills. Cloth woven on the automatic looms, and especially the Ruti, is better than that woven on the non-automatics. It contains fewer broken picks and starting places, faults which are associated with the frequent stops for shuttle changing on the non-automatics.

Warp breaks giving cloth faults are frequent and the chief cause is poor and irregular yarn. Clearance at cone-winding is minimal, hence many slubs get through into the warp and cause warp breaks in weaving.

There is a lack of quality awareness amongst the operatives. Most shift workers are on incentives and invariably sacrifice quality for production through careless work. There is no quality control in weaving or in sizing. Loomstate cloth is not inspected, merely measured, hence there is no feed-back on cloth fault incidence into the weaving department.

Size take-up on the warp is not monitored in sizing. Inadequate percentage size take-up gives poor weaving performance.

The following are the immediate steps which should be taken to improve the quality of loom-state cloth, viz:

1. Effective clearing of the yarn in cone-winding

2. Sample testing at size take-up in sizing at intervals sufficiently frequent to ensure adequately sized warps.

3. The introduction of cloth inspection with the recording of faults seen, and a system of reporting back to the weaving manager details of every roll containing more than an acceptable number of faults.

4. The introduction of a quality grading system of cloth with daily reports on the quality achieved passed to the weaving manager and the general manager.

6.3 Finishing

As far as could be ascertained, the main Quality Control effort was confined to spinning. We would suggest that this activity is extended to the finishing operations - using the existing laboratory facilities as a base. This would allow a greater degree of control than is currently available.

Apart from printed goods, the quality of finished goods appeared reasonable for existing markets. In the event of quality requirements being increased, it is considered that it would be necessary to make further capital investment in plant in order to maintain the volume throughput.

Printing

Opinion was sought as to the feasibility of acquiring post-printing equipment to allow a greater proportion of reactive prints to be produced in the future and as a means of overcoming the market complaints - current at that time.

In one view this would be inappropriate for the following reasons:

(i) The volume output from one automatic flat screen printing machine would not economically utilise such post-printing equipment.

(ii) Reactive prints can and are being produced in Ethiopia - using thermal fixation techniques.

(iii) Current problems are more basic - and will not be resolved merely by the acquisition of additional equipment.

The basic problems mentioned above, are considered to be:

(a) Inadequate preparation - as dealt with in the foregoing

(b) The silkscreen is too slack on the frame, allowing a longer dwell in the centre.

(c) The screen engraving should be such as to allow discreet (or staggered) joining of the design on printing - not straight line, as evident on several designs seen.

(d) Excess gumming paste on the blanket-allowing the printed colour to wick through the fabric - particularly in areas where extra pressure is applied e.g. in vicinity of screen frames.

(e) Insufficient control exercised on the viscosity of print pastes.

(f) A sprinkling of sand subsequently lacquered could be applied to the underside frames of screens falling after the blotch screen.

If problems are continuing to persist, we would recommend that a print-technologist, from one of the main colour supplying companies should be called in to work on overcoming these.

7.0 OPERATING PERFORMANCE

In the context of current standards within the Ethiopian Textile Industry the operating performance of the Bahr Dar mill is above average, but scope for improvement remains. Labour productivity is higher than in several other

N.T.C. mills and is comparable with the average levels of similar mills in other East African countries. Machine productivity is lower than the standard that should be expected and output figures should be approximately 15% higher to approach a satisfactory performance.

TABLE NO. M/1 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE COTTON SPINNING - BAHR DAR

Machine Description	Manufacturer	Model	Year of Manu'ture	No. of M/Cs	No. of Del's Sp'dles	Installed Power per Unit kW	Can, Bobbin or Tube size Ø mm	Height mm	Capacity kg	Working width m	Operating speed	Delivery speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per Unit per hr	Overall Efficiency %	Machine Conditions
Blending Openers	Marzoli		1961	6															2
Waste Hopper Feeder	"		1961	1															2
Horizontal Openers	"		1961	2															2
Step Cleaners (6)	"		1961	6		51											609kg		2
Double Beaters	"		1961	4															2
Scutchers	"		1961	4															2
Cards	Marzoli	T15/3	1961	84	1	1.25	355	914	2	(25[illegible])	10rpm						7kg	90	1
							305	914	2	(25[illegible])	10rpm						7kg	90	1
Cards	Crosrol	Tandem	1977	2	1	7.5	508	914	17.5								17.5kg	90	1
Drawframes 1st Pass	Marzoli	S.20	1968	3	2							200m/min		4 over 5	0.14	-	101kg	75	1
Drawframes 1st Pass	"	S.20	1974	3	2							200m/min		4 over 5	0.14	-	101kg	75	1
Drawframes 1st Pass	"	S.20	1978	3	2							200m/min		4 over 5	0.14	-	101kg	75	1
Drawframes	"	M.4	1961	12	4		NOW [illegible] AVAILABLE FOR DISPOSAL												4
Drawframes 2nd Pass	"	S.20	1968	3	2							200m/min		4 over 5	0.14	-	101kg	75	1
Drawframes 2nd Pass	"	S.20	1974	3	2							200m/min		4 over 5	0.14	-	101kg	75	1
Drawframes 2nd Pass	"	S.20	1978	3	2							200m/min		4 over 5	0.14	-	101kg	75	1
Roving Frames	Marzoli	BC/3	1968	5 (1)	92		DISMANTLED AND IN STORAGE												
Roving Frames	"	P/3G	1961	9	88	3.75		305	[illegible]		[illegible]rpm		None	Modified since new	1.00	0.96	46.6	80	2
Roving Frames	"	P/3G	1961		88	3.75		305	[illegible]		[illegible]rpm		None		0.70	0.86	66.8	80	2
Ring Frames	Marzoli	S5	1961	2	400	14.38	44 (2)	228	[illegible]		[illegible]rpm		Suction + O/H	UT3	9	9.8	26.4	75.1	2-3
Ring Frames	"	S5	1961	3	400	14.38	44 (2)	228	0.105		[illegible]rpm		"	UT3	10	10.8	23.6	77.2	2-3
Ring Frames	"	S5	1961	3	400	14.38	44 (2)	228	0.105		[illegible]rpm		"	UT3	13	11.8	18.0	78.4	2-3
Ring Frames	"	S5	1961	15	400	14.38	44 (2)	228	0.105		8110rpm		"	UT3	16	15.2	12.0	84.5	2-3
Ring Frames	"	S5	1961	23	400	14.38	44 (2)	228	0.105		8220rpm			UT3	21	17.8	8.4	84.6	2-3
Ring Frames	"	S5	1961	3	400	14.38	44 (2)	228	0.105		9615rpm			UT3	28	20.6	6.0	83.1	2-3
Ring Frames	"	S5	1961	1	400	14.38	44 (2)	228	0.105		10430rpm		"	UT3	34	23	4.8	83.3	2-3
Reeling Machines	Tessilizabo	50	1968	6	50	0.736					252rpm		Production not assigned to specific machines		10	-	- (3)	- (3)	1
Reeling Machines	Giacomo Bestono	40	1961	6	40	0.736					312rpm				16	-	- (3)	- (3)	1
															21	-	- (3)	- (3)	1
Winders	Savio		1961	6	100	6.2	196(M)	119	0.2			650m/min			9,13,16,21,28,34			- (3)	3
Twisters	Barmag		1974	1	224	37.44	210	137	1.5			1400			2/28	- (3)		- (3)	1
									1.25			1400			2/34	- (3)		- (3)	

(1) Needs Confirmation
(2) Ring Diameter
(3) Not Specified

TABLE M/2

STAFFING - SPINNING DEPARTMENT - BAHR-DAR

Opening and Cleaning	Day	1	2	3	Total
Blending tenters	-	3	3	3	9
Scutcher tenters	-	3	3	3	9
Cleaner	-	1	1	1	3
Lap weigher	-	1	1	1	3
Maintenance man	-	1	1	1	3
Supervisor	-	1	1	1	3
Total	-	10	10	10	30
Carding					
Operator	-	9	9	9	27
Cleaner	-	1	1	1	3
Total	-	10	10	10	30
1st Passage Drawing					
Operator	-	9	9	9	27
Total	-	9	9	9	27
Roving					
Tenters	-	11	11	11	33
Doffers	-	6	6	6	18
Supervisor	-	1	1	1	3
Mechanic	-	1	1	1	3
Cleaner	-	1	1	1	3
Total	-	20	20	20	60

TABLE m/2 (continued)

Ring Frame	Day	1	2	3	Total
Operators	-	54	54	54	162
Foreman	-	2	2	2	6
Supervisor	-	1	1	1	3
Transporters	-	2	2	2	6
Lappet cleaners	-	2	2	2	6
Floor cleaners	-	4	4	4	12
Leading doffers	-	5	5	5	15
Asst. mechanics	-	2	2	2	6
Tapemen	-	2	2	2	6
Bobbin arrangers	-	3	3	3	9
Total	-	77	77	77	231
Reeling					
Operators	-	20	20	20	60
Bundlers	-	6	6	6	18
Yarn conditioner	-	1	1	1	3
Sweeper	-	1	1	1	3
Bobbin transporter	-	1	1	1	3
Supervisor	-	1	1	1	3
Total	-	30	30	30	90
Winding					
Foreman	-	1	1	1	3
Operators	-	33	33	33	99
Relievers	-	12	12	12	36
Total	-	46	46	46	138
Doubling					
Operators	-	2	2	2	6
Total	-	2	2	2	6

Table K/3

WEAVING PRODUCTION PROGRAMME 1979/80

BAHR DAR TEXTILE MILLS

Fabric	Warp/Weft (Ne)	Loom Width (cm)	Looms per Cloth	Picks per cm	No of Ends	Loom %	Production per 24 Hours (m)
Khaki drill 36"	16 x 13	120	31	15	3220	78	4178.3
Khaki drill 36"	16 x 13	130	26	15	3220	73	3097.5
Blue jeans 42"	9 x 9	130	18	16	3009	67	1845.2
G. drill 42"	16 x 13	130	23	13	3415	70	3031.8
G. drill 42"	16 x 13	180	2	13	3415	70	299.5
D. twill 42"	2/34 x 2/28	180	6	16	5228	48	383.6
Dyed poplin 31"	21 x 28	120	26	20	2536	78	2628.3
Print poplin 36"	16 x 21	120	40	11.5	1982	80	1212.5
Khaki linen 36"	16 x 21	120	30	11.5	1982	80	5409.4
Abujedid 36"	16 x 13	120	25	12	1982	72	3838.0
Flannel 36"	21 x 9	120	15	16	1982	63	1652.4
Kuta 36"	16 x 21	120	30	12	1186	84	2443.2
Malmal 42"	16 x 28	130	5	8	1347	92	1407.5
D. sheet 54"	16 x 21	180	46	15	3058	79	5163.2
G. sheets 54"	21 x 21	180	36	15	2976	74	3785.0
D. sheets 160 cm	21 x 28	220	22	24	4404	64	1622.0
D. sheets 180 cm	21 x 21	220	25	18	4059	60	2304.0
Total			406				53281.4

Table X/4

PIRN WINDING - BAHR DAR TEXTILE MILLS

Winding Machinery

Make	Brugger
Country of Origin	Italy
Age	18 years
Machine Condition	3
Number of Machines	18
Spindles per Machine	20
Total Spindles	360
Description	
Magazine load	
Automatic change	
Winding speed	200 m/per minute
Efficiency achieved	80%
Spindles per Operative	30
Annual Output 1978/79	**953,166 kg**

Operatives per shift		Total on 3 shifts
Winding Operator	10	30
Mechanic	1	3
Foreman	1	3
Total	12	36

Hours of work: 24 per day; 168 per week; 8178 per year.

Table [illegible]

WARPING - BAHR DAR TEXTILE MILLS

Machinery

Make			Muzzi O.F.M.
Country of Origin			Italy
Age			2 Beamers & 2 Creels: 18 years
			1 Beamer & 1 Creel: 16 years
Machine Condition			2
Creel Capacity			600 ends
Output per machine/ hour			7,750 m
Yarn on beams			
	9 Ne	7,000 m	430 ends
	21 Ne	18,000 m	382 ends
	16 Ne	12,000 m	402 ends
Yarn on cones			38,000 m

Annual Output 1978/79 — 1,773,224 kg

Operatives per shift		Total on 3 shifts
Operators	3	9
Mechanic	1	3
Total	4	12

Hours of work: 24 per day; 162 per week; 8178 per year.

Table 1/6

SIZING - BAHR DAR TEXTILE MILLS

Machinery

Make: Muzzi - 2 machines, multi cylinder sizers
West Point - 1 machine " " "

Country of Origin: Italy & U.S.A.

Age: Muzzi machines, 18 years and 16 years
West Point machine, 4 years

Machine Condition: Muzzi, 3 West Point, 1

Operating Speed: Muzzi machines, 20 m per minute
West Point, 40 m per minute

Average Length of Run: 12,000 m

Annual Output 1978/79 1,754,943 kg

Operatives per shift		Total on 3 shifts
Machine Operators	3	9
Helpers	3	9
Size Mixer	1	3
Foreman	1	3
Total	8	24

Hours of work: 24 per day; 162 per week; 8178 per year.

Table [illegible]

DRAWING-IN - BAHR DAR TEXTILE MILLS

Equipment

3 Manual drawing-in frames.

3 Knotex knotting machines 1, 2, and 4 years old.

3 Uster knotting machines 19 years old and no longer used.

Machine Condition: Knotex 1, Uster 4.

Output

20 Beams at 3000 ends drawn-in per week.

400 Beams knotted per week in the department and in the loom shed.

(Week of 153 working hours).

Operatives per Shift			Total on 3 Shifts
Operators	4		12
Reedsman	1		3
Knotting Machinist	2		
(Employed in weaving shed)			
Total	5		15
Foreman	1	on day work	1
			16

Hours of work: 24 per day; 162 per week; 8178 per year.

DESCRIPTION OF

TYPE	GALILEO 18 auto pirn change 72 manual change

Specification

Country of origin	Italy
Model	T3C
Age (Years)	18
Width RS	180 cm
Number of looms	90
Speed ppm	148
Drive (transmission)	Gear
Shedding	Tappet & cam
Boxes	1 x 1
Warp stop	Mech.
Weft stop	Mech. side
Let-off	Positive
Change feeler	18 Optical
Picking	Under
Healds	Steel
Reed	Fixed
Shuttle size (mm)	430 x 50 x 35
Beam flange diameter	60 cm
HP of motor	1.5
Condition of machines	2

Table M/8

LOOMS - BAHR DAR TEXTILE MILLS

GALILEO 20 auto pirn change 52 unifil	GALILEO 36 auto pirn change 162 manual change	RUTI auto pirn change
Italy	Italy	Switzerland
T3C	T3C	
18	18	4
130 cm	120 cm	220 cm
72	198	48
170	180	192
Gear	Gear	Belt
Tappet & cam	Tappet & cam	Tappet
1 x 1	1 x 1	1 x 1
Mech.	Mech.	Electrical
Mech. side	Mech. side	Mech. side
Positive	Positive	Positive
Optical	36 Optical	Optical
Under	Under	Under
Steel	Steel	Steel
Fixed	Fixed	Fixed
430 x 50 x 35	430 x 50 x 35	420 x 54 x 35
60 cm	60 cm	70 cm
1.5	1.5	1.38
2	2	1

Table [illegible]/9

WEAVING SHED STAFF - BAHR DAR TEXTILE MILLS

Description	Number per shift	Total on 3 shifts
Supervisor	1	3
Foreman	11 + 4 reliefs	45
Loom Fixers/Mechanics	20 + 5 reliefs	75
Weavers	71	213
Spare Weavers	27	81
Battery Fillers	-	-
Cleaners	5	15
Oilers	2	6
Weft Carriers	6 + 1 relief	21
Cloth Carriers	2 + 1 relief	9
Warp Carriers	3	9
Knotting Machinists	2	6
Unifil Mechanic	1 + 1 relief	6
Others	23	69
Total	186	558

Hours of work: 24 per day; 162 per week; 8178 per year.

Table H/10

LOOMSTATE CLOTH INSPECTION - BAHR DAR TEXTILE MILLS

Inspection Tables: 4

Model: Muzzi V.T.

Description: Motor drive with lighted panel and cloth length counter.

Machine Condition: 2

Weekly length inspected: 360,000 m.

Operatives per Shift		Total on 3 Shifts
Inspectors	3	9
Weighing Clerks	2	6
Transporters	2	6
Helpers	3	9
Thread Cutters	4	12
Total	14	42

Hours of work: 24 per day; 162 per week; 8178 per year.

TABLE M/11

FINISHING EQUIPMENT - BAHR DAR

Item	Equipment	No. of units	Manufacturer	Year of Manf/Instal	Operating Width Cms	Operating Speed Mts/min	Condition	Remarks
1	Singeing M/c	1	Camerio	1961	160	41	2/3	Gasoline fuelled - not in regular use.
2	Shearing M/c	1	Menschener	1974	-	15	2/3	M/c is not functioning satisfactorily-manufacturer has attended to this with only limited success.
3	Mercerising	1	M.Gollar	1967		18/12	2/3	Frequent breakdowns when machine is run at faster speed - a production restricting factor.
4	Washing/Scouring M/c	1	Camerio Ericole	1961	160	33	3	Machine not working due to break-down. Awaiting spare parts
5	Bleaching/impregnator	1	Camerio Ericole	1961	160	13	3	Only 2 reaction chambers available - restricting production
6	Jig M/Cs	4	" "	1961	180	-	2	
7	Jig M/cs	4	" "	1961	100	-	2	
8	Jig M/cs	2	Smiths	1974	180	-	2	
9	Pad/hot flue	1	Camerio Ericole	1961	160	19	2/3	Padding unit in reasonably good condition. Hot flue section requires complete overhaul - fans and ventillation not working, rollers and bearings worn.
10	Padding M/c	1	Smiths	1976	-	-	2	
11	No.1 stenter	1	Camerio Ericole	1961	190	-	3	Machine under constant repair due to general condition. (Steam heated)
12	No.2 stenter	1	Artos		190	-	2	Automatic control equipment does not function satisfactorary (Thermal Oil Heated)
13	Crease rolling m/c	1	Camerio Ericole	1961	-	-	2/3	
14	Plating m/c	1	" "	1961	-	-	2/3	
15	Crease Rolling m/c	1	Smiths	1974	-	-	2	
16	Plating m/c	1	-	-	-	-	2	
17	Baling m/c	1	Ormic	-	-	-	2	
18	Raising m/c	2	Lamberti	1961	-	-	2	
19	Flat screen printing m/c	1	Storck Brabant	1969	100	15	2	Recommend that this machine be overhauled with particular attention given to the registration and timing mechanism

TABLE 1/12

FINISHING DEPARTMENT - LABOUR DEPLOYMENT - BAHR DAR

	FOREMAN/SUPERVISOR	OPERATIVES	ANCILLARY
Grey Room	1	-	2
Singe/Desize	4*	6	3
Scour/Washing	4*	3	
Bleaching	3	3	
Mercerising		3	
Intermediate Drying	3	3	
Continuous Dyeing			
Batch Dyeing			
Other Dyeing	6	24	
Printing Machines	3	9	
Studio/Designers		3	
Print Ancillary Machines		6	
Stenters	3	21	
Calenders		3	
Inspection		7	
Make-up and Baleing	5	12	8
Sheet Making	3	18	39
Chemical			2
Cleaners			
Departmental Mechanics	1	7	1
Reserves			21
Cone Dyer			1
Departmental Management	4		
	40	128	77

Departmental Total 245

Annual Production	16,735,300 metres
Production Area	2592 sq. metres
Annual Production/Employed Person	68,308 metres
Annual Production/Unit Area	6,457 metres
Operating Days Per Year	336
No of Shifts Operated	3
Hours Work Per Shift Per Week	54

*Eight Supervisors - covering shifts and ancillary processing.

DEBRE BERHAN WOOL FACTORY

Processes: Condenser Spinning; Weaving, Dyeing, Finishing.

Production: Woven blankets, Woollen cloth, Carpets.

1.0 MACHINE REGISTER

Table N/1 lists the spinning and associated processes' machinery used in the mill. There are a number of gaps in the table arising from a lack of knowledge of machinery manufacturers and in some instances, of productive capacity. In general the machines are old and a number are second-hand. Although they are operating at speeds well below those for which they were designed, their output is sufficient to satisfy production requirements.

The Debre Berham Wool Factory was built in 1964 with the intention of processing local wool. The sheep in this region of Ethiopia produce a wool which has been described as short, straight, coarse, brittle, lacks scale, and is therefore slippery. In short it lacks 'spinnability'. If spun into counts for blankets, then even after finishing, the blankets would retain an itchiness totally unacceptable to the local market. Probably the only acceptable application for this fibre would be the coarsest of carpet yarns.

Ethiopia's third largest export is animal skins after coffee, and fruit and vegetables. The local sheep which produce this poor textile wool, have relatively few hairs/cm^2 on their skins, which allows most of the grease formed to be washed out naturally by the rain. So with very little tending — all of an unskilled type, good quality, tender skins are produced. There is a local farm breeding textile-wool sheep, but so far output in one year corresponds roughly to one day's production at Debre Berhan. We see little point in further resources being devoted to the development of this fibre, believing that the existing arrangements are quite adequate to meet the needs of the existing blanket manufacturing firms.

As a consequence of these unacceptable fibre properties in the wool, the decision was made to import a more suitable fibre. This means that some of the machinery originally installed in the factory is inappropriate for the present processing sequence, which is:

- sorting
- pulling

Table N/1 lists the spinning and associated processes' machinery used in the mill. There are a number of gaps in the table arising from a lack of knowledge of machinery manufacturers and in some instances, of productive capacity. In general the machines are old and a number are second-hand. Although they are operating at speeds well below those for which they were designed, their output is sufficient to satisfy production requirements.

- wet and dry finishing
- mending
- packing and storing

2.0 PRODUCTIVE CAPACITY

2.1 Sorting

The fibre is a mixture of synthetic (mainly acrylic but with a little polyester and polyamide) and rayon waste collected in the United Kingdom. As much of it can be described as sweepings, the principal types of impurity are dirt, dust and occasional metallic items. Other countries have been approached as possible suppliers, namely Italy and some Eastern Bloc countries, but what little has been brought from these sources has been of an inferior quality. The waste is relatively cheap, (management estimates the raw material costs account for no more than 20% of blanket conversion costs) because labour costs in the U.K. are higher than in Ethiopia, and it is the sorted cost which has to show a worthwhile price differential when compared with the equivalent virgin fibre.

Untreated bales of fibre contain a mixture of soft and twisted waste, the latter requiring pulling. White fibre is unsuitable for blankets and therefore is used to blend with the basic fine qualities to produce 24 different colours. Based on sorting department returns for the year 1978/79, roughly 8% of the 823 tonnes of sorted fibre was of the hosiery variety, that is 66 tonnes.

Sorting, which is entirely a manual occupation, is carried out by 44 (classified as skilled) sorters, which absenteeism reduces to a nominal 40. Based on the best months (May 1978) recorded performance this team is able to sort 1050 tonnes/year. An 8-hour day, 6-day week is worked, so that throughout the year the department worked 2416 hours, sorting at an average rate of 341 Kg/hr.

2.2 Pulling

Three pulling machines are installed, two manufactured by Houget Duesberg Bosson (one is not working owing to a shortage of spare parts), and one by Antefa.

Very rough estimates based on production records suggest that of the 350 tonnes pulled in the 12 months 1978/79, between $\frac{1}{4}$ and $\frac{1}{3}$ were returns from the factory itself.

At the moment there is no pneumatic transport duct from the delivery end of the pulling machines, so fibre is pressed (manually) back into sacks to form bales which are pushed by truck back into the sorted fibre store. We concur with the management suggestion that this work is best done by a press and one should be purchased for this purpose. Management have also suggested that the pulled material store houses another willow as part of an expanded blending/preparation facility necessary to match the increase in carding capacity arising from the installation of a new Befema card (not shown on the Machine Inventory). The installation of the proposed fibre transport ducting and the willow will enable the pulling section to be utilized more intensively, but without requiring additional capacity.

2.3 Blending

A blending sequence comprising; hopper feeder, shaker, and willow is used. The output from the willow is then transported pneumatically to the blending bins arranged in front of the cards. The overall capacity of the blending line is estimated to be between 300 and 350 Kg/hr if only one pass through the willow is needed. However the properties of the fibre are such that current practice is to allow two passes, thereby dropping the capacity of the line to half this value. The second willow, mentioned in the section dealing with pulling (2.2) is to overcome this bottleneck.

During the year 1978/79 the company blended at the rate of 123 Kg/hr. A small insignificant adjustment to this figure to take account of the oiling which is sprayed on in order to facilitate spinning is theoretically necessary. (The adjustment is 75 litres/tonne of oil added at the rate of 15 litres/tonne of fibre, that is 1.5%.)

2.4 Carding

Three cards are currently used by the company; a fourth, manufactured by Befema is being installed and can be expected to increase the total carding capacity to 170 Kg/hr. Operating efficiencies are relatively lower than we would have expected, but the most significant cause of this is likely to be the poor state which the cards are in. The fourth card will allow the mill to introduce planned preventive maintenance at the card without critically reducing production levels.

2.5 Spinning

Three spinning machines are used with a combined capacity of 254 Kg/hr at 100% efficiency. In fact in March 1979 the monthly average efficiency of the three frames was 64.3%, 55.1% and 73.8% for the No.1, No.2A and 2B respectively. At these efficiencies, the productive capacity of the spinning department reduces to 162 Kg/hr. In view of the number of staff available to creel and doff these machines, the overall operating efficiency of frames 1 and 2A is particularly low. But the condition of these machines (discussed later) is the main cause of this unsatisfactory state of affairs. Additional capacity in spinning would be a relatively cheap method of increasing the mill's total output.

2.6 Post Spinning Processes

Large bobbins from No.3 card for the warp for blankets and cloth is rewound on the Gilbos cone winder, together with assembly wound cotton blanket yarn. It is possible, in addition, to use 3 cones of two-fold yarn to twist into 6-ply yarn for cotton warp in carpet weaving. The operation of these winding units is complex, but no shortage of winding capacity is reported, and though the age of the machines is in some instances indeterminate, they all have sufficient capacity to meet existing and foreseeable demand (that is, after the additional card is installed and operating).

2.7 Weaving

The weaving shed contains forty looms producing blankets, ten looms producing a woollen type dress fabric, and one 4 metre wide carpet loom. All were non-automatic with efficiencies (excluding the carpet loom) ranging from 40 to 66%. With the course weft (nm 1.5) and one loom per weaver minimum efficiencies of 65% should be expected. The woollen dress fabric was produced on ten Lentz looms of which several were stopped owing to lack of orders.

The carpet loom also was stopped, in this case for repairs. It is understood that its average efficiency when running is in the low 30s.

Warp and weft preparation had a capacity in excess of that required and was consequently under-utilized.

It is felt that this weaving department would achieve higher levels of producitivity and machine efficiencies if it concentrated on blanket weaving. This implies an increase in the number of blanket looms installed, and the cessation of woollen cloth and carpet production and the disposal of the Lentz looms and the carpet loom.

2.8 Finishing

Currently, the department is working on two shifts, the introduction of a third shift would therefore cope with present or foreseeable expansion plans with ease.

In the absence of precise information, it is difficult to comment in detail regarding plant utilization. Comment is therefore a reflection of observations rather than the result of detailed survey work. Loose stock dyeing production averages 500 Kg per shift or potentially 1500 Kg per day — some doubt was expressed whether this would meet expanded manufacturing demand, particularly if there was a market trend to coloured blankets. Owing to limitations of equipment and altitude, the maximum temperature attainable during dyeing was 86°C, at this temperature, colour yield is very low and dye fixation tends to be poor - giving rise to complaints of loose colour (poor rubbing fastness) on the finished product and high colour costs. Loose stock drying is carried out on the drying unit of the loose stock washing range — from appearance, this did not appear to be an efficient means of drying, in view of rising energy costs it is suggested that the economics of running this machine should be examined. Dyed carpet yarns, after hydro extracting are dried in the sun — the company has resorted to this method as the drying unit (V. Charpentier and Co.) causes severe colour migration and consequential discolouration of the dyed yarn.

Relating work in progress to activity and utilization, the carpet processing section would be considered to be under-utilized — indicating that there is available capacity, which to some extent can be taken up with increased blanket production.

The company has a continuous wool scouring range which is not utilized owing to the unsuitability of the Ethiopian wool crop for carpet yarns. It is understood that experimental breeding is producing more suitable wool for carpet yarns; but it is likely to be several years before this is available in commercial quantities. As the normal raw material used at the plant does not require such processing, this particular range is not utilized.

3.0 BUILDINGS AND SERVICES

3.1 Buildings

These are generally of suitable construction and design for their intended use. The site location is such that varying elevations present some difficulties in the movement of heavy goods and plant within the factory site.

Storage buildings are in the main well sited and adequate for purpose. Because of the supply nature of raw material, quantities of this are stored externally in temporary storage conditions; although to some extent such materials are exposed to the weather, assurance was given that this did not constitute a production problem.

3.2 Service Installations

3.2.1 Air conditioning

No air conditioning plant whatsoever is installed in the mill. Management have expressed the wish to install a simplified system of humidifiers and steam heated fan heaters to overcome the occasional -6°C temperature which occurs in the winter. However we feel that the first requirement is that the existing processing machinery should be restored to a satisfactory condition for without this prerequisite air conditioning would be entirely wasted. In any event, the arguments in favour of air conditioning a mill spinning predominantly man-made fibres for such low quality, utility products as Debre Berhan does, must be purely marginal, the final factor tipping the scales in favour being the desire to improve the general working conditions rather than a need to control the working environment. In Debre Berhan the present working conditions for operatives are superior to those in the cotton mills in the Addis area.

3.2.2 Steam generation

Steam is supplied from a single boiler as detailed below. It is planned to install a second boiler of the same make and model — thereby doubling generating capacity in the near future.

Boiler	—	Dawson Steam Block
Year Manf.	—	1963
Heating Surface	—	126 m^2
Generating	—	300 HP
	—	2 560 000 cals/hr
Working Pressure	—	12 Kg/cm^2
Flue Temperature	—	150°C

Installation of the second boiler will ensure adequate steam supply to support the envisaged expansion

3.2.3 Electricity supply

Grid mains supply — presenting no problems and capacity available for expansion.

The company has standby generating unit — output sufficient for emergency lighting only.

3.2.4 Water supply

Process water is abstracted from local river source. Town's water is used for domestic purposes. All process water is floculated ($AlSO_4$), filtered and passed to water tower for storage and distribution. The supply of water was reported as satisfactory throughout the year.

3.2.5 Effluent disposal

All process effluent is collected and discharged to open settling pond where volume is lost by evaporation. This system is adequate for dealing with the daily volume discharged (70 m^3) and could continue in service for a number of years before de-sludging is necessary.

4.0 CONDITION OF EQUIPMENT

4.1 Spinning

4.1.1 Spinning preparation

The powerful but relatively simple opening and cleaning machinery is being adequately maintained at the plant. Opening cylinders are refurbished at irregular intervals but the effect is nevertheless satisfactory. Fans and ducting likewise would benefit from more frequent dismantling and reconditioning but not to the extent that would prevent production targets being met. We therefore conclude that though this machinery is now obsolete it is still capable of performing satisfactorily and is expected to continue doing so for at least another five years.

The over-riding impression in the card-room is one of a complete disregard for safety. Guards were missing from the cards and if not actually missing, were lying so close to unprotected drives that the probability was high that they would get inadvertantly knocked into the way of the drive belts. Gears were in many instances poorly meshed and if pulley drives were used, then frequently the pulleys were mounted eccentrically.

Card cylinders are scheduled for regrinding every month in the case of the first cylinder and every two months for later cylinders. Every year the first cylinder is scheduled to be rewound completely, and every two years the remaining cylinders. It was however most noticeable that the card cylinders were not carrying the web equally across their faces. When questioned about this, the fitters explained that it was due to unequal wear across the face of the card. We therefore conclude that, as in other mills in the country, the preventive maintenance schedules are simply not being adhered to.

In order to bring the cards up to a sufficient standard of operation and safety we believe it will be necessary for the mill to seek the assistance of suitable foreign commissioning engineers. We estimate the likely cost of this rehabilitation programme to be not less than U.S.$ 240 000 for the three existing cards. On completion of such a programme the cards are expected to have a future serviceable life of not less than 7 years.

4.1.2 Spinning machines

The HDB frame is in a poor condition. Drafting pulleys are poorly aligned, spindles are vibrating more than we would have expected and there was a considerable variation in spindle speed when this parameter was checked with a stroboscope. The condition of the second frame (No.2A) was however worse. Only one side of the frame is in use; the other is completely dismantled, and the variation in spinning speed recorded on the spindles examined amounted to 5%. Even on the running side 10% of the spindles for a variety of reasons were disconnected. These two frames have been given a machine condition rating of 3. In order to rehabilitate them, an expenditure of roughly U.S.$ 25 000 would be necessary, but this investment really warrants a much deeper appraisal prior to any decision being made in order to ensure an adequate return on investment both for the proposed new and existing units.

4.1.3 Post spinning process machinery

Unlike the Delerue cop winding machines, the Ovemag unit is proving difficult to maintain without an adequate supply of spare parts. In some instances parts are being manufactured by the mill's own mechanical workshop but failure to obtain the correct raw materials from which to machine the parts is often causing parts manufactured here to have a life only 35% as long as that of the original manufacturer's parts. We are uncertain of Ovemag's continuing existence and until this is established a final decision regarding the correct rating for the machine (3 or 4) will have to wait. The other winding units have all been rated 3 in accordance with our recommendation that in order to continue working satisfactorily for the next 5 to 7 years it is essential that they be thoroughly rehabilitated now. A very rough estimate for the likely cost of this programme is U.S.$ 30 000.

4.2 Weaving Preparation and Weaving

4.2.1 Weaving preparation

Although the Hacoba pirn winders are 15 years old they are in good condition and provided spare parts continue to be available they should last for another five years.

There has been some delay in obtaining spare parts for the SACFEM warping machine but these are now expected shortly. The automatic stop mechanism is broken but with the arrival of the spare parts this will be rectified. With reasonable maintenance the machine and creel should have five years of useful life remaining.

4.2.2 Weaving

The three older types of looms demand considerable maintenance effort because of their age. They are robust machines, slow running and long lived. However, the Hanflet looms with their jacquard shedding mechanisms are over 50 years old and extremely slow. Whilst they will continue to be capable of production for several years yet, their increasing demands on maintenance labour and on difficult-to-obtain spare parts leads to the conclusion that they should be scrapped.

The Snoeck and Schonherr looms are worth keeping but their useful economic life is probably limited to a maximum of five further years. The Lentz looms are 11 years old and in better condition. They have a useful life remaining in excess of five years.

The Van de Wiell carpet loom is over 30 years old. Spare parts are difficult to obtain, leading to some down-time, and the loom as a design is obsolete. For these and other more important reasons it is recommended that this loom be scrapped.

4.3 Dyeing and Finishing

With some exception, the condition of processing equipment is reasonable and along with the new raising equipment being installed, should serve the plant's requirements over the next five year period — providing that maintenance standards are improved and maintained.

In our opinion, items of equipment requiring major attention — where continued production will justify this are:

(i) Fulling Machine (Jos. Kruckels) - This machine is not in use, nor is likely to be in the foreseeable future.

(ii) Drying Unit (V. Charpentier and Co.) - Not in use, this should be renovated or replaced depending upon demand.

(iii) Centrifuge-Hydro Extractor - The condition of this machine is approaching a need for major overhaul.

(iv) Pressing and Decatiser Machine - Approaching the need of major overhaul, providing there is a continuance of production demand for these styles of product.

5.0 WORKING ENVIRONMENT

Accepting that raw material sorting is a dusty and dirty task, the general environmental working conditions are reasonably good in all departments.

It is the company's policy to provide protective clothing where this is appropriate.

5.1 Health and Safety

The main hazard to safe working within the plant is the ineffective safe-guarding of machinery and moving parts. This is particularly so on the condenser carding units and pulling machines where main driving gear is fully exposed — constituting a constant danger to workers and passers-by. It was reported that 3/4 serious injuries had occurred during the last two years. The more effective guarding of such machines should be given a priority rating.

The company maintains a medical clinic equipped and staffed to render first-aid and treat minor injuries. More serious injuries are referred to the local hospital.

5.2 Welfare

The factory maintains good welfare facilities for persons employed by the company, these consist of — canteen, showers, changing rooms and transport facilities.

5.3 Fire Precautions

The provision of fire fighting equipment — water hydrants, extinguishers, is at a reasonable level, although the standard could be improved in areas of higher risk — intermediate/storage areas where there may be chance of spontaneous combustion of materials under certain conditions, and in the vicinity of finishing stenters.

6.0 MAINTENANCE

The firm employs a maintenance labour force of 47 persons comprising; 3 foremen, 6 fitter/mechanics, 3 electricians, 17 other skilled workers, 6 unskilled workers: for example, labourers, greasers, cleaners, etc. and 12 semi-skilled welders, plumbers, carpenters/joiners, etc. Added to these must be those in the production departments whose normal activities are concerned, either fully or in part, with the routine maintenance of the production machines. Their number is not identified. Their workload cannot be accurately determined because in the recent past production considerations have over-ruled maintenance requirements to the extent of preventing all useful scheduled maintenance. In addition we suspect that a large proportion of this unidentified number were assisting with the installation of the new Befema card. Certainly a large work-force was so engaged.

One conclusion therefore is that though the mill has well-equipped mechanical, carpenter/wood working and electrical workshops, at the moment management is effectively giving a low priority to the running of any planned maintenance programmes. The recent addition of two qualified engineers to help on the maintenance side is expected to allow management to devote a greater effort to the introduction and sustained running of these maintenance programmes. No maintenance cost recording system is employed and from the evidence of the manning level of the maintenance department and the general condition of the machinery it is likely to be costing the mill relatively large sums of money to continue operating. This is an additional factor in favour of the company undertaking a fundamental examination of its short and long term investment opportunities.

7.0 PRODUCT QUALITY AND CONTROL

Quality control procedures, though consisting mostly of wrappings or weight/unit area measurements are carried out on a regular basis. A feature of the organisation at Debre Berhan, is the way in which these checks are used and integrated for both quality and production control procedures. Thus blanket areas and weights are recorded, the average weight/unit area calculated, and the quotient compared against a specific standard. Fabric weights and areas are recorded before and after raising and again the difference compared with a known standard.

These simple yet regular checks play an important role in allowing the management to exercise the necessary control over the quality of its output. Faults which inevitably occur are cut to form smaller acceptable quality goods and the remainder is either recirculated or sold as seconds depending upon the nature of the fault. From the quality of the fabrics that were seen it appears that these inspection and mending checks also contribute greatly to the successful promotion of the firm's reputation.

The above comments do not apply to the carpet production. Although woven on a Wilton type loom, i.e., an expensive, high quality method of carpet production, the specification of the carpet sample seen was very low, to the point of being inferior to the average quality produced by the much cheaper tufting method of production.

The production value of the carpet produced at Debre Berhan is approximately 32 Birr per m^2. For comparison the U.K. manufacturer's selling price for a plain Wilton Brussels carpet, 80% wool, 20% nylon, of a much superior quality, was U.K. £7.5 in 1979, i.e. approximately 30 Birr. A U.K. produced tufted carpet, 80% wool, 20% nylon, of superior specification to the Debre Berhan carpet, has a retail price of approximately U.K. £4 per m^2, (16 Birr), which means the manufacturer's price is approximately 8 Birr. Thus, considering quality in relation to cost and price, the carpet quality at Debre Berhan compares unfavourably with the products from other countries with much higher labour costs.

8.0 WORK FORCE

A complex shift system is worked at the mill in order to achieve a departmentally balanced production flow. Table A below summarises the number of shifts worked in each department, and the number working on each of those shifts.

TABLE A. Shift Arrangements : Debre Berhan

	No. of Shifts worked a day.	No. of workers a shift.[1]	% of total.
1. Wool store	1	11	4.5
2. Sorting	1	46	19.0
3. Pulling	3	4	4.9
4. Shaker	3	3	3.7
5. Carding	3	12	14.8
6. Spinning	3	20	24.8
7. Cops	2	20	16.5
8. Cotton twisting	2	9	7.4
9. Carpet twisting	2	3	2.5
10. Yarn packaging store	2	2	1.7

Total Number above: 242 persons.

Note[1]: Average number in attendance. Estimates of the number on the books would be 15% higher.

No break-down of these departmental manning levels are available; it is consequently impossible to comment in detail on the levels. However comparisons with other countries' figures, necessarily made over a broad range of activities reveals the following.

(1) The number of sorters employed at Debre Berhan is disproportionately large. The teams of seven girls work well together and management rate the quality of their work highly, but 46 persons working in the sorting department means on average, less than 12 Kg/hr per sorter is processed. We would normally expect the rate to be some three to four times greater.

(2) The output of woollen yarn per worker in Italy, France and the United Kingdom (all in 1970) was 5.88, 7.33 and 6.86 tonnes a year. These figures compare with the calculated value for Debre Berhan (based on average number working and an annual production rate of 308 x 24 x 160 Kg/hr = 1183 tonnes) of 4.88 tonnes a year. However the average count spun at Debre Berhan is obviously lower than those national averages with which it is compared, so the relative closeness of the two sets of values gives a somewhat distorted picture. A reduction in the number of sorters however, which accounts for 19% of the labour force, would obviously help to raise the output/operative to a more desirable level.

Table B summarises our ratings for the level of skills available in the existing work force at Debre Berhan. Some up-grading is obviously necessary and the staff with whom we discussed the matter emphasised the need for greater theoretical knowledge at all levels. The size of the woollen sector is so small in Ethiopia however that it is not worth setting up local training facilities especially for this sector. The necessary training will have to be obtained overseas. Only a few of the supervisory staff would however benefit from such visits; we suggest that initially courses could be arranged for the following:

Spinning and Weaving Masters.

Quality Controller.

Duration of such a course would not need to exceed 3 months, the main purpose of which would be to familiarise the participants with modern practice in similar organisations.

TABLE B. Level of Skills Available at Debre Berhan

	Excellent	Good	Satisfactory	Poor	Bad
Technical supervision					
competence			—		
diligence				—	—
Direct Operatives: skilled			—		
unskilled		—	—		

9.0 OTHER METHODS OF PRODUCTION

If the N.T.C. intend to continue with carpet production it is recommended that tufting machines be used and not looms. It must be pointed out, however, that the production rate of a tufting machine is very high. One machine working three shifts will produce in one week as much as the average annual production of the carpet loom installed at Debre Berhan. Clearly, before any decision is made a study of the potential markets is essential, taking into account the fact that the price per m^2 of tufted carpet would probably be less than one half of the price of a similar carpet produced on a loom, i.e., the market would, therefore, be larger.

WOOLLEN SPINNING - DEBRE BERHAN

TABLE NO. N/1 - MACHINE INVENTORY

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/Cs	No. of Del's Sp'dles	Installed Power per Unit kW	Can, Bobbin or Tube size			Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data				
							Ø mm	Height mm	Capacity kg						Output Count Nm	Turns per inch	Prod'n per Unit per hr	Overall Efficiency %	Machine Condition
Pulling Machine	Houget Duesberg Bosson	-	1964	1	1	11.1				500					-	-	200kg	32	1
Pulling Machine	H.D.B.	-	-	1	1	Not working owing to shortage of spare parts													3
Pulling Machine	Autefa	-	1969	1		55				600							250kg	26	1
Hopper Feeder	Charpentier	-		1															2
Shaker	H.D.B.	-	1965(1)	1		14.8													2
Willow	H.D.B.	-	1965(1)	1		16.9													2
Fibre Transport Fan	Unknown	-	1965(1)	1		22.0													1
Card	Duesberg & Bosson	-		1	8 x 12	30.5				2000		20m/min			1.5 - 2.8 (1.5)		76.8kg	65.5	3
Card	Alexander & Antoine	-		1	8 x 14	23.5				2200		20m/min			1.5 - 2.8 (1.5)		89.6kg	67.4	3
Card	Alexander & Antoine	-		1	16 x 10	23.5				2200		18m/min			5.0 - 10.0 (5)		28.8kg	64.2	3
Ring Frame	H.D.B.	-	c.1960	1	2 x 60	29.4	150(2)	455	0.5			18-20 m/min			1.5		96kg		3
Ring Frame	Houget	-	But purchased	1	112	27.2	130(2)	455	0.42		2750 rpm	18-20 m/min			1.5		89.6kg		3
Ring Frame	Unknown	-	second-hand	1	288	23.8	130	455	0.42		3150rpm	18-20 m/min			5.0		69.12kg		2
Cop Winder	Delerue	-	7.4	1	15												4.5kg		2
Cop Winder	Delerue	-	5.1	1	12												3.6kg		2
Cop Winder	Ovemag	-	1.6	1	10												7.9kg		3
Cone Winder	Gilbos			1	24														3
Twister	H.D.B.	-	11.1	1	40						2300rpm								3
Hank Winder	Giacomo Bertona	-	-	1	20														1
Firn Winder	Hacoba	-	-	1	12														3
Double & Twisting Machine	Pfernninge-berg	-	4.0	1	2 x 96		70(2)		0.08		2445rpm	12.3 m/min			17.8		7.96kg		3

(1) Estimated

(2) Ring Diameter

Table N/2

LOOSE STOCK DYEING AND FINISHING - DEBRE BERHAN

ITEM	EQUIPMENT	NO. OF UNITS	MANUFACTURER	YEAR OF MANF/INSTAL.	OPERATING LOAD	CONDITION	REMARKS
2	Stock Dyeing M/c	1	Callebant De Bliguy	1967	-	2	
3	Fulling M/c	1	Jos Kruckels	-	-	3/4	Not in use
4	Suction Hydro Extractor	1	Krantz	1968	-	1	
5	Centrifuge Hydro Extractor	1	Y. Charpentier & Co.	1963	-	2/3	
6	Drying Unit	1	" "	1963	-	3	Not in use - results in shade variation in hanks due to uneven drying.
7	Rope Washer	1	Ateliers Raxhon	1963	-	2/3	
8	Stenter	1	Tessile Mecc-anica	1967	-	2	2.6 m width capacity
9	Raising M/c	1	Mario Crosta	1967	-	2	24 Rollers
10	Raising M/c	1	Comet	1963	-	3	24 Rollers
11	Shearing M/c	1	Comtex	1964	-	2	
12	Stenter	1	Krantz	1967	-	2	2.6 m width capacity
13	Pressing M/c	1	Krantz Muller	1967	-	2/3	
14	Decatising M/c	1	Monforts	-	-	2/3	
15	Carpet Shearing M/c	1	Mario Crosta	-	-	2	

TABLE N/3

PIRNWINDING DEPARTMENT - DEBRE BERHAN

Machines

Make:	HACOBA
Type:	Non-automatic
Number:	3 machines of 9 spindles each. (1 only in use).
Age:	15 years
Machine condition:	2
Count wound:	8 Ne.

Labour

Operatives per shift		2 shift total
Winder	1	2

Hours of work: 15 per day. 90 per week. 4575 per year.

TABLE N/4

WARPING DEPARTMENT - DEBRE BERHAN

Machine

Type:	Section warper
Make:	SACFEM (Italy)
Number	1
Creel:	155 ends
Number:	1
Machine condition	3

Labour

Operatives per shift		2 shift total
Indirect	1	2
Direct	2	4
Total	3	6

Hours of work: 15 per day. 90 per week. 4575 per year.

TABLE N/5

WEAVING DEPARTMENT - DEBRE BERHAN

Machines

Make of Loom	HANFLET	SNOECK	SHONHEER	LENTZ
Age (years)	50	16	25	11
Width R.S. (cm)	350	218	218	218
No. of looms	6	6	28	10
Speed (ppm)	73	96	98	138
Shedding	Jacquard	Dobby	Dobby	Dobby
Boxes	4 x 1	4 x 4	4 x 4	4 x 4/4 x 1
Warp stop	None	None	None	Electrical
Weft stop	None	None	None	Centre Fork
Let-off	Negative	Negative	Negative	Positive
Change feeler	None	None	None	None
Picking	Under	Under	Under	Under
Heald wires	Steel	Steel	Steel	Steel
Reed	Fixed	Fixed	Fixed	Fixed
Machine condition	4	3	3	2

TABLE N/6

WEAVING LABOUR - DEBRE BERHAN

Staff per shift	A	B	General	Total
Production foreman			1	1
Maintenance foreman			1	1
Assistant foreman			1	1
General foreman			1	1
Shift foreman	1	1	-	2
Loom mechanic	3	3	-	6
Weaver	42	42	5	89
Spare weaver	5	5	-	10
Cleaner	2	2	-	4
Oiler	1	1	-	2
Weft/cloth carrier	2	2	1	5
Warp carrier	1	1	-	2
Dobby card fixer	1	1	-	2
Total	58	58	10	126

Hours of work: 15 per day. 90 per week. 4575 per year.

TABLE N/7

FABRICS PRODUCED - DEBRE BERHAN

1. Family blanket. Type 1801

   Warp: 2/15.5 Ne cotton. Weft: 1.5 Nm synthetic waste.

   Ends per cm: 6.8 Picks per cm: 11

   Width: 2.2m Length: 1.6m

2. Double-faced blanket. Type 1805

   Warp: 5 Nm cotton. Weft: 1.5 Nm synthetic waste.

   Ends per cm: 7.5 Picks per cm: 11

   Width: 1.6m Length: 2.2m

3. Yekatit and 1200A.

   Warp: 5 Nm cotton. Weft: 1.5 Nm synthetic waste.

   Ends per cm: 7.5 Picks per cm: 7.3

   Width: 1.6m Length: 2.2m

4. New Yekatit.

   Warp: 2/15.5 Ne cotton. Weft: 1.5 Nm synthetic waste.

   Ends per cm: 7.5 Picks per cm: 8.2

   Width: 1.6m Length: 2.2m

5. Twill cloth.

   Warp: 8s Ne wool mixture. Weft: 8s Ne wool mixture.

   Ends per cm: 10 Picks per cm: 11

   Width: 1.5m

Annual production	m^2
Blankets 1800 group	483,700
Blankets Yekatit group	565,300
Total	1,049,000
Twill cloth	31,600

TEXTILE MILLS OF DIRE DAWA

Processes: Spinning-short staple, acrylic, waste.
Weaving: Dyeing, Printing, Finishing

Ring Spindles: 50 208. Other spindles: 5 100. Looms: 1080
Annual production 29, million m^2.

1.0 MACHINE REGISTER

The register of spinning machinery installed at Textile Mills of Dire Dawa is presented in Tables O/1 to O/5. Unfortunately it was not possible in the time to obtain all the information required by the terms of reference for this report. Some of the model type references are omitted, and less frequently, the year of the machine's manufacturer. However, the most important failing of the tables is the inability to match, in all cases, production to machinery. This failing of course, has little effect on the compilation of the machine register. Running speeds are those quoted by the mills. In some instances machines are being run more slowly than is necessary in order to balance production at the different processing stages. Some specific instances are discussed below, nonetheless there remains the overall impression that this capacity of the equipment is really greater than that quoted in the tables. Pre-requisites for such an increase in capacity would be improved quality control, maintenance, operative training and probably some experimentation to find an alternative blend of fibres.

2.0 MACHINE PRODUCTION LEVELS AND CAPACITIES

2.1 Spinning Mills

2.1.1 Carding

Mill 1 is equipped with Platt and Toyoda cards.

At the time of the visits 9 of the 24 Platt cards were covered by taupaulins, but only one was being resurfaced. Clearly the carding section is being run considerably below its nominal capacity, a fact confirmed by the low operating efficiency. All (5) of the latest Toyoda cards (1970) are to be transferred to Mill 5 when the proposed extension to that mill comes on stream. A conservative estimate based on the above arguments therefore suggests that TMDD have a carding capacity approximately 26% greater than their current demand, as indicated by the target production data for September 1979, requires them to use. This surplus capacity is equivalent to an hourly production rate of 251 Kg/hr. Table A shows the basis on which these estimates have been prepared. Mill 5 is equipped exclusively with Toyoda Type CE cards manufactured between 1965 and 1970. This was Toyoda's transitional model which saw the company offering several variants and conversions capable of operating with doffing speeds from 6 r.p.m. to 27 r.p.m. (in the 'Stage 2' conversion). The doffer speedused in Mill 5 is between 8 and 10 r.p.m, that is, about as slow as the cards can run. Management, when questioned about this relatively slow speed of operation claimed that it was necessary in order to avoid the formations of nep in the card web. But the five classes of nep are:

(i) process nep, commonly produced by faulty carding

(ii) mixed nep, fibres tangled around a foreign nucleus

(iii) immature nep, generated by the processing of immature fibre

(iv) homogeneous dead nep, a tangle of nearly all dead fibre

(v) fuzz nep, a tuft of short fuzz fibres, i.e. the coarse and short fibres forming an undergrowth on the cotton seed.

Thus only one variety of nep, (i), is produced at the card and the likelihood is that the main causes of high nep counts in the Ethiopian textile industry are malpractices in the cotton growing farms and at the cotton ginneries.

In any event experiments carried out, and published by Toyoda, suggest that there is no increase in nep count from simply running cards faster, at least until the production rates exceed 70 lb/hr on their high production cards. Thus we believe that doffer speeds of between 10 and 12 r.p.m. can be used on these Type CE cards yielding increases in machine productivity of between 20 and 40% respectively.

Productivity could be further increased if the flexible flats are replaced by semi-rigid flats and the cylinder and doffer speeds are increased to 300 and 27 r.p.m. respectively. It is, however, unlikely that this conversion is economically attractive at the moment.

TABLE A. T.M.D.D. Theoretical Carding Capacity

		Capacity in Kg/hr at 100% Efficiency		
Mill No.		1	3	5
Card Type	No.			
Platt 1950	24	192		
Toyoda 1950	13	104		
Toyoda 1970	5	40		
Toyoda CK-7C	11		242	
Toyoda CE	42			752
Mill Totals	95	336	242	752
Grand Total				1330

Notes: 1. Allowing for an efficiency of 90% the Grand Total is equivalent to an hourly production of 1197 Kg/hr.

2. Assuming current production needs are the same as those for September, 1979, then after allowing for waste multiplier factors based on Akaki returns (none are available for TMDD) carded yarns require 21071 Kg/day and combed yarns 1632 Kg/day production at the cards. In total this amounts to 946 Kg/hr production at the cards.

2.1.2 Combing and Combing Preparation

Mill 5 is the only unit to have any combing capacity. The main feature of the combing and associated processes is the inbalance between them; no doubt reflecting the relatively low demand for combed sliver and yarn. The approximate total daily demand for combed yarn in mills 3 and 5 is 1300 Kg. This corresponds to hourly production rates of 70 Kg and 60 Kg at the precomber drawframe and combers respectively. The lap former however has a production capacity of 193 Kg/hr @ 100% efficiency. Hence to balance the plant and operate it at the present efficiencies, 3 drawframes, 1 lap former and 8 combers would be necessary, thereby giving a production capacity of 160 Kg/hr; an increase of 160% over existing levels. Room for this expansion could be obtained from the saving in carding space achieved with the higher operating speeds previously discussed. The additional cost of the equipment to balance the plant would be an estimated US $ 400 000.

2.1.3 Drawframes

Total current drawframe capacity for mills 3 and 5 is 1150 Kg/hr at 100% efficiency. This compares with a demand of 711 Kg/hr of yarn from the two mills, or 787 Kg/hr of drawframe sliver. Even if an overall operating efficiency of 85% is assumed (this is the claimed value in Mill 3) then there remains nearly 200 Kg/hr spare capacity in the drawing process - roughly equivalent to a 25% surplus.

2.1.4 Roving frames

Operating at their present speed, the Mill 3 roving frame capacity broadly matches the present level of demand (measured by September 1979 production requirements).

The returned questionnaires from TMDD Mill 5, fail to assign the machines to the production of particular rovings. However, by analysing the demand according to the various blends and their frame operating speeds, it is possible to deduce that the current demand can be met on marginally less than 12 frames. The current capacity therefore is 17% greater than demand, and corresponds to 516 Kg/hr a surplus of 75 Kg/hr.

We are uncertain of maximum operating speed of these frames which are older than those running in Mill 3. We note, however, that in the case of Mill 5's Blend B they are in fact running faster than Mill 3's frames. If the same increase in operating speed which is possible in Mill 3 is equally possible in Mill 5 then this surplus can theoretically be increased to 150 Kg/hr.

2.1.5 Ring frames

The arrangements estimated average overall efficiency of the ring frames is satisfactory in relation to their age and condition. Their capacity is in balance with the demand in September 1979. There is no spare capacity similar to that in the preparation stages.

2.1.6 Twisting frames

The 21 frames are fully utilized with no spare capacity. The department is operating at reasonable levels of efficiency.

2.1.7 Reeling frames

No problems are found with the operation of the reeling machines. Management policy has recently required a greater emphasis on the production of woven fabrics the effect of which is to leave 9 of the 33 units without work. Existing capacity is therefore 37% higher than demand. Management is expected to keep these machines operating satisfactorily beyond the end of the 1980's - even though some were manufactured as early as 1948.

2.2 Weaving Mills

There are 1082 looms installed in the two Dire Dawa weaving mills, i.e. mills numbered two and five, viz:

Looms	Mill 2	Mill 5	% Efficiency
Toyoda	–	648	68
Kovo	398	–	80
Ruti	12	12	82
Astra	6	–	45
Northrop	6		30
	422	660	

The equipment in the weaving preparation departments is in balance with the looms. It would not be so in number two mill if the Toyoda looms were running at a higher efficiency level than the 68% at present being achieved.

With the exception of the Astra blanket looms,all the machines were originally automatic, i.e. they were fitted with automatic pirn change or shuttle change mechanisms. They have long since been removed from the Northrop and the Kovo looms because of difficulty in getting spare parts and the problems of maintenance. Hence these looms are being operated as non-automatics and their efficiencies must be judged in that light.

The six Northrop's are weaving towels and high warp breakage rates are normal with such fabrics. However, the 30% efficiency level obtained on the Northrops is abnormally low and a level of at least 60% should be expected, even allowing for high warp breaks and manual pirn changing.

The efficiency of the Kovo looms at 80% is excellent and demonstrates the benefits of specialisation of production. Only two fabrics are woven in the Kovo's with 362 of the 398 looms on one fabric.

Looms per weaver in number two mill vary from five to ten depending on skill and experience, with a very satisfactory average of $8\frac{1}{2}$.

The Ruti looms in both mills are achieving 82% at a speed of 200 r.p.m. whilst this compares favourably with the performance of the other types of looms, it should be borne in mind that the Ruti's are fairly modern automatic looms of high quality. Weaving the simple plain fabrics which are in the looms an efficiency of 90% should be attainable.

The performance of the Toyoda looms in number five mill is less than satisfactory. They are operating at an average efficiency of 68%. These are ostensibly automatic looms with automatic shuttle change mechanisms. Unfortunately, the mechanism gives a great deal of trouble, and at any particular time it is out of action on roughly one half of the 648 looms. This is the major cause of the low loom efficiency. Later in this report a recommendation will be made to remove the mechanism from the looms and operate them as non-automatics. The number of looms per weaver, (currently 11), would then be reduced, but with manual shuttle changing an efficiency level of 80% is feasible.

The productivity levels of the weaving preparation departments are roughly what one would expect with the type and age of the machinery in use, e.g. manual cone winders, old pirn winders on which the automatic change mechanisms are not working. Overall labour productivity is diminished by a legal requirement to provide light work for female workers when pregnant. Thus two pirn stripping machines are unused to give employment as manual pirn cleaners to large numbers of women. There are up to 60 pregnant women on light duties in No.5 mill alone.

2.3 Finishing

The department has excess capacity over weaving. Selected additional production could be taken in, either on own account or on commission basis, from elsewhere within the N.T.C. (Asmara Textiles), to satisfy any overall shortage of dyed/printed goods.

Surplus Equipment

Caustic Lye Refrigerator Unit	(Hitachi Hasegawa) - 1964 - would require refurbishing for future use.
Schreiner Calender	(Kleinwerfers) - 1959 - The equipment is in good condition considering age.
Raising machine	(Monforts) - 1953
Raising machine	(Onki) - 1965 Both machines are in reasonable condition; but in all probability would require recarding before use.

3.0 BUILDING AND SERVICES

3.1 Buildings

The buildings on the site are of various ages, the oldest being about 45 years old. Precise information is not available because many of the factory records were lost in the 1940's.

In general the condition of the various buildings is reasonably good in relation to age. The site is well laid out and has space for expansion amounting to 250 000 m^2, at which 20% is within the existing boundary fence and the rest on adjacent land.

3.2 Fire Precautions

The plant is well equipped with fire fighting equipment including hydrants, extinguishers wet and dry, and sand buckets.

3.3 Steam Generation

From five package type boilers:

Boiler No. 1	Type KMH - 8	Rating 4 000 Kg/hr	1975
No. 2	MP - 506	4 200 Kg/hr	1965
No. 3	MP - 708	5 200 Kg/hr	1967
No. 4	MP - 708	5 200 Kg/hr	1969
No. 5	MP - 708	5 200 Kg/hr	1969

The steam generating plant was operated in a well organized and efficient manner. Boiler water treatment and chemical listing being carried out on a regular basis. Steam condensate only partially utilised though work is in hand to improve this situation.

Boiler feed water is filtered and chemically treated, facilities for the chemical testing of this are to hand.

3.5 Water Supply

The Company sources of water are own artesian wells and a small river flowing within the vicinity of the factory. Both sources are prone to drying up during the dry seasons - normally December-January; but also August/September during 1979. Drilling for additional water supplies is under way some distance from the factory - these sources have still to be proved and capital acquired for the laying of a pipe line. Since the known shortage of water accounts for a 10-15% reduction in budgeted annual volumes, the provision of such capital should be a priority in the event of the new drillings being positive. Required water demand is 2000 m^3 per day.

3.6 Process Effluent

Domestic effluent is fed direct to municipal drain system. Process effluents are passed to a series of settling tanks prior to discharge to municipal drains - no treatment is given prior to discharge. There is no local legislation specifying the limits of impurities discharged. Total effluent discharge is approximately 1 500 m^3 per day.

3.7 Air Conditioning

Air conditioning installations at TMDD are designed and manufactured by Hall and Kay Ltd, England. They are central station installations with additional water spray units to assist with humidity in the weaving departments. A summary of the installations is given in the table below:

TABLE A. Air Conditioning Installations (Hall and Kay)

Area		Installation	Capacity
Mill 1		None	—
Mill 2		1 Central station, 2 supply fans	2 x 40 000 CFM
Mill 3		1 Central station, 3 supply fans	3 x 44 660 CFM
Mill 5:			
	Blowing and Carding	1 Central station, 1 supply fan	72 000 CFM
	Ringframes	1 Central station, 2 supply fans	2 x 40 000 CFM
	Expansion	1 Central station, 1 supply fan	67 500 CFM
	Weaving Prep	1 Central station, 2 supply fans	2 x 40 000 CFM
	Weaving	1 Central station, 2 supply fans	2 x 36 000 CFM
	Expansion	1 Central station, 1 supply fan	80 000 CFM
Mill 7:		1 Central station, 2 supply fans	2 x 50 000 CFM

We have been unsuccessful with our attempts to obtain the detailed technical specifications from Hall and Kay Ltd. Some years ago (1974) the ownership of the company changed hands and it seems that the technical records may have been lost during the changeover. However, discussions with their technical representatives lead us to believe that the Mill 3 installations were nor equipped with return air filtration. They believe that Mills 5 and 7 however, are equipped with air filtration.

It is not Hall and Kay's policy to issue standard operating and maintenance manuals. However, the company has offered to prepare some information on these subjects, and these will be forwarded to TMDD separately.

The conditions of the installations at TMDD varied from poor to bad. The mill operated the plants manually, essentially in two modes; one for dry weather and one for wet. Some installations had the automatic controls functioning, and records suggested that intermittantly, sometimes for periods up to several weeks duration, the plant was supplying air to specified conditions. However, the general conditions of the plants suggested that the standard of maintenance is inadequate. Typical faults found during examination of the plants are:

(a) Mill 2 — Water separators not cleaned properly, so droplets are drawn down the supply air ducts.

(b) Mill 3 — Control system functions correctly, but the textile operatives, who have access to the keys locking the plants, shut down the butterfly valves controlling the flow of water to the sprays - apparently without explanation or notification to the air-conditioning engineer. Water separator blades need cleaning properly.

(c) Mill 5 — 1 set of fresh air control louvres not operating. System set to full fresh air by setting the temperature controller to $0^{\circ}C$. Watersupply control valve locked in position. Operatives unable to move the valve and do not know if it is locked in the open or closed position. The condition of the wiring to electrical switch-gear is bad, and very dangerous. Water separator blades are damaged and water droplets pass freely into the supply air ducts. Under these conditions misting of the supply air duct work is hardly surprising. In one instance sections of the ducts have needed replacing only five years after being installed.

(d) Mill 7 In this mill there is some evidence of better communication between the technical management and the air-conditioning engineer. The plant is operating in a more stable manner. The condition of the installation is satisfactory – probably reflecting the fact that it is relatively new. The fact remains however, that generally speaking the air conditioning installations are poorly maintained and operated. Answers to questions regarding current air-conditioning maintenance staffing levels suggest that the resources allocated to this sector are too low. In order to staff adequately all the air-conditioning plants on the site we believe it necessary for management to employ full time, the following:

Air conditioning mechanical engineer.	1
Conditioning room shift mechanics	9 (3 shifts)
Maintenance mechanics	5
Others	2
Total	17

Note: The maintenance mechanics should include at least two instrument engineers.

In order to bring the existing plants up to full working order, we believe TMDD should employ the services of a commissioning engineer from Hall and Kay. The cost of such an engineer, in time and subsistence, plus an allowance for replacement and spare parts would we believe amount to US $ 440 000. Current replacement costs for the plants would be roughly 4 times this cost.

4.0 ASSESSMENT OF MACHINERY CONDITION

4.1 Short Staple Spinning - Mills 1, 3, and 5

4.1.1 Opening and cleaning machinery

In Mills 3 and 5 the opening and cleaning machinery is manufactured exclusively by Howa. That in Mill 5 receives a slightly lower rating (2) than that in Mill 3, (rated 1), because latter needs the services of an Howa engineer to cure the problems with the automatic doffing and weighing scutchers specifically, and more generally to rehabilitate the remainder of the plant.

Both these opening and cleaning plants should continue to operate satisfactorily until the end of the 1980's; given the existing level and quality of maintenance available at the plant, and that the services of the Howa engineer be obtained. The machinery is designed according to modern practice and in our judgement based on relevant social, technological, and economic trends is unlikely to become obsolete within that period.

In Mill 1 the situation is different. The machinery is manufactured by Trutzschler and Platts. and it is old - the latter dating from 1950, the former from 1939. Already obtaining spares for the Platt machines is becoming difficult. The management propose to preserve the existing opening and cleaning equipment for the preparation of waste raw material, mainly for spinning into market yarns. We do not agree with this proposal. Though the necessary spares probably can be made on site, the demand for skilled fitters and machinists is so high in Ethiopia generally and in the public sector in particular, that we believe their employment on this type of work is not cost effective. They are better employed keeping more modern machines operating at a higher level of productivity. We therefore recommend scrapping this machinery. Spinning waste will then be processed in the normal way using the labour available in Ethiopian mills for grading and blending the fibre.

Examples of soft waste, suitable as a diluent for the raw cotton consumed in Blend B, for coarse count yarns, was noted at Debre Birhan woollen spinning plant. This waste was allegedly from Dire Dawa (a fact firmly denied by the Dire Dawa management). In any event the quality was too good for the intended end-use. Currently TMDD is blending roughly 2½% of reasonable waste from Mill 3, and 5% to 6% waste from Mill 1 with the raw cotton used in Mill 3. In the light of the range of counts spun in Mill 3, this level of consumption is satisfactory.

4.1.2 Carding

Mill 3 is equipped exclusively with Toyoda Type CK-7C cards manufactured in 1972. Except for a recurring problem with the clutch overheating now resolved by the use of a different type of clutch, this model card is of modern design and well established throughout the world.

All the cards, including those manufactured by Toyoda in 1950, should, if properly maintained continue to give satisfactory service for the next five years. With the exception of the Toyoda Type CE cards, those manufactured since 1970, that is the high production units, are expected, with the same priviso regarding maintenance, to give a satisfactory performance until the end of the 1980's.

4.1.3 Drawframes

The drawframes installed in Mill 1 are old. They are probably uneconomic to run when compared with new models and, in a technical stage quite obsolete. They should be scrapped. The existing capacity of 45 Kg/hr could be easily handled by two modern frames, are for each of the first and second passages. The third passage would then be no longer required. Cost of these replacements is roughly US $ 70,000 at present prices.

Mills 3 and 5 have Toyoda drawframes throughout. The narrower and coarser range of counts spun in Mill 3 enables coarser roving to be processed on the drawframes consequently a higher production rate is achieved. Theoretically it would be possible to increase the output from Mill 5's drawframes by following the same reasoning. However, the quality control and supervision staff are effectively overstretched as it is, so we think it best that Mill 5's high level of standardisation be kept, and that the single but relatively fine sliver count remain unaltered.

All the drawframes have been given a rating of 2. We believe, as with other machinery, that they would benefit from a visit by a skilled Toyoda engineer. He would be able to correct the minor faults occurring on the machines at the moment; namely, the difficulty aligning both the photo-electric stop motion and the coiler tube. It was interesting to note that better regularity is obtained with the older machines. No doubt the engineer, during his visit, would also improve the regularity on the newer frames.

After rehabilitation these frames should last until 1985.

4.1.4 Roving frames

The Platt MS-1 roving frames running at only 700 r.p.m. and with small packages, were producing poor quality roving. Even though the end-use is sales yarn, it is better that these machines be scrapped. More regular roving, produced at higher speeds, on new machines would yield useful benefits at subsequent processes, for example; more regular yarns, stronger yarns, fewer end-breaks, higher operative productivity etc.

Mill 3 and 5 are equipped with Toyoda machinery.. Mill 3 has the more recent Model FL-6 frames. They are however, only running at 850 r.p.m. when their maximum possible speed is, according to the manufacturers catalogue, 1300 r.p.m. This slower speed probably reflects the poor quality of the card and drawframe feed slivers. A concerted effort by management and staff to lift the sliver quality should enable the rotational speed to be increased to 1000 r.p.m. and yield an increase in useful economic benefits and roving capacity of 17%.

With proper maintenance the frames should continue to give satisfactory service until the end of the 1980's.

The Model FA-1000 units receive a higher machine condition rating (2) than the newer model FA-4 units (rated 3) manufactured in 1968 and 1970, because the former units, according to management give better roving. Nevertheless, all frames would benefit from servicing by Toyoda or other skilled engineers, particularly the drafting systems on the newer frames. Estimated current maximum cost including replacement parts but excluding subsistence and other expenses incurred by the engineers is unlikely to exceed US $ 120000.

4.1.5 Combing

All the machinery in this section is expected to have a satisfactory operating life throughout the 1980's. It is in very good condition at the moment, no doubt reflecting its under utilization.

4.1.6 Ringframes

Mill 1's Platt ringframes were manufactured between 1948 and 1960. By comparison with machinery installed in other Ethiopian mills they are old. However, they can be rehabilitated. Replacing the existing drafting systems, creels, spindles and rings the productivity can be increased by an estimated 67% at a cost of roughly US $ 450000. After such an overhaul the machine life is expected to extend beyond the end of 1980's.

Mills 3 and 5 use more modern frames, operating at speeds consistent with front roller and traveller life limitations. The estimated cost of rehabilitating the frames in Mill 5 necessary to ensure a satisfactory life until the end of the 1980's in both mills is US $ 1 360 000 which includes refurbishing the pre-1970 frames with umbrella type creels, fitting replacement drafting rollers to all the frames, and completely overhauling the frames in both mills.

4.1.7 Winding machines

The relatively simple and easily maintained Murata winders are operated well below their theoretical maximum operating efficiency. This reflects the demand for doubled yarn and cone/cheese wound packages. But the prevailing management attitude that any quality of yarn can be sold is reflected in the settings of the clearers, that is they are set wide open. At this setting they are totally inaffective, and might as well be removed from the winding units. The machine condition is generally satisfactory, but they would still benefit from a thorough overhaul - hence their rating of 2.

Once this overhaul has been completed the machines should continue to give satisfactory service until 1985.

4.1.8 Twisting frames

As with the winders, the frames in Mill 5 would benefit from a thorough overhaul, so as to standardize the quality of the machinery, that is, to bring the feed rollers, guides, spindles etc up to a consistent standard. Once such a procedure has been completed the frames will give a satisfactory performance until 1985.

4.1.9 Acrylic staple spinning

Mill No. 7 is engaged in the manufacture of two-fold hand knitting yarns (2/32 Nm and 2/36 Nm) from 100% acrylic fibre. It is therefore outside of the main stream of textile processing in Ethiopia and for this reason is treated separately.

Fibre is purchased in two forms; in bales and in tow. The baled form accounts for roughly one third of the consumption and the first operation it receives is carding. The carded sliver is then blended with the tow at the mixing gill. The newly acquired Befama carding unit will enable the mill to alter the blend in future to two-thirds carded sliver and one third tow, thus increasing the value added at the mill.

Total capacity at each processing stage is as follows:

Carding	180 Kg/hr
mixing gill	189 Kg/hr
pin drafter 1st pass	184 Kg/hr
pin drafter 2nd pass	184 Kg/hr
pin drafter 3rd pass	101 Kg/hr
roving machine	190 Kg/hr
ringframes	172 Kg/hr

Two factors are puzzling about the above arrangement. The relatively low capacity of the third passage pin drafting and the use of autolevelling pin drafters at the second stage of drafting rather than the first. We strongly recommend the mill to consider dropping the first passage pin drafting sequence and using the following process; carding, mixing gill, HL-4 first pin drafting, HG-4 second pin drafting, roving and ring spinning in order to achieve a better balanced plant. The number of doublings should still be adequate for the process even with this revised arrangement. The revised capacity of the plant will then be roughly 140 Kg/hr, which for the 7392 working hours a year gives a total annual production of 1030 tonnes, a figure which the mill already exceeds. We therefore, question the accuracy of the returned questionnaire, particularly the processing speed of the pin drafters.

The condition of the machinery is relatively good at the moment though for reasons of expense odd spare parts, for example for the Pneumablo fitted to the ringframe have not been replaced. The machinery is all rated either 1 or 2.

Staffing levels are satisfactory generally though the doffers are only handling 150 packages per hour which in view of the three sides per spinner (150 spindles per side) is relatively low. However, it is unlikely that management will be able to raise this figure without introducing the formal work measurement techniques recommended for the whole sector in Ethiopia.

4.1.10 Condenser spinning

A small waste spinning facility is included on the site mainly for consuming waste fibre produced on the conventional cotton spinning plants. The yarns spun (1.5 Ne or 2.7 Nm) are consumed mainly in blanket weaving also carried out on the site. The complete spinning process consists of the following four stages: willowing, lap forming, carding and spinning. Some idea of the under-utilization of the plant, which does not stem from a shortage of suitable fibre is that the card produces at only 6 Kg/hr, which for waste processing is roughly 10% of its nominal capacity. We estimate the capacity of each processing sector to be:

willowing	250 Kg/hr
lap forming	100 Kg/hr
carding	60 Kg/hr
spinning	16 Kg/hr

The machinery dates from 1952 and clearly if this sector of the industry is to be expanded, as we believe is the case, then a new installation would certainly produce blanket yarn more economically than the present system, even allowing for the fact that the existing machinery will have no depreciation cost after this interval of time.

4.2 Weaving Preparation and Weaving

4.2.1 Conewinding

Number 2 Mill is equipped with Schlafhorst conewinders, model BKN, whilst number five mill is equipped with Japanese Murata machines. The various machines range in age from nine to twenty-two years. They are manual machines, i.e., creeling, doffing and knotting is done by hand.

Although they are labour intensive and running at slower speeds than modern machines, because they are in reasonable mechanical condition, and spare parts are available they are expected to have a life expectancy of five plus years.

4.2.2 Pirnwinding

Of the four makes of pirnwinders in use the Murata and Schweiter are in good condition with many years of useful life remaining. The other two makes are Koa (Japanese), and Schlafhorst. Both types were originally automatic but are currently used as manual machines. It is recommended that the Koa machines be overhauled by the manufacturers engineers, and that their automatic mechanisms be restored. The cost for the 18 machines (432 spindles) is roughly estimated at US $ 200 000 including the cost of renewal parts.

The 20 years old Schlafhorst machines are in very poor condition and spare parts are unobtainable. It is recommended that they be scrapped and replaced by new automatic pirn winders of modern design. These may be Schlafhorst, Scharer, or Schweiter, all are excellent machines of their type. The cost of new machines with spindles totalling 168 is US $ 750 000.

It is possible that good second-hand machines can be obtained in the European textile industry areas at about 25% of the new price.

4.2.3 Warping

The warping equipment is in good condition and should last for five to ten further years depending upon the age of the machines.

4.2.4 Sizing

The four Japanese Baba machines are in good condition but the two Sucker machines in number two mill are in need of major overhaul. This is within the capability of the mill staff. After overhaul the machines will be expected to have a useful life in excess of five years.

4.2.5 Weaving

Provided the Ruti looms receive good maintenance they should last for another ten years.

The Northrop looms on towel weaving have very low efficiencies but this is due to high warp breaks and frequent manual shuttle changing. No change is recommended.

The Astra looms employed on blanket weaving are robust simple looms and will last for many years provided that spare parts are available.

The Kovo looms, whilst obsolete, have been well maintained and will last for five or more years provided spare parts are available.

Of the looms the Toyoda present the greatest problems. Although only 9-14 years old their shuttle change mechanisms had been obsolete for 30 years when the looms were built. It is a mechanism which wears and breaks shuttles quickly, and which makes heavy demands upon the loom mechanic, particularly when the loom is ageing. It is claimed that 50% of the shuttle change mechanisms at the Dire Dawa are out of order at any one time. Hence for practical purposes half the Toyoda looms are being operated as non-automatics with the shuttle changing carried out manually by the weaver.

It is recommended that the shuttle change mechaism be removed from the Toyoda looms and that they be operated as non-automatic looms, i.e. weft be replenished manually by the weaver. It will be necessary to reduce the numbers of looms per weaver. By how much depends upon the frequency of pirn changes, but it is suggested that eight looms per weaver should be feasible, i.e. a reduction of three from the present 11. The chief benefits will be, (i) reduced work load on the mechanics which should lead to higher standards at other aspects of loom maintenance, and (ii) a reduction in the cost of shuttle consumption, viz:

Shuttles used in one year on 648 Toyoda looms:

22800 Cost US $ 312 360
Cost per shuttle US $ 13.7
Shuttles per loom year: 35
Cost per loom/year US $ 480

Shuttles used in one year on 398 Kovo looms:

840 Cost @ US $ 13.7 = US $ 11 508
Shuttles per loom year 2.1
Cost per loom/year US $ 29

The Toyoda looms run faster than the Kovo at 160 p.p.m. compared with 145 p.p.m. If it is assumed that the Toyoda shuttle consumption, running as a manual change loom, is double that of the Kovo, i.e. at a cost of US $ 58 per year, then the saving per loom/year is US $ 422, or approximately US $ 273 000 for all 648 Toyoda looms.

Weavers are currently operating 11 looms and receiving approximately 110 Birr per month in wages. With three shift weaving there are three weavers per loom set, hence;

Weaver wage bill per 11 looms per year
= 3 x 110 Birr, x 12 = 3960 Birr
or approximately US $ 2000
or US $ 182 per loom/year

Clearly more weavers can be employed and a substantial saving from reduced shuttle consumption will still be gained. Furthermore, the cost of extra weavers wages will be in Ethiopian Birr whilst the whole of the saving will be in foreign exchange.

If this recommendation is accepted it is anticipated that the higher standard of loom maintenance that will result will give the Toyoda looms a life expectancy in excess of five years.

4.3 Finishing

This unit is probably the best organised and controlled of all the units visited in Ethiopia. To maintain this state in the future, some urgent consideration should be given to key areas which unattended to could jeopardise the continued success. In our opinion these are:

1. Consideration to be given to the replacement/renewal of equipment for the preparation of fabric prior to dyeing, printing etc. Continuous or large batch methods would be a preferred system (for quality and efficiency reasons) than the present small batch method on jigger machines.

2. Several key items of equipment are in urgent need of major overhaul, which in all probability, is beyond the resources of the department. Capital provision for this should be made. (refer to inventory of equipment).

4.3.1 Preparation Equipment

Approximately 80% of factory production is initially batch prepared on the jigger machines. Fourteen (of seventeen) machines are twenty years old and although running have been cannabalised to varying extents - this being the case, there is considerable doubt as to the continued availability of spares and therefore, life of these machines. To avoid this becoming a serious bottleneck a replacement programme should be drawn up for implementation in the forseeable future - either with replacement machines or continuous equipment, the latter allowing greater uniformity and better labour efficiencies.

4.3.2 Singeing equipment

Although the equipment appeared to be functioning correctly, it was reported that due to variation in the quality of fuel - that the effectiveness of the operation was unpredictable. The fuel being kerosene. As this may be attributable to failure of the carburettor system, this should be investigated and rectified. Alternatively, if this is not possible the replacement of this equipment should be considered and budgeted for.

4.3.3 Yarn dyeing-processing

Both the yarn bleaching and Acrylic yarn dyeing plants were operating as well organised production units. With the exception of two old type hank dyeing machines in the yarn bleach section the equipment is good and has been maintained in this condition.

4.3.4 Comments on equipment inventory table

Comments on finishing equipment

Machine No.2	Machine reported as working inefficiently (quality-wise) owing to variation in available fuels.
3	All seals for pressure lids badly badly or missing completely.
4	Frequent break-downs reported, delays in repair owing to non-availability of spare parts. Most panels on control boxes missing - aggravating the deterioration of electrical and mechanical components.
9	1964 equipment - one unit is a complete write-off, the second unit is operational and could be maintained by cannibalising the write-off unit.
13	The Hot Flue Unit in need of complete refurbishing.

Machine No. 18		1964 temperature control inadequate, causing fixation problems. Further problems caused by condensation droppings - suggesting an inbalance in the machines ventilation system.
	20	Rubber shrinking sleeve badly damaged - suggesting that the machine has been stopped on occasions at full heat. Overheating of sleeve stated to be a problem - this could be reduced by the installation of additional spray unit serving the inside of the sleeve.
	21	Not in use - surplus to requirements.
	25	Production demand is satisfied by one machine. The second machine is being cannibalised to maintain the one in production.

Cotton Hank Processing Plant

7	Not required to meet production targets.

5.0 WORKING ENVIRONMENT

5.1 Atmospheric Conditions

5.1.1 Spinning

High levels of airborne dust are observed in all spinning departments. Lack of air-conditioning machinery, or in those mills which do have plant, either bad design or bad maintenance are the main causes. We recommend TMDD to issue their blow-room operatives with face masks.

Working conditions in the waste spinning section are particularly bad. It is understood that plans exist for the ceasation of production in this section - otherwise, it would be our recommendation that an air-conditioning/ventilation system be installed.

5.1.2 Weaving

No. 2 mill - air conditioning plant could be more effective with the provision of a false ceiling. This particular shed somewhat dirty in comparison to others - otherwise, satisfactory in respect of floors, spacing and lighting.

Conditions in No.5 are excellent, comparing well with general international standards.

5.1.3 Finishing

Working conditions were reasonable within the department - some forced air ventillation in localised 'hot spots' could be advantageous in improving operative performances.

5.2 Health and Safety

5.2.1 Spinning

With the exception of the cards on which guards were removed in order to assist machine cooling, the company supervision is successful ensuring that machines are well guarded. However, last year we believe the company treated some 472 accidents (mainly to hands), of which 79 are classified as major, that is resulting in either amputation or an insurance claim of more than 18% of the annual salary. Doctor attributes many of the accidents to poor training. High intensity noises are causing impaired hearing. No ear plugs are provided at present.

5.2.2 Weaving

There were no unusual hazards present in the weaving and weaving preparation departments. Machine guards were used where appropriate and the passage ways between machines were adequate and kept clear.

Workers in the weaving shed did not use any protection for their hearing. It is recommended that they be issued with ear plugs or muffs.

5.2.3 Finishing

Whilst not commanding any management priority the standard of machine guarding (withsome noteable exceptions) appeared better than at other factories - a factor possibly attributable to a better standard of engineering maintenance apparent in the factory.

5.2.4 Health care

The factory maintains a health centre that is available to all employees. This is a model unit - worthy of adoption at other major manufacturing centres. Apart from normal first-aid facilities, it houses a fully qualified medical unit complete with X-ray equipment. From medical diagnosis it has already identified the first cases of Bissinosis - and is taking positive action to reduce the effects of the disease with suspect cases, statistically monitoring the occurences.

Absenteeism is claimed to be high, especially in the weaving department. Sickness is the usual cause, usually associated with the chest, asthma etc. The mill is operating for 8 448 hours per year on three shifts, i.e. 2816 hours per operative/year, or 56 hours per operative/week.

It is suggested that these working hours are excessive, and that much of the sickness amongst employees may be attributed to cumulative fatigue. It is recommended that the hours per shift per employee be reduced by the introduction of a fourth shift. This would reduce the hours worked on shift to approximately 42 per week per man. Extra employees will be needed but not 33% more for the extra shift can be manned to a large extent by operatives currently employed on day work. Consideration of this proposal is strongly recommended.

6.0 MAINTENANCE

The textile mills in Ethiopia are conscious of a need to improve the level of machine maintenance. In the main, mills are thinking of introducing planned maintenance, but TMDD is exceptional in that most of the schemes they operate have been introduced and operated for a number of years now. These schemes include those which monitor

- the number of rollers ground
- the height and condition of flats on cards
- card clothing condition
- spare parts fitted to all machines, stock levels of these parts and their cost when purchased
- repairs carried out on all machines; each machine having its own repair record card.
- scheduled maintenance programmes for spinning machines cards, loom - all either being prepared or introduced in 1979, and for the future
- full maintenance cost control and recording system.

However, the introduction of these schemes has failed to yield the standard of maintenance that we expected. The main reasons for this failure are we believe:

- sporadic implementation of the schemes, confirmed by record sheets
- inadequate supervision of the schemes
- inadequate supply of skilled technicians with which to carry out the work

TMDD has no difficulty obtaining spare parts from overseas suppliers, and the workshop machinery it possesses is comprehensive in both its capacity and variety. One noted exception is that the workshops include no heat-treatment facility to enable them to stress relieve welded parts. However, we believe that such facilities do exist in the town of Dire Dawa and therefore their provision at the mill should not be rated as a high priority.

In order to prevent the rapid deterioration of the spare parts stored on the TMDD site we recommend that the store be improved so that more room is available. Management have suggested that Mill 1 might, after roof repairs have been completed, because the new site of an expanded store. We concur with this suggestion, but if space considerations still dictate that some machine parts have to be stored on racks which do not allow them to be stored separately, then these parts could be coated with a suitable compound prior to storage. A suitable coating medium can be obtained from:

Cray Valley Products
Orpington, Kent. Contact Mr O'Hara for details of application.

If the malpractices and limiting factors noted above can be corrected, then the benefits which would come into being in the mill would be mainly related to improved quality of product and improved labour productivity. No increase in machine productivity can be forseen without some increase in existing spinning capacity.

No evidence was found in the mill of any appreciation of the benefits which can accrue to mill management from collaboration between maintenance departments and quality control department. The maintenance department tended to work to objectives set for itself rather than for the overall benefit of the company as a whole.

7.0 QUALITY

7.1 Spinning

Quality control and yarn quality in TMDD

Eight people were observed working in the Quality Control department which serves the cotton yarn and weaving departments. The department operated a limited range of tests mainly concerned in spinning with the control of laps, second passage drawframe sliver, and yarn. The frequency of some of the tests carried out is given in Table B below:

TABLE B Testing programme at TMDD

Department		Frequency of test		
A.	Blowing room	Lap weight, ounces/yd	-	monthly
		Waste, percentage	-	monthly
		Raw cotton, moisture %	-	weekly
B.	Card room	Sliver weight. grains/yd	-	monthly
		Waste, percentage	-	monthly
C.	Drawing	Sliver weight, grains/6 yd	-	weekly
D.	Combing, lapformer	Sliver weight/yd	-	fortnightly
	comber	Sliver weight grains/yd	-	weekly
		Noil percentage	-	fortnightly
		Moisture content	-	fortnightly
		U %	-	fortnightly
E.	Simplex	Roving weight grains/120 yd	-	monthly
		U %	-	monthly
F.	Ringframes	Yarn weight, grains	-	daily
		Lea strength	-	3 days
		Single yarn strength	-	weekly
		U %	-	monthly
		Blackboard examinations	-	unknown

The testing programme outlined above is suitable for determining the overall quality standards in the various departments, but quite clearly lack sensitivity. For example, the weighing of the laps will indicate any long-term variation in lap weight, but yields no information about the variation in lap weight across the width of the scutcher. It is therefore impossible to use the test as any basis for anything but the most generalised comment on the settings on the scutcher. The frequency of the test is also of questionable value. The scutchers can deteriorate well beyond acceptable limits within a 28 day period.

A similar criticism can be levelled against the spun yarn tests, though the frequency of the daily tests is acceptable. In order to be able to react to machinery malfunctions as quickly as possible, and to determine the probable nature of the malfunction we recommend that the daily test programme presently carried out is augmented by daily tests on the Uster Evenness Tester. It is unlikely that the Acrylic mill testing programme is fully utilising the installations there. This expanded programme of tests will provide the information necessary for the mill to begin a quality improvement programme and at the same time help to promote the communication between mainrenance and quality control departments which is so necessary to change the prevailing attitude; that any quality produced can be sold.

Blackboard tests are carried out on parallel boards. If taper boards were used, then again additional information on yarn irregularity would be revealed to the testing department. The evidence, based on an examination of the three grades of yarn identified when Mill 5 was first commissioned, suggests that the mill is now unable to produce yarns to the highest standard. An admittedly small sample of the current production appeared similar to the second grade standard of a three standard scale.

Finally the recommended number of staff and their respective titles for providing adequate control coverage of all the spinning mills in TMDD is we believe:

Supervisor	1	
Calculator	1	
Preparation analysers	5	
Yarn analysers	5	
Raw cotton analysers	2	
Twist analysers	4	
Uster operators	3	
Yarn appearance	4	
Transport	4	
Total	29	all working one shift/day.

7.2 Weavings

The Kovo, Northrop and Astra looms were weaving without warp stop mechanisms. This means that every warp breaks creates a serious fault for a warp thread is missing for several inches. Cheap fabrics destined for the unsophisticated rural market were produced on the Kovo looms, and fabric faults are acceptable to those consumers. For a more sophisticated market with higher quality standards such faults would be unacceptable.

The Toyoda looms were producing a variety of fabrics, most of which were of a higher standard than those woven on the Kovo looms. Nevertheless, many cloth faults occurred,the most of which was weft bars at the shuttle change. The fault seemed to occur at every shuttle change i.e. every half metre of cloth, and is symptomatic of maintenance problems with the shuttle change mechanism and variation in tension between the different shuttles.

The Ruti looms produced the best quality and for this reason the more expensive polyester/cotton twill was woven in those looms.

Although the cloth was not good enough for export to a developed country, by the standards required in the Ethiopian market, or East Africa generally, the quality was adequate.

Cloth inspection procedures were good and superior to those found in other mills. Faults were recorded and information on especially bad rolls of cloth was fed backto the weaving shed for action.

7.3 Finishing

From observations of materials to hand, the quality of finished products, in all sections, appeared to be good and at a level above that observed in other units processing similar qualities.

For the further advancement of product quality, an enlarged quality and technical control section - suitably staffed and equipped would be recommended.

8.0 WORKFORCE, PRODUCTIVITY AND SKILLS

8.1 Spinning

Labour productivity in Mill 1 is very low. No particular process is responsible for the situation which arises mainly as a result of the poor conditions of the machines and their products. This, however, cannot be the sole reason obsolescence probably accounts for no more than 50% of the difference. Rather is is caused by atrocious working conditions arising from the lack of air-conditioned and filtered air and general run-down condition of the equipment when compared with other mills on the site. The knowledge that the company is in effect negotiating to replace this mill will also be a contributary factor.

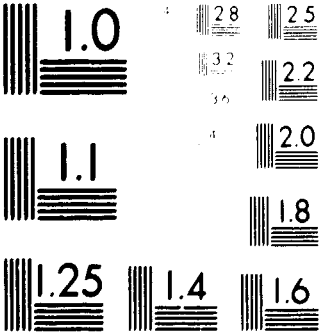
Mill 3 has an overall count corrected OHK value roughly 150% higher than the target figure. In this mill the distribution of surplus labour is not found to be equally distributed across all the processes. Both the roving frame and ringframe processes are roughly 250% higher than target. Part of the explanation for this difference has already been dealt with in the examination of the machines performance where it was pointed out that there exists a significant surplus of capacity at the roving frames. In addition the 'target' roving frames are based on easy doffing frames on which the flyers lift well clear of the spindle in order to facilitate doffing. Not all the frames had this facility in Mill 3. However, the largest single cause of low labour productivity is the higher number of ring spinning doffers used in Mills 3 (and 5). In mill 3 the average nett weight of yarn on the bobbins is roughly 90 grams. With a daily production of 7431 Kg, 3440 doffs/hr are necessary. To carry out this doffing the mill employs 21 doffers giving a doffing rate of only 163 per hour. Even allowing for a 25% absenteeism, the rate only increases to 215 doffs/hour/doffer. If, as we believe, 350 doffers/hour/doffer is a reasonable short-term target for Dire Dawa to aim for, then in order to achieve this the following objectives need to be achieved:

* reduce absenteeism to 10% - saves 4 doffers
* increase labour productivity - saves 4 doffers

The picture in Mill 5 is similar but not quite so bad. The doffing rate, after allowing for the same level of absenteeism is marginally greater than 300 doffs/hour/doffer.

Mill No.5 only requires a reduction of its OHK based labour productivity of 45% in order to reach the target values. We believe that such a reduction is possible if preceded by the establishment of a work study department to study work allocation within the mill. Such a department is also required for other purposes, but does not provide a short term solution.

81.09.28



MICROCOPY RESOLUTION TEST CHART

Direct labour skills are similar to the levels common in other N.T.C. mills which are universally low. Training is of the 'on the job' variety and is inadequate. More formal methods of training are recommended for all but unskilled tasks. The Dire Dawa plant is large enough to sustain a viable training school staffed by professional instructors and a strong recommendation is made that the establishment of such a school be a priority project.

8.2 Weaving

Labour productivity is roughly similar to that in other N.T.C. weaving mills. It is low in relation to similar type weaving mills in other parts of East Africa, viz.

Operative hours per 100 000 m of weft inserted

No.2 mill:	8.0 hrs
No.5 mill:	7.5 hrs
Kenya, automatic looms:	4.0 hrs
Kenya, non-auto looms:	5.9 hrs

The operatives included in the calculation are the total operatives employed in weaving preparation, weaving, and grey cloth inspection. A substantial number of excess workers are employed to cover absentees, usually through sickness. Other recovering from sickness or permanently disabled or pregnant are employed on light duties for which jobs frequently have to be created. There are sufficient employees in the plant to operate a four shift system giving shorter working hours per employee. For example, in No.2 mill there are 11 loom mechanics on each of the three shifts, plus 22 on day work, whilst in No. 5 mill there are 11 loom mechanics per shift plus 51 on day work. Many spare weavers are employed, 27 per shift in No.2 mill and 45 per shift in No. 5 mill. The introduction of four shift working with the existing labour force is strongly recommended.

Skills of the technical staff, e.g. mechanics and other maintenance workers, are limited by inadequate training and lack of maintenance manuals. Supervisory staff are hampered in their training role by the same problem, lack of instruction manuals in Amharic. Translations of such manuals are an urgent requirement and their provision should be a priority task. This comment applies to all the N.T.C. mills.

The turnover of workers is said to be high with weavers providing one of the biggest problems; weaver turnover is estimated at about 20% per annum. This level of wastage, about 150 per year justifies the establishment of a Training School on the site. On of the job training training which is the current practise is inadequate in these circumstances.

8.3 Finishing

Whilst existing first and second level line management are fully experienced and technically competent, concern was expressed that there was am extreme shortage of trained technical and management staff at lower levels.

In the absence of finalised operative training schemes, the only training extended was by way of time and experience.

TABLE No. O/1 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - DIRE DAWA - MILL No. 1

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	PRODUCTION DATA: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Blending Feeder	Trutzschler		1939	1		6.5[1]													4
3-Bladed Opener	"		1939	1		4.5[1]													4
Hopper feeder	"		1939	1		6.5[1]													4
Scutcher	"		1939	1		6.5[1]													4
Blending feeder	"		1939	1		6.5[1]													4
Hopper feeder	Platt		1950	1		3.5[1]													4
3-Bladed opener	"		1950	1		4.5[1]													4
Scutcher	"		1950	1		4.0[1]													4
Condenser	Trutzschler		1939	1		2.0[1]													4
Material transfer wheel	Platt		1950	1		0.5[1]													4
Cards	Platt		1950	24	1	1.5	300	880	3.02		9.96 rpm (doffer)				0.142	-	6.67 kg	70%[1]	3
Cards	Toyoda		1950	13	1	1.5	300	880	3.02		9.96 rpm (doffer)				0.142	-	6.67 kg	70%[1]	2
Cards	Toyoda		1970	5	1	1.5	300	880	3.02		9.96 rpm (doffer)				0.142	-	6.67 kg	70%	2
Drawframe 1st pass	Platts		1929	1	4	1.5	300	880	4.12			72 m/min		4 over 5	0.141	-	18.09 kg	75%[1]	4
Drawframe 1st pass	"		1950	1	4	1.5	300	880	4.12			72 m/min		"	0.141	-	18.09 kg	75%[1]	4
Drawframe 1st pass	OKK		1935[2]	1	4	1.5	300	880	4.12			35 m/min		"	0.141	-	8.79 kg	40%[1]	4
Drawframe 2nd pass	Platts		1950	1	4	1.5	300	880	4.12			62.7 m/min		"	0.144	-	15.42 kg	75%[1]	4
Drawframe 2nd pass	Platts		1959	1	4	1.5	300	880	4.12			62.7 m/min		"	0.144	-	15.42 kg	75%[1]	4
Drawframe 2nd pass	OKK		1935	1	4	1.5	300	880	4.12			35 m/min		"	0.144	-	8.91 kg	40%[1]	4
Drawframe 3rd pass	Platts		1950	2	4	1.5	300	880	4.12			62 m/min		"	0.151	-	14.55 kg	70%[1]	4
Drawframe 3rd pass	"		1959	1	4	1.5	300	880	4.12			62 m/min		"	0.151	-	14.55 kg	70%[1]	4
Roving frames	Platts	MS-1	1950	4	120	2.5			0.48		700 rpm			SKF 3-zone	1.05	1.08	66.65 kg	50%[1]	4
Ring frames	Marzoli		NOT WORKING AND PLANNED TO BE SCRAPPED																
Ring frames	Platts		1948	1	400	8.25		203	0.74		6450 rpm		Pneumafil	2-zone	10.00	11.46	20.26 kg	82%[1]	3
Ring frames	"		1948	3	400	8.25		203	0.74		6930 rpm		"	2-zone	13.00	15.05	12.75 kg	82%[1]	3
Ring frames	"		1950	4	400	8.25		203	0.74		6930 rpm		"	2-zone	13.00	15.05	12.75 kg	82%[1]	3
Ring frames	"		1960	5	400	8.25		203	0.74		6930 rpm		"	2-zone	13.00	15.05	12.75 kg	82%[1]	3
Ring frames	"		1960	3	400	8.25		203	0.74		6930 rpm		"	2-zone	21.00	19.51	6.09 kg	82%[1]	3
Twisting frames	Hamel		1960	6	380	NOT IN OPERATION OWING TO SURPLUS CAPACITY									2.32				3

(1) Estimated
(2) Platts 1914 markings

TABLE No. O/2 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - DIRE DAWA - MILL No.3

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	PRODUCTION DATA Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Blending feeder	Howa		1972	2															1
Hopper mixer	"		1972	2															1
Step cleaner	"		1972	2													110 kg		1
Cylinder opener	"		1972	2		26.2											x2		1
Cylinder opener	"		1972	2															1
Control feeder	"		1972	2															1
Scutcher	"		1972	2															1
Cards	Toyoda	CK-7L	1972	11	1	6.2	508	1016	13.6	1016	33.7 rpm(doffer)		Yes	1.72 ratio	0.119	-	27.1 kg	90	2
Drawframe 1st pass	Toyoda	DK-95	1972	2	4	4.3	508	1016	16.3	-		164 m/min	Integral	4 over 5	0.122	-	190 kg	85	2
Drawframe 2nd pass	"	DK-95	1972	2	4	4.3	508	1016	18.3	-		161 m/min	Integral	4 over 5	0.125	-	182 kg	85	2
Roving frames	Toyoda	FL-6	1971	4	96	11.3		406			850 rpm		Yes	2 apron-	0.883A	0.907	91 kg	83	2
								(BDB)						2 zone	B	0.933	89 kg	83	2
Ring frames	Platt		1950	6	408	16.5		203 Lift	.092		11600 rpm		Pneumafil	SKF PK 220-17	A 20	17.14	12.42 kg	96(1)	3
Ring frames	"		1950	5	408	16.5		203 "	.082		11900 rpm		"	" "	A 24	19.58	9.30 kg	96(1)	3
Ring frames	"		1950	8	408	16.5		203 "	.093		12000 rpm		"	" "	A 32	22.43	6.14 kg	96(1)	3
Ring frames	Toyoda	RY	1972	2	400	16.5		203 "	.092		9050 rpm		"	" "	B 13.5	15.73	15.34 kg	96(1)	2
Ring frames	"	RY	1972	8	400	16.5		203 "	.072		9050 rpm		"	" "	B 18	17.45	10.37 kg	96(1)	2
Ring frames	"	RY	1972	4	400	16.5		203 "	.087		9613 rpm		"	" "	B 21	18.45	8.93 kg	96(1)	2
Ring frames	"	RY	1972	1	400	16.5		203 "	.065		10730 rpm		"	" "	C 34	23.40	4.85 kg	96(1)	2
Ring frame	"	RY	1972	1	400	16.5		203 "	.068		9435 rpm		"	" "	C 50	30.00	2.26 kg	96(1)	2
		NOTE: THE ABOVE FIGURES SHOW. 19 PLATT FRAMES AND 16 TOYODA FRAMES WHEREAS DRAWING ENTITLED 'GENERAL PLAN OF T.M.D.D. SHOWS 20 PLATT & 15 TOYODA																	
Winders	Murata		1958	1	120	3.86	127	127				536 yds/min			KN 24	-	86.82 kg	50(1)	2
Winders	"		1958	1	120	3.86	127	127				536 yds/min			C 34	-	61.28 kg	30(1)	2
Winders	"		1965	1	100	3.86	127	127				536 yds/min			C 50	-	34.73 kg	50(1)	2
Winders	Franzmuler		-	1	80	3.86	127	127				146 yds/min			B 21	-	18.02 kg	40(1)	2
Reeling machines	Iwagana		1964	3	80	PRODUCTION NOT					220 rpm				21		1.19 kg		1
Reeling machines	"		1968	4	80	ASSIGNED TO					220 rpm				40 HT		1.78 kg		1
Reeling machines	"		1970	4	80	PARTICULAR					220 rpm				40 N		1.28 kg	35(1)	1
Reeling machines	"		1971	2	80	MACHINES					220 rpm				60 HT		1.28 kg		1
Reeling machines	Nakat		1971	1	80						220 rpm				60 N		1.28 kg		1
Reeling machines	Kimoto		1915	3	80														1
Reeling machines	Platts		1948	16	80														1

(1) Estimated

TABLE NO. O/3 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - DIRE DAWA - MILL NO. 5

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data: Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Blending Feeder	Howa	HS	1969	1															2
Hopper Mixer	"	HS	1969	1															2
Step Cleaner	"	HS	1969	1		20kW													2
Cylinder Opener	"	HS	1969	1															2
Creighton Opener	"	HS	1969	1															2
Condenser Feeder	"	HS	1969	1															2
Scutcher	"	HS	1969	1															2
Blending Feeder	"	12H	1965	1															2
Hopper Mixer	"	12H	1965	1		28.3kW													2
Double Beater Opener	"	12H	1965	1															2
Blending Reserve Box	"	12H	1965	2															2
Scutcher	"	12H	1965	2															2
Precomber Drawframe	"	DF	1969	1	4	3.57	406	1067	10.7			94m/min			0.142	-	93.80kg	-	1
Automatic Lap Former	"	DY-5	1969	1		4.10			7.0			56.7m/min			0.01042	-	193.0kg	85(1)	1
Combers	"	Cartory K	1969	6	2	5.23	406	1067	10.4		200npm		13/15%		0.142	-	29.70kg	70(1)	1
Cards	Toyoda	CE	1965	48		1.5	406	1067	10.4		10rpm	(doffer)			0.142	-	5.75kg	85(1)	2
Cards	"	CE	1968	16		1.5	406	1067	10.4		10rpm	"			0.142	-	5.75kg	85(1)	2
Cards	"	CE	1969	20		1.5	406	1067	10.4		10rpm	"			0.142	-	5.75kg	85(1)	2
Cards	"	CE	1970	10		1.5	406	1067	10.4		10rpm	"			0.142	-	5.75kg	85(1)	2
Drawframe 1st Pass	Toyoda	DK	1965	4	4		355	1067	10.8			78m/min		4over5	0.142	-	77.84kg	75(1)	2
Drawframe 1st Pass	"	DK-9F	1968	1	4	21.8kW	406	1067	11.4			156m/min		4over5	0.142	-	155.68kg	75(1)	2
Drawframe 1st Pass	"	DK-9S	1970	2	4		406	1067	11.4			156m/min		4over5	0.142	-	77.84kg	75(1)	2
Drawframe 2nd Pass	"	DK	1965	5	4	23.3kW	355	1067	9.0			78m/min		4over5	0.142	-	155.68kg	75(1)	2

SHORT STAPLE SPINNING - DIRE DAWA - MILL NO. 5

TABLE NO. 0/3 - INVENTORY OF SPINNING MACHINERY

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size			Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data				Machine Condition
							Ø mm	Height mm	Capacity kg						Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	
Drawframe 2nd Pass	Toyoda	DK-9F	1968	1	4	23.3kW	355	1067	9.0			156m/min		4over5	0.142	-	155.68kg	75 (1)	2
Drawframe 2nd Pass	"	DK-9S	1970	2	4		355	1067	9.0			156m/min		4over5	0.142	-	155.68kg	75 (1)	2
Drawframe 3rd Pass	"	DK	1965	1	4	1.5kW	355	1067	10.0			70.5m/min		4over5	0.142	-	70.36kg	75 (1)	2
Roving Frames	Toyoda	FA-100	1965		96	5.5								3-zone: A	1.38	1.2	44.16kg	80 (1)	2
Roving Frames	"	FH-4	1968	14	96	5.5		NOTE: Production not assigned to particular frames.						3-zone: B	1.05	1.1	61.44kg	80 (1)	3
Roving Frames	"	FH-4	1970		96	5.5								3-zone: C	1.38	1.2	44.16kg	80 (1)	3
														3-zone: T/C	1.38	0.75	69.12kg	80 (1)	3
Ring Frames	Toyoda	RR	1965	30	400	12.1					10920 rpm (3)				B/21	19.40	0.55 (2)	95 (1)	3
Ring Frames	"	RR	1967	5	400	12.1					11730 rpm (3)				A/24	18.57	0.54 (2)	95 (1)	3
Ring Frames	"	RR	1968	15	400	16.5	NOTE: Production not assigned to particular frames.				11250 rpm (3)		Pneum-afil for broken ends	No modifications since new	A/24 KNT	17.81	0.345 (2)	95 (1)	3
Ring Frames	"	RY	1969	15	408	16.5					12040 rpm (3)				A/32	22.38	0.345 (2)	95 (1)	3
Ring Frames	"	RY	1970	10	408	16.5					11860 rpm (3)				A/40	24.34	0.25 (2)	95 (1)	3
											12380 rpm (3)				A/40 HT	39.68	0.25 (2)	95 (1)	
											11650 rpm (3)				C30	21.67	0.16 (2)	95 (1)	
											11860 rpm (2)				C40	24.34	0.25 (2)	95 (1)	
											10580 rpm (2)				C60 N	27.82	0.13 (2)	95 (1)	
											10420 rpm (2)				C60 HT	39.60	0.09 (2)	95 (1)	

TABLE NO. 0/3 - INVENTORY OF SPINNING MACHINERY

SHORT STAPLE SPINNING - DIRE DAWA - MILL NO. 5

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size			Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data				Machine Condition
							Ø mm	Height mm	Capacity kg						Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	
(Ring Frames continued)					NOTE: Production not assigned to particular frames.							11770 (3) 12710 (3)			T/C34 T/C 45/50	20.29 23.18	0.35kg 0.25kg	95 (1) 95 (1)	
Assembly Winder	Murata	22	1965	3	100	3	45	203	1.292			461m/min			A20/2		163kg	35	2
Assembly Winder	"	22	1968	2	100	3	45	203	1.292			461m/min			A24/2		136kg	35	2
Assembly Winder	"	23	1970	2	100	3	45	203	1.292			461m/min			A32/2		102kg	35	2
									1.420			461m/min			T/C 34/2		96kg		
									1.420			461m/min			T/C 45/2		72kg		
Twisting Frame	Toyoda	RG	1965	11	400	11	55	254			6850 rpm (1)				A20/2	11.48	21.5kg (2)	105 (3)	2
Twisting Frame	"	RG	1968	2	400	11	55	254			8150 rpm (1)				A24/2	13.40	18.2kg (2)	105 (3)	2
Twisting Frame	Kaj	S-75	1971	8	400	11	55	254			8150 rpm (1)				A32/2	17.86	10.3kg (2)	103 (3)	2
											8150 rpm (1)				T/C 34/2	20.10	8.6kg (2)		
											8150 rpm (1)				T/C A5/2	18.76	6.9kg (2)		

NOTE: Overall efficiency is calculated to be 105% completed questionnaire shows an average of 90%.

(1) Estimated

(2) Production in kg/sp'dle/day (September 1979 Data)

(3) Calculated from (2) above.

TABLE No. O/4 - ACRYLIC SPINNING PLANT - Dire Dawa - MILL No.7

MACHINE INVENTORY

							Can, Bobbin or Tube Size								PRODUCTION DATA				
Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Ø mm	Height mm	Capacity kg	Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Output Count Nm	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	Machine Condition
Carding set	Mackie		1975	1		3.5							Yes. Unit						
Carding set	Befama	NOT YET OPERATIONAL																	
Mixing gill	Osaka Kiko	HM-4	1972	1	1	3.7	825	970	15			100 m/min		Inserted	0.046		77 kg	70	
Mixing gill	" "	HM-4	1975	1	1	3.7	825	970	15			100 m/min		faller	0.046		77 kg	70	
Pin drafter 1st pass	" "	HG-C4	1972	1	1	2.2	825	970	15			150 m/min		" "	0.046		115 kg	80	
Pin drafter 1st pass	" "	HG-C4	1975	1	1	2.2	825	970	15			150 m/min		" "	0.046		115 kg	80	
Pin drafter 2nd pass	" "	HL-4	1972	1	1	2.2	825	970	15			150 m/min		" "					
Pin drafter 2nd pass	" "	HL-4	1975	1	1	2.2	825	970	15			150 m/min		" "					
Pin drafter 3rd pass	" "	HG-4	1973	2	2	2.2	530	980	18			150 m/min		" "					
Pin drafter 3rd pass	" "	HG-4	1975	2	2	2.2	530	980	18			150 m/min		" "					
Roving frame	Toyoda	FL-2	1972	3	48	7.5	178	355	1.80		750 rpm.			4-line	1.9			80	
Roving frame	"	FL-2	1975	2	48	7.5	178	355	1.80		750 rpm			single apron	1.9	0.61		80	
Ring-frame	Murubehi	OM	1972	10	300	7.5	85	228	0.110		171 rpm		Not yet working	3-line double apron				90	
Ringframe	"	OM	1976	7	300	7.5	85	228	0.110		171 rpm		Yes, but not working	" " " "				90	
Reeling	Seiwa		1972	10	40	0.4					170 rpm							25	
Reeling	"		1975	6	40	0.4					170 rpm							25	
Assembly winding	Murata	23	1972	1	50	1.5	200(m)	152	1.50			500 m/min		Production				70	
Assembly winding	Murata	23	1976	1	50	1.5	200(m)	152	1.50			500 m/min		not assigned				70	
Winding	"	12	1972	7	120	1.5	180	152	1.22			600 m/min		to	32 and		79.7+	50	
Winding	"	12	1975		120	1.5	180	152	1.22			600 m/min		specific	36		70.9	50	
Twister	Murubehi	O.M	1972	2	200	9.0		330	0.275		5000 rpm			m/cs.	2/32 and			90	
Twister	"	O.M	1975	5	200	9.0	50	330	0.275		5000 rpm				2/36			90	
Twister	Majed	PL'7A	1978	4	288	9.0	54	280	0.139		4460 rpm								

CONDENSER SPINNING PLANT - DIRE DAWA

TABLE NO. 0/5 - MACHINE INVENTORY

Machine Description	Manufacturer	Model	Year of Man'ture	No. of M/cs	No. of Del's Sp'dles	Installed Power kW	Can, Bobbin or Tube Size			Working Width mm	Operating Speed	Delivery Speed	Waste Removal System	Drafting System	Production Data				Machine Condition
							Ø mm	Height mm	Capacity kg						Output Count Ne	Turns per inch	Prod'n per unit per hr	Overall Efficiency %	
Opening	Willow		1952	1															
Cleaning	Scutcher		1952	2															
Carding	Platts		1952	3	30	4.88					195rpm				1.59	2.03		40	
Ringframe	Platts	Chapon	1952	3	98	2.75					6rpm				0.19			65	

TABLE O/6

STAFFING - SPINNING - MILL No.1 DIRE DAWA

Opening and Cleaning	Day	1	2	3	Total
Tender	-	2	2	2	6
Lattice Feeder	-	2	2	2	6
Sweeper	-	1	1	1	3
Total	-	5	5	5	15
Carding					
Tender	-	4	4	4	12
Lap Carrier	-	1	1	1	3
Total	-	5	5	5	15
Drawing					
Tender	-	3	3	3	9
Sweeper	-	1	1	1	3
Total	-	4	4	4	12
Roving					
Tender	-	2	2	2	6
Doffers	-	4	4	4	12
Total	-	6	6	6	18
Ringframe					
Spinner	-	13	13	13	39
Head Doffer	-	2	2	2	6
Doffer	-	21	21	21	63
Bobbin Carrier	-	3	3	3	9
Sweeper	-	3	3	3	9
Total	-	42	42	42	126

TABLE O/7

STAFFING - SPINNING - MILL NO.3 DIRE DAWA

Opening and Cleaning	Day	1	2	3	Total
Tender	-	1	1	1	3
Lattice feeder	-	2	2	2	6
Interim hand	-	1	1	1	3
Sweeper	-	1	1	1	3
Total	-	5	5	5	15
Carding					
Tender	-	2	2	2	6
Lap carrier	-	1	1	1	3
NAF: Tender (air suction)	-	1	1	1	3
Total	-	4	4	4	12
Drawing					
Tender	-	4	4	4	12
Doffer	-	4	4	4	12
Sweeper	-	1	1	1	3
Total	-	9	9	9	27
Ring Frame					
Spinner	-	12	12	12	36
Doffer	-	21	21	21	63
Bobbin carrier	-	4	4	4	12
Bobbin sorter	-	2	2	2	6
Sweeper	-	3	3	3	9
Others	-	7	7	7	21
Total	-	49	49	49	147

TABLE O/7 (continued)

Reeling		Day	1	2	3	Total
Reeler		-	66	66	66	198
Checker		-	1	1	1	3
Sweeper		-	1	1	1	3
Others		-	5	5	5	15
	otal	-	73	73	73	219
Winding						
Tender		-	6	6	6	18
	Total	-	6	6	6	18

TABLE O/8

STAFFING - SPINNING - MILL NO.5 DIRE DAWA

Opening and Cleaning	Day	1	2	3	Total
Tender	-	2	2	2	6
Lattice Feeder	-	3	3	3	9
Sweeper	-	2	2	2	6
Total	-	7	7	7	21
Pre-Comber Drawing					
Tender	-	1	1	1	3
Lap Former	-	1	1	1	3
Total	-	2	2	2	6
Combing					
Tender	-	2	2	2	6
Total	-	2	2	2	6
Carding					
Tender	-	6	6	6	18
Lap Carrier	-	2	2	2	6
Sweeper	-	1	1	1	3
Total	-	9	9	9	27
Comber Lap Forming					
Tender	-	1	1	1	3
Pre-comber Drawer	-	1	1	1	3
Comber Lap Former	-	1	1	1	3
Total	-	3	3	3	9

TABLE O/8 (continued)

Drawing	Day	1	2	3	Total
Tender	-	6	6	6	18
Total	-	6	6	6	18
Roving Frame					
Tender	-	7	7	7	21
Doffer	-	7	7	7	21
Bobbin Carrier	-	2	2	2	6
Sweeper	-	1	1	1	3
Checker	-	1	1	1	3
Total	-	18	18	18	54
Assembly Winding					
Tender	-	28	28	28	84
Cheese Carrier	-	1	1	1	3
Checker	-	1	1	1	3
Sweeper	-	1	1	1	3
Total	-	31	31	31	93
Ringframe					
Spinner	-	25	25	25	75
Doffer	-	16	16	16	48
Bobbin Sorter	-	5	5	5	15
Waste Sorter	-	2	2	2	6
Checker	-	2	2	2	6
Bobbin Carrier	-	5	5	5	15
Sweeper	-	5	5	5	15
Total	-	60	60	60	180
Doubling					
Spinner	-	8	8	8	24
Doffer	-	8	8	8	24
Bobbin Carrier	-	1	1	1	3
Sweeper	-	2	2	2	6
Total	-	22	22	22	66

TABLE O/9

STAFFING - ACRILIC SPINNING - DIRE DAWA

Opening and Cleaning	Day	1	2	3	Total
Operatives	-	4	4	4	12
Total	-	4	4	4	12
Precomber Drawing					
Operatives	-	4	4	4	12
Total	-	4	4	4	12
Carding					
Bale opener/feeder	-	1	1	1	3
Doffer tender	-	1	1	1	3
Total	-	2	2	2	6
Drawing					
Operative	1	3	3	3	10
Total	1	3	3	3	10
Roving					
Operative	-	1	1	1	3
Helper	-	1	1	1	3
Carrier	-	1	1	1	3
Total	-	3	3	3	9
Ring Frame					
Supervisor	-	2	2	2	6
Spinner	-	1	1	1	3
Doffers	-	1	1	1	3
Total	-	4	4	4	12
Reeling					
Operative	-	16	16	16	48
Total	-	16	16	16	48

TABLE O/9 (continued)

Assembly Winding		Day	1	2	3	Total
Operative		-	4	4	4	12
	Total	-	4	4	4	12
Winding						
Operative		-	7	7	7	21
	Total	-	7	7	7	21
Doubling						
Operative		-	8	8	8	24
Doffers		-	4	4	4	12
	Total	-	12	12	12	36

TABLE O/10

STAFFING - WASTE SPINNING - DIRE DAWA

Opening, Cleaning & Blending	Day	1	2	3	Total
Operator/transporter/feeder	-	6	6	6	18
Total	-	6	6	6	18
Carding					
Operator	-	3	3	3	9
Feeder	-	1	1	1	3
Sweeper	-	1	1	1	3
Total	-	5	5	5	15
Condenser Spinning					
Operator	-	16	16	16	48
Total	-	16	16	16	48

[illegible]

PIRN WINDING - TEXTILE [illegible]

inding Machinery

ake	Murata	KC[illegible]	Schlafhorst	Schweiter
ountry of Origin	Japan	Japan	Germany	Switzerland
umber of Machines	6	18	14	2
ge	5 - 1971 1 - 1978	3 - 1970 1 - 1971 2 - 1972 12 - 1976	? - 1957 ? - 1967	1 - 1971 1 - 1975
achine Condition	2/1	3	4	2
pindles per Machine	24	24	12	12
otal Spindles	144	432	168	24

scription

nding speed (m/min)	400	400	500	800
ading	Auto	Manual	Manual	Auto
rn Change	Auto	Manual	Manual	Auto
fficiency Achieved		65.[illegible]% (overall)		
pindles per Operative		2[illegible] (overall)		

erative	Per Shift	Total on 3 Shifts
remen	2	6
ad Pirn Winders	2	6
rn Winders	31	93
bbin Cleaners	13	39
bbin Carriers	5	15
eam Setter	1	3
lief Workers	15	45
	69	207

Hours of Work: 24 hours per day; 168 per week; 8448 per year.

Table O/12

WARPING - TEXTILE MILLS OF DIRE DAWA

Machinery

Make	Schlafhorst		BABA		BABA		
Country of Origin	Germany		Japan		Japan		
Model	BSD		HW		VW		
Year Made	1959		1965: 1968		1970		
Number of Machines	3		2		1		Total=6
Number of Creels	3		2		1		" 6
Machine Condition	2		2		2		
Creel Capacity	3 x 500		2 x 576		1 x 600		
Output per machine hr			6,400 metres and 1,900 metres				
Efficiency (Machine)			22.9%		11%		
Yarn Count (Ne)	24/2	13.5	32/2	34/2	20 and 21	45/2	40
Yarn Length on cone (m '000)	33	25 and 37	44	63	55 and 58	83	110
Number of ends on beam	565	455 and 525	560	540	500 and 510	517	507 and 525
Warp beam length (m '000)	9	10	13	6	15.5	7	29 and 44

Operatives	Per Shift	Total on 3 Shifts
Head Beamer	2	6
Beamer	12	36
Creeler	3	9
Relief Workers	5	15
Total	22	66

Hours of work: 24 per day; 168 per week; 8448 per year.

Table Q/13

SIZING - DIRE DAWA TEXTILE MILLS

Machinery	SUCKER	BABA	BABA
Make/Model	EMTC	HB3-6	HC3-5
Country of Origin	W. Germany	Japan	Japan
Year Made	1953	1966	1970; 1971
Machine Condition	3	2	2
Number of Machines	2	2	2

Operating Speed (Average)	22 metres per min.
Machine Efficiency (%)	50.4
Average Length of run (M)	15,600 metres

Operatives	Per Shift	Total on 3 Shifts
Head Sizer	2	6
Sizer	12	36
Mixer	2	6
Relief Workers	2	6
	18	54

Hours of Work: 24 per day; 168 per week; 8448 per year.

Table Q/14

WARP DRAWING IN DIRE DAWA TEXTILE MILLS

Equipment	Todo	Todo	
Make/Model	R75	R55	
Country of Origin	Japan	Japan	
Age	13 and 14 years (1965 and 1966)		
			Total
Number of Frames	5	2	7
Number of Machines	5	2	7
Machine Condition	2	2	

Output

Number of beams per week	83
Average ends per beam	3672

Operatives	Per Shift	Total on 3 Shifts
Head Drawer	2	6
Drawer	8	24
Other	2	6
	12	36

Hours of work: 24 per day; 168 per week; 8448 per year.

Table Q/15

LOOMS - TEXTILE MILLS OF DIRE DAWA

LOOMS	TOYODA	KOVO	RUTI	ASTRA	NORTHROP
Type	Auto, shuttle change	Auto, cop change by hand	Auto, cop change	Auto, shuttle change by hand	Auto, cop change by hand
Make	Japan	Czechoslovak	Swiss	W.Germany	British
Model	G-3	F44/1	CUIN	GM	LTYD
Year Made	1966-71	1958-64	1972/75	1953/64	1964
Width RS	52"	120 cm	180 cm	75"	52"
No. of Looms	648	398	24	6	6
Speed (rpm)	160	145	200	85	145
Drive (transmission)	V-belt + clutch	V-belt + clutch	V-belt + clutch	V-belt + clutch	V-belt + clutch
Shedding (tappet/dobby etc.)	Rest-tappet	tappet	tappet	tappet	tappet
Boxex (1 x 1, 4 x 1, etc.)	1 x 1	1 x 1	1 x 1	1 x 1	1 x 1
Warp stop (mech/elec)	Mech	No	Elec	No	No
Weft stop (side/centre)	Side	Side	Side	Side	Side
Let off (positive/negative)	Positive	Positive	Positive	Negative	Positive
Change feeler (mech/elec)	Mech	No	Elec	No	No
Picking (over/under)	Under	Under	Under	Under	Under
Healds (steel/cotton)	Steel (wire)	Steel (wire)	Steel (flat)	Steel (wire)	Steel (wire)
Shuttle size	368 x 46 x 34	51 x 49 x 34/35	429 x 53 x 35/31.5	600 x 67.5 x 53/43	
Beam flange diameter	610 MM	550	700	550	610
H.P. of motor	1 HP	1.066 HP	2 HP	1.039 HP	1.25 HP
Machine condition	4	3	2	3	3

Table O/16

WEAVING PRODUCTION 1978/79 - TEXTILE MILLS OF DIRE DAWA

Mills	Cloth Name	No. of Looms	Weave	Fibre Warp	Fibre Weft	Warp Count	Weft Count	Ends/ inch	Picks/ inch	Cloth Width in inch	Total ends	Woven in loom type/ width	Length produced per year (yards)
	Standard	362	plain	cotton	cotton	13.5's	18's	50.5	45.7	36	1820	Kovo 120cm	12,367,835
	New Sheet	35	"	"	"	21	21	53	52	38¼	2040	" "	1,186,063
No 2	Bed Sheet	12	"	"	"	20	20	64	53	62.5	4096	Ruti 180cm	477,229
	Towel	6	"	"	"	13.5	21	56	60	42	G+s1236 P 1044	North Rop 52cm	61,094
	Blanket	6	"	"	"	13.5	1	14.2	15	61	698	Astra 75cm	189,460
	Sub Total	421											14,281,544
	White Mull	66	plain	cotton	cotton	40	40	41.2	30	43¾	1800	Toyoda 52cm	3,312,251
	T/C Twill	10	twill	polyester	polyester	34/2	34/2	107	53	44	4860	" "	291,461
	Twill	216	"	cotton	cotton	32/2	24/2	114.5	55	44	5040	" "	5,561,628
	F. Twill	50	"	"	"	24/2	20/2	57.2	43	39.5	2260	" "	1,403,390
	Drill	25	"	"	"	13.5	10	81.5	45	38.5	3150	" "	665,604
	Broad	82	plain	"	"	40	40	125	65	38	4752	" "	1,742,905
	C. Broad	34	"	"	"	c 40	c 40	131.8	70	38¾	5070	" "	630,576
	N. Sheet	48	"	"	"	21	21	53	52	38¼	2040	" "	1,845,806
	T/C Tussor	10	"	polyester + cotton	polyester + cotton	45/2	34/2	110	48	47½	5170	" "	306,240
	CB Poplin	48	"	cotton	cotton	20	20	91	50	38½	3500	" "	1,385,179
	Standard	57	"	"	"	13.5	18	50.5	45.7	36	1820	" "	1,002,769
	Bed Sheet	12	"	"	"	20	20	64	53	62.5	4096	Ruti 180cm	305,721
	Sub Total	658											18,453,580
	TOTAL	1079											32,735,124

Table O/17

WEAVING SHED STAFF - TEXTILE MILLS OF DIRE DAWA

No. 2 Mill Weaving

Position Title \ Shift	A	B	C	D	Total
Supervisory Staff	1	1	1	1	4
Foremen	6	6	6	-	18
Overlooker/Fixers	11	11	11	22	55
Weavers	57	57	57	-	171
Spare Weavers	27	27	27	-	81
Battery Fillers	11	11	11	-	33
Cleaners	-	-	-	6	6
Oilers	-	-	-	4	4
Warp Carriers	10	10	10	-	30
Knotting M/c Operators	4	4	4	-	12
" " Assistants	3	3	3	-	9
Smash Hand	4	4	4	-	12
Head (Knotex + Drawings)	1	1	1	-	3
Drawers	3	3	3	-	9
W/C Cleaners	1	1	1	-	3
Controllers	1	1	1	1	4
Production Calculators	-	-	-	4	4
Testers	-	-	-	1	1
Greasers	-	-	-	2	2
Tech. Helpers	-	-	-	6	6
Nozzle Cleaner	-	-	-	1	1
Total	140	140	140	48	468

Table O/18

WEAVING SHED STAFF - TEXTILE MILLS OF [illegible]

No. 5 Mill Weaving

Shift / Position Title	A	B	C	D	Total
Supervisory Staff	1	1	1	2	5
Foremen	4	4	4	1	13
Overlookers/Fixers	11	11	11	51	84
Weavers	61	61	61	-	183
Spare Weavers	45	45	45	-	135
Battery Fillers	30	30	30	-	90
Cleaners	-	-	-	3	3
Oilers	-	-	-	6	6
Cloth Carriers	7	7	7	-	21
Warp Carriers	7	7	7	-	21
Knotting M/c Operatives	7	7	7	-	21
Knotting M/c Assistants	8	8	8	-	24
Smash Hand	7	7	7	-	21
Unifil Mechanic	-	-	-	-	
M/C Cleaners	1	1	1	-	3
Controllers	1	1	1	1	4
Production Calculators	-	-	-	5	5
Testers	-	-	-	2	2
Sub Foreman	-	-	-	1	1
Sweepers	-	-	-	6	6
Nozzle Cleaners	-	-	-	1	1
Tech. Helpers	-	-	-	9	9
Drawers	6	6	6	-	18
Total	196	196	196	87	675

Hours of work: 24 per day; 168 per week; 8448 per year.

Table O/19

GREY CLOTH INSPECTION - TEXTILE MILLS OF DIRE DAWA

Inspection Tables	Mill 2	Mill 5
Make and Model	KOMINAMI CK 201	KOMINAMI CK 201
Country of Origin	Japan	Japan
Age	15 years	15 years
Machine Condition	2	2
Number of Machines	4	6
Working Width (cm)	140	140

Description

Inclined table (40°) all machines fitted with 0.53 HP motor with reversible switching - maximum cloth speed - 40 metres/min.

Cloth Folding Machines	Mill 2	Mill 5
Make and Model	KOMINAMI AF2-57	KOMINAMI AF2-57
Country of Origin	Japan	Japan
Age	15 years & 8 years	15 years & 13 years
Number of Machines	2	2
Working Width (cm)	140	140
Machine condition	2	2
Description		
Type	Flat - Motor 1 HP	Flat - Motor 1 HP
Speed	70 m/min	70 m/min

Weekly length inspected 650,350 m/week

Operatives	Per Shift	Total on 3 Shifts
Supervisory	2	2
Foremen	1	3
Inspectors	6	18
Cloth Checkers	18	55
Cloth Folders	7	21
Sewers	4	11
Cloth Carriers	5	14

Fi

	MACHINE	QUANTITY	YEAR OF MANUFACTURE
1	Brushing Machine	1	1964
2	Singeing & Desizing Machine	1	1959
3	Tensionless Scouring Jigger	5	4-1964 1-1970
4	Bleaching & Dyeing Jigger	16	14-1959 2-1971
5	Scouring & Bleaching Jigger	1	1971
6	Rewinding Machine	1	1964
7	Batching in Machine	1	1974
8	Main Air-Compressor	1	1974
9	Refrigerator	1	2-1964 1-1974
10	Mercerizing Range	1	1964
11	Washing & Dyeing Range	1	1969 1972
12	Continuous Dyeing Range	1	1964 1972
13	Dyeing Padder & Hot Flue Dryer	1	1959, 1964, 1969
14	Thermosol Dyeing Range	1	1972
15	Mangle & 24 Cylinder Dryer	1	1965
16	Stentering & Drying Range	2	1-1965 1-1969
17	Heat Stenter (Resin Finishing Range)	1	1972
18	Baking Machine	1	1964 1972
19	Screen Printing Machine	2	1-1964 1-1970
20	Sanforizing Range	1	1969
21	Schreiner Calendar	1	1959
22	4-B Calendar	1	1959
23	Folding Machine	3	2-1959 1-1970
24	Stamping Machine	1	1971
25	Doubling & Winding Machine	2	1964
26	Winding Machine	1	1974
27	Baling Press	1	1970
28	H.S. Steamer	1	1975
29	Inspecting Machine	1	1964

COTTON HANK BLEACHING

1	Hank Bleaching Machine	1	1968
2	Hydro - Extractors	1	1968
3	Hank Dryer	1	1968
4	Bundling Press	3	1-1964 2-1974
5	Bundling Press	2	1975
6	Hank Bleaching M/C	1	?
7	Hank Dyeing Unit	1	?
8	Hank Bleaching M/C	1	?

TABLE NO. O/20

nishing Equipment - Dire Dawa

MAKER	MACHINERY CONDITION
Kyoto Machinery	2
Walter Osthoff	3/4
Kyoto Machinery	2 (Seals)
Kelezenberg	3
Kelezenberg	3
Kyoto Machinery	3
Kyoto Machinery	1
Hitachi	1
Hitachi Hasegawa	1. (1974) One not working - 4/2nd - 3
Kyoto Machinery	2
Kyoto Machinery	-2
Kyoto Machinery	-2
Kleinewefers, Kyoto Machinery	-1 Hot Flue
Kyoto Machinery	2
Kyoto Machinery	2
Kyoto Machinery	2/2
Kyoto Machinery	2
Kyoto Machinery	1964 - 3/1972 - 2 Temperature Control and Condensation
Toshin Kogyo	1964/2 1970/2 - Registration faulty
Kyoto Machinery	2
Kleinewefers	2 - Standing
Kleinewefers	1/2
Monforts, Komina mi Iron	1969 - 2/3 1970 - 2
Tanaka Iron Works	2
Kyoto Machinery	1 M/C - 2 2nd M/C - 2. Used as spares
Kominami Iron Works	1
Hanei Iron Works	2
Stork Box Meer	1
Kominami	3 - not in regular use
Vald Henriksen	1
Officinc Minnetti	2
Officinc Minnetti	1
Kati Iron Works, Sakai Iron Works	2
Hanei Iron Works	1
Nissan	3
Nissan	4
Nissan	3

TABLE NO. O/20 (continued)

Finishing Equipment - Dire Dawa

	ACRYLIC HANK PROCESSING PLANT	QUANTITY	YEAR OF MANUFACTURE	MAKER	MACHINE CONDITIONS
1	(Steaming Box)	1	1971	Koshio M.F.G.	3 Steam Leak-ages
2	Hydro-Extractors	2	1-1972 1-1975	Nissan Machinery, Tanabe Iron Works	2
3	Hank Dyeing Machine	4	1972	Vald Henriksen	1
4	Hank Dryer	1	1972	Officine Minnetti	1
5	Bundling Press	2	1972	Hanei Iron Works	1
6	Baling Press	1	1972	Hanei Iron Works	1
7	Hank Dyeing Machine	1	1975	Vald Henriksen	1
	Mill No. 2				
1	Raising Machine (Napping Roller)	1	1953	Monforts	2/3
2	Raising Machine (Napping Roller)	1	1965	Ohki (Japan)	2/3
	(Both out of use for last seven years)				

NOTES

Machine No.	Remarks
2	Machine reported as working inefficiently (quality wise) owing to variation in available fuels.
3	All seals for pressure lids badly perished or missing completely.
4	Frequent break-downs reported, delays in repair owing to non-availability of spare parts. Most panels on control boxes missing - aggravating the deterioration of electrical and mechanical components.
9	1964 equipment - one unit is a complete write-off, the second unit is operational and could be maintained by cannabalising the write-off unit.
13	The Hot Flue Unit in need of complete refurbishing.
18	1964 Temperature control inadequate, causing fixation problems. Further problems caused by condensation droppings - suggesting an unbalance in the machines ventilation system.
20	Rubber Shrinking Sleeve badly damaged - suggesting that the machine has been stopped on occasions at full heat. Over heating of Sleeve stated to be a problem - this could be reduced by the installation of additional spray unit serving the inside of the Sleeve.
21	Not in use - Surplus to requirements.
25	Production demand is satisfied by one machine. The second machine is being cannabalised to maintain the one in production.
	Cotton Hank Processing Plant
7	Not required to meet production targets.

Table O/21

FINISHING DEPARTMENT - LABOUR EMPLOYMENT -

TEXTILE MILLS OF DIRE DAWA

	Foreman/Supervisors	Operatives	Ancillary
Grey Room		10	1
Singe/Desize	4	10	-
Scour/Washing	3	50	-
Bleaching	-	19	-
Mercerising	-	15	-
Intermediate Dying	3	15	-
Continuous Dyeing	-	29	6
Steamer/Curing	-	6	-
Colour Kitchen	3	3	-
Specialists	-	5	-
Print Machines	7	30	18
Studio/Designers	-	2	-
Stenters	-	34	-
Calenders	-	4	-
Shrinking M/c	-	7	-
Inspection/Make-up	3	30	-
Parcelling	-	14	-
Baling	2	12	1
Finished Goods Store	-	9	-
Departmental Maintenance	8	25	
Cleaners	-	-	2
	33	379	28

Grand Total 440

Departmental Area 6,893 sq. metres

Annual Production 19.5 Million metres

Annual Production/Person Employed 44,318 metres

Annual Production/Unit Area 2,829 metres

Operating Days Per Year 318

No. of Shifts Operated 3

Hours Worked Per Shift Per Week 53.3 Average

Table O/21 Continued

COTTON YARN - BLEACHING AND DYEING -
TEXTILE MILLS OF DIRE DAWA

Departmental Staff

Foremen/Supervisors	10
Operatives	6
Ancillary	35
Total	51

Annual Production 480,000 kgs

Production Area 917 sq. metres

ACRYLIC YARN - BLEACHING AND DYEING

Departmental Staff

Foremen/Supervisors	9
Operatives	10
Ancillary	88
Total	107

Annual Production 1,200,000 kgs

Production Area 906 sq. metres

Production/Person Employed 11,215 kgs

Production/Unit Area 1,325 kgs

Operating Days Per Year 318

No. Of Shifts Operated 3

Hours Worked Per Shift Per Week 53.3 Average

Table O/21 (continued)

Operating Days Per Year	250
No. Of Shifts Operated	3*
Hours Per Shift Per Week	70*

* Three shifts are employed; but only two of the three are working in any one week. The Company is in a position to revert to three shift working when circumstances permit.

Shirley Institute

10356
(5 of 6)

Client Report

CONFIDENTIAL

SECTOR STUDY OF THE ETHIOPIAN TEXTILE INDUSTRY

FINAL REPORT

APPENDICES:

Appendix 'A'	Job description of 35 occupations in textile factories.
Appendix 'B'	Description of job evaluation techniques.
Appendix 'C'	Details of wage piece rate systems used in the textile mills of Dire Dawa.

Prepared by:

The Technical Economy Department

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February 1981

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APPENDIX 'A'

Job Descriptions in the Cotton Textile Industry

APPENDIX 'A'

JOB DESCRIPTIONS IN THE COTTON TEXTILE INDUSTRY

1. Job: BALE BREAKER
Place: Blow room

SUMMARY OF DUTIES:

Takes delivery of bales of raw cotton, checks weight, opens bales, and places them convenient to combination machine feeder.

WORK PERFORMED:

1. Takes bales of cotton to scales, by means of hand truck, weighs them, and checks with invoice. (In some cases a mechanical device is used for placing bales in position on scales).
2. Trucks bales to stack and places them in rows, each grade being kept in the same row.
3. According to mixing sheet, trucks the necessary bales to space near combination machine.
4. Opens bales by hitting iron bands smartly with mattock, pulling them from under bale by hand.
5. Slashes hessian covering with knife and pulls hessian from around bales.
6. Bags cotton waste, weighs it, trucks it (generally by hand) to lorry for despatch as required.

SPECIAL REQUIREMENTS OF JOB:

Care in arrangement of bales for correct mixing.

MACHINE,TOOLS, AND MATERIALS:

Machine	-	
Tools	-	Mattock, hand truck, knife.
Materials	-	Bales of raw cotton, cotton waste.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-50
Education	Completion of Primary School
Physical requirements	Strong. Slight physical or visual defect no handicap.
Temperament	

WORKING CONDITIONS: May be dusty, quiet.

NATURE OF WORK: Routine, rather heavy manual work

TRAINING: Learns on the job.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs: Feeder, Lap Carrier, Scutching Hand.

2. Job: FEEDER

Place: Blow room

SUMMARY OF DUTIES:

Feeds raw cotton into machine. Sweeps floor several times during shift. Thoroughly cleans and oils combination machine at least once weekly.

WORK PERFORMED:

1. Brushes and cleans outside of machines.
2. Oils bearing and movable parts.
3. Removes inspection plate and pulls out cotton waste.
4. Removes collections of cotton accumulated around bearing surfaces by scraping with a picker.

Feeding

5. Rolls a layer of cotton by hand from top of bale and feeds into hopper bale breaker at end of combination machine.
6. Follows with a similar layer from each of the other bales to give an even mixture.
7. Watches machine and pokes clear any cotton which accumulates around moving parts with picker to prevent undue friction.
8. Keeps floor clear from dust and waste.

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS:

Machines	-	Willow machine; Combination machine comprising Hopper Bale Breaker, Hopper Opener, Hopper Feeder, Lattice Feeder, Orighton Opener.
Tools	-	Picker, oil-can.
Materials	-	Raw cotton from opened bales.

Combination Machine. Opens up and blends the cotton fed in from the bales and expels heavier impurities such as seed, stalk, leaf, motes, and sand. This is carried out by a blowing process and by a system of beaters acting on the cotton fibres and knocking out the dirt before sending them forward to the lap-forming section of the machinery.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	16-50
Education	Completion of Primary School
Physical requirements	
Temperament	

WORKING CONDITIONS: Noisy, may be dusty

NATURE OF WORK: Routine, walking, lifting

TRAINING: Very simple. Learns on the job.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs: Scutching Hand, Lap Carrier, Can Breaker.

3. Job: SCUTCHING HAND (Blowing Room Hand)
Place: Blow room

SUMMARY OF DUTIES:

Breaks out lap from exhaust opener. Drops lap into position on finisher, carries lap from finisher to stack, checks weight. Cleans and oils machines.

One man looks after one exhaust opener and two finishing machines.

WORK PERFORMED:

1. At least once a week the first half-hour of each shift is spent in cleaning and oiling machines.

Exhaust Opener

2. Starts motor.
3. Threads layer of cotton through rollers with fingers.
4. Drops slip roller into position.
5. Starts cotton feeding on to slip roller by wrapping cotton around roller with fingers.
6. When lap is full pushes a lever to discontinue the feed unless it is the type of machine which does not stop; in which case the lap is taken off and replaced without discontinuing the feed.
7. Inserts a lap rod (4 ft. x $\frac{1}{2}$ in. steel pin) into hollow centre of slip roller.
8. Pulls slip roller from lap by hand.
9. Grasps end of lap rod in left hand, places right arm under lap which is thrown on to right shoulder.
10. Drops lap into position on finishing machine.

Finishing Machine

11. Raises hinged cover from lap.
12. Inserts lap rod into hollow centre of slip roller.
13. Grasps one end of lap rod in each hand, carries lap and drops on to pan of spring balance.
14. Checks weight to nearest half pound and places lap in stack.
15. Replaces slip roller in position.
16. Starts new lap by feeding first layer around roller by hand.

The above process is repeated on each of the three machines, approximately every seven minutes.

continued

3. (continued)

SPECIAL REQUIREMENTS OF JOB:

Co-ordination of tasks to ensure continuous operation of machines. Muscular and visual judgement necessary to drop laps into correct position on finishing machine. Dexterity in feeding cotton on to slip roller.

MACHINE, TOOLS, AND MATERIALS

Machines	-	Exhaust Opener, Finishing Machine.
Tools	-	Spring-balance weighing machine.
Materials	-	Cotton laps.

Finishing Machine. Forms cotton into lap sheet of even substance and weight per yard, by winding loose cotton into layers round a roller.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-45. 18-30 preferred.
Education	Preferably some secondary education.
Physical requirements	Strength, height an advantage.
Temperament	Self-confident, alert.

WORKING CONDITIONS:	Noise, a certain amount of dust, particularly when cleaning.
NATURE OF WORK:	Routine, walking, lifting.
TRAINING:	Simple, but job requires conscientious and sensible handling. Can learn in three to six months.

RELATION TO OTHER JOBS:

Promotion to:	Stripper and grinder.
Allied Jobs:	Can breaker.

4. Job: LAP CARRIER
Place: Card room

SUMMARY OF DUTIES:

Ensures that every card machine has spare lap ready for the Stripper and Grinder to drop into position when required. Sweeps floor.

WORK PERFORMED

1. Grasps in both hands vertically projecting end of rod, lifts 35-50 lb. roll of raw cotton (lap) on to specially designed carrier.
2. Repeats until the carrier (lap truck) contains six or eight laps.
3. Pushes lap truck along rail to card machine.
4. Grasps projecting rod in left hand, places right arm around lap and throws on to shoulder.
5. Places lap on chest-high rests at card machines.
6. Repeats 3, 4, and 5 on all machines.
7. Sweeps floor.

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS:

Machine	-	
Tools	-	Lap truck.
Materials	-	Cotton laps.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-50. Junior preferred.
Education	Completion of Primary School.
Physical requirements	Strength.
Temperament	

WORKING CONDITIONS — Noisy, may be dusty.

NATURE OF WORK: Simple labouring work. Routine, lifting, pushing, walking.

TRAINING: Very simple. Learns on the job.

RELATION TO OTHER JOBS:

Promotion to:	Stripper and Grinder.
Allied Jobs:	Bale Opener, Feeder, Can Breaker, Scutching Hand.

5. Job: CAN BREAKER

Place: Card room

SUMMARY OF DUTIES:

Removes cans of cotton yarn from card machines and replaces empty cans. Oils and cleans machines, sweeps floor.

WORK PERFORMED:

As can be seen to fill -

1. Grasps can with hand and lifts away from card machine.
2. With right hand places empty can on its slowly rotating platform which is at floor level.
3. Drops end of yarn into empty can.
4. Carries full can to stack.
5. Repeats as required.
6. If web breaks pieces it up and threads through front rollers.
7. Cleans and oils machines.
8. Sweeps floor.

SPECIAL REQUIREMENTS OF JOB:

Co-ordination of hands in changing cans. Piecing up of web and threading through front roller. Taking away the full can and replacing empty can simultaneously.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Card Machine.
Tools	-	Cans.
Materials	-	Cotton slivers and cotton waste.

Card Machine. Finally cleans the cotton and arranges its fibres into a web and transforms it from a roll of lap into a rope-like untwisted strand, a sliver. It consists of a feeding device which rolls the cotton lap under a revolving cylinder covered with thousands of wire teeth and against a series of metal slats, also covered with wire teeth. The teeth comb the fibres so that when they are removed from the doffer they are largely free from impurity.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Usually Male
Age	16-40. Junior preferred.
Education	Completion of primary school.
Physical requirements	Stamina required, but not necessary special physical strength.
Temperament	Smart and energetic.

WORKING CONDITIONS: Fluffy, noisy

NATURE OF WORK: Simple, routine, constant standing and walking.

TRAINING: Learns on the job.

RELATION TO OTHER JOBS:

Promotion to: Stripper and grinder

Allied Jobs:

6. Job: STRIPPER AND GRINDER

Place: Card room

SUMMARY OF DUTIES:

Two men working together extract the deposits of waste cotton which accumulate between the wire pins on the card cylinder and doffer by a mechanical process (stripping).

They set up and adjust mechanical grinder to sharpen wire points on card cylinder, doffer, and flats (endless belt consisting of a series of flat sections of wire).

WORK PERFORMED:

Stripping - two men working together.

1. Stop three or four machines and open hinged covers.
2. With one man at each end lift the strip brush (rotary brush) into guides on cylinder.
3. One man places hand belt on strip brush pulley and flips hand on revolving loose pulley of card machine.
4. The other man connects hose from the metal cover of strip brush to overhead suction intake.
5. After two revolutions of card drum, number one flips band off loose pulley.
6. They then lift strip brush into guides over doffer.
7. One man opens hinged cover over card cylinder.
8. He then turns strip brush with one hand and holds sickle (a hard, firm and wide hand brush) against strip brush to remove the collected cotton waste.
9. After two revolutions of doffer, they disconnect hose pipe and lift stripping brush to the next machine.
10. Sometimes a Cook Stripper, which draws away by pumping, is used as well as the brush method.

The above process takes one to two minutes, about thirty (30) machines being stripped three times during each shift.

Grinding - two men working together.

11. Lift grinding roller into position on the card cylinder and doffer and connect belt to rotate grinder. Grinding roller is a spindle on which a pulley is already fitted, the surface of which is covered with emery cloth. When in operation the pulley automatically moves backward and forward along spindle.
12. One man lowers or raises adjustable bearing supports making the adjustments by sound.
13. After final adjustment leave grinding roller in position for upwards of four hours.

A somewhat similar process is repeated with the doffer drums and flats, two card machines being ground each shift.

continued

6. (continued)

14. Drops lap into place at end of card machine as required (about $2\frac{1}{2}$ hours on each machine).
15. Cleans and oils machines, and overhead shafting.

SPECIAL REQUIREMENTS OF JOB

Sensitive hearing for adjusting grinder, coupled with mechanical aptitude in handling equipment.

MACHINE, TOOLS, AND MATERIALS

Machine	-	Card Machine
Tools	-	Strip brush, grinding roller, sickle (sometimes called hand card), spanner.

QUALIFICATIONS FOR EMPLOYMENT

Sex	Male
Age	18-40. Younger man preferred.
Education	Completion of Primary School.
Physical requirements	Strength. Hearing must be good.
Temperament	Energetic

WORKING CONDITIONS: Noisy, dusty.

NATURE OF WORK: Walking, lifting, active.

TRAINING: Learns on the job. Can learn in six months, but will often work in the Blow Room or as lap carrier or can breaker first.

RELATION TO OTHER JOBS:

Promotion to:	Leading Hand.
Allied Jobs:	Lap Carrier, Can Breaker.

7. Job: DRAWER
Place: Card room

SUMMARY OF DUTIES

Operates draw frames by placing 6 full draw cans of sliver in position and feeding slivers through machines, when 6 slivers are drawn and emerge as one loose sliver. Generally tends three frames.

WORK PERFORMED

1. Places draw cans in position.
2. Joins sliver by dividing one end into two and rubbing other end or by passing two overlapping ends under roller together.
3. Starts machine by turning handle. (Each 6 draw cans operated separately.)
4. Repairs breaks (machine stops automatically).
5. Removes cans of sliver when full (machine stops automatically) and replaces them with empty ones.
6. Removes cans from behind when empty and replaces them with full ones.
7. Pulls out any cotton which is too thick.
8. Removes flat dirt from top of rollers (while machine is running).
9. Removes flat dirt from underneath rollers (while machine is running).
10. Clean machine once a week, and dusts down each day.

SPECIAL REQUIREMENTS OF JOB

Dexterity in handling cans and keeping machine running to capacity.

MACHINE, TOOLS, and MATERIAL

Machine	-	Draw Frame.
Tools	-	Draw Cans.
Materials	-	Cotton Slivers.

Draw Frame. This straightens the fibres and combines six slivers into one sliver by stretching it between rollers until the final sliver is about the same size and weight as any one of the originals. Six slivers are led from six draw cans through moving rollers, (each revolving faster than the one before) which stretch the several strands of sliver into one thin strand. This travels through a funnel-like condenser which compresses it and a coiling head that leads it in one sliver into empty draw cans.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Usually female
Age	17-45. 17-25 preferred.
Education	
Physical requirements	Strength, sufficient stamina for fairly constant work.
Temperament	Patient.

WORKING CONDITIONS: Warm, noisy, fluffy.

NATURE OF WORK: Medium to heavy, routine, standing, walking, lifting, opportunity to sit at odd moments.

TRAINING: Starts as back tenter and then becomes frame tenter.

RELATION TO OTHER JOBS:

Promotion to:

8. Job: SLUBBER

Place: Card room

SUMMARY OF DUTIES

Tends slubbers by threading sliver (slubber roving) through the machine, mending breaks, and by removing empty draw cans and replacing them with full ones. Replaces full bobbins by empty ones. This process results in fairly thick, loosely twisted cotton threads sufficiently strong to go through the fly frames without much breaking. Cotton is now wound on bobbins for first time.

WORK PERFORMED:

1. Threads the slubber roving through the spindle flyer.
2. If slubber roving breaks, joins it with her fingers by rolling it.
3. Starts machine by a lever.
4. Removes empty draw cans and replaces them with full ones.
5. Joins sliver in the draw cans by dividing it and rubbing it together with the palms of her hands.
6. Repairs breaks.
7. Brushes fluff from the machine with a small brush.
8. Removes flat dirt from the top of rollers.
9. Removes flat dirt from underneath rollers.
10. Turns hand wheel to loosen belt and resets machine.
11. Slackens the end of the slubber rovings.
12. Lifts up full bobbins and places it on top of the machine.
13. Slips an empty bobbin on to its place.
14. Stacks full bobbins in a crate.
15. Carries full bobbins and places them on creel of intermediate.
16. Cleans the machine (once a week at least).

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Slubber
Tools	-	Cans, bobbins
Materials	-	Cotton sliver

Slubber. This transforms finished sliver into roving, stretches it and gives it a slight twist. The sliver from about 45 draw cans is drawn from the cans by three pairs of drawing rollers which stretch it at progressively faster speeds. The sliver passes through a flyer that revolves around the top of the bobbin on which it winds the cotton (now roving). The revolving motion of the flyer gives a slight twist to the cotton and from here on the cotton is called roving until it reaches the spinning frame where it is spun into yarn.

QUALIFICATIONS FOR EMPLOYMENT

Sex	Female[1].
Age	14-45. 15-25 preferred
Education	
Physical requirements	Strength, sufficient stamina for fairly continuous work, good eye-sight.
Temperament	Patient, careful.

continued

8. (continued)

WORKING CONDITIONS:	Warm, noisy, fluffy.
NATURE OF WORK	Routine fairly heavy, standing, walking, some lifting, opportunity to sit at odd moments.
TRAINING:	Starts as back tenter and becomes slubber tenter.
RELATION TO OTHER JOBS:	
Promotion to:	Back tenter to slubber tenter
Allied Jobs:	Rover.

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1 In this and other jobs where a night shift is worked only male labour is used on that shift.

9. Job: ROVING (Intermediate)
Place Card room

SUMMARY OF DUTIES

Keeps the roving or intermediate frames in operation by threading the roving through the flyer, and starting the machine. Takes off empty bobbin and replaces with new bobbin and joins roving. This process further thins and straightens strands in cotton sliver.

WORK PERFORMED

1. Threads the roving through the flyer.
2. If roving breaks, joins it.
3. Starts machine.
4. Repairs breaks.
5. Creels in. (Takes off empty bobbin and with creel peg pull down a full one. Pulls remaining sliver off old bobbin and throws bobbin into a basket. Puts new bobbin on the creel peg and joins roving.)
6. Pulls off roving which is too thick.
7. Removes flat dirt from top of rollers.
8. Removes flat dirt from underneath rollers.
9. Loosens belt and resets machine.
10. Slackens roving.
11. Lifts off full bobbin and replaces it with empty bobbin.
12. Removes fluff from machine.
13. Cleans machine. (Once a week at least)

SPECIAL REQUIREMENTS OF JOB:

MACHINES, TOOLS, and MATERIAL

Machines	-	Intermediate Frames and Roving Frames.
Tools	-	Bobbins
Materials	-	Cotton roving.

Intermediate or Roving Fly Frame. This is essentially the same as the Slubber, except that instead of sliver in cans, the feed is roving wound on bobbins which is drawn through the frames into thinner roving and wound on to smaller bobbins.

QUALIFICATIONS FOR EMPLOYMENT

Sex	Female
Age	15-45. (15-25 preferred)
Education	
Physical requirements	Above average height, average strength, good eyesight.
Temperament	Patient, careful.

WORKING CONDITIONS: Warm, noisy, and fluffy, but not as much as draw frames or slubbers.

NATURE OF WORK: Routine, standing, walking, lifting, stooping pushing, opportunity to sit at odd moments.

TRAINING: Starts as back tenter and then becomes frame tenter.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs: Work on intermediate and roving frames close'y

10. Job: SPINNER[2]
Place: Spinning Department

SUMMARY OF DUTIES

Keeps ring spinning frames in operation by rapidly repairing breaks in cotton threads, and replacing empty bobbins with full bobbins. Mends breaks in roving sliver also. (Some machines are faster than others and coarser cotton is put on the fast machines. When a girl is working on a fast machine, she generally looks after two sides of one instead of two sides of one and one side of another.)

WORK PERFORMED:

1. Starts machine
2. If thread breaks, grasps bobbin firmly by the side, pulls out the thread and loops it through the traveller (a small metal ring) at the base of the bobbin.
3. Attaches the end to the moving roller so that it is sucked under.
4. When roving on intermediate sliver breaks, leads end through between rollers and proceeds with 2.3.4.
5. Creels in (same as for roving).
6. Cuts out any cotton which has become entangled in the rollers.
7. Brushes fluff off the machine.
8. Cleans top and bottom of the machine.
9. Stops machine when bobbins are full.

SPECIAL REQUIREMENTS OF JOB:

Manual dexterity in piecing up broken threads.

MACHINE, TOOLS, AND MATERIALS

Machine	-	Ring spinning frames.
Tools	-	Bobbins.
Materials	-	Roving.

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[2]Mule Spinning. Although fairly common in wool processing in Australia, mules are rarely seen in cotton factories. A small number is in use in the manufacture of towels.

This is a highly skilled occupation in which, so far only male labour is employed. It is estimated that it takes about seven years to become an expert mule spinner.

Ring Spinning Frame. This transforms one or two strands of slightly twisted roving into tightly spun yarn. Bobbins of roving are placed on spindles at the top of the machine and the roving is drawn through a series of pairs of progressively faster rollers between two strands of roving are stretched and combined into one. The yarn then passes through a guide wire to a small 'traveller' that runs around on a ring in the ring bar that moves up and down by the bobbin, thus winding the yarn evenly on the bobbin that revolves on a spindle inside the ring.

continued

10. (continued)

QUALIFICATIONS FOR EMPLOYMENT

Sex	Female
Age	15-45. (15-25 preferred).
Education	
Physical requirements	Average height and strength, good eyesight.
Temperament	Patient, careful.

WORKING CONDITIONS: Hot, humid, noisy, fluffy.

NATURE OF WORK: Routine, fairly light, standing, walking, lifting, stooping, opportunity to sit when machine is not requiring attention.

TRAINING: Starts as a doffer and then becomes a spinner. May take up to a year to become expert spinner. In some cases may go straight on to machine and learn on the job by working with an experienced spinner.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs:

11. Job: DOFFER

Place: Spinning Department

SUMMARY OF DUTIES

Quickly removes full bobbins from spindles on spinning frames, replaces them with empty ones and starts thread on empty bobbins.

WORK PERFORMED

1. Fills section of doffing box with empty ring bobbins.
2. Carries box to her appointed position at the frame.
3. Pulls off full bobbin.
4. Throws it into one section of the box.
5. Drops empty bobbin on to a spindle.
6. Knocks down the bobbin with a full bobbin.
7. Joins broken ends when machine is restarted.
8. Carries box away.
9. Empties bobbins from box into skip at end of machine.
10. Before beginning to doff make adjustment to machine by turning wheel by hand. (Duty of head doffer only.)

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS

Machine	-	Ring Spinning Frames.
Tools	-	Bobbins.
Material	-	Cotton Yarn.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Female preferred, sometimes junior male.
Age	15-45. (Juniors preferred)
Education	
Physical requirements	Average stamina.
Temperament	Co-operative.

WORKING CONDITIONS: Hot and fairly humid.

NATURE OF WORK: Routine, standing, walking, lifting. Doffers often have time between doffing at the different frames and can sit and rest.
The doffers work in teams of 8 or 10. It is very important to have a good head doffer as the harmony with which the girls work depends so much on her[3].

TRAINING: New ones work in group with more experienced doffers.

RELATION TO OTHER JOBS:

Promotion to:	Head doffer or spinner
Allied Jobs:	

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[3] In some factories Ring Jobbers are appointed in the Spinning Room to take charge of a group of machines to assist with maintenance and adjustment. Where a Head Doffer is not appointed Jobbers exercise some control over a group of doffers, seeing that machines are doffed quickly and set in motion again. They usually start in the mill as boys and may be promoted to Assistant Foreman in line for foremanship.

12. Job: CREEL CARRIER

Place: Spinning Department

SUMMARY OF DUTIES

Shifts baskets of full bobbins and replaces empty baskets.

WORK PERFORMED:

1. Wheels basket truck of bobbins to lift.
2. Wheels empty basket to spinning machines.
3. Such other odd jobs as set by the Foreman such as sweeping floor,etc.

SPECIAL REQUIREMENTS OF JOB:

Machine	-	
Tools	-	Basket trucks
Materials	-	Bobbins of cotton yarn.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	16-60.
Education	Completion of Primary School.
Experience	
Physical requirements	
Temperament	

WORKING CONDITIONS: Surroundings are often hot, humid, noisy.

NATURE OF WORK: Simple labouring work.

TRAINING: Simple. Learns on the job.

RELATION TO OTHER JOBS:

Promotion to:	Bander and Oiler
Allied Jobs:	Bale Opener, Can Breaker, Scutching Hand, Lap Carrier, Feeder.

13. Job: WINDER
Place: Winding Department

SUMMARY OF DUTIES:

Keeps the winders in operation by rapidly mending broken threads, replacing empty ring bobbins, and removing full cheeses or cones. This process transfers the cotton thread from the ring bobbins to cheeses or cones, ready for the weaving room.

WORK PERFORMED:

1. Fills bobbin box with ring bobbins.
2. Puts the full bobbin on to the spindle.
3. Passes end of yarn under, round or over thread guides depending on make of machine (cheese winding). Passes thread through metal ring (cone winding).
4. Twists it round the cheese tube (paper cone) metal cone.
5. Pulls handle and drops cheese tube (paper cone) metal cone on to metal roller (drum).
6. If thread breaks pushes cheese tube (paper cone) metal cone up with handle, unless the machine is one which stops automatically when the thread breaks.
7. Joins ends of thread with weavers' knots.
8. Throws bobbin when empty into skip beside her.
9. Pulls handle and drops cheese tube (paper cone) metal cone on to the metal roller or drum.
10. When cheese tubes (paper cone) metal cones are the right size takes off spindle and stacks on top of machine.
11. Cleans frames daily.
12. Cleans machine once a week.

SPECIAL REQUIREMENTS OF JOB:

Quickness and neatness in knotting ends together.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Winding Frames
Tools	-	Bobbins
Materials	-	Cheeses or Cones of Cotton Yarn.

Winding Frame. This winds the yarn from bobbins on to cones or cheeses. The full bobbins are placed on spindles and the yarn passes through a guide wire. A guiding mechanism distributes the yarn evenly over the cones or cheeses.

continued

13 (continued)

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Female
Age	15-45. 15-25 preferred.
Education	Ability to read and write.
Physical requirements	Average strength, good eyesight.
Temperament	Patient, co-operative.

WORKING CONDITIONS: Noisy, may be warm, some fluff.

NATURE OF WORK: Constant, routine, monotonous. Standing, stooping. Companionship of other people near at hand.

TRAINING: Learns on the job. In some cases adults are given preliminary period of three months' training before paid full award wage, or are paid by piece rate as soon as capable of earning the minimum wage.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs: Doubler.

14. Job: DOUBLER (or Twister)
Place: Winding Department

SUMMARY OF DUTIES:

Keeps the doublers in operation by mending threads as soon as they break so that adjacent threads will not be spoilt. Gates in after machine has been doffed. Keeps machine clean.

WORK PERFORMED

1. Keeps creel filled (i.e. pegs for holding full bobbins of cotton yarn).
2. Place empty bobbin on spindle.
3. Take 2, 3, or 4 threads from creel and passes them under sets of rollers and on to spindle.
4. If thread breaks pieces up broken ends with dog knots.
5. Stops spindle with knee-brake to replace bobbin.
6. Threads yarn under traveller on ring, through thread guide and places on rover.
7. When machine has been doffed gates in again.
8. Cleans frame daily.
9. Cleans machine once a week.

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Doubling Frame
Tools	-	Bobbins
Materials	-	Cheeses, cotton yarn

Doubling or twisting Frames. These machines form a strong, smooth, non-snarling thread by twisting two or more single yarns round each other in the opposite direction to the original twist. Doubled yarns are ready for weaving without further processing. Cabling is a further twisting of 'doubled yarn' and this yarn is used in the manufacture of tyre cord.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	-	Female
Age	-	15-35. 15-25 preferred.
Education	-	Ability to read and write.
Physical requirements		Average strength, good eyesight.
Temperament		

WORKING CONDITIONS: Noisy, may be warm near machine, some fluff.

NATURE OF WORK: Light, routine, monotonous. A good deal of walking around machines, may be opportunity to sit at odd moments.

TRAINING: Generally starts as a doffer and when capable is given charge of machine or machines.

RELATION TO OTHER JOBS:

Promotion to:	Doffer to Doubler
Allied Jobs:	Winder.

15. Job: WARPER
Place: Warping Department

SUMMARY OF DUTIES:

Attends to warping mills by winding ends of thread from cheeses around mill and starting machine. Attends to broken threads. Creels in and reverses mill when warp is completed. This process transfers yarn from cheeses to warping mill ready for warping mills, and then to warping beam.

WORK PERFORMED

1. Places cheeses or cones (about 300) in creel.
2. Winds ends round the mill or beam.
3. Keeps warp straight and watches for broken ends.
4. Join ends.
5. Passes them through their correct holes in reed.
6. Marks selvedge when bell rings, or when machine stops automatically.
7. Cuts threads at end of each section and ties them underneath.
8. Moves guide to next section.
9. Creels in.
10. Reverses mill when warp is complete.
11. Cuts off ends and ties them together.

SPECIAL REQUIREMENTS OF JOB:

MACHINES, TOOLS, AND MATERIALS:

Machine	-	Warper, Creel.
Tools	-	Scissors.
Materials	-	Cheeses of cotton yarn.

Warper. This winds yarn from cheeses on to a warping beam. It consists of a creel, i.e. a rack holding hundreds of cheeses and a frame that holds the warping beam on which the warp is wound. The threads pass through a guide bar and comb that distribute the warp evenly over the warping beam when the beam revolves.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Female
Age	15-45. 15-25 preferred.
Education	Ability to read and write.
Physical requirements	Sufficient stamina for fairly constant work. Good eyesight.
Temperament	Patient, careful.

WORKING CONDITIONS: Quiet unless located in weaving room, may be fluffy.

NATURE OF WORK: Routine, standing, walking, time to sit occasionally.

TRAINING: Learns on the job by assisting with creeling in.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs: Beamer.

16. Job: BEAMER
Place: Warping and Beaming Department

SUMMARY OF DUTIES:

Keeps beaming machine in operation by keeping creel supplied with full cones, twisting ends from cones around the beam and winding threads around beam. Stops machine when beam is full. This process is used instead of warping when it is necessary to size the yarn. About 400-500 cones are placed in the creel.

WORK PERFORMED:

1. Places cones (400-500) in creel.
2. Twists the ends of the yarn around the beam.
3. Starts machine with a foot lever.
4. Joins broken threads with dog knots (except on fast machines where weavers' knots must be used. On these machines a red light shows when a thread breaks and the machine stops automatically).
5. Replaces pins which have fallen into a tray.
6. Stops machine.
7. Creels in (that is, leads the yarn from new cone through porcelain guides, comb, and drop wire and joins with broken thread).
8. Starts machine again.
9. When beam is full, places wooden roller on the yarn.
10. Cuts the yarn and ties off the ends.
11. Reverses the machine and so slackens the yarn.
12. Removes beam with help of male.
13. Cleans machine (once a day).

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Beaming machine
Tools	-	Beam
Materials	-	Cones, cotton yarn.

Beaming Machine. This winds yarn from cones on to section beams to make the warp. These section beams then go to the Sizing Room where they are sized to strengthen them. Hundreds of cones are placed in a creel and the threads led through a comb to separate them as they are wound on to the beam which revolves when the machine starts.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Usually female, sometimes boys.
Age	15-45. 15-25 preferred.
Education	Ability to read and write.
Physical requirements	Sufficient stamina for fairly constant work. Good eyesight.
Temperament	Patient, careful.

WORKING CONDITIONS: Quiet unless located in weaving room, fluffy.

NATURE OF WORK: Fairly heavy, routine, standing, walking, stooping.

TRAINING: Time to sit occasionally. Learns on the job by assisting with creeling in.

RELATION TO OTHER JOBS

Promotion to:
Allied Jobs: Warper.

17. Job: BEAMER ATTENDANT (LABOURER)

Place: Warping and Beaming Department

SUMMARY OF DUTIES:

Helps to lift cases of cotton yarn off lorry. Wheels cases to creel frame as required. Assists female beamer. General labouring.

WORK PERFORMED:

1. Assists lorry driver to unload cases of cotton yarn and loads empty cases.
2. Trucks cases by hand to orderly stack.
3. Trucks cases by hand to end of creel as required.
4. Trucks empty cases to stack.
5. With assistance of another labourer lifts full beam off beaming machine by grasping extending end of spindle.
6. Rolls beam to scales.
7. Weighs beam and enters weight and quality particulars in book. (Quality obtained from ticket.)
8. Trucks beam to Sizing Room by hand.

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Weighing Machine
Tools	-	Hand truck
Materials	-	Cotton yarn in cases and on beams

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-45. (18-40 preferred).
Education	Completion of Primary School.
Physical requirements	Strength.
Temperament	

WORKING CONDITIONS: Warm, may be noisy.

NATURE OF WORK: Simple, labouring work.

TRAINING: Learns on the job.

RELATION TO OTHER JOBS:

Promotion to:	Finishing Room.
Allied Jobs:	May be transferred to various other labouring grades.

18. Job: TAPE SIZER

Place: Sizing Department

SUMMARY OF DUTIES:

Runs cotton yarn by machine through sizing liquid solution, through dryer and on to warp (roll of cotton yarn).

WORK PERFORMED:

1. Lifts beam of cotton yarn into creel (stand).
2. Ties small bunches of cotton ends from beam to similar groups protuding from machine.
3. Runs sizing composition into tank, unless this is automatic.
4. Runs machine until the tied ends show.
5. Wraps cotton yarn of new warp around weaver beam to start the new warp. (2 cwt. roll of cotton yarn).
6. With fingers and thumb periodically feels amount of sizing on yarn.
7. Constantly watches machine for and remedies fouling yarn threads.
8. Lifts warp off machine.

SPECIAL REQUIREMENTS OF JOB:

Judging the sizing on cotton yarn by touch. Dexterity in clearing fouled yarn threads without interfering with adjacent threads.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Tape Sizer.
Tools	-	Spanner.
Materials	-	Beams of cotton yarn.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	19-40
Education	Preferably some secondary education.
Physcial requirements	Strength, average eyesight and hearing.
Temperament	

WORKING CONDITIONS: Hot, humid.

NATURE OF WORK: Routine, standing, lifting.

TRAINING: Learns by assisting in department. May take up to 12 months as this is quite a responsible job.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs:

19. **Job:** DRAWER IN

Place: Twisting, Tying-in, and Drawing-in Department

SUMMARY OF DUTIES:

Draws in cotton ends through gears in accordance with pattern or draft. Slays cotton ends through reed ready for tuner to set up on weaving loom.

WORK PERFORMED:

1. Rolls warp (2 cwt. roll of cotton yarn) on to small cradle truck.
2. Pushes truck and warp to work place.
3. With assistance of another person lifts warp on to knee-high frame by grasping extending ends of spindle.
4. Lays ends of cotton across overhead cross beam allowing them to hang immediately behind gears or slay.
5. Insert reed hook through eye of separating wires of gear slay or slay.
6. Withdraws reed hook with thread of cotton yarn, which in some cases is selected by an automatic device.

When all yarn threads have been drawn through reed frame:

7. Ties small bunches of cotton ends together.
8. With assistance of another person lifts warp from frame to small truck.
9. Wheels warp to stack and rolls it off truck.

SPECIAL REQUIREMENTS OF JOB:

Concentration in selecting the correct sequence of threads if no automatic device. Dexterity in using reed hook.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Drawing and Twisting Frame.
Tools	-	Reed hook, slay knife.
Materials	-	Cotton yarn on warp.

Drawing and Twisting Frame. This prepares the warp for use on the loom by drawing individual threads of the warp through gears. It consists of a big frame across which the gears are stretched, i.e. metal strips with holes in the centre. The ends of the warp are threaded through these holes by means of a reed hook.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male-Female suitable if award conditions allow, and often employed, but does not then lift the beams.
Age	Male - 15-20. Female 15-40.
Education	Preferably some secondary education.
Physical requirements	Average strength, shortness an advantage, unimpaired fingers.
Temperament	Patient.

WORKING CONDITIONS: Congenial. May be done under artificial light as good lighting is required. Quiet unless located in weaving roo[m]

NATURE OF WORK: Tedious and monotonous. Much patience needed.

TRAINING: Learns on the job. Can learn in 3 to 6 months. Often junior labour.

RELATION TO OTHER JOBS:

Promotion to:	Apprentice tuner if male.
Allied Jobs:	Alternates job with twister.

20. **Job:** TWISTER - TYER IN

Place: Twisting, Tying-in, and Drawing-in Department

SUMMARY OF DUTIES:

Joins ends of cotton yarn together by hand. Joins the strands of warp yarn (ends) from a full warp beam to the corresponding strands of the exhausted warp.

WORK PERFORMED:

1. Rolls warp (2 cwt. of cotton yarn) on to small truck.
2. Pushes truck to work place.
3. With assistance from another person, lifts warp into knee-high frame by grasping extended ends of spindle.
4. Cleans gears by wiping with a rag.
5. Separates alternate threads (one by one) by raising shafts and tying to overhead cross section.

Then sitting with cotton join to be joined at left and right hand, respectively:

6. Ties small bunch of cotton ends at right together and places in twisting hook with similarly tied bunch from left side.
7. Slides first and second finger of right hand under cotton yarn at right separating a single thread.
8. Slides thumb of left hand under cotton yarn at left separating a single thread.
9. Snaps both threads simultaneously from twisting hook.
10. With thumb and first finger of one hand twists cotton ends together.

After all threads have been joined:

11. Pushes slay over joined yarn.
12. Repairs any threads broken by slay.
13. Lowers shafts and lifts warp from frame to truck.

SPECIAL REQUIREMENTS OF JOB:

Keen eyesight in selecting correct and opposite threads.
Dexterity in separating correct single thread.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Drawing or Twisting Frame
Tools	-	Twisting hook, rag cloth
Materials	-	Warp yarn

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male (female suitable if award provisions allow employment).
Age	Male 15-20. Female 15-30.
Education	Preferably some secondary education.
Physical requirements	Average strength, good eyesight, slight hearing defect no handicap.
Temperament	Patient.

WORKING CONDITIONS: Congenial. May be done under artificial light as good lighting is required. Quiet unless located in weaving ro

NATURE OF WORK: Involves a lot of sitting. Tedious, monotonous.

TRAINING: Learns on the job. Can learn in 3 to 6 months. Often junior labour.

RELATION TO OTHER JOBS:

Promotion to:	Possible transfer to apprentice tuner.
Allied Jobs:	Alternates job with drawer-in.

21. Job: PIRN WINDER
Place: Weaving Department

SUMMARY OF DUTIES:

Operates pirn winder by placing pirns in position in machine, joining broken threads. Places full cones or cheeses in position and removes full pirns. This process winds the yarn from cones or cheeses on to pirns for use on the weaving looms.

WORK PERFORMED:

1. Places pirns in position on winding spindle.
2. Joins broken threads.
3. Places cones or cheese in machine.
4. Brings thread through guides to join with other end.
5. Removes pirns when full.
6. Cleans machines.

SPECIAL REQUIREMENTS OF JOB:

Quickness in taking off full bobbins and replacing with empty ones.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Pirn Winder
Tools	-	
Materials	-	Cones or cheese, pirns, cotton yarn.

Pirn Winder: Similar in principle to Winder.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Female
Age	15-45. Young preferred.
Education	Ability to read and write.
Physical requirements	Sufficient stamina for constant work.
Temperament	

WORKING CONDITIONS: Very noisy, fluffy.

NATURE OF WORK: Light, routine, constant, standing, monotonous.

TRAINING: Learns on job.

RELATION TO OTHER JOBS:

Promotion to:	From battery girl, to pirn winder, then weaver.
Allied Jobs:	

22. Job: WEAVER

Place: Weaving Department

SUMMARY OF DUTIES

Keeps weaving looms running and attends to broken threads.

WORK PERFORMED:

1. Starts machine.
2. Watches for broken threads.
3. Stops machine.
4. Ties the ends.
5. Pulls broken warp through heidel and reed with a hook.
6. Reverses machine to where weft is broken.
7. Pulls out flaws with sharp pointed scissors.
8. Pulls the shuttle out and threads it by hand.
9. Repairs faults by cutting weft.
10. If plain loom is used, places full pirn in shuttle by hand each time one is emptied.

SPECIAL REQUIREMENTS OF JOB:

Production of clean, even weave by constant attention.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Weaving Loom
Tools	-	Scissors, reed hook
Materials	-	Rolls of warp thread, pirns of yarn,

Loom: The loom weaves the weft yarn, contained on the pirns and placed in shuttles, back and forth across the longitudinal warp yarn. It consists of a beam of warp, a set of harness for raising and lowering the warp threads so that the shuttle-throwing mechanism may weave the weft back and forth between alternating groups of warp thread, a mechanism that raises and lowers the harnesses, and a reed that tightly packs the weft so that the cloth is evenly woven. The cloth is rolled on to another beam.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Female
Age	15-45. 15-25 or 30 preferred.
Education	Ability to read and write.
Physical requirements	Sufficient stamina for constant work.
Temperament	Patient, careful.

WORKING CONDITIONS: Very noisy, fluffy, may be warm.

NATURE OF WORK: Heavy, routine, standing, walking, stooping.

TRAINING: Starts as battery girl. May take up to two years to acquire real skill in weaving.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs:

23. Job: BATTERY GIRLS

Place: Weaving Department

SUMMARY OF DUTIES:

Keeps weavers supplied with full pirns by collecting empty shuttles and pirns, and refilling shuttles with pirns. Places pirns in magazine at end of loom.

WORK PERFORMED:

1. Collects empty shuttles and pirns.
2. Refills shuttles with pirns.
3. Places shuttles in the loom.
4. Takes away empty pirns.
5. Places full pirns in magazine at end of loom.

SPECIAL REQUIREMENTS OF JOB:

MACHINE, TOOLS, AND MATERIALS: Attends at looms.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Female
Age	15-45. Young preferred.
Education	Ability to read and write.
Physical requirements	
Temperament	

WORKING CONDITIONS: Noisy, fluffy.

NATURE OF WORK: Light, routine, standing, walking, manual work. Girls move about looms, have freedom and companionship of other girls.

TRAINING: Learns on the job.

RELATION TO OTHER JOBS:

Promotion to:	Pirn Winder and Weaver.
Allied Jobs:	

24. Job: TUNER (Apprenticed Trade)
Place: Weaving Department

SUMMARY OF WORK:

Maintains mechanical efficiency of looms. Effects minor repairs, sets up weaving pattern on loom.

WORK PERFORMED:

1. Sets loom and adjusts mechanical operations of machine for weaver according to written instructions regarding the pattern.
2. Checks pattern with instructions.
3. Supervises the standard of work by the weaver.
4. Repairs and adjusts minor mechanical faults.
5. Dismantles machine part when major fault occurs.
6. Assembles machine after repair.

SPECIAL REQUIREMENTS OF JOB:

Trained mechanical skill in locating and repairing faults.
Discrimination between colours and patterns.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Weaving looms.
Tools	-	Personally owned general mechanical kit.
Materials	-	

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	21-50
Education	3 years' indentured apprenticeship
Physical requirements	Average strength, eyesight, hearing.
Temperament	

WORKING CONDITIONS: Noisy, fluffy, may be warm.

NATURE OF WORK: Skilled, varied.

TRAINING: Must be trained by weaving room supervisor. This is an apprenticed trade involving efficiency in loom maintenance work and ability to set patterns on looms.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs:

25. Job: MACHINE OPERATOR (Desizer)
Place: Finishing Department

SUMMARY OF DUTIES:

Gets pieces of woven cloth from the warehouse. Sews pieces together and rolls on to gig (cylinder), (termed 'batches on gig'.) Desizes material by feeding through a chemical 'wash'. Feeds through drying machine. Oils and cleans machines.

WORK PERFORMED:

1. Lifts cloth pieces by hand on to flat-topped truck, taking care to lay each piece either face to face or back to back with piece immediately underneath, leaving 3 or 4 feet of ends loose to simplify sewing.
2. Pushes truck from warehouse to finishing section.
3. Using treadle or electric sewing macnine, sew ends of pieces together.
4. Pushes truck under tension bar.
5. Lifts end of cloth over tension bar (about 7 ft. high).
6. Wraps one layer of cloth around gig.
7. Starts machine.

When batches are rolled on to gig.

8. Stops machine.
9. Prepares wash according to instructions.
10. Connects start of batch to cloth end. (The cloth end is a special piece of cloth wrapped on roller to draw batch through the caustic wash.)

(Stages 7 to 10 may be performed by a scouring machine).

11. Stops machine, feeds batch through a mangle and over a high folder.
12. Places a platform or box truck in position under folder. (When sufficient labour is available the desizer may not operate drying machine, covering stages 13 to 16.)
13. Wheels truck to drying machine.
14. Ties end of cloth to tapes and starts machine.
15. Watches temperature of drier periodically while drying is in progress.
16. Half-hour towards end of shift, cleans machines and floor.

SPECIAL REQUIREMENTS OF JOB:

Preparing chemical wash according to formula.

MACHINES, TOOLS, AND MATERIALS:

Machines	-	Desizing Machine (Gig), Scouring Machine, Drying Machine, Sewing Machine (treadle).
Tools	-	Box truck, rubber gloves, knife.
Materials	-	Cotton cloth, chemicals.

continued

25. (continued)

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	19-40. (19-30 preferred).
Education	Preferably some secondary education.
Physical requirements	Average strength, average eyesight.
Temperament	

WORKING CONDITIONS: Hot, humid, may be noisy.

NATURE OF WORK: Standing, walking, lifting.

TRAINING: Learns on the job - generally the supervisor or foreman will give instruction in preparation of 'wash'.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs:

26. Job: TENTER

Place: Finishing Department

SUMMARY OF DUTIES:

Feeds woven material through tentering machine to restore to original width.

WORK PERFORMED:

1. Wheels roll of cloth to tentering machine on small hand truck.
2. Lifts one end of extending spindle into knee-high grooved rest.
3. Lifts other end of extending spindle into grooved rest.
4. Presses edge of cloth into pin belt on each side of machine.
5. Starts machine.
6. At other end of machine wraps one turn of cloth around spindle.
7. Watches machine continually.

SPECIAL REQUIREMENTS OF JOB:

No special skill, but good type of worker required.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Tentering Machine
Tools	-	Small hand truck
Materials	-	Rolls of woven cloth.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-40
Education	Completion of Primary School
Physical requirements	Average strength, good hearing.
Temperament	

WORKING CONDITIONS: Noisy.

NATURE OF WORK: Standing, walking, lifting, requires concentration.

TRAINING: Learns on job. Fairly responsible work.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs: May operate napping machine at the same time. Interchanges job with desizer. (Machine Operator).

27. Job: LABOURER (Filling)
Place: Finishing Department

SUMMARY OF DUTIES:

Runs woven cloth through liquid solution to give 'body' to the fabric, through a mangle and over drying rollers.

WORK PERFORMED:

1. Boils solution in steam-heated tank to oral instructions of foreman.
2. Pushes box truck of material into position.
3. Sews pieces of material together using treadle sewing machine.
4. Feeds material through liquid tank and mangle.
5. Opens valve to run solution into liquid tank.
6. Feeds cloth through drying rollers and over folding arm.
7. Pushes box truck into position to receive material.
8. Starts combined filling and drying machine.
9. Hoses drying machine cylinders with water as required.
10. Watches machines

SPECIAL REQUIREMENTS OF JOB:

Visual discrimination as to quality and correctness of solution. Judgement of machine operation, and of correct finish of material.

MACHINES, TOOLS, AND MATERIALS:

Machines	-	Filling Machine, Drying Machine. Treadle Sewing Machine.
Tools	-	Knife hose.
Materials	-	Woven cloth.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-45. (18-40 preferred)
Education	Completion of Primary School
Physical requirements	Average strength
Temperament	Responsible

WORKING CONDITIONS: Hot, humid, may be noisy.

NATURE OF WORK: Labouring work, but good man required.

TRAINING: Learns on the job. Can learn in three months.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs: May be transferred to Dyeing, Kier, washing or Sanforizer Machines.

28 Job: LABOURER (Sanforizer)
Place: Finishing Department

SUMMARY OF DUTIES:

Feeds woven cloth through sanforizer shrinking machine. Sets the machine for correct shrinkage.

WORK PERFORMED:

1. Tests shrinkage of material in small sample washing machine.
2. Calculates mathematically the setting of the sanforizer. (Size of Feeder roller, blanket and heating required.)
3. Sets up and adjusts the correct feed rollers, electrical heating, shoes, blanket, steam, air and water pressure.
4. Feeds material through tension rollers, blanket belt and metal cylinders.
5. Adjusts clip tenter (a narrow endless pin belt on each side of machine which grips the edge of the material).
6. Starts machine.
7. Continually watches machine.
8. Towards completion of day's work runs machine until cool

SPECIAL REQUIREMENTS OF JOB:

Calculating the setting of the Sanforizer from the sample test wash. Mechanical aptitude. Dexterity and agility in attending to any imperfect running of he material.

MACHINES, TOOLS, AND MATERIALS:

Machines	-	Sanforizer, sample washing machine
Tools	-	Hand truck
Materials	-	Woven cloth

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-30. (Under 25 preferred)
Education	Preferably some secondary education
Experience	
Physical requirements	Average strength
Temperament	

WORKING CONDITIONS: Hot, humid, may be noisy.

NATURE OF WORK: Walking, standing, lifting.

TRAINING: Learns on the job receiving training in use of machines. Can learn in one or two years.

RELATION TO OTHER JOBS

Promotion to:
Allied Jobs: May be transferred to Dyeing, Kier, Washing, or Filling Machines.

29. Job: LABOURER (Kier Machine)
Place: Dyehouse

SUMMARY OF DUTIES:

Two men working together run woven cloth through a weak caustic solution on batching machine to form rolls of cloth ready to be put into kier (pressure chamber) to extract foreign matter from the cloth.

WORK PERFORMED:

1. Wheels cloth from Grey Room to batching machine in box truck.
2. Feeds cloth through roller guides and around batch rollers.
3. Turns water tap on and half fills tank, adds caustic and fills tank with water to the required level.
4. Starts machine.
5. One man stands at each side of machine to guide cloth straight on rollers.
6. Stops machine.
7. Lifts batch by electric hoist on to kier trolley.
8. Winds crab (winch) to pull trolley into kier.
9. Closes kier door, tightening nuts with lever.
10. Closes outlet valve, opens inlet valve and turns steam valve on.
11. When the required steam pressure is registered, starts machine and keeps operating for the stipulated time.
12. Operates valves to reduce pressure and extract liquid.
13. Opens door and extracts trolley with the crab.
14. Lifts batch to ordinary trolley be electric hoist.

SPECIAL REQUIREMENTS OF JOB:

Dexterity in guiding cloth on roller. Attention to details in mixing caustic solution and working kier oven.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Batching Machine, Kier.
Tools	-	Lever, (special design), box truck, trolley.
Materials	-	Woven cloth.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	21-45. (Under 30 preferred)
Education	Preferably some secondary education
Physical requirements	Average to good strength
Temperament	

WORKING CONDITIONS: Hot, humid, may be noisy

NATURE OF WORK: Standing, walking, lifting.

TRAINING: Learns by working in the department.

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs: May be transferred to Washing, Dyeing, Kier or Filling Machines, Sanforizer, or Hydro-Extractor.

30. Job: LABOURER (Yarn Dyeing)
Place: Dyehouse

SUMMARY OF DUTIES:

Affixes cones of yarn to dye carriers, boils dye and operates machine mechanism to force dye through cones.

WORK PERFORMED

1. Tips bucket of dye (powder or liquid) into tank and turns on water steam.
2. Wheels box truck (or hand truck) with case of cones adjacent to dye carriers.
3. Places 80 cones on 80 projecting spindles of dye carrier.
4. Screws on cap over each cone, tightening nut by hand.
5. Lifts dye carrier by electric hoist into dyeing machine.
6. Clamps dye carrier into position with wheel screw.
7. Closes lid, tightens ring bolts with tommy bar.
8. Opens valves to pour dye from tank into dyeing machine.
9. Starts machine.
10. After 20 minutes changes direction of flow:

    (a) Stops motor,
    (b) Alters change-over gear by screw lever.
    (c) Starts motor.

    Repeats periodically.

11. Opens valve to remove dye and allows water to rinse clear.
12. Opens lid and loosens dye carrier.
13. Lifts dye carrier to floor by electric hoist.
14. Unscrews nuts and caps.
15. Throws cones into box truck.

SPECIAL REQUIREMENTS OF JOB:

Judgement in operating electric hoist and valves.
Dexterity in screwing and unscrewing caps and nuts.
Discrimination of colour of dye.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Dye machine
Tools	-	Electric hoist, box trucks or hand trucks Tommy bar.
Materials	-	Cones of cotton yarn, dye.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-45. (18-30 preferred)
Education	Intermediate standard
Physical requirements	Average strength
Temperament	

WORKING CONDITIONS: Hot, humid, may be noisy

NATURE OF WORK: Walking, standing, lifting.

TRAINING: Learns by working in the department. (Courses in dye chemistry are available at Melbourne and Sydney Technical Colleges).

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs: Men on Hydro Extractor and Drying Oven depend on regular flow of dyed yarn from Dyeing Machine. May transferred to Kier, Washing, Sanforizer, or Filling

31. **Job: LABOURER (Piece Dyeing)**
Place: Dyehouse

SUMMARY OF DUTIES:

Forms a batch of cloth, fixes it on to the machine and runs cloth through dye.

WORK PERFORMED:

1. Sews 'pieces' together with treadle machine.
2. Forms batch by winding cloth on one roll in machine.
3. Wheels batch to dyeing machine and lift it one end at a time, into knee-high rests by extended ends of spindle.
4. Threads cloth through machine.
5. Wraps cloth around roller on other side of machine.
6. Boils dye in steam tank and runs through tap into machine.
7. Starts machine, reversing machine several times when cloth is almost run through.
8. Adds dye when necessary.
9. Opens valve in bottom of machine to run dye away.
10. Lifts end of cloth over high cross-beams (about 7 feet) and feeds through a mangle

    (a) Fold into box truck, or
    (b) Roll on to batch.

SPECIAL REQUIREMENTS OF JOB:

Judging shade of dye. Alertness to stop machine when end of cloth is reached. Ability to understand dyeing formulae.

MACHINE, TOOLS, AND MATERIALS:

Machines	-	Dyeing Machine, Batching Machine, Mangle, Sewing Machine.
Tools	-	Knife
Materials	-	Woven cloth

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-35 or 45. Under 25 preferred.
Education	Preferably some secondary education.
Physical requirements	Average strength
Temperament	

WORKING CONDITIONS: Hot, humid, may be noisy

NATURE OF WORK: Lifting, walking, standing

TRAINING: Learns on the job. Can learn in three to six months. (Courses in Dye Chemistry are available at Melbourne and Sydney Technical Colleges).

RELATION TO OTHER JOBS:

Promotion to:
Allied Jobs: May be transferred to Kier, Washing, Sanforizer or Filling Machines, Drying Ovens or Hydro Extractor.

32. Job: LABOURER (Hydro Extractor)

Place: Dyehouse

SUMMARY OF DUTIES:

Stack cones of yarn in hydro extractor, operates machine and places cones in box truck.

WORK PERFORMED:

1. Lifts 2, 3, or 4 cones between the palms of both hands and throws into hydro extractor.
2. Stacks cones around circumference of hydro extractor.
3. Drops wooden pegs into centre of each cone.
4. Closes lid and starts machine.
5. Stops machine and opens lid.
6. Lifts 2 or 3 cones between the palms of both hands and taps them smartly against side of extractor to remove peg.
7. Throws cones into box truck.

SPECIAL REQUIREMENTS OF JOB:

Dexterity in handling cones.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Hydro Extractor
Tools	-	Box truck
Materials	-	Cones of cotton yarn.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-45. Under 30 preferred
Education	Completion of primary school
Physical requirements	
Temperament	

WORKING CONDITIONS: Hot, and humid.

NATURE OF WORK: Standing, walking, lifting.

TRAINING: Learns by working in the department.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs: Drying oven operator is dependent on flow of work. May be transferred to Drying, Kier, Washing, Dyeing, Filling Machines or Sanforizer.

33. Job: LABOURER (Washing and Drying)
Place: Dyehouse

SUMMARY OF DUTIES:

Feeds woven material through an eight-compartment washing tank, adjusts and supervises tension rollers, flow of water and steam. Feeds material through drying rollers. Maintains liquid in each compartment in conformity with instructions.

WORK PERFORMED:

1. Pushes trolley into position at end of washing machine.
2. Saws end of batch (roll of cloth) to protruding end of cloth with treadle sewing machine.
3. Turns steam and water taps on of both washing and drying machines.
4. Starts both machines.
5. When box truck at end of drying machine becomes full, stitching is cut with a knife, box truck is pushed away and replaced with empty truck.
6. Constantly watches machine.

SPECIAL REQUIREMENTS OF JOB:

Constant attention to and watch over machine. Mechanical management of machine.

MACHINES, TOOLS, AND MATERIALS:

Machines	-	Washing Machine, Drying Machine, Sewing Machine
Tools	-	Knife, box truck, trolley
Materials	-	Woven cloth

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-40. 18-30 preferred
Education	Preferably some secondary education
Experience	
Physical requirements	Average strength
Temperament	

WORKING CONDITIONS	Hot, humid, may be noisy
NATURE OF WORK:	Walking, standing, pushing.
TRAINING:	Learns by working in the department.

RELATION TO OTHER JOBS:

Promotion to:	
Allied Jobs:	May be transferred to Dyeing, Filling, Sanforizer or Kier Machines.

34. Job: NAPPER
Place: Finishing Department

SUMMARY OF DUTIES:

Feeds woven material through napping machine.

WORK PERFORMED:

1. Wheels truck of material to napping machine.
2. Lifts cloth over overhead (about 7 feet high) cross section by hand.
3. Pushes treadle sewing machine to convenient position.
4. Sews end of new batch to protruding end of previous batch.
5. Starts napping machine.
6. When joined ends are exposed, cuts stitching with knife.
7. Pushes box truck into position to receive material.
8. Pushes box truck of finished material to finishing room.

SPECIAL REQUIREMENTS OF JOB:

MACHINES, TOOLS, AND MATERIALS:

Machines	-	Napping Machine, Sewing Machine
Tools	-	Knife
Materials	-	Woven cloth

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male
Age	18-40
Education	Completion of Primary School
Physical requirements	Average strength, slight hearing defect no handicap
Temperament	

WORKING CONDITIONS: May be noisy. Not hot unless located with other processes.

NATURE OF WORK: Walking, standing, lifting, Simple.

TRAINING: Learns on job.

RELATION TO OTHER JOB:

Promotion to:
Allied Jobs: Interchanges job with Desizer (Machine Operator). May operate tentering machine at the same time.

35. Job: CLOTH EXAMINER

Place: Finishing Department

SUMMARY OF DUTIES:

Checks woven material for flaws. Measures length of material checked.

WORK PERFORMED:

1. Lifts roll of cloth on to rack or cradle under table.
2. Pulls end of cloth from roll on sloping table.
3. Posts specifications at end of cloth into book.
4. Throws end of cloth over mechanical folding arm
5. Sets lineal measuring cloth to zero.
6. Operates machine by foot pedal.
   (Sometimes 1 to 6 are done by turning over folded pieces instead of having a roll unwinding.)
7. Visually checks cloth as it moves slowly across table or is turned over fold by fold.
8. Removes loose cotton threads with burler (tweezers).
9. Reports flaws or defects in pattern or weave to foreman.
10. Enters clock recording in book and on end of cloth.
11. Lifts folded cloth to adjacent stack.

SPECIAL REQUIREMENTS OF JOB:

Visual discernment in colour and pattern. Dexterity in removing loose cottons without stopping the machine.

MACHINE, TOOLS, AND MATERIALS:

Machine	-	Overlooker (cloth examining machine)
Tools	-	Burler or picker
Materials	-	Woven cloth

Cloth Examining Machine. A roll of cloth is placed under a large, flat, sloping surface. The cloth is fed over this surface and under a roller at the top. As the cloth passes over the open surface it can be inspected. An automatic measuring clock indicates length of each roll. Cloth is further cleaned by action of brushes under the roller at the top of the flat surface.

QUALIFICATIONS FOR EMPLOYMENT:

Sex	Male or female
Age	16-40
Education	Ability to read and write
Physical requirements	Average strength, good eyesight
Temperament	

WORKING CONDITIONS: Natural temperature, clean, quiet. May be done under articifical light as good lighting conditions are required. Companionship of other workers.

NATURE OF WORK: Standing, sometimes sitting, lifting. Requires close attention.

TRAINING: Learns on the job. Helps on simple jobs until capable of assuming responsibility.

RELATION TO OTHER JOBS:

Promotion to:

Allied Jobs:

APPENDIX 'B'

Introduction to Job Evaluation

APPENDIX 'B'

INTRODUCTION TO JOB EVALUATION

(Extract from 'Job Evaluation - an analysis of the existing structure in the Ahmedabad Textile Industry') Ahmedabad Textile Industry Research Association.

One of the most important problems in industry is to determine what is a fair day's work and what is a fair wage for it. The first part of the problem, namely what is a fair day's work, is dealt with by time studies and workloads. The second part of the problem, namely what is a fair wage, is dealt with by Job Evaluation studies.

The present wage structure of the textile industry in Ahmedabad is partly a remnant of the structure that developed because of the available skilled and unskilled labour at the time when textile mills were started here and partly due to ad hoc changes that were asked for by certain occupations at different periods. In 1948 the wage structure was revised at the instance of the Labour Association by the Industrial Court of Bombay, but these revisions were not based as far as is known on any objective methods of job assessment. The result is that we still have a wage structure which is not based on objective and rational grounds. Disputes between management and labour frequently arise for the adjustment of wages in certain occupations. There is no objective data acceptable to both parties on the basis of which wage negotiations can be discussed. Even if a wage increase is agreed to in a particular job it does not solve the problem, because other jobs in relation to it become in a state of inequilibrium, and a series of similar demands are asked for by the workers in the remaining occupations. A piecemeal procedure, without taking the total situation in consideration, will only perpetuate the inequalities. The solution lies in viewing the total wage structure on some rational basis and then adjusting wages in any particular job in relation to the framework of all the jobs. This system would result in every job being paid fairly according to the nature of the work and the effort and ability involved in it.
To achieve a perfect wage structure is impossible, but there are well-tried ways of getting closer to an equitable wage distribution within an industry.

There is no doubt that in the near future serious efforts would be made to increase efficiencies and to decrease manufacturing costs in order to compete favourably in the world market. This will involve rationalisation, alterations in production methods, mechanisation and other changes. With these changes will come inevitably adjustments in wage and salary levels which would provide a suitable opportunity for reducing the existing inequities in the wage structure.

In U.S.A. and in Britain, Job Evaluation is being used for obtaining information upon which wage negotiations are based. Thus, in the United States Steel Corporation the whole wage structure was re-organised in 1944-45 on the basis of Job Evaluation procedures. Both the Union and Management felt satisfied about the results obtained. Both believed that 'not only does the system remove inequities and rationalise the wage structure, but it greatly simplifies the process of technical change. A major difficulty in the past arising out of the introduction of new machines and processes had been the question of wage rate adjustments. Changes in job content led to wage disputes, but under the Inequities Programme (Job Evaluation) such a change can easily be evaluated and translated into new wage rates. If new and larger furnaces, for example, were installed in a plant, the charging machine operators' responsibility for materials, tools, and equipment, and perhaps for operations would be greater and would 'automatically' lead to an increase in his job class number entitling him to a higher hourly wage rate' (14).

Whether the wage rates in any unit or industry are decided by collective bargaining or Industrial Awards, it would be useful, and perhaps necessary in case of differences of opinion to use Job Evaluation as a means of getting comparative information concerning the wages of employees. Generally, in collective bargaining, the wages are decided by the strength of the bargaining parties, and very seldom indeed is the relative value of the job taken into consideration. Grades and differences in grades of occupations are to some extent recognised, but without any definite clarification of the factors involved in the efficient performance of the job.

The absolute value or the worth of any job is difficult to evaluate because it is influenced by a number of factors such as:

(1) Supply and demand of labour
(2) Capacity of industry to pay
(3) Relative wage levels in other industries and in the country as a whole
(4) Social, political, and economic considerations

However, if the basic wage in any industry is determined by a consideration of the above-mentioned factors, then Job Evaluation can assist in the determination of just and equitable differentials that should be paid for different jobs within the industry. Job Evaluation is limited to the determination of differences in payment for different jobs by taking into consideration their relative value. The only standards of judgement are the necessary requirements for the efficient performance of the job and judgements are only about differences in payment and not on absolute values of payment.

JOB EVALUATION METHODS

There are four recognised methods of Job Evaluation:

(1) Ranking system
(2) Job classification system
(3) Factor comparison system
(4) Point system

1. Ranking System

In this system all the jobs in a department are carefully analysed and ranked in their order of importance, or in their order of value to the company. The jobs are evaluated in terms of other jobs and not in salary or wage rates.

After the departmental rankings are done, the jobs are placed in one organisational ranking. This combining necessitates agreement between departmental heads which at times may be quite difficult to establish, because consideration of the present job holder or the existing salaries or wage rates may bias the opinions of the raters.

The Ranking Method can be applied effectively in small units only, because as the number of jobs increase it becomes difficult to find sufficient judges familiar enough with all the jobs that need to be rated. Also, the method merely places jobs in order without indicating the extent to which they differ from one another, so that the degree of wage differentials between different jobs is still undetermined.

2. Job Classification Method

In this method a number of classifications are established in advance according to the nature of the job, such as, skilled, semi-skilled, unskilled, supervisory, etc. A Committee then allocates each job in one classification or the other, and differences between jobs are made by ranking them within their grade.

This system has the same difficulties as mentioned in the Ranking Method. Further, there is the problem that many jobs may have duties which would fit a number of classifications.

3. Factor Comparison Method

In this method a number of key jobs are selected in which the wage rates are considered appropriate and are not subject to controversy. These key jobs are generally evaluated in terms of 5 critical factors: skill demands, mental demands, working conditions, physical requirements, and responsibility. These 5 factors are combined or broken down into further subdivisions depending on the special requirements of the industry. The raters rank each key job in relation to the factors chosen and in each case decide what proportion of the current wage is represented by each factor. A scale is then prepared for each factor on which the key jobs are placed in order of their value assessed for that factor. The remaining jobs are then compared with the key jobs in each factor and are inserted in their correct positions on the scale. The total of the factor values determined for each job represents is evaluated cash rate.

This system is complex and difficult to explain to workers. It is however, being fairly satisfactorily used in a number of firms and factories.

4. Point System

In the Point System, as in the Factor Comparison System, the critical factors that are considered important and common to all the jobs are first determined. As mentioned earlier, these are generally five, but depending on the nature of the industry and the importance of certain factors, the number of basic factors can be increased or decreased.

It is generally agreed that the relative importance of the basic factors in the determination of wages is different. Thus skill and mental effort are generally considered of greater value in wages than physical working conditions. But how exactly to determine the importance of each factor? Generally, the Job Evaluation Committee assigns weights based on subjective judgement to each factor on a percent basis according to what they consider is the importance of each factor. After the relative importance of each factor is determined the factors are subdivided in degrees and each degree is given a range of numerical points. The factor of skill receives the highest weight. This means that the degree of skill involved in a job is considered the most important determinant in the wage level of any particular job.

After the factors have been selected and the relative value of each factor decided, the next step is to rate each job to assign numerical points for each factor. The total points to any job gives the relative value of the job in relation to others.

The advantage of the Point System is that it is easy to understand and if the weights to factors are once determined, then the relative differences among jobs in monetary values can be assigned in a consistent manner. Although this system like others is subject to certain limitations it enables workers' questions concerning wage differentials to be answered more conveniently than do the other systems.

Although Job Evaluation is based on human judgement, it necessitates careful analysis of job requirements and ensures that wage differentials arrived at are fair and logical. No Job Evaluation system can establish a wage structure divorced from Industrial Awards, supply and demand of labour, and prevailing rates in other centres, but it certainly helps to find the relative wage differentials on a systematic and logical basis.

In this Research Note, the Point System of Job Evaluation has been used. The determination of the relative value of each job as rated by a panel of experienced technicians has been discussed.

PROCEDURE

The purpose of this study is to find the relative value of each job in the textile industry of Ahmedabad in terms of the job content and job requirement of each job.

PLAN OF STUDY

1. On examining the different Job Evaluation systems, it was decided to use the Point System of Job Evaluation.

2. On examining the job descriptions of the different job in the textile industry prepared by a panel of technicians, the following eight factors were considered important as determinants of the relative wage differentials.

(1) Skill
(2) Mental effort
(3) Physical effort
(4) Responsibility for equipment
(5) Responsibility for material
(6) Responsibility for work of others
(7) Working conditions
(8) Hazards

All the eight factors may not be applicable to all the jobs but each is applicable to some job or the other.

3. In order to rate each job on the above mentioned factors it was necessary to have job descriptions of the various jobs. A comprehensive Job Analysis Schedule prepared at the instance of the Millowners' Association in 1948 by a panel of experienced technicians was used. The number and description of job duties performed in each job have been listed in the Job Analysis Schedule.

4. Since there are about 220 jobs listed in the Job Analysis Schedule, it was felt that no technician would be sufficiently familiar with all the jobs in order to rate them accurately according to the factors given. Therefore, three experienced technicians were chosen from each department for rating of jobs. Thus, three departmental heads from different mills were selected in the following sections.

(a) Spinning
(b) Weaving
(c) Dyeing, bleaching, finishing, and printing
(d) Engineering

5. First, a general meeting of the selected technicians was convened in which the idea and concept of Job Evaluation was discussed, and the cooperation of the technicians was solicited. It was generally agreed by the group that the rating of jobs would be facilitated and there would be an increased degree of agreement among the different raters if there were some concrete examples from the industry for the different factors and the degrees involved as guides for rating of jobs. Subsequently, a series of meetings were arranged with the raters of each department in order to arrive at a common basis of understanding concerning the definition of factors and the degrees used. For each factor and for each degree, examples from each department were discussed, and at least three examples were chosen for each factor and for each degree. Only those examples were taken where there was unanimity among the different raters. These examples gave in concrete terms an idea of what is implied in the factor and the amount of that factor in a particular job.

6. A Job Evaluation Manual was prepared for raters in which instructions were given as to how to rate the different jobs. In the Manual the definition of factors and degrees with appropriate examples were given for ready reference. The definition of factors and degrees were taken from the Job Rating Manual of the National Electrical Manufacturer's Association, (NEMA) 1946 edition.

7. Rating sheets were prepared. Eight factors were listed for each job, and each factor was sub-divided in 5 degrees. Further, for each degree there was a range of 10 points. Thus, for each job in each factor the rating could vary from 0 to 50 points.

8. After each job was rated, further meetings were called of the technicians of the Spinning and Weaving departments to discuss differences in ratings between different raters. It was found after discussion that in most factors differences in ratings were eliminated. In 'working conditions' and 'hazards', however, some of the differences persisted, probably reflecting real differences in the working conditions in individual

mills. The jobs in the Dyeing, bleaching, and finishing department, and jobs in the Engineering department were not further discussed with the raters. It is difficult to estimate in these jobs to what extent differences in ratings are due to differences among raters and to what extent to real differences in the job duties, responsibilities, working conditions, etc. in each mill.

9. Each rater was also asked to mention certain jobs in his department which he believed were adequately and appropriately paid in regard to the existing wage structure. These selected jobs indicated the relative wage differentials that they believed are appropriate. The stress was on relative differentials rather than on the absoluteness of the wages.

ANALYSIS OF DATA

In jobs where it was found that point ratings of the different raters were more or less similar, the average rating was taken. Where the differences in ratings was considerable, that is, above two degrees, the value where 2 raters agreed was taken. Generally, however, there was a good deal of agreement between the different raters.

WEIGHTING OF FACTORS

Generally, in Job Evaluation systems factors are weighted according to their relative importance as determined by the Job Evaluation Committee. The factor of 'skill' may be weighted 5 times more than the factor of 'working conditions', or 'hazards', and these weights are assigned on the basis of experience and judgement of the members of the Job Evaluation Committee. Why one factor should be 5 instead of 2 or 7 times as important as another factor in the determination of wages is not generally explained by the Job Evaluation Committee. According to the prevailing thinking of the community, the importance of each factor is reflected in the weights given by the raters. Thus, the social-economic philosophy of one c[illegible]y may believe that 'skill' or 'mental effort' is as important as 'working conditions' or 'hazards'. In India, where the value of capital goods, like machinery, etc. is rated higher than in a country like the United States, the weights given to the factors of 'responsibility for equipment and process' will be higher than in U.S.A. Again, it is possible that in a country where a very high standard of living and full employment has been achieved, factors like 'physical effort' or 'working conditions' will be weighted higher than in a country like India, because in such countries it would be difficult to find workers who are willing to work in non-congenial environment, unless sufficiently compensated.

The weights given to factors, therefore, would differ in the different countries depending on the socio-economic and political thinking of the country. The weights given to factors in one country or one particular industry may not be applicable in other countries or in other industries. These will have to be worked out in each case to reflect the thinking of that particular community in regard to that particular industry. This is important if the Job Evaluation system is to be acceptable to the community in terms of its own standards. The wages of the various jobs would vary depending on the weights given to the different factors. Thus, if 'skill' is weighted high certain jobs will have the advantage of higher wages, if 'responsibility for equipment' is weighted high certain other jobs will have the advantage of higher wages, and so on. The determination of the weights which would result in an acceptable wage structure is therefore important.

The British Institute of Management conducted a nation-wide opinion survey for evolving a uniform weight structure for factors generally used in Job Evaluation (3). After considerable testing with key jobs the following weights were arrived.

Mental requirement	16%
Physical requirement	16%
Acquired skills and knowledge	40%
Working condition	28%

The definition of factors in different systems vary. In the B.I.M. survey, the factor of responsibility is partly covered by mental requirements, and partly by acquired skills and knowledge. If the degree of nervous tension in doing the job is also considered a measure of responsibility, then responsibility is also covered by the main head of working conditions.

On a survey of several successful Job Evaluation schemes covering manual jobs in different industries it is seen that the weights assigned range as follows (3).

Skill required	..	46-60% of total points
Responsibility	..	12-20% of total points
Effort required (Mental and Physical)	..	15-20% of total points
Working conditions	..	10-15% of total points

Although the weights assigned depend on the nature of the industry and also on the opinion and experience of the Committee, the broad pattern of weights to different factors is more or less the same. Skill factor is weighted the highest, then come factors of responsibility and effort and last of all the factor of working conditions.

The problem for us to determine is what are the most appropriate weights for the selected eight factors. The ultimate criterion of the validity of the weights is the acceptability of the resultant relative values by both management and labour. The following are some of the procedures which could be useful in determining the weights to the different factors.

1. A Committee of representatives from management, labour, and industrial economists could assign weights to each factor that are acceptable to the parties concerned.

2. The above Committee could select a number of key jobs representing different wage levels which are agreed to be more or less appropriately paid. The weights which show the best fit for these selected jobs could be taken.

3. The prevailing standards of importance of each factor as reflected in the ratings of the jobs could be assessed by statistical methods (Factor Analysis). This system would have the advantage of deriving weights from the existing value system of the community.

4. It is possible that our existing value system in regard to the importance of each factor is not what it should be. For example, in the past we may not have attached sufficient importance to 'physical working conditions' or 'hazards' of the job. It may now be considered necessary to compensate workers for relatively bad physical conditions of work. A modified system based on (3) could therefore be used.

The particular system selected for determining weights would depend on what considerations one wants to reorganise the wage structure.

1. If the main purpose is to upgrade the wages of unskilled workers, then factors like physical effort and physical working conditions should be weighted to the extent to give the desired differentials between selected skilled and unskilled jobs (i.e. 1).

2. If the main purpose is to organise the wage structure on a systematic basis with the minimum of changes, then the weights giving the line of best fit for key jobs would be the most satisfactory solution (i.e. 2). New jobs can then be fitted in the existing structure in a systematic manner.

3. If the wage structure is to reflect the existing thinking pattern of the community in regard to the importance of factors then perhaps weights derived by Factor Analysis would be the most satisfactory solution (i.e. 3).

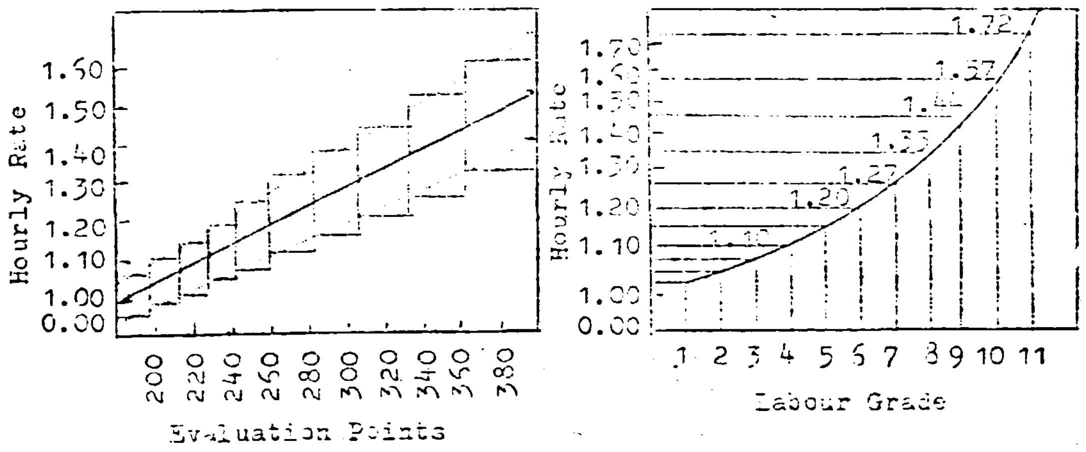
4. If the existing socio-economic thinking pattern of the industry needs to be modified in certain respects then the last system of weights suggested could be used (i.e. 4).

The selection of a particular weight system depends on the socio-economic considerations in mind. In any case, whatever weights are used for the different factors, the resultant wage differentials should seem fair and reasonable in the frame of reference determined.

DETERMINATION OF WAGES

After the weights for each factor have been agreed by management and the labour union, the rating of each job on each factor should be multiplied by its appropriate weight. The resultant point score on each factor is added to give a total score for each job. The total score gives the relative value of each job in non-monetary terms.

In converting the total point score to money value, it is necessary to have a minimum of 2 reference points. These reference points may be the point of origin and the minimum wage, or the minimum wage and any other accepted job, or any two accepted jobs (accepted as appropriately paid by both labour and management). The line joining the 2 reference points can either be a straight line or one whose slope increases with the total point ratings. The straight line and the sloped line relation are illustrated as follows:



The straight line or slope can be broken into a number of convenient steps, thus classifying jobs in a number of predetermined grades.

The broad classifications can be unskilled, semi-skilled, skilled supervisory, clerical, etc., and within each classification further subdivisions can be made. A different total score for each job does not mean that a separate wage rate should be given for each single job in the industry. This would result in an exceedingly complicated wage administration. Jobs should be classified in a convenient number of categories and wages determined for each category.

APPENDIX 'C'

Methcd of calculation of wage piece rates
used at the Textile Mills of Dire Dawa

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የፈትል ክፍል

July 1976

CALCULATION OF PIECE WAGE FOR THE SPINNING DEPARTMENT

A. MILL No. 1

1. Drawing Section

Wage = Total Hanks x Rate + (Stop Hour x Stop Rate) / (No. of Machines Operated by One Person)

No. of Machines operated by one person : 1.0   1.5   2.0   2.5

Rate in Birr : 0.1503   0.0942   0.1161   0.0949

N.B.: Drawing with 3 heads (passages) is considered equivalent to 1.5 machines.

2. Simplex Section

Wage = Total Hanks x Rate + (Stop Hour x Stop Rate) / (No. of Machines Operated by One Person)

No. of Machines operated by one person: 2.0

For an operator with an hourly rate of:

up to Birr 0.4968 — Hank rate is Birr 0.4355

between Birr 0.4969 and 0.5304 — " " " " 0.4619

above Birr 0.5305 — " " " " 0.4771

3. Ring Spinning Section

a. Frame without Pneumafil Set Roller Craft System

Wage = No. of Hours Worked x Rate + (Stop Hour x Stop Rate) / (No. of Machines Operated by One Person)

Count	No. of Machines 1.0	No. of Machines 1.5	Minimum Number of Hanks
	Rate Per Hour in Birr		
10	0.5480	0.6915	7.0
13.5	0.5340	0.6253	6.0
18	0.5340	0.6253	4.9
21	0.5340	0.6253	4.7

b. Frame with Pneumafil Set Roller Draft System

Wage = Hourly Rate x No. of Hours Worked + (Stop Hour x Stop Rate) / (No. of Machines Operated by One Person)

Count	No. of machines		Minimum Number of Hanks
	1.5	2.0	
	Rate Per Hour in Birr		
10	0.5678	0.6915	7.0
13.5	0.5340	0.6253	6.0
18	0.5340	0.6253	4.9
21	0.5340	0.6253	4.7

4. Twisting Section

Wage = Total Hanks x Rate + (Stop Hour x Stop Rate) / (No. of Machines Operated by one person)

Type of Machine	Count	Rate Per Hank in Birr
Hamel	32/2	0.2802
Howard B.	32/2	0.4007

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የሽመና ክፍል

CALCULATION OF PIECE WAGE FOR WEAVING DEPARTMENT
(MILL NO. 2 AND MILL NO. 5)

1. Cone Winder Section

   Wage = (No. of Boxes used x Rate) + (Stop Hour x Stop Rate) + (Ordinary Hours x Ordinary Hourly Rate)

Item	Mill No. 2		Mill No. 5	
Type of bobbin	Single yarn	Twist yarn	Single yarn	Twist yarn
Rate per Box in Birr	0.3658	0.2581	0.3079	0.2581

N.B: The number of bobbins in one box must be 100 both for single yarn and twist yarn.

2. Pirn Winder Section

   Wage = (No. of Boxes used x Rate) + (Stop Hour x Stop Rate) + (Ordinary Hours x Ordinary Hourly Rate)

Item	Mill No.2	Mill No. 5					
Yarn Count	10 16 21	10	21	20 (Schweiter	40 C40	24/2 20/2	P/C 34/2 P/C 45/2
Rate per Box in Birr	0.3491	0.2733	0.2733	0.2733	0.3572	0.2444	[illegible]

N.B: The number of pirns in one box must be 100 for every count.

3. Weaving Section

   Wage = (Pick Hour) x (Pick Rate per Hour) + (Stop Hour x Stop Rate) + (Ordinary Hours x Ordinary Hourly Rate)

PICK RATE TABLE FOR KOVO AND RUTI LOOMS

EFFICIENCY		KOVO LOOMS STANDARD AND NEW SHEETING [illegible] LOOMS	6 LOOMS	7 LOOMS	10 LOOMS	RUTI LOOMS EFFICIENCY		RED SHIRT CLOTH 12 LOOMS
43 - 47	P R	[illegible] [illegible]	[illegible] - 25.0 0.4520	26.1 - 30.3 0.4983	38.8 - 43.2 0.6404	70 - 72	P R	104.[illegible] - 107.3 0.5631
48 - 52	P R	[illegible].7 - [illegible] 0.4[illegible]	26.0 - 28.7 0.4831	30.4 - 33.5 0.5177	43.3 - 47.8 0.6570	72 - 74	P R	107.4 - 110.3 0.5713
53 - 57	P R	[illegible] [illegible]	26.8 - 31.4 0.5494	33.6 - 36.6 0.5908	47.9 - 52.3 0.6737	74 - 76	P R	110.4 - 114.3 0.5797
58 - 62	P R	[illegible] [illegible]	31.5 - 34.1 0.5908	36.7 - 39.8 0.6253	52.4 - 56.9 0.6915	76 - 78	P R	113.[illegible] - 116.2 0.5880
63 - 67	P R	[illegible] [illegible]	34.2 - 36.9 0.6059	39.9 - 43.0 0.6404	57.0 - 61.5 0.7247	78 - 80	P R	116.3 - 119.2 0.5962
68 - 72	P R	[illegible] [illegible]	37.0 - 39.6 0.6253	43.1 - 46.2 0.6570	61.6 - 66.0 0.7430	80 - 82	P R	119.3 - 122.2 0.6046
73 - 77	P R	[illegible].1 - [illegible] [illegible]	39.7 - 42.4 0.6406	46.3 - 49.4 0.6737	66.1 - 60.6 0.7578	82 - 84	P R	122.3 - 125.2 0.6144
78 - 82	P R	[illegible] [illegible]	42.5 - 45.1 0.6570	49.5 - 52.6 0.6915	70.7 - 75.1 0.7840	84 - 86	P R	125.[illegible] - 128.2 0.6212
83 - 87	P R	[illegible].7 - [illegible].9 0.6404	45.2 - 47.8 0.6737	52.7 - 55.8 0.7065	75.2 - 55.8 0.8157	86 - 88	P R	128.3 - 131.1 0.6307
88 - 92	P R	40.0 - [illegible] 0.657[illegible]	47.9 - 50.6 0.6915	55.9 - 69.0 0.7247	79.8 - 84.3 0.8320	88 - 90	P R	131.2 - 134.1 0.6390
93 - 97	P R	[illegible].2 - [illegible].4 0.677	50.7 - 53 0.7065	59.1 - 62.2 0.7398	84.4 - 88.8 0.8489	90 - 92	P R	134.2 - 137.1 0.6460

PICK RATE TABLE FOR TOYODA LOOMS (PART 1)

EFFICIENCY		FABRIC AND NUMBER OF LOOMS									
		STANDARD GREY MULL		C.B. POPLIN WHITE MULL		TWILL, DRILL FRENCH TWILL		BROAD COMBED BROAD		TC TUSSOR TC TWILL	
		10	12	10	12	10	12	10	12	10	12
50-52	P	48.6-50.4	58.3-60.5	48.6-50.4	58.3-60.5	48.6-50.4	58.3-60.5	48.6-50.4	58.3-60.5	48.6-50.4	58.3-60.5
	R	0.3808	0.4196	0.4196	0.4540	0.4569	0.4857	0.5160	0.5650	0.4967	0.5483
52-54	P	50.5-52.4	60.6-62.9	50.5-52.4	60.6-62.9	50.5-52.4	60.6-62.9	50.5-52.4	60.6-62.9	50.5-52.4	60.6-62.9
	R	0.3864	0.4279	0.4279	0.4637	0.4637	0.4955	0.5250	0.5740	0.5056	0.5572
54-56	P	52.5-54.2	63.0-65.1	52.5-54.2	63.0-65.1	52.5-54.2	63.0-65.1	52.5-54.2	63.0-65.1	52.5-54.2	63.0-65.1
	R	0.3934	0.4375	0.4375	0.4706	0.4706	0.5052	0.5328	0.5818	0.5135	0.5650
56-58	P	54.3-56.3	65.2-67.6	52.3-56.3	65.2-67.6	54.3-56.3	65.2-67.6	54.3-56.3	65.2-67.6	54.3-56.3	65.2-67.6
	R	0.4030	0.4445	0.4445	0.4789	0.4789	0.5121	0.5418	0.5908	0.5225	0.5740
58-60	P	56.4-58.2	67.7-69.9	56.4-58.2	67.7-69.9	56.4-58.2	67.7-69.9	56.4-58.2	67.7-69.9	56.4-58.2	67.7-69.9
	R	0.4127	0.4540	0.4540	0.4857	0.4857	0.5219	0.5495	0.5985	0.5301	0.5818
60-62	P	58.3-60.2	70.0-72.3	58.3-60.2	70.0-72.3	58.3-60.2	70.0-72.3	58.3-60.2	70.0-72.3	58.3-60.2	70.0-72.3
	R	0.4196	0.4637	0.4637	0.4955	0.4955	0.5300	0.5585	0.6076	0.5393	0.5908
62-64	P	60.3-62.1	72.4-74.5	60.3-62.1	72.4-74.5	60.3-62.1	72.4-74.5	60.3-62.1	72.4-74.5	60.3-62.1	72.4-74.5
	R	0.4279	0.4706	0.4706	0.5052	0.5052	0.5370	0.5675	0.6167	0.5469	0.5985
64-66	P	62.2-64.1	74.6-76.9	62.2-64.1	74.6-76.9	62.2-64.1	74.6-76.9	62.2-64.1	74.6-76.9	62.2-64.1	74.6-76.9
	R	0.4375	0.4789	0.4789	0.5121	0.5121	0.5465	0.5753	0.6243	0.5560	0.6076
66-68	P	64.2-66.0	77.0-79.2	64.2-66.0	77.0-79.2	64.2-66.0	77.0-79.2	64.2-66.0	77.0-79.2	64.2-66.0	77.0-79.2
	R	0.4445	0.4857	0.4857	0.5219	0.5219	0.5562	0.5780	0.6334	0.5650	0.6167

PICK RATE TABLE FOR TOYODA LOOMS (PART 2)

%											
68-70	P R	66.1-67.9 0.4540	79.3-81.5 0.4955	66.1-67.9 0.4955	79.3-81.9 0.5300	66.1-67.9 0.5300	79.3-81.5 0.5631	66.1-67.9 0.5921	79.3-81.5 0.6411	66.1-67.9 0.5728	79.3-81 0.6[illegible]
70-72	P R	68.0-69.9 0.4637	81.6-83.9 0.5052	68.0-69.9 0.5052	81.6-83.9 0.5370	68.0-69.9 0.5370	81.6-83.9 0.5714	68.0-69.9 0.6011	81.6-83.9 0.6502	68.0-69.9 0.5818	81.6-8[illegible] 0.6334
72-74	P R	70.0-71.8 0.4706	84.0-86.2 0.5121	70.0-71.8 0.5121	84.0-86.2 0.5465	70.0-71.8 0.5465	84.0-86.2 0 5792	70.0-71.8 0.6102	84.0-86.2 0.6592	70.0-71.8 .5895	84.0-8[illegible] 0.64[illegible]
74-76	P R	71.9-73.8 0.4789	86.3-88.5 0.5219	71.9-73.8 0.5219	86.3-88.5 0.5562	71.9-73.8 0.5562	86.3-88.5 0.5880	71.9-73.8 0.6178	86.3-88.5 0.6669	71.9-73.8 0.5995	86.3-8[illegible] 0.650[illegible]
76-78	P R	73.9-75.7 0.4857	88.6-90.9 0.5300	73.9-75.7 0.5300	88.6-90.9 0.5631	73.9-75.7 0.5631	88.6-90.9 0.5962	73.9-75.7 0.6269	88.6-90.9 0.6760	73.9-75.7 0.6076	88.6-9[illegible] 0.659[illegible]
78-80	P R	75.8-77.7 0.4955	91.0-93.2 0 5370	75.8-77.7 5370	91.0-93.2 0.5714	75.8-77.7 0.5714	91.0-93.2 0.6046	75.8-77.7 0.6346	91.0-93.2 0.6837	75.8-77.7 0.6153	91.0-9[illegible] 0.6669
80-82	P R	77.8-79.6 0.5052	93.3-95.5 0.5465	77.8-79.6 0.5465	93.3-95.5 0.5792	77.8-79.6 0.5792	93.3-95.5 0.6144	77.8-79.6 0.6437	93.3-95.5 0.6927	77.8-79.6 0.6243	93.3-9[illegible] 0.67[illegible]
82-84	P R	79.7-81.5 0.5121	95.6-97.9 0.5562	79.7-81.5 0.5562	95.6-97.9 0.5880	79.7-81.5 0.5880	95.6-97.9 0.6212	79.7-81.5 0.6527	95.6-97.9 0.701[illegible]	79.7-81.5 0.6321	95.6-9[illegible] 0.6837
84-86	P R	81.6-83.5 0.5219	98.0-100.2 0.5631	81.6-83.5 0.5631	98.0-100.2 0.5962	81.6-83.5 0.5962	98.0-100.2 0.6307	81.6-83.5 0.6605	98.0-100.2 0.7095	81.6-83.5 0.6411	98.0-1[illegible] 0.692[illegible]
86-88	P R	83.6-85.4 0.5300	100.3-102.5 0.5714	83.6-85.4 0.5714	100.3-102.5 0.6046	83.6-85.4 0.6046	100.3-102.5 0.6390	83.6-85.4 0.6695	100.3-102.5 0.7185	83.6-85.4 0.6502	100.3-1[illegible] 0.701[illegible]
88-90	P R	85.5-87.4 0.5370	102.6-104.9 0.5792	85.5-87.4 0.5792	102.6-104.9 0.6144	85.5-87.4 0.6144	102.6-104.9 0.6461	85.5-87.4 0.6773	102.6-104.9 0.7262	85.5-87.4 0.6578	102.6-1[illegible] 0.70[illegible]
90-92	P R	87.5-89.3 0.5465	105.0-107.2 0.5880	87.5-89.3 0.5880	105.0-107.2 0.6212	87.5-89.3 0.6212	105.0-107.2 0.6543	87.5-89.3 0.6862	105.0-107.2 0.7352	87.5-89.3 0.6669	105.0-1[illegible] 0.718[illegible]
92-94	P R	89.4-92.3 0.5562	107.3-109.5 0.5962	89.4-91.3 0.5962	107.3-109.5 0.6307	89.4-91.3 0.6307	107.3-109.5 0.6652	89.4-91.3 0.6952	107.3-109.5 0.7443	89.4-91.3 0.6746	107.3-1[illegible] 0.726[illegible]

PICK RATE TABLE FOR TOYODA LOOMS (PART 3)

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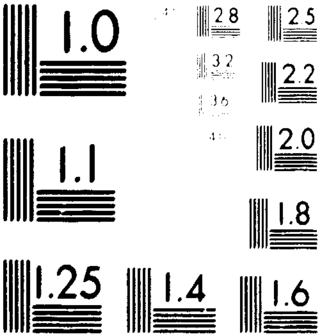
%											
94-96	P R	91.4-93.2 0.5631	109.6-111.9 0.6046	91.4-95.2 0.6046	109.6-111.9 0.6390	91.4-93.2 0.6390	109.6-111.9 0.6722	91.4-93.2 0.7031	109.6-111.9 0.7520	91.4-93.2 0.6837	109.[illegible] 0.[illegible]
96-98	P R	93.3-95.2 0.5714	112.0-114.2 0.6144	93.3-95.2 0.6144	112.0-114.2 0.6461	93.3-95.2 0.6461	112.0-114.2 0.6805	93.3-95.2 0.6490	112.0-114.2 0.7610	93.3-95.2 0.6927	112.0-[illegible] 0.[illegible]
98-100	P R	95.3-97.1 0.5797	114.3-116.5 0.6212	95.3-97.1 0.6212	114.3-116.5 0.6543	95.3-97.1 0.6543	114.3-116.5 0.6902	95.3-97.1 0.7188	114.3-116.5 0.7688	95.3-97.5 0.7005	114.[illegible] 0.[illegible]
100-102	P R	97.2-99.0 0.5880	116.6-118.9 0.6307	97.2-99.0 0.6307	116.6-118.9 0.6652	97.2-99.0 0.6652	116.6-118.9 0.6971	97.2-99.0 0.7289	116.6-118.0 0.7778	97.2-99.0 0.7093	116.[illegible] 0.[illegible]



MICROCOPY RESOLUTION TEST CHART

Shirley Institute

10356
(6 of 6)

Client Report

NATIONAL TEXTILE CORPORATION

PORTFOLIO OF MANAGEMENT CONTROL INFORMATION

AND

INTERPRETATION

Prepared by:

The Technical Economy Department

Shirley Institute Reference No. 21/13/939 February 1981

Shirley Institute, Didsbury, Manchester M20 8RX England
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- Index -

WEEK ENDED	1977 £'000	%	1978 £'000	%	1979 £'000	%				
SALES	4.900		5.000		6.000					
± WIP/FS	+ 100		+ 80		− 130					
SVP	5.000		5.080		5.870					
		% SVP		% SVP		% SVP				
Matl.	2.220	44	2.170	43	2.540	43				
Labour	470	9	480	9	600	10				
Fact. O/h.	1.160	23	1.190	23	1.370	23				
Mfg. Profit	1.150	23	1.240	24	1.360	23				
		% Sales		% Sales		% Sales				
Selling	600	12	600	12	800	13				
Company	300	6	330	7	430	7				
Net Profit before Tax	250	5	310	6	130	2				

DEPARTMENT	SECTION	
TRADING	CARD 1	PAST RESULTS

CARD 1

INTERPRETATION

Trends: Sales - £ : Volume, Selling Price, Product Mix.
SVP - £ : Volume, Selling Price, Product Mix.
Costs - %'s : Expense, Selling Price, Product Mix, Volume.

SUPPORTING DATA

Graph: Total Costs and Mfg. Costs as % SVP

Other Cards: None

SOURCES

Annual (or half-yearly) Trading Statements.

OTHER COMMENTS

Change in WIP/FS is at the valuation used in the Trading Statement. The basis may be Materials and Labour (i.e. Prime Cost), Prime Cost + x%, Standard Cost or one of many variations. Check that one basis has been consistently used or adjust to show the effect of any change as an item of Expense.

WEEK ENDED	JANUARY £'000	%		FEBRUARY £'000	%		MARCH £'000	%		QUARTER %
SALES	500			440			600			
± WIP/FS	+ 10			+ 60			- 10			
SVP	510			500			590			
		% SVP			% SVP			% SVP		% SVP
Matl.	220	43		220	44		250	42		43
Labour	50	10		50	10		60	10		10
Fact O/h	120	24		120	24		140	24		24
Mfg. Profit	120	24		110	22		140	24		23
		% Sales			% Sales			% Sales		% Sales
Selling	60	12		60	14		80	14		13
Company	30	6		30	7		40	7		6
Net Profit before Tax	30	6		20	5		20	3		4

DEPARTMENT	SECTION	
TRADING	CARD 2	CURRENT RESULTS - 1980

CARD 2

INTERPRETATION

Trends:

Profit	- £ & %	:	Overall Success
Sales	- £	:	Volume, Selling Price, Product Mix.
SVP	- £	:	Volume, Selling Price, Prod· ct Mix.
Costs	- %'s	:	Expense, Selling Price, Product Mix, Volume.

SUPPORTING DATA

Graph: Total Costs and Mfg. Costs as % SVP

Other Cards:

Expense - Material : Scrap and Rejects (Cara 12), Prices (Card 18)
- Labour : Staff & Wages (Card 11), Overtime (Card 12) Turnover & Absence (Card 16), Wage Rate Changes (Card 18)
- Other : Factory, Selling, "Company". (Cards 13, 9, 15)
- Prod. Costs : Main Products (Card 17)

Price - Changes (Card 18)

Volume - Order Position (Card 7), Sales Credits (Card 10), ± WIP/FS (Card 14)
- Physical : Deliveries/Production (Card 16)

Mix - Sales Analysis (Card 10)

SOURCES

Sales	:	Sales Day Book or equivalent
± WIP/FS	:	see Card 14
Material	:	Prices requisitions, or Opening Stock (Card 14) + Purchases (from Invoice Analysis) - Closing Stock (Card 14)
Labour	:	Payroll Summary
Other	:	see detail Cards

OTHER CO.MMENTS

See Card 1.

£'000

WEEK ½ YEAR ENDED	ASSETS FIXED	ASSETS CURRENT		LIABILITIES DEFERRED	LIABILITIES CURRENT		NET WORTH	CAPITAL EMPLOYED		% RETURN ON CAPᴸ EMPL
1977:1										
:2										
1978:1										
:2	1,515	1,849		661	854		1,849	2,510		12·3
1979:1										
:2	1,716	1,746		591	1,068		1,802	2,394		5·6
1980:1										
:2										

DEPARTMENT	SECTION	
FINANCE	CARD 3	CAPITAL EMPLOYED

CARD 3

INTERPRETATION

Ratios: Return on Capital Employed - % : Ability to raise fresh Capital.

Trends:
- Net Worth : Growth in Value of Owners/Shareholders Stake.
- Capital Employed : Growth in Size of business (overall)
- Return on Capital Employed -% : Success (relative)

SUPPORTING DATA

Graph: Block-Chart of % Return on Capital Employed.

Other Cards: Liquidity - Itemised (Card 4)

SOURCES

Annual (or half-yearly) Balance Sheets

OTHER COMMENTS

Beware of quoting a "standard" % Return on Capital Employed. "Risk" substantially dictates what is required.

£'000

WEEK MONTH ENDED	LIQUID ASSETS CASH	DEBTORS		CURRENT LIABILITIES OVERDRAFT	CREDITORS	TAX etc		NET LIQUID ASSETS	LIQUIDITY RATIO	DEBTORS - Months
31-12-79	125	873		140	742	186			0·93	1·5
1980 JAN	5	900		128	800	28			1·0	1·8
FEB	15	850		24	750	29		62	1·1	1·9
MAR	90	800		–	750	–		140	1·2	1·3
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
FINANCE	CARD 4	LIQUID RESOURCES - 1980

CARD 4

INTERPRETATION

Ratios: Liquidity : 1 to 1 is sound.
: Less than 1:1 is unsound unless Profits are being earned at a level which will attract fresh Capital
: More than 1:1 may indicate surplus Cash

: Debtors (Months) : Should be not more than $1\frac{1}{4}$ times normal terms of trade.

Trends: Net Liquid Assets : Financial strength (a factor)
Liquidity Ratio : " "
Debtors (Months) : Debt collection efficiency (overall)

SUPPORTING DATA

Other Cards: Cash (Net) - Forecast Summary (Card 4A)
- Capital Commitments (Cards 5 and 5A)
Debtors - "Ageing" Summary (not illustrated)
Creditors - Months o/s (Card 6)

SOURCES

Cash (and Overdraft) : Cash Books
Debtors : Debtors (Sales) Ledgers (Control Accounts)
Creditors : Creditors (Bought) Ledger (Control Accounts)
Tax : Annual Accounts - see Accountant or Auditors for Current portion
Prepayments (Debtors) Accruals (Creditors) : Schedule of main periodic payments + monthly calculation after noting payments made in month.

OTHER COMMENTS

Cash Forecasts are only necessary if Cash is short or Capital Commitments are heavy.

Debtors (months) should be Trade Debtors only (excluding prepayments etc.) i.e. they should be in respect of Sales only.

£'000

WEEK MONTH ENDED	LIQUID ASSETS CASH	LIQUID ASSETS DEBTORS		CURRENT LIABILITIES OVERDRAFT	CURRENT LIABILITIES CREDITORS	CURRENT LIABILITIES TAX etc.		NET LIQUID ASSETS	LIQUIDITY RATIO	DEBTORS - Months
1980 JAN	5	780		92	750	28			0·9	1·5
FEB	156	750		–	750	29		127	1·2	1·5
MAR	137	750		–	750	–		137	1·2	1·5
APR	151	750		–	750	1		150	1·2	1·5
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
FINANCE	CARD 4A	LIQUID RESOURCES - FORECAST

CARD 4A

INTERPRETATION

This card summarises essential details of the Cash Forecast and permits advance interpretation of the probable liquid position on the same lines as Card 4.

SUPPORTING DATA

None.

SOURCES

Long Method: Forecasting Receipts and Payments

Short Method: Forecast Net Current Assets - see next page
Forecast Working Capital Requirements - see next page
Derive Cash and Bank Balances - see next page

The principles of the Short Method are:

1. Net Current Assets will be increased by Profits, before Depreciation and will be decreased by Capital Expenditure and Dividends.

2. Working Capital Requirements can be forecast by the use of Ratios - applying policy decisions as appropriate.

3. Net Current Assets less Working Capital Requirements gives the Net Cash and Bank Balance.

OTHER COMMENTS

Where Forecasts are necessary (see Card 4) they should be made monthly for the end of the following month. Thus, the end-March forecast should be made when the end-January figures are available i.e. about mid-February.

Supplement to Card 4A

CASH FORECAST

Forecast Net Current Assets	Apr. £	Mar. £	Feb. £
Opening Net Current Assets:			
- Net Liquid Assets (Card 4)	62	(51)	(70)
- Stocks (Card 14)	670	770	750
	732	719	680
Anticipated Profit - 2 months	100	100	100
Add: Depreciation	34	34	34
	866	853	814
Less: Capital Expenditure	34	34	5
: Dividends - Preference (accrued)	2	2	2
- Ordinary (as declared)	-	-	-
Anticipated Net Current Assets at end	830	817	807

Working Capital Requirements		Apr. £	Mar. £	Feb. £
Sales -	Anticipated weekly average £500 per month ÷ 4.33	115	115	115
Stocks	8 weeks x 43% Sales	400	400	400
WIP	1.4 weeks x 60% Sales	100	100	100
FS	2.0 weeks x 77% Sales	180	180	180
Debtors	1.5 months x £500 Sales	750	750	750
		1,430	1,430	1,430
Less:	Creditors 2.5 months x £300 Purchases	750	750	750
:	Tax & Dividends	1	-	29
		679	680	651

Cash & Bank Balances	Apr. £	Mar. £	Feb. £
Net Current Assets (£830) - Working Cap. Requirements (£679)	£151	137	156

WEEK MONTH ENDED	COMMITMENTS £	£	£	£		CUM. NET PROFIT + DEPREC^N	PROV^N TAX + DIV^DS		CUM. CASH FLOW	CUM. SPENT
1979		£66,000				300,000	195,000		105,000	106,000
	as at	31st December 1958								
1980 JAN	(1) ~~3,000~~	(1) ~~2,000~~				47,000	4,500		42,500	5,000
FEB						84,000	9,000		75,000	8,000
MAR	(2) ~~26,000~~	(3) ~~3,000~~	(4) 6,000			121,000	13,500		107,500	38,000
APR										
MAY										
JUN										
JUL	(5) 20,000									
AUG	(6) 5,000									
SEP										
OCT	(7) 7,000									
NOV										
DEC	(9) 10,000									

DEPARTMENT	SECTION	
FINANCE	CARD 5	CAPITAL COMMITMENTS - 1980

CARD 5

INTERPRETATION

Cumulative Cash Flow less Cumulative Capital Expenditure shows current progress in improving Liquidity (see Card 4). Future Commitments (including past commitments not yet spent) should be compared with the anticipated future Cash Flow to judge whether the business is likely to run out of ready cash - and when.

SUPPORTING DATA

Other Cards: Commitments (details) (Card 5A)

Separate Data: Long-term Budgets

SOURCES

Cumulative Net Profit before Depreciation	:	Trading Statements + calculation Schedules (Depreciation)
Provision for Tax and Dividends	:	Special calculations
Capital Expenditure Commitments	:	Purchase Orders, Board Minutes, Management Correspondence Files, verbal enquiry (but set up a formal authorisation procedure)
Capital Expenditure (Actual)	:	Purchase Invoice Analysis
	:	Cash Book (if not in P. Inv. Anal.)

OTHER COMMENTS

Often the most carelessly controlled aspect of a business on which it is therefore difficult to obtain full information.

CAPITAL COMMITMENTS

No	ITEM	£	App'd	Due	No	ITEM	£	App'd	Due
1	5 Tube Printers	✓ ~~3000~~	8/79	1/80					
2	Alu Tube Line	✓ ~~25,000~~	9/79	3/80					
3	Lathe	✓ ~~2,000~~	10/79	1/80					
4	2- Rover Cars	✓ ~~3,000~~	"	3/80					
5	Alu. Tube Line	20,000	11/79	7/80					
6	6- Annealing Ovens	6,000	-	3/80					
7	Boiler	7.000	12/79	10/80					
	TOTAL AT 31-12-58	66,000							
8	10 Ton Press	5,000	1/80	8/80					
9	3- Trucks	10,000	3/80	12/80					

CARD 5A

CARD 5A

see Card 5

WEEK ½ YEAR ENDED	TURNOVER / CAPITAL EMPLOYED		NET TANGIBLE ASSETS / ISSUED CAPITAL		MONTH		CURRENT ASSETS / CURRENT LIABILITIES		TRADE CREDITORS (Months)	
					1979		1·6		1·8	
					1980					
1977: 1					JAN		1·8		2·5	
: 2					FEB		2·0		2·5	
					MAR		2·0		2·1	
1978: 1					APR					
: 2	2·0		2·6		MAY					
					JUN					
1979: 1										
: 2	2·5		2·1		JUL					
					AUG					
1980: 1					SEP					
: 2					OCT					
					NOV					
					DEC					

DEPARTMENT FINANCE | SECTION CARD 6 | FINANCIAL RATIOS

CARD 6

INTERPRETATION

Ratios:

Ratios:	Current	:	a ratio of more than 2:1 is desirable - always consider in conjunction with Liquidity (Card 4)
	Creditors (Months)	:	should reflect normal credit terms.
Trends:	Turnover/Capital Employed	:	Overall productivity
	N. T. A/Issued Capital	:	Owners/Shareholders security
	Current	:	Credit soundness
	Creditors (Months)	:	Increasing - suppliers may restrict delivery.
		:	Decreasing - waste of Working Capital?

SUPPORTING DATA

Other Cards: : % Return on Capital Employed (Card 3)
% Net Profit on Turnover (Cards 1 and 2)

SOURCES

Sales	:	Trading Statement
Creditors (Months)	:	Creditors - Creditors (Bought) Ledger Purchases - Purchase Day Book (or equivalent) (essentially purchases posted to Crs. Ledger)
Other Figures	:	from the relevant Cards, Balance Sheet, Trading Statement.

OTHER COMMENTS

The Ratios illustrated are a selection. Use others if appropriate; but limit total number to 3 - 5.

WEEK MONTH ENDED	CURRENT - £'000 ORDERS	INVOICED	ON HAND	CUMULATIVE - £'000 ORDERS	INVOICED	ON HAND	WEEKS OF WORK ON HAND
1979	500	500	600	6,000	6,000	600	5·2
1980							
JAN	300	500	400	300	500	400	3·1
FEB	540	440	500	840	940	500	4·0
MAR	700	600	600	1,540	1,540	600	5·1
APR							
MAY							
JUN							
JUL							
AUG							
SEP							
OCT							
NOV							
DEC							

DEPARTMENT	SECTION	
SALES	CARD 7	ORDER POSITION

CARD 7

INTERPRETATION

Ratio: Weeks of Work : Not below a minimum appropriate to type of business

Trends:
- Orders : Salesmen's performance
- Invoiced : Delivery performance
- On Hand - £ : Future Volume (but check WIP & FS)
  : Past Delivery performance
- On Hand (weeks) : Future Volume & probable delivery (but check WIP/FS)
  : Past Delivery performance

SUPPORTING DATA

Graph: Moving Annual Totals of Orders & Invoices

Other Cards:
- Future Volume - WIP/FS (card 14) i.e. orders on hand may be partly processed or available from Finished Goods Stock.
- Forward Load - Bottleneck Depts - Volume limitations) not
  - High Overhead Depts - Profitability)illustrated
- Future Potential - Enquiries (card 8)

SOURCES

Orders: Special Records - It is important to deduct cancellations (see T.G. Rose).

Invoiced: Sales Day Book (or equivalent)

Orders on Hand: Monthly Count
or Opening Orders + Received - Invoiced: BUT Received and Invoiced must be at same Prices.

OTHER COMMENTS None

WEEK MONTH ENDED	ENQUIRIES RECᴰ	QUOTATIONS SENT		ENQUIRIES ON HAND			ORDERS RECᴰ		% ORDERS OF QUOTES	
1979	80	80		10			17		24%	
1980 JAN	75	65		20			15		23%	
FEB	80	70		30			15		21%	
MAR	80	70		40			12		15%	
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT SALES | SECTION CARD 8 | ENQUIRY POSITION

CARD 8

INTERPRETATION

Trends:

Enquiries received	:	Volume potential
Enquiries on Hand	:	Work Load on Estimating Dept.
	:	Danger of losing potential orders.
Orders/Quotes Ratio	:	Price, Delivery achievement.

SUPPORTING DATA

None.

SOURCES

Special Records (ignore order cancellations).

OTHER COMMENTS

None.

£'000

WEEK MONTH ENDED	PROMOTION		SELLING		DISTRIBUTION		ADMINISTRATION			% of SALES	
	ADVERT	GIFTS etc	REMUNn	EXPENSES	WAGES	OTHER	SALARIES	OTHER	TOTAL	Month	Cum
1979	10	1	10	6	10	13	10	7	67		13·3
1980											
JAN	2	3	9	6	10	13	10	7	60	12·0	12·0
FEB	10	–	19	5	10	12	10	3	60	13·6	12·7
MAR	7	5	11	8	13	16	10	10	80	13·3	13·0
APR											
MAY											
JUN											
JUL											
AUG											
SEP											
OCT											
NOV											
DEC											

DEPARTMENT	SECTION	
SALES	CARD 9	SELLING EXPENSES (SUMMARY)

CARD 9

INTERPRETATION

Trends: % of Sales : Expense, Selling Price, Product Mix, Volume.
Items - £ : Expense (but check Volume and identify Fixed items)

Comparisons: Against last year's monthly average, or Budgets.

SUPPORTING DATA

Other Cards: Volume)
Price) (as Card 2)
Product mix)

Staffing - No. (Card 10)

SOURCES

Payroll & Salaries Books)
Purchase Invoice Analysis) General or Nominal Ledger
Cash Book(s) Payments) (or equivalent), - if written up.
Petty Cash Payments)
Schedule of Periodic Payments)
etc.

OTHER COMMENTS

Wages items may include 5 weeks payments in one month even when 4/5 - week Accounting Periods are not in use.

WEEK MONTH ENDED	STAFFING SELLING	DISTRIB'N	ADMIN.	TOTAL		SALES CREDITS (£'000)		SALES ANALYSIS RETAIL	W'SALE	EXPORT
1979	10	16	20	46		5		40%	50%	10%
1980 JAN	10	15	20	45		4		35%	53%	12%
FEB	10	15	20	45		15		32%	48%	20%
MAR	10	15	20	45		7		43%	57%	-
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
SALES	CARD 10	STAFFING, CREDITS, SALES ANALYSIS

CARD 10

INTERPRETATION

Trends:

- Staffing : Expense, Volume
- Sales Credits (Returns etc) : Expense (rectification), Volume.
  : Quality - Production, Packing, Handling.
- Sales Analysis : Overall Profitability (Mix of Sales).

SUPPORTING DATA

Other Cards: None.

Other Data: The Sales Analysis should be supported by a periodic investigation into relative profitability under the headings used for analysis. i.e. in this case - by Outlets; in other cases - by Product Groups or Main Products. More than one analysis may even be necessary.

SOURCES

- Staffing : Payrolls, Personnel Dept. Records (end of each month).
- Sales Credits : Sales Credit Book, or 'Red' figures in Sales Day Book.
- Sales Analysis : Special procedure to meet needs.

OTHER COMMENTS

None.

WEEK MONTH ENDED	STAFFING				WAGES – £'000					% WAGES OF SVP
	DIRECT	INDIRECT	STAFF		DIRECT	INDIRECT	STAFF	TOTAL		
1979	800	600	180		50	33	17	100		17.0
1980 JAN	830	598	180		50	30	15	95		14.6
FEB	820	595	175		50	30	15	95		15.0
MAR	800	640	185		60	40	18	118		22.0
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
MANUFACTURE	CARD 11	STAFF AND WAGES

CARD 11

INTERPRETATION

Trends:

Wages % of SVP	:	Expense, Volume
No. of Employees	:	Supporting data only
Wages Paid	:	Supporting data only

SUPPORTING DATA

Other Cards: % Indirect/Direct Wages (Card 12)
Volume (as Card 2)

SOURCES

Number of Employees	:	Payrolls & Salaries Books) or Personnel Dept. Records)	end of month figures
Wages Paid	:	Payrolls & Salaries Books.	

OTHER COMMENTS

"Number of Employees" usually has a stronger impact than "Wages Paid".

Remember that 5 weeks wages may be paid in one month even if 4/5 week Accounting Periods are not in use.

WEEK MONTH ENDED	SCRAP & REJECTS				OVERTIME WORK					INDIRECT WAGES / DIRECT WAGES
	SHOP SCRAP	INSP^N REJECTS	TOTAL		DIRECT HOURS	%	INDIRECT HOURS	%		
1979	5.3%	6.9%	12.2%		3,300	2.5	2,000	2.0		67%
1980 JAN	6.5%	8.0%	14.5%		1,900	1.4	1,000	1.0		60%
FEB	4.9%	10.8%	15.7%		2,100	1.6	6,000	5.0		60%
MAR	4.4%	9.1%	13.5%		2,300	1.4	3,500	2.7		67%
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
MANUFACTURE	CARD 12	FACTORY CONTROL DATA

CARD 12

INTERPRETATION

Trends:
- Scrap & Rejects % (or Units) : Expense, Volume
- Overtime : Cost (Premium), Volume
- % Indirect : Expense

Comparisons: Against last year's monthly average, or Budgets.

SUPPORTING DATA

None.

SOURCES

Scrap	:	Special returns
Rejects	:	Inspection reports
Overtime Hours	:	Payroll or subsidiary records
% Indirect	:	Indirect Wages - Payroll (Card 11) Direct Wages - Payroll (Card 11)

OTHER COMMENTS

Remember that 5 weeks Overtime Hours may be recorded against one month even when 4/5 - week Accounting Periods are not in use. The %'s are always valid.

INCREASING PROFITS

PROFITABILITY

IMPROVE SELLING PRICES

Maximise the Contribution to Fixed Overheads and Profit -

e.g. : By Charging the Optimum Selling Price (see Notes 4/6 & 7)

IMPROVE THE PRODUCT MIX

Maximise the Contribution to Fixed Overheads and Profit by selling more of the more profitable lines and less of the less profitable lines (see Notes 4/8 and 9).

e.g. : By Control and Incentives (Salesmen)
: By Variety Reduction

NOTE:

Production Capacity may limit the extent to which Sales of the more profitable lines can be increased, even at the expense of the less profitable lines. Clear information on the facilities used by each Product is therefore necessary as well as a measure of Relative Profitability.

INCREASING PROFITS

EXPENSE

Direct Materials (including Bought-Out Parts and Processes)

BUY LESS

1. Avoid Losses -

   e.g. : By effective Stock Control
   : By improving Security

2. Reduce Waste -

   a) Deliberate Scrap -

   e.g. : By making use of Supplier's Tolerances
   : By improving methods

   b) Spoilage -

   e.g. : By improving materials (c.f. Price)
   : By improving Methods (Operations, Handling, Packaging).
   : By improving Inspection
   : By better Maintenance (Tools etc.)

   c) Obsolescence -

   e.g : By planning Purchases to meet Programmes
   : By effective Communication of discontinuations

3. Reduce Usage -

   e.g : By Value Analysis
   : By Redesign
   : By making use of Customer Tolerances

PAY LESS

1. Buy at a Lower Price -

   e.g. : By obtaining Competitive Quotations.
   : By ordering in bigger quantities and in good time

2. Make correct "Make or Buy" Decisions

3. Sell Scrap and By Products at a Higher Price

INCREASING PROFITS

EXPENSE

Direct Labour

BUY LESS

1. Avoid Losses -

   e.g. : By ensuring prompt starting and finishing
   : By effective Work Checking

2. Reduce Waste -

   a) Performance while Working -

      e.g. : By Control and Incentives
      : By better training (Personal Methods)

   b) Non-Saleable Work -

      e.g. : By Control and Incentives
      : By eliminating Lost Time
      : By Longer Runs
      : By reducing Spoilage (see Direct Material)

3. Reduce Usage -

   e.g. : By improving Manufacturing Methods to reduce the Work Content

PAY LESS

1. Reduce Wage Rates (present method) -

   e.g. : By correct Grade/Sex
   : By using more Junior Labour
   : By reducing Overtime
   : By "Homework"
   : By improving Reputation as an Employer

2. Improve the Method to reduce the Skill required.

INCREASING PROFITS

EXPENSE

Overheads

Overheads are incurred by:

Production	-	Departments
	-	Engineers
	-	Stores
	-	Other
Sales	-	Promotion
	-	Selling
	-	Distribution (Transport)
	-	Administration
Administration	-	

The money is spent on:

Materials and Services

Labour

The principles underlying the practical approach to Direct Material and Direct Labour therefore apply, the objectives in all cases being improved effectiveness and reduced cost. For examples of what can be done, refer to PS (Indirects), SD, SM, CO and MO Manuals and Write-Ups.

NOT RUNNING OUT OF MONEY

CAPITAL EXPENDITURE

BUY LESS

1. Make better use of existing facilities -

   e.g. : By increasing the effectiveness of Direct Labour and Machines
   : By Working longer hours
   : By Working extra shifts

2. Justify expenditure by need -

   e.g. : By buying the machine for foreseeable needs, not future hopes or pride
   : By subcontracting to cover minor shortages of capacity

3. Justify expenditure by profitability -

   e.g. : By evaluating all potential projects and selecting those which give the highest return on the money spent.

PAY LESS

1. Buy at a lower price -

   e.g. : By obtaining competitive quotations
   : By making correct "Make or Buy" decisions
   : By selling replaced (or redundant) machines in working order instead of as scrap

2. Hire rather than Buy when appropriate -

   Note : The main advantage is to defer expenditure, but some Hire schemes are of absolute advantage because of Taxation aspects - usually where assets will be replaced after a short period (3 - 5 years).

NOT RUNNING OUT OF MONEY

WORKING CAPITAL

REDUCE NEEDS

1. Stocks -

   e.g. : By selective Stock Control

2. WIP and Finished Goods Stock -

   e.g. : By improved Work Flow
   : By effective Programming and Scheduling
   : By better Progress Control
   : By obtaining "Payments on Account"

3. Debtors -

   e.g. : By ensuring conformity with Terms of Trade
   : By prompt settling of Retentions (Contractors)

4. Creditors -

   e.g. : By paying only when due or to take advantage of Discounts

   Note : Taking more Credit than is allowed by the agreed Terms of Trade may damage the business' Credit-standing generally and should only be used as a temporary expedient.

JUSTIFY INCREASES

1. Maintain Profits -

   e.g. : To meet Changing Terms of Trade

2. Increase Profits -

   e.g. : To carry increased profitable Volume

NOT RUNNING OUT OF MONEY

NET CASH FLOW

INCREASE PROFITS

1. Volume, Profitability, Expense (see Pages 1 - 5)
2. Gain on Realisation of Assets

MINIMISE "DISTRIBUTIONS"

1.	Taxation	-	avoidance not evasion (use the Client's Accountants)
2.	Dividends	-	This involves Policy and Judgement and is often very personal - leave alone unless you have to, then bring in the Auditors, Solicitors, Stock-brokers as appropriate.

NOT RUNNING OUT OF MONEY

FRESH CAPITAL

To be more successful, a business may have to obtain fresh Capital to improve or expand its facilities, including the provision of adequate Working Capital.

The practical way of ensuring such a supply is to maintain a good Profit Record (i.e. by making good use of existing resources).

It is obviously desirable that the new money should be obtained on the best possible terms. To do this, it is essential to have time to select a favourable moment (FORESEE THE NEED) and to know where and how such money can be raised (SOURCES).

FORESEE THE NEED

1. Consider the implications of all Commitments and Policy Changes before they are effective.

2. Continuously look far ahead -

   e.g. : By Annual Cash Forecasts looking 5 - 10 years on (see supplement to Card 4A)

SOURCES

1. Factors Involved

   A firm seeking finance must have the answers to four questions:

   a) What is the money needed for?
   b) How much is required?
   c) For how long is it needed?
   d) In what form is it needed?

   The most suitable source of finance may be selected in the light of the answers to these questions:

   a) What will be the true cost of borrowing this money, i.e. the interest or dividend paid plus the repayments, if any, in relation to the expected increase in profits?

b) How will the taxation position of the company be affected?
c) Is there any surrender of management control involved?
d) How will the rest of the capital structure of the firm be affected?

The final choice is a matter for the individual Company, and should be made only after weighing all relevant factors - effect on Costs, on Control, on Balance Sheet etc. Professional advice should normally be obtained through the firm's Accountants, Bank or one of the Institutions which specially deals with such matters.

2. <u>Temporary Sources</u>

e.g. : Bank Overdraft
: Bills of Exchange
: Hire Purchase

3. <u>Permanent Sources</u>

e.g. : Existing Shareholders, Partners, Friends
: Mortgage on Property
: Sale of Freehold and lease back
: Insurance Companies, Investment Trusts, Merchants Banks and similar Institutions
: Conditional Aid Revolving Fund (BOT)
: General Public (Public Companies only)
: Private Investors (often want control)
: Government help

i) Leases of equipment, buildings (defence)
ii) Development areas
iii) Productivity (e.g. fuel saving)
iv) Inventors
v) Farming and Films

For further information, read the Financial Press, Consult R. & D. (specific cases - state factors involved).

INCREASING PROFITS

INCREASE VOLUME

OBTAIN MORE ORDERS

1. Increase the salesmen's performance

   e.g. By direction of effort
   By Control and Incentives

2. Increase the saleability of the products

   e.g. By improving the product itself
   By improving appearance
   By improving service
   By improving promotion
   By reducing price - a last resort

3. Increase Selling Capacity

   e.g. By employing more salesmen
   By introducing additional products

OBTAIN MORE OUTPUT

1. Make better use of existing facilities

   e.g. By increasing the effectiveness of direct labour and machines
   By working longer hours
   By working extra shifts

2. Increase Productive Capacity

   e.g. By sub-contracting
   By removing bottlenecks and balancing capacities
   By hiring more labour
   By buying or renting more plant
   By improving layout to provide more space for more plant
   By buying or renting more space

Shortage of funds may limit the extent of an increase in volume. Ways of overcoming financial limitations must be established before action is taken.

INCREASE PRICE

1. Charge more

   e.g. By increasing List Prices
   By increasing Profit Additions (Jobbing)
   By surcharging small orders
   By introducing saleable features

2. Allow Less

   e.g. By ensuring discounts only allowed when due
   By reducing rates of discount

IMPROVE PROFITABILITY

Increase sales of the more profitable products and outlets at the expense of the less profitable

e.g. By direction
By price adjustments
By Control and Incentives (Salesmen)
By Variety Reduction
By better marketing and selling

Production Capacity may limit the extent to which sales of the more profitable lines can be increased even at the expense of the less profitable lines.

Clear information on the facilities used by each product is therefore necessary as well as a measure of Relative Profitability.

REDUCE EXPENSE

MATERIALS

Buy Less

1. Reduce usage

   e.g. By Value Analysis
   By redesign
   By producing closer to the lower tolerance limits

2. Reduce deliberate scrap

   e.g. By making use of supplier's tolerances
   By improving methods

3. Reduce accidental scrap

   e.g. By improving quality of material
   By improving methods (operations, handling, storage, packaging)
   By improving inspection
   By better maintenance
   By control and incentives

4. Avoid obsolescence

   e.g. By planning purchases to meet programmes
   By effective communication of discontinuations

5. Avoid Losses

   e.g. By improving security
   By effective Stock Control

Pay Less

1. Buy a[illegible]wer price

   e.g. By obtaining competitive quotes
   By increasing order quantities
   By ordering in good time

2. Make correct "Make or Buy" decisions

3. Sell scrap and by-products at a higher price

DIRECT LABOUR

Use Less

1. Increase performance while working

   e.g. By Control and Incentives
   By improving methods to reduce Work Content
   By using higher grade labour
   By replacing plant - but ensure there is a satisfactory additional profit and cash flow on the additional investment
   By better training and re-training

2. Increase the proportion of Attendance Time spent on saleable work

   e.g. By Control and Incentives
   By eliminating the causes of Lost Time
   By programming work to give longer runs
   By reducing scrap and spoilage
   By reducing training time

3. Avoid Losses

   e.g. By ensuring prompt starting and finishing
   By effective work checking

Pay Less

1. Ensure rates of pay are as low as possible, compatible with the needs of the present method

   e.g. By using correct grade/sex
   By using more junior labour
   By reducing overtime
   By "homework"
   By improving reputation as an employer

2. Improve the method to reduce the skill required.

OVERHEADS

Pay Less

1. Reduce the quantity required to provide the existing facilities

   e.g. By stricter control of requisitions for purchase or issue
   By increased effectiveness in use
   By effective care and maintenance
   By journey planning
   By improved clerical procedures

2. Reduce the quantity required by reducing the facilities required

   e.g. By selling plant which is causing excessive maintenance, spare parts etc.
   By sub-letting or selling unused space
   By using height to conserve floor space

WEEK MONTH ENDED	INDIRECT MATERIAL	INDIRECT LABOUR	FUEL & POWER	STAFF WAGES	STANDING CHARGES	TOTAL MONTH	TOTAL CUM		% of SVP MONTH	% of SVP CUM
	£'000									
1979	33	33	10	17	21	114	1370		[illegible]	[illegible]
1980 JAN	35	30	19	15	21	120	120		23·5	23·5
FEB	25	30	29	15	21	120	240		24·0	23·8
MAR	40	40	21	18	21	140	380		23·8	23·8
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
MANUFACTURE	CARD 13	FACTORY OVERHEADS

CARD 13

INTERPRETATION

Trends: % of SVP : Expense, Selling Price, Product Mix, Volume.

Items - £ : Expense (but check Volume, and identify Fixed items).

Comparisons: Against last year's monthly average, or Budgets.

SUPPORTING DATA

Other Cards: No. of employees - Indirect Labour (Card 11)
- Staff Wages (Card 11)

Volume)
Price) - (As Card 2)
Product Mix)

SOURCES

Payroll and Salaries Books)
Purchase Invoice Analysis) General or Nominal
Cash Book(s) Payments) Ledger (or equivalent)
Petty Cash Book Payments) - if regularly written up.
Schedule of Periodic Payments)
- etc.)

OTHER COMMENTS

Wages items may include 5 weeks payments in one month even when 4/5 - week Accounting Periods are not in use.

WEEK MONTH ENDED	VALUE OF STOCKS - £'000 RAW MATERIAL	WIP	FINISHED	TOTAL		WEEKS OF PRODUCTION RAW MATERIAL	WIP	FINISHED		% STOCKS / TURNOVER
1979	500	100	150	750		9·6	1·4	1·6		12·5
1980 JAN	510	110	150	770		9·3	1·4	1·5		12·0
FEB	350	90	230	670		6·4	1·2	2·4		12·5
MAR	350	110	200	660		7·0	1·6	2·2		11·3
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
MANUFACTURE	CARD 14	STOCKS AND WIP

CARD 14

INTERPRETATION

Ratio: % Stocks/Turnover : It should be possible in some cases to set a "standard" for the individual business.

Trends:

- Value of Stocks - £ : Liquidity
- Weeks of Production : Justification for reduced liquidity
  : Production flow efficiency (WIP)
  : Future Delivery periods (Finished Goods).
- % Stocks/Turnover : Increase = Falling Sales, Rising Stocks.

SUPPORTING DATA

Graphs:

- Jobbing businesses - Orders on Hand (Est. SP - £) v WIP (Est. SP - £)
- "Ex - Stock" business - Orders on Hand (SP - £) v Fin. Stock (Est. SP - £)

Other Cards: Orders on Hand (weeks) (Card 7) - Compared with WIP/FS as appropriate, indicates net forward load, and to some extent, delivery efficiency.

SOURCES

Stock and Work-in-Progress Valuation - see following pages.

OTHER COMMENTS

None.

STOCK AND WORK-IN-PROGRESS VALUATION

The greatest single difficulty in providing short-term Trading Results and Financial Information is the evaluation of Stock and Work in Progress at the end of each period. The extent of the problem will depend upon the nature of the business and the state of the existing internal procedures. For this reason, specific guidance to cover every case cannot be given. As a general rule, however, the best solution is obtained:

a) by instituting Stock Records covering Raw Materials and Finished Stocks.

b) by taking a physical count of Work-in-Progress at the end of each month.

The following notes amplify this approach and also deal with the case where a physical count of WIP is impracticable.

Raw Material Stock Records

The records should be prepared from Goods Received Notes and Material Requisitions, and may be limited to important items; Stocks of unimportant items being taken at the "Opening" valuation.

The Goods Received Notes must be checked with the Purchase Invoices and the Purchase Invoices must be recorded in the Ledger as at the same date as the GR Note is entered in the Stock Record.

The Value of Issues in a period and the Stock Valuation at the end of it may be obtained in one of two ways:

a) By pricing all requisitions on some suitable basis (First-in-first-out, Standard, Average) and evaluating them to give the issues for the period. The Stock Valuation is then obtained from Opening Stock + Purchases - Issues.

b) By evaluating the Stock Balances shown on the Stock Records (again on one of the bases suggested above) to give the Stock at the end of the period. The total Value of Issues for the period is then obtained from Opening Stock + Purchases - Closing Stock.

Whichever method is used, an "audit" of the calculation must be carried out periodically by physical stock count. If the former method is used (i.e. evaluation of requisitions) the physical count must embrace all stock covered by the calculation of the Stock Valuation. If the latter method is used (i.e. evaluation of recorded Stock) then the physical count can be staggered - a few items being checked each week to give full coverage in (say) 3 months and discrepancies being written off individually as they are discovered.

Finished Stock Records

Two methods are again available:-

a) Finished Production (taken into Stock) is evaluated at Selling Price (before any discounts). The change in Finished Stock is derived from (Finished Production at Selling Price - Sales in the Period) less a % to approximate the Annual Accounts' basis of valuation.

   If desired, Finished Production and Sales could be evaluated from Product Costs; but this is clerically cumbersome and of little added value unless Standard Costing procedures are in operation.

b) Continuous Records are maintained of the Stock of each item of Finished Stock. The Recorded Stock of each item is evaluated at the end of each period to give the Finished Goods Stock Valuation. The individual values used may be derived from Product Costs (e.g. Material, Labour and Factory Overhead) or may be based on Selling Prices (e.g. Selling Price less a % to approximate the basis used in the Annual Accounts).

Again, an "audit" of the calculation must be carried out periodically by physical stock count. And again, if the former method is used (i.e. evaluation of Finished Production) the physical count must embrace all Finished Stock. If the latter method is used (i.e. evaluation of Recorded Stocks) then the physical count can be staggered.

Work in Progress

It has been stated above that the best solution with Work in Progress is usually to take a physical count. There are methods of calculating theoretical WIP but these either assume a rate of profit margin - tantamount to assuming what is to be proved - or depend on Standard Costing procedures

- not necessarily available. It is, in fact, surprising how often the count of WIP can be organised and simplified until it requires little effort. Energy is usually much better spent organising the "physical" approach, rather than devloping the "theoretical" approach. "Tricks" worth remembering are:-

a) Pareto - count the significant items and add 10-20% to cover the others.

b) Reduce - make speical efforts towards the end of every period to ensure that WIP is as low as possible.

c) Tidiness - keep the factory tidy and ensure that WIP is always in a "countable" condition. Racks etc., containing a specified number can be invaluable.

d) Exhaust - Build up each stack to a specified number and then start a new one. Draw from one stack only until it is exhausted. Only the current stack, or - if sequence of issue is important - the first and the last stacks, need to be counted.

e) Measure - Use a convenient, rather than an accurate, measure where it gives a reasonable approximation. e.g. The height of a stack of cardboard times an "area of board" factor gives approximate weight. Where convenient use a valuation price expressed in terms of the convenient measure rather than the familiar measure.

f) Estimate - the practical man can often make a very good guess - even in total.

g) Ignore - if WIP is not substantial, publish the results as "subject to WIP change".

It may sometimes be that a regular and accurate physical count of WIP is not a practical proposition. In this event it may be necessary to develop movement records of individual products and components and organise a valuation procedure, using standard or estimated costs. Periodic 'audits' of the records - perhaps using selected control points - must be instituted if this approach is used.

Valuation

For Income Tax purposes, Stocks and Work in Progress must be valued at "The lower of Cost or Market Value". In this context, Market Value may be replacement cost or realisable value. This convention is almost always nominally adopted by businesses for normal accounting purposes; but interpretation varies widely.

The essential, for intelligible internal control purposes, is that the basis of valuation at the beginning and end of a given period should be consistent - the effect of any deliberate variation being separately reported.

Where Stocks are subject to violent fluctuations it is important to choose a basis of valuation which will most accurately depict the true contribution made by the period to Annual Profit. This can only be determined for the circumstances of the individual case.

£'000

WEEK MONTH ENDED	RESEARCH REMUN^N	RESEARCH OTHER	ADMIN WAGES & SALARIES	ADMIN OTHER	MANAGEMENT SALARIES	MANAGEMENT OTHER	FINANCE & STANDING CHARGES	TOTAL MONTH	TOTAL CUM	% SALES (CUM)
1979	5·0	3·0	10·0	3·0	5·0	1·0	9·0	36	430	7·2
1980										
JAN	4·8	–	9·4	1·0	5·0	0·8	9·0	30	30	6·0
FEB	4·8	0·2	9·5	–	5·0	1·5	9·0	30	60	6·4
MAR	5·4	5·2	11·0	4·0	5·0	0·4	9·0	40	100	6·5
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
GENERAL	CARD 15	COMPANY EXPENSE

CARD 15

INTERPRETATION

Trends: % of Sales : Expense, Volume, Selling Price, Mix of Sales.
Items - £ : Expense, Volume.

Comparison: Against last year's montly average, or Budgets.

SUPPORTING DATA

Other Cards: No. of Employees - R & D (Card 16)
- Admin (Card 16)
Volume)
Price) - as Card 2.
Product Mix)

SOURCES

Payroll & Salaries Books)
Purchase Invoice Analysis) General or Nominal
Cash Book (s) Payments) Ledger (or equivalent)
Petty Cash Payments) - if regularly written up.
Schedule of Periodic Payments)
etc.)

OTHER COMMENTS

Wages items may include 5 weeks payments in one month even when 4'5 - week Accounting Periods are not in use.

WEEK MONTH ENDED	DELIVERIES (Units)		PRODUCTION (Units)	Added Value per Day		LABOUR TURNOVER	ABSENCE - DAYS		H.O. STAFF RESEARCH	MANAGT & ADMIN
1979	5,200		5,170	136		45·0%	250		60	200
				£'000						
1980										
JAN	5,000		5,100	145		24·0%	226		60	195
FEB	4,400		5,200	140		25·0%	256		59	197
MAR	6,000		5,850	136		27·0%	570		58	201
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
GENERAL	CARD 16	MISCELLANEOUS STATISTICS

CARD 16

INTERPRETATION

Ratios: Labour Turnover : It should be possible in some cases to set a standard based on Industry Statistics - possibly different for men & women.

Trends:

- Labour Turnover % : Expense, Volume
- Absence : Expense, Volume
- Deliveries : Volume
- Production - Units - Added Value : Overall Productivity
- Staffing : Expense

SUPPORTING DATA

None.

SOURCES

- Labour Data and Staffing : Personnel Dept., Wages Office Records
- Deliveries : As appropriate
- Production : As appropriate - preferably Final Inspection data.

OTHER COMMENTS

None.

WEEK MONTH ENDED	STANDARD	FLOLINE	VARITOP	CADET	PRINCESS		REMARKS
	21	21	21	21	21		
31-12-79	11/6	12/6	17/6	8/3	11/4		
1980							
JAN	11/7		17/4				
FEB		12/6					
MAR	11/8		18/2	8/3	11/5		Aluminium increase - 0·54 each (approx)
APR							
MAY							
JUN							
JUL							
AUG							
SEP							
OCT							
NOV							
DEC							

DEPARTMENT GENERAL | SECTION CARD 17 | PRODUCT COSTS (MAIN PRODUCTS)

CARD 17

INTERPRETATION

Trends: Expense, Volume

SUPPORTING DATA

Other Cards: Expense) Volume) - (as Card 2)

SOURCES

Costing Dept.

OTHER COMMENTS

Select the few significant Products.
Cost only the significant elements of Expenditure.

WEEK MONTH ENDED	MATERIAL PRICES: VIRGIN ALUMINIUM	SHEET STEEL	OTHER		WAGE RATES: GENERAL	OTHER			SELLING PRICES: %	PRODUCTS
31-12-79	£180/ton	£55/ton								
1980 JAN					+4%					
FEB	+2%					+7%	Transport			
MAR		-5%	£75-£76/ton	Lead		+5%	Engineers		+3%	Alu. Products
APR										
MAY										
JUN										
JUL										
AUG										
SEP										
OCT										
NOV										
DEC										

DEPARTMENT	SECTION	
GENERAL	CARD 18	SELLING PRICES, MATERIAL PRICES, WAGE RATES

CARD 18

INTERPRETATION

Absolute Figures: Material Prices : Check with Commodity Market Prices etc. (Financial Times, Economist)

Wages Rates : Agreements, Local factories etc.

Trends: Material Prices : Expense

Wage Rates : Expense

Relationships: Selling Prices must recover increased Costs unless Policy dictates otherwise.

SUPPORTING DATA

None.

SOURCES

Material Prices : Buying Dept.

: Purchase Invoices - to derive monthly average prices if appropriate.

Wage Rates : Periodic agreed changes

: Periodic calculation from Payroll data

Selling Prices : Periodic agreed changes

: Pricing Policy formula changes (Jobbing)

OTHER COMMENTS

Select the significant few.

PRACTICAL WAYS OF MAKING A

BUSINESS MORE SUCCESSFUL

- Index -

INCREASING PROFITS

VOLUME

OBTAIN MORE ORDERS

1. Increase the Salesman's Performance -

   e.g. : By Direction of Effort
   : By Control and Incentives

2. Increase the Saleability of the Products -

   e.g. : By improving the Product itself
   : By improving Appearance
   : By improving Service
   : By improving Promotion (e.g. Advertising)

3. Increase Capacity -

   e.g. : By employing more Salesmen
   : By introducing additional Products

OBTAIN MORE OUTPUT

1. Make better use of Existing Facilities -

   e.g. : By increasing the effectivements of Direct Labour and Machines (see page 4)
   : By working longer hours
   : By working extra Shifts

2. Increase Capacity -

   e.g. : By Sub-contracting (other firms, "Homework", "Institutions").
   : By removing Bottlenecks and balancing Capacities
   : By hiring more Labour
   : By buying or renting more Plant
   : By improving Layout to provide space for more Plant
   : By buying or renting more Space.

NOTE:

Shortage of Money may limit the extent of an increase in Volume. Ways of overcoming such Financial Limitations are given on pages 6 to 10.