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DIAGNOSTIC APPRAISAL FOR REHABILITATION OF KADUNA TEXTILES LTD.

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NIGERIA

Technical report: Appraisal report*

Prepared for the Government of the Federal Republic of Nigeria
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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United Nations Industrial Development Organization
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* This document has not been edited.

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APPRAISAL OF KADUNA TEXTILES LIMITED

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APPRAISAL OF KTL

1. EXECUTIVE SUMMARY

At first sight KTL appears to be an old and rather run down plant but deeper study reveals that it is a company with considerable assets, not least of which as a stable and largely experienced work force of some 2,400 persons, mainly men.

There is a ready market for the fabrics and yarn produced by KTL which are targetted to the lower priced sector. The main products are African prints, bleached shirting and baft. The target is 18 million metres per annum.

Until 1978 the operation was very profitable but since then KTL has been experiencing difficulties which have led to considerable losses. Last year they made a small profit.

The location in the Kaduna South Industrial Estate and close to the Makera district, which is a high density residential area for mainly low-income earning workers, is very convenient.

The site is good and more than adequate for all activities.

The buildings date from 1956, 1962 and 1969. They are a little old fashioned, but still serviceable and suitable for the work carried out.

The original layout of spinning and weaving was very good from the point of view of flow of production. Now it appears less so because some sections of machinery have been scrapped or stopped, but in general the flow of material is still quite good, except that some of the printing and finishing department activities are carried out in the original factory and others in the adjacent, recently acquired printing unit, which involves a great deal of transporting of rolls of cloth back and forth.

MACHINERY AND EQUIPMENT

Much of the machinery and other equipment is becoming old and has

been allowed to fall into a poor state of repair. This is partly due to a lack of essential spare parts resulting from insufficient working capital, but it is also partly due to failure to maintain correct settings and follow the recognised planned maintenance schedules and/or to make the best use of the spare parts that are available.

On the other hand, some equipment is reasonably modern, eg. open end spinning, the polypropylene bag plant and some of the printing equipment. These departments represent important profit centres and should be running non-stop, on a 4-shift basis.

BALANCE OF THE PLANT

Because some of the machines have become completely worn out and scrapped, the plant is no longer balanced. The installed weaving capacity has been reduced from 2,214 looms to 850 looms, whilst the printing capacity is very large because of the acquisition of NNTL which used to be an entirely independent unit.

CAPACITIES

At the present time the spinning department is capable of producing less than 100 tons per week of 120 hours (3 shifts) but this is more than adequate to feed the 850 looms which are only capable of producing a maximum of 445,000 metres per week, or approximately 67 tons per week, whilst the printing department is capable of handling many times this quantity.

In the first 10 months of this year (1987/88) the average production achievements were spinning 58.5 tons/week and weaving 242,500 metres or 30.3 tons/week.

RECOMMENDATIONS

Despite all the problems it would appear that, from the technical point of view, KTL still has considerable potential.

As much of the machinery is basically sound, although run down because of the shortage of capital for renewal of equipment, it has been decided to recommend a 3-phase approach, viz:-

PHASE I - SELF HELP

Mainly by adjustment and resetting the machines correctly the productivity, quality and efficiency will be improved.

PHASE II - REFURBISHMENT OF EXISTING MACHINES

Acquire and apply the essential spare parts to further improve the performance of the existing machines.

PHASE III - NEW EQUIPMENT

The main object of Phases I and II is to demonstrate the determination of the management to make KTL a viable operation. It is hoped that the evidence of improvement following the completion of Phases I and II will encourage investment, either from Nigerian institutions or from outside, so that it will be possible to modernise the plant to some extent and make it even more profitable.

Fairly detailed recommendations have been made in this report but, as Phase III is not expected to start for at least 2 to 3 years, they should be carefully reviewed at a later date in the light of developments that may occur. In the meantime, the activities may be summarized as follows:-

SPINNING - PHASE I

Bring the department up to the best condition possible by grinding cots, re-setting machines and generally improving the housekeeping. Concentrate on the equipment · Mills 1 and 3 as most of that in Mill 2 is very old and should oe scrapped.

There will be very little cost and the programme should be completed in 2 to 3 months.

SPINNING - PHASE II

Purchase and apply all parts needed to bring the equipment in Mills 1 and 3 up to standard. This is mostly card clothing and cots and aprons. The card clothing operation should be supervised by the suppliers. Some parts will be required to bring the 5 rotor spinning machines into full production.

Phases I and II could well overlap, in which case the whole operation

could be concluded in 1 year.

The estimated cost of spare parts for Phase I and Phase II is approximately 900,000 U.S. dollars.

WEAVING - PHASE I AND PHASE II

The only difference between Phases I and II is that for Phase II there should be a substantial injection of spare parts.

Phase I will involve re-setting the looms, applying the 250 sets of shuttle change mechanisms at present in stock and thus increasing productivity and raising quality.

At the same time, pickers and shuttles should be ordered for the Northrop looms and fitted as soon as possible.

The cost of parts for Phase I and Phase II will be about 1 million U.S. dollars.

The outcome will be an increase of production capacity to 21.7 million metres a year of better quality fabric than now.

When the machines are in better condition 4-shift working (168 hours per week) should be introduced as this would give a further 40% increase in production.

This programme should be completed within 2 to 3 years.

At the same time, the maintenance staff and operatives should be retained to ensure that the improvements brought about during Phase I and Phase II will be maintained.

PRINTING AND FINISHING PHASE I AND II

A small quantity of spare parts will be required for the existing bleaching/drying/stentering equipment in KTL. But, apart from that, only minimum maintenance should be carried out as it is envisaged that these machines will be phased out in 2 to 3 years time.

The approximate cost for Phase I will be U.S. $70,000 and for Phase

II U.S. $300,000.

SPINNING - PHASE III

Additional new spinning capacity is suggested under Phase III at a cost of approximately U.S. $4,400,000 in order to feed the increased weaving capacity envisaged in Phase III and still produce surplus yarn for sale. This will consist of:

1 Blowroom
5 Cards
2 Drawframes
5 Open End (Rotor) Spinners
Modernization of 13 Ring Frames

WEAVING - PHASE III

In Phase III, new looms with an output of a further 30.6 million metres a year (4,600 tons approximate) together with sufficient preparation machines are proposed. The cost will be approximately U.S. $14,000,000. The equipment will consist of:

6 Cone Winders
1 Warping Machine
1 Sizing Machine
150 Double Width Looms

PRINTING - PHASE III

At some future date it is envisaged that the bleaching and printing facilities of KTL and NNTM will be combined into one physical entity based on NNTM.

At this stage some capital investment will be required, for example to introduce open-width bleaching and improve the singeing and stentering facilities.

The estimated cost of the proposed equipment is U.S. $1,900,000 which includes some additional items of equipment for the Chemical Laboratory. The main items are:

1 Open Width Washing Range
1 Open Width Bleaching Range
1 Singeing Machine
1 Pin and Clip Stenter
Laboratory Equipment

CONSULTANCY

It is very important that the work of resetting and refurbishing the machines should be carried out in a thorough and meticulous manner. Whilst the national staff have the necessary knowledge and skill to carry out most tasks the presence of experts on some specific machine refurbishing is inevitable. For this purpose it is recommended that some expatriate consultants are engaged for the second phase of the rehabilitation programme whose assignments shall ensure that the specialized work of refurbishing are carried out in order and to train the staff on the shop floor. One of the consultants should be a training expert to strengthen the capabilities of the training centre and to develop a system of follow-up when the trainees start to work in the factory.

One method of approach would be to appoint individual consultants, but since many repeated short visits might be more effective than a few long missions the possibility of entrusting the work to a consulting company should be considered. The following consultancies are suggested:

Spinning	12 man/months	
Weaving	24 man/months	(2 persons)
Printing	6 man/months	
Training	18 man/months	
Chief Technical Adviser	12 man/months	(split missions)
TOTAL	72 man/months	

If things go according to plan, it should be possible to complete the whole operation in 3 to 4 years.

SUMMARY OF EQUIPMENT COSTS

The estimated costs for the spare parts and machinery required for the 3 phases are as follows:

		U.S. Dollars
Phase I	Spinning	-
	Weaving	315,000
	Printing	70,000
	Sub-Total	385,000
Phase II	Spinning	900,000
	Weaving	1,000,000
	Printing	300,000
	Total Phase II	2,200,000
Phase III	Spinning	4,400,000
	Weaving	14,000,000
	Printing	1,900,000
	Total Phase III	20,300,000

EXPECTED BENEFITS

SPINNING

After Phase II, which will, hopefully, overlap with Phase I, the plant will be in balance. The theoretical capacity, which is now less than 400 tons/month due to the bottleneck in carding, will be raised to 680 tons/month which will be more than sufficient to feed all the looms after Phase II weaving has been completed and still leave a substantial surplus of yarn for sale.

The yarn quality will be improved which will give better processing and efficiency in winding and weaving.

Phase III will further expand the spinning capacity and producing high quality rotor yarns for the modern shuttleless looms which are proposed in Phase III weaving. In addition, the section or ring frames with the oldest drafting systems will be modernized to produce the high quality ring yarns required for efficient operation of modern looms.

WEAVING

After Phase I and Phase II the number of operational looms will be increased from 764 looms with a theoretical production capacity of 1.60 million metres/month, but an actual production of only 0.97 million metres/month, to 850 looms with a capacity of 1.78 million metres/month which should be achieved given a regular supply of raw material.

There would also be the possibility of 4-shift operation which would raise the capacity to 2.49 million metres/month.

The quality of the fabric produced will be much improved and the efficiency of the looms will be increased from 60% at present to 70% or 75%.

Because of the better running of the looms the number of looms/weaver will be able to be increased to the extent that it will be possible to start a 4th shift without engaging any extra labour.

PRINTING AND FINISHING

On completion of Phase I and Phase II a realistic target for the product mix will be 27 million metres/annum, compared with the actual average production rate of about 17 million metres per annum over the past 6 months. This will substantially reduce the direct cost per metre and increase the production per operative.

On completion of Phase III the weaker sections such as singeing will be brought up to a good standard and potential bottlenecks such as printing, where only one machine is operational, will be eliminated. The oldest equipment will have been phased out and most of the activities will be consolidated at NNTM. This will lead to a much more efficient flow of material and reduce damaged goods caused by transportation back and forth between KTL and NNTM.

The capacity of the printing and finishing department will still far exceed that of the weaving departments. Commission printing should be undertaken in order to achieve better utilization of this expensive equipment.

Printing and finishing should be regarded as a separate cost (or profit) centre.

FINAL COMMENTS

Whilst there are many problems to be overcome, it is felt that there is great potential at KTL if the recommendations outlined in Phases I, II and III can be implemented.

During the course of the study, it is true to say that many negative points have been observed and recorded, but this should be balanced with the positive points which have also been noted, for example

- eagerness and willingness of KTL management to help in the study and their frank and open assessment of the actual situation as found;
- the impression received from staff that they realise things are not going well, and they wish to improve the situation by instituting change.

These are very positive and important points.

2. BACKGROUND AND HISTORY

2.1 THE NIGERIAN TEXTILE INDUSTRY

Nigeria is Africa's largest national economy with a population of over 100 million and a wide natural resource base. Nigeria enjoyed high growth rates during much of the 1970's but the country has experienced serious economic difficulties since then. In 1985 Nigeria reasserted itself to recover from the economic recession of the late 1970's. The Nigeria textile industry is the largest in West Africa in terms of production capacity. The industry grew rapidly during the 1960's due to large-scale foreign investment, but its raw materials base remains undeveloped. Profit rates were high during the 1960's due primarily to high levels of protection, but supply constraints led to the closure of many textile mills in the 1970's. In the early 1980's, supply problems became acute - with local production accounting for less than 28% of the industry's needs. Nigeria needs more than 800 million metres of cloth a year but, according to the Textile Manufacturers' Association, more than half is supplied by goods imported unofficially from neighbouring Cameroon and Cote d'Ivoire, as well as India, the Republic of Korea and Europe. The Nigerian textile industry is estimated to operate some 693,000 spindles, about 17,500 looms, some 80 printing machines, and around 50 knitting machines. In 1982, it produced about 410 million metres of fabrics or about 51% of the estimated total consumption in the country. The importance of the textile industry lies foremost in its employment generation ability. It has always been the leading employer in manufacturing.

2.2 KADUNA TEXTILES LIMITED (KTL)

Kaduna Textiles Limited (KTL) was incorporated in 1955 and started production in 1957 at the dawn of industrialization in Nigeria. It represented the first major industrial venture to utilize locally available agricultural produce. David Whitehead and Sons Limited were the Managing Agents.

The first 15 years of operations were very successful for KTL. The first mill started to produce grey cloth in 1957 and went on to 3-shift operation in 1958. Bleaching equipment was added in order to produce white shirting.

No 2 Spinning and Weaving mill came on stream in 1962 and No 3 mill in 1970/72. A small dyeing section was added. The main products were baft, bleached shirting and print cloth.

In 1972 a polypropylene plant was also installed to produce sacks from polypropylene chips under the brand name "Kadsack".

In 1978 KTL acquired a printing unit, Northern Nigerian Textile Mill (NNTM), in order to process their own production of print cloths.

David Whitehead and Sons relinquished direct management in 1979 and became technical consultants. Their activities were gradually phased out and the last ex-patriate left in 1986.

A new polypropylene plant was installed in 1981 and the old plant was temporarily closed down.

The mill is normally supplied with electricity from the National grid but there are frequent power cuts. Between 1982 and 1987 five new standby generators were installed to offset the effects of frequent power cuts. The total capacity of the generators is 4,310 kva.

A computer department was started in May 1985 with the installation of a Wang VS 45 computer and 3 terminals. 10 more terminals were added in 1986.

The department started with payroll/personnel records in July 1985 and added the following services:-

Customer order/processing/sales/invoicing	1985
Accounts receivable	1986
Inventory of stocks, materials and spare parts	1986
Purchase orders/accounts payable	1986
Cash book	1987

Since then they have been trying to streamline and maintain the systems.

Everything is not working perfectly yet, for example information regarding stocks of spare parts is not being efficiently communicated to the persons concerned, but this department is a great asset.

The maximum annual output of 23,656 tons of yarn and 67 million metres of cloth was achieved in 1972/73 when there were over 2,200 looms operating.

Since 1978, KTL has experienced difficulties in its operations resulting in considerable losses. Some of the oldest equipment has been scrapped and some other sections are stopped due to shortage of raw materials, spare parts and consumables and/or imbalance between the different departments. The number of looms operable is now reduced to only 850 and the output in 1986/87 was only 2,859 tons of yarn and 12 million metres of loom-state cloth.

KTL is now a subsidiary of the New Nigerian Development Company Limited (NNDC). David Whitehead appears to have lost interest in the Company. Jama'atul Nasil Islam became a shareholder because of the acquisition of the print works (NNTM). The present ownership structure is:

New Nigerian Development Company Limited (NNDC)	78%
David Whitehead and Sons Limited	17%
Jama'atul Nasil Islam	5%

2.3 RECENT REPORTS

In attempts to resuscitate the operations of KTL, NNDC and KTL have commissioned a number of studies and investigations with a view to determining the nature and extent of the problems. The most recent reports have been:

"Financial Analysis and Appraisal of Operations of KTL", A.W. Consultants Limited, Lagos, June 1983.

"Financial Analysis and Appraisal of Operations of KTL Phase II", A.W. Consultants Limited, Lagos, August 1983.

"Kaduna Textiles Limited, Appraisal Report", Phoenix Investment Services Limited, Kaduna, January 1984.

"Kaduna Textiles Limited, Proposal for Modernisation of the Spinning Facilities", Phoenix Investment Services Limited, Kaduna, February 1985.

"Survey and Valuation Report on the Assets of Kaduna Textiles Limited", Alagbe and Partners, Kano, June 1988.

A consortium of textile machinery makers recently made detailed proposals for rejuvenating the spinning department but this amounted to some 5 million U.S. dollars. A much greater sum would be required to modernise the weaving department, together with further investment in printing. Such investment was thought to be out of the question at the present time. UNIDO was therefore requested to carry out an independent, unbiased appraisal of the existing facilities and equipment and to make practical recommendations for reactivation/rehabilitation of the plant to make it competitive at the National level in an economical way.

3. MARKET AND PLANT CAPACITY

According to the Nigerian Textile Manufacturers' Association, the estimated annual consumption of fabric in Nigeria is some 800 million metres, about 50% of which is manufactured locally, whilst the rest is imported, officially or unofficially.

90 to 95% of all cloth sold in Nigeria is plain weave. The most popular width is 48/50 inches. The predominant requirement is for African prints followed by polyester/cotton materials for dress goods; Jacquards, brocades and other fancy weave; lace; bandages; drills, etc for uniforms; bleached goods of various constructions; bed sheets; curtains; upholstery and shirtings.

The demand for the specialised fabrics comes from the wealthier section of the community. In this case, price is not so important but the market is limited and most of the goods are imported anyway. The predominant requirement is for low cost fabrics and this is the area in which KTL operate.

KTL can sell virtually all it can produce of the above fabrics provided that the price is right, i.e. sufficiently low.

The market for yarns has been depressed over the past few years but prospects are now good because the Government has imposed an import duty of 70% on imported yarn.

SALES AT KTL

The product range at KTL is determined largely by the capabilities of the installed machinery. Most of the looms are only suitable for plain weaves 48/50 inches wide. The main products therefore are African prints, bleached shirting and baft. Just a few looms are kept for specialised fabrics such as bandages.

The present production target is made up as follows:

African Prints	0.8	million	metres	per	month
Bleached Shirting	0.5	"	"	"	"
Baft	0.2	"	"	"	"

which corresponds to 18 million metres per year.

The printing department works on the rotary screen principle and can print up to 8 colours. The capacity is very large.

There is very little seasonal variation apart from an increase in demand for printed dress-goods prior to religious and other festivals. The demand for polypropylene sacks is highest at harvest time.

Most sales are channelled through registered customers of whom there are about 400. These are merchants and distributors of fabric. Each customer has his own account in which he places a deposit against which KTL allocates goods from future production. This is possible since demand exceeds supply.

Originally the deposits were paid in cash but nowadays most customers prefer to pay their deposits in kind, e.g. bales of raw cotton, chemicals, dyestuffs, etc, and they are credited with the value of the goods supplied. This creates a cash-flow problem and so KTL has to request customers to recycle at least some cash (i.e. make part of their deposits in cash) so that they can pay the wages and salaries, settle bills and so on.

This system has been forced upon KTL because of the lack of working

capital. The operation of the system depends very much on goodwill and its success speaks well for the reputation of KTL in the market.

4. MATERIALS AND INPUTS

The main raw material imput is cotton. Other items include chemicals and dyeing and printing materials. In 1986 the consumption was:

Raw Cotton	6,626,092 Naira
Other Direct Materials	2,714,230 Naira

The polypropylene mill consumes mainly polymer chips, twine, printing ink and solvents.

In 1985 the production of cotton lint in Nigeria was 53,000 bales and the price was N3.5 per kg. By 1988 the production had increased to 200,000 bales and the price had risen to N12 per kg. This amount still represents only about 50% of the total required and in 1989 it is expected that the production will reach 300,000 bales and the price will be N10 per kg. In the meantime, cotton is being imported from neighbouring countries, mainly Chad and Cameroun.

Although the production has virtually quadrupled there has been very little increase in ginning capacity. Also, most of the ginneries are old and fell into disrepair some years ago when the production of cotton was very low, so it is not surprising that the standard of ginning is very poor. Complete seeds often are found in the lint.

5. LOCATION AND SITE

The main textile mill of Kaduna Textiles Limited is located at No 1 Textile Road, in the Kaduna South, Industrial Estate. It is about 5 km from the town centre and close to the Makera District which is a high-density residential area for mainly low-income-earning factory workers.

Kaduna has a population of about 1,000,000. It is connected by metalled roads and railways to Lagos and other major cities. There is an air service from Kaduna to Lagos, Kano and Jos. The site covers approximately 30 hectares of substantially developed land which is

enclosed by a boundary fence of steel mesh supported by concrete posts.

There are six other textile factories and several other industrial enterprises in the area.

The Printing Unit premises adjoin the main factory except for a road which passes between them.

The total built-up area is less than 50% of the total area. About 10,000m^2 of floor space is now unoccupied in mills 1, 2 and 3 as the machinery has been removed, whilst on the printing site there is an uncompleted building of about 18,000m^2.

6. PROJECT ENGINEERING

Layout plans are attached as Annex 1 and Annex 2 (Printing Unit) of this report. The technology used is quite conventional.

The production buildings date from 1956, 1962 and 1969 but they are still in reasonably good condition. The floors are reinforced cast concrete, screeded smooth on the surface. The walls are sandcrete blocks, rendered and painted on both faces. The roof is multiple lean-to in shape and comprises of corrugated iron sheets.

The equipment used is described in detail and discussed in sections 9, 10 and 11 which are appraisals of the Spinning, Weaving and Printing departments, respectively.

7. PLANT ORGANISATION AND OVERHEAD COSTS

Accounting is computerised using the following cost centres:

Capital
Fixed Assets
Stock
Debtors
Banks
Creditors
Inter-Group Accounts

Sales
Direct Cost
Direct Wages and Salaries
Ancillary Wages and Salaries
Direct Expenses
Consumables
Factory Expenses
Administrative Expenses
Welfare
Depreciation

Direct Cost (Polypropylene Plant)
Direct Wages (Poly)
Direct Expenses (Poly)
Factory Expenses (Poly)
Stock (Poly)
Sales (Poly)
Administrative Cost (Poly)

8. FINANCIAL STANDING

8.1 BANKS

The First Bank of Nigeria Limited has been KTL's major banker since the Company was established in 1957. Currently they have the following accounts:

(i) Loan Account of N17,470,263. This was consolidated last year into a seven year term loan.

(ii) Shortfall Account of N1,260,690. This amount, though carried in KTL's books, is still contestable. It is an amount emanating from shortfall on the Letters of Credit established with the Bank. This, they say, came about as a result of the fluctuation in the value of the Naira vis-a-vis other major trading currencies.

(iii) Current Account N962,884. This is used mainly as the Working Capital resources.

(iv) United Bank of Nigeria Limited N828,047. Current Account used mainly for paying salaries.

8.2 CREDITORS

There are no permanent creditors apart from the Banks. However, there are a few seasonal creditors who help finance cotton lint purchase for the Company. Others help finance the purchase of chemicals, dyestuffs and spare parts. Most of these people are also fabric customers. In most cases what KTL does is to credit their account with KTL and supply them with finished goods in due course.

8.3 CUSTOMERS

KTL's standing with their customers is very good because their products are moderately priced and are targetted for the low to middle income group and this is where the major bulk of the market is.

The bleached shirting is regarded highly. The major disadvantage is the poor quality of the goods arising from the performance of old machines creating sometimes more grade B than A.

8.4 CAPITAL STRUCTURE

Capital Stock. Distribution into shares is as follows:

	Shares issued	Nominal amount (Naira)	Paid-up amount (Naira)	Votes per share
Ordinary	20,816,800	15,000,000	10,408,400	1
Preference	-	-	-	-
Deferred	-	-	-	-

8.5 PRODUCTION COSTS

The production costs over the past 2 years were as follows:

	1987	1986
Direct Material and Inputs	13,995,220	8,674,245
Direct Manpower (Labour & Staff)	8,999,149	6,155,326
Factory Overhead Costs (Manpower & Materials)	3,920,323	3,143,899
Depreciation	2,887,506	2,478,899
Administrative Overheads	3,552,522	5,816,343
Financial Overheads	3,061,434	2,504,239
Sales and Distribution/Total Production Costs	-	-

Fixed and Variable Costs as percentage of Production Costs	35%	43%
Maintenance Expenditures	1,897,829	985,178

8.6 ACCOUNTS AND STATEMENTS

Copies of the last five annual reports, income statements, cash-flow tables and balance sheets have been studied and may be referred to at UNIDO.

Internal audits are carried out.

8.7 TAX POSITION

The following tax legislation is applicable to the Company:

Production or turnover tax - nil.

Income tax, 40% on declared profit.

5% excise duty on all sales.

8.8 Insurance coverage is provided for fixed assets, inventories, etc, fire, burglary and Plant All risk (PAR).

8.9 There are no pending litigations by or against the Company.

9. APPRAISAL OF THE SPINNING DEPARTMENT

The general situation in the spinning department is poor. Output is low and quality is poor. Unless urgent remedial action is taken, the life of this yarn manufacturing operation will be very limited.

Through the false economy of not maintaining the machinery properly, by not supplying spare parts as required, and by a lackadaisical approach by the maintenance staff, the Company's assets have been seirously eroded. Even during periods when much of the plant has been idle through material shortages, the opportunity to get ahead with machinery maintenance has not been taken. This has led to a serious lowering of yarn quality which is also affecting proccess-ability, output and machine allocation to operators.

The heavily printed designs on African prints are hiding faults in cloth . otherwise would be downgraded, thus limiting the end-use of the . ..

The poor condition of the raw material coming from the ginneries is causing tremendous problems. Poor ginning is leaving a large proportion of full seeds in the Nigerian cotton used and no amount of maintenance and machine reconditioning can overcome this problem which is rendering the use of stationary tops on the cards impracticable. It is surprising that there has not already been sufficient of an outcry to force the ginners to remedy this situation. Action needs to be taken <u>now</u>. Cotton imported from neighbouring countries is much better ginned.

The conditon of the coverings of the top drafting rollers has a great influence on yarn quality. Although new costs and people and equipment are available, this aspect of the operation is also being neglected; the roller cots on the drawframes are in particularly bad condition. The normal routine is to grind all cots at least every 3 months. The drawframe cots should be ground much more frequently and the period between grindings should increase through the different processes to the ring frame, with the front rollers needing more attention than the back rollers. This is not being done and the resulting quality of sliver, roving and yarn as indicated by Uster U%

figures and traces would be considered unacceptable by most companies.

There is a serious shortage of spare parts and consumables but better use could be made of the parts that are available. There is also poor control over spare parts in the stores so that at times much needed items have actually been in stock but were "lost".

There is over-manning in some sections.

Not enough attention has been paid to air conditioning although this has caused tremendous problems in No 1 Mill. During the mission Mill 1 had to be stopped because the R.H.% was too high. It has now been found that water was flooding from the ground into the return air ducts causing an increase in humidity. This should be remedied as soon as possible.

On the other hand, the factory still has considerable potential. There is a ready market for all its fabrics and the demand for yarn is expected to increase. Also, although most of the equipment is rather old, it is basically sound and with a modest investment and a great deal of effort it could be brought back to good condition.

A 3-phase programme is proposed to rehabilitate and further develop the plant, and other recommendations are also given.

9.2 BACKGROUND

Mill 1 was commissioned in 1957 when it was equipped with low production machinery but it was modernized between 1966 and 1968 with equipment similar to Mill 2 and then the cards were replaced by high production cards in 1975 and '76.

Mill 2 was commissioned in 1962 with low production cards, but otherwise more up-to-date machinery. Mill 2 now has the oldest equipment.

Mill 3 was commissioned in 2 phases in 1970 and 1972 with the latest machinery available at that time.

5 rotor spinners have been introduced more recently to process much of the waste that would otherwise be sold but otherwise, the technology

has little changed.

On the other hand, for various reasons, including shortage of spare parts and changes in demand for yarn, a lot of machines have been stopped and some of them have been cannibalised to such an extent that they are now beyond repair. This report is concerned only with the machinery that is running today or which could be restored to operable condition at reasonable cost.

9.2 RANGE OF PRODUCTS

Apart from the introduction of some open-end spinning to utilize waste, the range of yarns produced is the same as when the factory was built.

9.3 RAW MATERIALS

All the yarns produced are 100% cotton.

The policy is to use Nigerian cotton wherever possible but, as cotton production is insufficient to meet the requirements of all the spinning mills in Nigeria, some imported cottons from neighbouring countries, mainly Chad and Cameroun, are also used. In general, the quality of ginning of the imported cottons is good whilst that of the Nigerian cotton is poor. The main reason for this is that the farmers have responded to increasing demands for cotton, whilst there has been very little increase in the ginning capacity. The output of the ginneries has increased from 31,000 bales in 1985 to 150,000 in 1987 and 200,000 bales in 1988. It is expected that the output in 1989 will reach 300,000 bales.

Details of the cottons used are as follows:-

	Nigerian Class 1B	Chad	Cameroun
Effective Length	1"	$1\frac{1}{16}$"	$1\frac{1}{16}$"
Micronnaire	4.0	3.93	3.88
Trash Content	5.0%	4.3%	2.6%
Cage Loss	1.4%	0.8%	0.9%
Availability	Not Good	Good	Good

A typical mix for ring spinning is 10 bales Nigerian + 1 bale Cameroun + 1 bale Chad.

The mix for rotor yarn is 25% cotton + 75% waste (flat strips, card fly, pneumafil and other soft waste).

9.4 BUILDINGS

The single storey buildings date from 1956, 1962 and 1969. They are getting old but are still serviceable and suitable for their purpose. The production areas have temperature and humidity control.

During the mission there was heavy rainfall and it was noticed that the relative humidity in Mill 1 was much higher than in Mills 2 and 3. This resulted in more end-breaks and machine down-time in Mill 1. This is apparently always a problem during the rainy season and sometimes results in the entire mill being stopped. Eventually the cause was traced to water seeping into the under-floor, return-air ducts due to rising of the water table. This should be rectified as soon as possible as it is a very costly fault.

9.5 TECHNOLOGY

The technology is mostly conventional ring spinning but there is a small section of open-end, rotor spinning. If the department were to be re-equipped today it might well be decided to install up-dated versions of the existing machines but with greater emphasis of open-end (OE).

There is no attempt at automation but, since labour in Nigeria is still cheap, it is not unreasonable to use manually operated equipment.

The machines installed in the 3 mills are described in Appendices S1, S2 and S3 respectively and summarized in Appendix S4.

9.6 LAYOUT OF MACHINERY

The original layouts in the 3 mills were very good and even though some sections of machinery have been stopped or scrapped (e.g. 50 old, low-production cards) the flow of material is still quite good. The spacing between the machines is reasonable and there is adequate space for the work in progress.

9.7 TECHNICAL DETAILS (SPIN PLANS)

The technical details (hanks, drafts and doublings, machine delivery rates, waste allowance, expected efficiencies etc.) are shown in Appendix S4. They are quite normal for the types of machines used, except that some machines have been slowed down in an attempt to improve processability. This is permissible because the spinning capacity is greater than necessary for weaving, but it does not appear to have had the desired effect.

9.8 BALANCE OF MACHINERY

The capacity of the spinning department far exceeds the requirements of the weaving department because the total number of looms has been reduced from 2,214 in the mid-seventies to only 850 operable looms at present. The reasons for this are discussed in Chapter 10.

Within the spinning department itself there is also some imbalance with carding being the bottleneck. As shown below, the existing ring frames would be capable of producing about 123 tons a week if it were not for the carding section which can only produce a maximum of 100 tons a week.

9.9 PRODUCTION CAPACITIES

The production capacities of the operable machines in the different sections at expected efficiencies and average count Ne 21.4 are:-

Section	Possible Output (kg/week)
Blowroom	196,000
Carding	100,029
Drawing	153,401
Roving	129,500
Ring Spinning	123,400

It will be noted that carding is the bottleneck and limits spinning capacity to less than 100 tons/week.

The maximum output achieved in 1972/73 was 23,656 tons or 455 tons/week. At present the output is only about 58.5 tons/week.

The production programme is based upon 120 running hours per week.

Saturday and Sunday are not normally working days but some overtime is worked when necessary (at premium rates). The current production programme is as follows:-

Count (Ne)	Material	System	Kg/week
24	100% Cotton	Ring	30,388
20	100% Cotton	Ring	14,836
13	100% Cotton	Ring	6,627
10.5	75% Cotton/25% Waste	Rotor	6,649
	Total (120 hours)		58,500

The Ne 24 yarn goes into African prints as both warp and weft. The Ne 20 is used for bleached shirtings. The Ne 13 goes into the warp of the heavy baft fabric, whilst the Ne 10.5 rotor yarn provides the weft.

Details of the cloth constructions are given in Chapter 10, "Appraisal of the Weaving Department".

9.10 MACHINE PERFORMANCE

The machines are running at approximately the same speeds as when installed, and the original production rates and quality levels could still be achieved if the machines were refurbished.

9.11 SPARE PARTS

There is a serious shortage of spare parts. Although there are considerable quantities of spare parts in the stores, in general they are not the most urgently needed parts such as card clothing and roller cots and aprons.

The spare parts inventory is now held in the computer. There are nearly 3,000 inventory items listed for the spinning department. However, some anomalies were noticed and the store rooms themselves are not very well organized. A physical check of all spare parts should be made. Useless parts should be scrapped. Good parts should be pigeon-holed. Copies of the computer print-outs should be distributed to the heads of sections and eventually there should be a computer terminal in the stores. Whenever a part is taken from stores, the fact should be recorded and central records informed

so that a maximum minimum stock procedure can be implemented.

9.12 MAINTENANCE PROCEDURES

Routine oiling and greasing must have been carried out regularly over the years as otherwise the machines would be in a far worse condition than they are now.

There exist planned maintenance schedules for all the machines but the replacement of worn out parts, e.g. card clothing and roller cots, is in most instances long overdue because of the lack of spare parts - see Appendix S5. The poor condition of the roller cots is illustrated in the following table:-

SURVEY OF TOP ROLLER DIAMETERS, AUGUST 1986

	Nominal (mm)	Actual Diameters (mm)		
		Front	Middle	Back
Drawframe	33.2	33/28	29/26	28/25
Roving	32.2	32/27	32/27	32/27
Ring frames	28.0	28/25	-	28/25

9.13 MAINTENANCE STAFF

The number of maintenance workers is quite high by European standards. Their deployment is reasonable and they appear to know how to carry out settings and adjustments, although their attitude is rather casual. Tighter supervision is needed to ensure that the work is carried out thoroughly and correctly.

9.14 MACHINE TENDING

Most operatives have quite lengthy experience and good manual dexterity but, here again, better supervision is needed. Training should be directed as much towards changing people's attitudes as to teaching the manual skills.

9.15 HOUSEKEEPING

The housekeeping is very poor. The cleaning of the machines and working areas, the removal of waste, the organization of the work in progress and the handling of material is not being done properly and this is causing a lot of damage to the work in progress and a lot of scrap. This is unnecessary, especially in a factory with

low wage rates.

9.16 WASTE

Approximately 10% waste is lost in spinning. The breakdown process by process of useable and non-useable waste is shown in Appendix 4.

3.9% soft waste is rather high.

Flat strips, card fly, pneumafil and other soft wastes are used in the waste blends on the rotor spinners.

9.17 QUALITY CONTROL LABORATORY

The spinning laboratory is dark and dismal and located behind the generators. When the generators are working the noise is appalling and the exhaust gases actually blow into the laboratory. There is no air-conditioning so there is no possibility of carrying out tests under internationally recognised standards of temperature and humidity.

9.18 TESTING EQUIPMENT

The bare minimum of testing equipment is available. The condition is poor. The Uster unevenness tester (a key machine) has not been serviced for 8 years. A list of the equipment available is given in Appendix S6.

9.19 SAMPLING, TESTING AND RECORDING

The staff are going through the motions but there is a lack of enthusiasm and appreciation of the work of the laboratory, which should really be the heart of the operations and play a positive role in improving quality, efficiency and productivity.

9.20 STANDARDS

The routine tests carried out and the standards accepted are shown in Appendix S7. In general, the quality expectations from the factory are very low.

As soon as practicable a quality audit should be carried out to establish and set new standards based upon practical tests within the factory.

9.21 MANPOWER

There was some retrenchment in 1986/87 since the production programme has been reduced. The production/operative hour is still low but as wages are also quite low this is not too serious. It should be remembered that, in spinning, it is not feasible to give an operative 5 or 10% more load. For example, ring spinners look after 4 sides at present, and the smallest reasonable increase would be to 5 sides, i.e. an additional 25%.

Because there is a shortage of jobs in Kaduna, labour turnover is almost zero and absenteeism is low.

The total number of persons employed in spinning at present is 558. The deployment of operatives to the various processes is shown in Appendix S4. A list of operatives is given in Appendix S9.

Additional people are being trained in anticipation of an increase in production requirements.

9.22 SUPERVISION

As in many other places, the weakest link in the management chain seems to be the supervisors, many of whom appear to be ineffective. Several examples were noticed where workers could and would do their jobs correctly when some knowledgeable person was taking an interest but not when left to themselves. Most of the supervisors have been promoted from the mill floor and may be lacking in management skills and this could have a bearing on the problem.

9.23 CONSTRAINTS ON PRODUCTION

As the potential output of the spinning section far exceeds the maximum demand of the weaving department, and as the market for yarn has been depressed until recently, there has been little incentive to increase production in spinning. The main constraints on spinning production therefore are:-

Lack of demand for yarn
Shortage of raw material
Lack of spare parts
Power cuts
Imbalance (low production from cards)

The underlying problem is shortage of working capital for raw meterials and spare parts. The market for yarn is now more buoyant since the Government has imposed 70% excise duty on imported yarns so an increase in demand for yarn is expected.

9.23 RECOMMENDATIONS

In order to meet the expected increase in demand for yarn and to be able to satisfy the requirement of the weaving department when it is put into good order, a 3-phase programme is recommended.

PHASE I will consist of bringing the plant up to the best condition possible utilizing only available resources, by cot-grinding and resetting of the machines. Yarn cleanliness, evenness and strengh will improve, as a small trial carried out during the mission has already shown. An improvement in processability in spinning and at later stages will also be seen. The cost of this will be very low. Phase I should be completed in 3 months.

The activities envisaged during Phase I are detailed in Appendix S8.

PHASE II will involve the purchase of the parts needed to bring Nos 1 and 3 Mills up to standard as regards production, quality and processability. The approximate cost of these spare parts will be 900,000 U.S. dollars including the services of the supplier's engineer to supervise clothing of the cards. Phase II should be completed in 9 to 12 months.

It is recommended that 2 ex-patriate consultants should be fielded to assist with Phases I and II and to retrain the maintenance staff.

The machinery in No 2 Mill is, for the most part, very old and in bad condition and should be scrapped except for the drawframes, ringframes and blowroom which should be retained for possible future use.

Phases I and II will, hopefully, overlap and result in the following benefits:-

MAXIMUM PRODUCTION CAPACITIES (Tons/120 hour week)		
	At Present	After Phases I & II
	(Mills 1, 2 and 3)	(Mills 1 and 3)
Blowroom	196	196
Cards	100 (1)	180
Drawframes	153	197
Roving	130	153
Ring Spinning	123	153
Rotor Spinning	13	16

Note (1) At present the cards represent a bottleneck.

Note (2) After Phases I & II the plant will be in balance. (Although in the drawframe capacity will be a little high this will not be any problem.)

PHASE III is a proposal for expanding the spinning capacity by instaling a new rotor spinning plant comprising the following:-

1 Blowroom

5 Cards

2 Drawframes

6 Open End Machines (about 1300 rotors)
Modernization of 13 Ring frames

If the most sophisticated equipment were selected the cost would be about $5 million. With less automation (which may be more suitable for KTL) the cost would be about 4.4 million at present price levels.

This type of equipment should be run 168 hours per week, in view of the high capital cost, in which case 4-shift operation would be recommended. The merits of 4-shirt working are discussed elsewhere in this report.

This new plant would produre about 27 tons per week of 168 hours in addition to the 150 tons of ring yarn (120 hours only) giving a total of 177 tons per week.

At the same time the Quality Control laboratory should be improved by the addition of an automatic single thread tester for strength and elasticity and a modern yarn evenness tester with allied equipment

which are included in the above estimate.

The new machinery could well be located in the existing No 2 mill whilst still utilizing Mills 1 and 3 for ring spinning.

9.24 OTHER RECOMMENDATIONS

Other recommendations are as follows:-

- Strong representation should be made to the ginning factories to improve the quality of ginning. It is reported that some Nigerian factories are installing their own ginneries to overcome the problem of bad ginning.
- No Pressley index figures nor maturity figures are available. These tests are necessary as micronnaire value of cotton is not a reliable indication of maturity.
- Bale numbers in stock should be recorded and again when taken out of stock into production. Bales should always be used in rotation.
- The present mix of 12 bales is rather low for cotton. It would be beneficial to double the size of the mix.
- Large clumps of bale are sometimes fed to blenders, this hampers cleaning and blending. Only small pieces of bale should be fed to the blenders.
- The rotor machines at KTL are suited to the waste yarns which are being spun on them. A fairly bulky yarn is being produced at high speed. It is suitable for the weft of the heavy baft coth into which it is woven. Before purchasing any new machinery a study should be made to see whether rotor yarn could be used in other applications as rotor spinning is the most economic way of producing low count yarns.
- The weekly production report should give average count and efficiency in terms of operative hours per unit of production (OHP) so that accurate comparison of performance can be made.

9.25 EFFECTS OF THE RECOMMENDATIONS

(a) Quality will be improved leading to better performance not only in spinning but also in winding and weaving.

(b) Production will be increased from a possible 100 tons/week at present (58.5 tons/week actual) to over 150 tons/week on completion of Phase II on 3 shift working as at present or over 210 tons/week on 4 shifts.

(c) Productivity in terms of production per spindle and production per operative will be increased and production costs per kilogram will be reduced.

(d) On completion of Phase III a further 27 tons/week of high quality, open-end spun yarn will be available based on 4-shift working in this section.

(e) The cost will be:

Phase I	-
Phase II	U.S. $900,000
Phase III	U.S. $4,000,000

(f) The working capital will have to be increased to provide the extra raw materials etc that will be required in view of the increased production

(g) The effect on the number of machines in operation will be:-

	Actual (Mills 1, 2 & 3)	After Phase II (Mills 1 & 3)	Phase II + 4-shifts (Mills 1 & 3)
Blowrooms	5 lines	4 lines	4 lines
Cards	48 (+ 20 conventional)	68	68
Drawframes	13 (x 2)	18 x 2	(18 x 2)
Speedframes	13	16	16
Ringframes	109	148	148
Rotor Spinners	4	5	5
Production/month	234*	600	840

* Maximum at present is 400 tons/month.

(h) The effect on the labour complement will be as follows:-

	Actual (Mills 1, 2 & 3)	After Phase II (Mills 1 & 3)	Phase II + 4-shifts (Mills 1 & 3)
Managerial	2	2	2
Blowroom	49	44	55
Carding	60	51	65
Drawing	43	75	100
Speedframes	69	94	122
Ringframes	288	377	500
Quality Control	5	5	5
Clerical	42	39	41

A detailed list of the personnel is given in Appendix S9.

Since more machines will be working after Phase II, the labour force will have to be increased from 558 at present to 687 on 3-shift working or 890 on 4-shifts. However, since the production rate will be raised from 58.5 tons/week (100 tons maximum) at present to 150 tons/week on 3-shifts or 210 tons/week on 4-shifts the productivity of the operatives will increase from 0.10 ton/week at present to 0.22 tons and 0.24 tons/week on 3 or 4 shifts respectively.

10. APPRAISAL OF THE WEAVING DEPARTMENT

All the Weaving Units were reviewed and detailed studies were made of the condition and performance of typical machines in each of the Preparation and Weaving sections.

In the past there were over 2,200 looms in operation. The total number of operable looms now is only 850.

The general impression was that all the operating looms were in an unsatisfactory technical condition partly due to lack of spare parts and partly because the operatives and particularly the maintenance workers do not pay sufficient attention to detail. Housekeeping is poor and too much waste is being created. The automatic shuttle change mechanism is not working on any single loom.

Although the equipment is somewhat dilapidated, it would be possible to bring the 850 looms and associated preparation equipment up to a reasonable standard so that they would then (assuming normal maintenance) give good service for another 10 years or more.

As weaving is the main bottleneck in the factory, the possibility and implications of increasing the weaving capacity at a later stage have been considered. A 3-phase approach is recommended, viz:-

PHASE I

(a) Retrain all workers to achieve a better condition of the looms and therefore higher productivity and quality.
(b) Order pickers and shuttles for all the Northrop looms.
(c) Complete 250 looms with the shuttle change mechanisms already in the stores and thus achieve a production increase of about 80,000 metres per month.
(d) Implement 4-shift working as soon as possible when production would be increased by about 40% more.

The estimated cost of Phase I is 315,000 U.S. dollars.

PHASE II

Refurbish 850 looms using the parts ordered during Phase I.

After this maintenance the output of fabrics would be approximately 21.7 million metres a year on 3 shifts or 30 million metres on 4 shifts.

PHASE III

Increase production by adding new looms with an output of 23 million metres/year, equivalent to 3,450 tons on 4 shifts and sufficient cone winders to feed the new looms, together with 1 warping machine and 1 sizing machine. The total output of fabrics would then be about 53 million metres a year with 4-shift working.

Lists of the spare parts and machine requirements for each phase have been compiled and the cost estimated for budgetting purposes (copies are at UNIDO). Most of the work of Phases I and II could be carried out by the mill staff but it would be advisable to have consultants present to check the quality of work during Phase I and finalize the lists of spares for Phase II and advise on details of machinery required for Phase III and its installation and commissioning. The consultants need not be present all the time; preferably they should make fairly short, repeated visits to help maintain the momentum. Ideally there should be one consultant for Preparation and another in Weaving because of the large number of looms involved. A total of 24 man/months of consultancy is proposed.

The cost of materials for Phase II is estimated at 1 million U.S. dollars.

10.1 RANGE OF PRODUCTS

The following fabric constructions are in use at the present time:-

Cloth	Structure			
	Ends/inch	Picks/inch	Ne Warp	Ne Weft
Bleached Fabric				
Bandage	28	20	20	20
Baft No. 3	40	32	13	10.5
Kadcord	80	45	13	13
Check	66	66	20	20
Stripe	80	72	24	24
Shirting	56	42	20	20

Grey Drill				
Godm Drill	80	84	13	10.5
Godm Drill	80	25	13	10.5
Baft No. 2	40	32	13	10.5
Printed Fabrics				
Print Cloth	56	48	24	24

10.2 RAW MATERIALS

All fabrics are 100% cotton made from yarns produced in the spinning department.

10.3 BUILDINGS

The buildings are getting old but are serviceable and suitable for their purpose.

10.4 TECHNOLOGY

The technology is conventional with shuttle change looms.

10.5 LAYOUT OF MACHINERY

Several sections have been closed down and the machinery scrapped. Layout of the remaining equipment is quite good.

10.6 WORKING HOURS

All the calculations in this report are based on the following assumptions (unless otherwise stated);-

Working hours per day:	22.5
Working days per month:	21

10.7 PRODUCTION PER SPINDLE AND PER OPERATIVE

These ratios are based upon the actual productions achieved and average number of operatives employed during the period October 1987 to July 1988.

10.8 DESCRIPTION OF THE PREPARATION MACHINES

4 Savio Cone Winders (1985)

Total spindles:	224
Operable Spindles:	224
Efficiency:	75%

Production/Spindle:	1.12 kg/h
Production/Operative:	3,520 kg/month

The machines are in good condition and the quality of the cones is good. The production per spindle is satisfactory but the production per operative is low. The production would be greater if the yarn quality was better.

11 Barber Colman Spoolers (1957/61/72)

Total Spindles	1962
Operable Spindles	810
Production/Spindle	0.51 kg/hour
Production/Operative	3,175 kg/month

The machines are in bad condition. 396 spindles are stopped because of a shortage of spare parts and 756 because they are now surplus to requirements.

The production rates are only 50% of what would be expected.

The quality of the cones is bad and too much material is wasted.

12 Schweiter Cone Winders (1978)

Total Spindles:	120
Operable Spindles	Nil
Delivery Rate	1,000 m/min
Efficiency	90%
Calculated Production	1.35 kg/spindle hour

All the machines are stopped due to missing parts. The necessary parts should be ordered as soon as possible as these modern machines have high productivity and are capable of giving very good quality.

6 Leesona Warping Machines (1957/61/72)

Operable Machines	5
Efficiency	50%
Production/Machine	47.5 kg/hour
Production/Operative	5,904 kg/month

The machines are in poor condition and the quality of the beams is not good. One machine is stopped for spare parts.

7 Leesona Sizing Machines (1957/61/72)

Machines Operable	4	
Efficiency	45%	
Production/Machine	816	m/hour
Production/Operative	42,907	m/month

The technical condition is insufficient and the beams are of poor quality. Sometimes the machines are without control. The beams used are dirty and should be cleaned before use.

Two machines are stopped for spare parts and one other is surplus to requirements.

15 Schweiter Pirn Widing Machines (1957/61/72)

Total Spindles	1080	
Operable Spindles	504	
Efficiency	50%	
Production/Spindle	0.039	kg/hour
Production/Operative	294	kg/month

This output again is extremely low and too many operators are involved.

10.9 LOST HOURS

During the period October 1987 to July 1988 there were 4,048 working hours available. The lost time is shown in the following table.

Machine	Hours Lost	% Working Hours
Savio Winders	1,533	62.1%
Spoolers	1,429	64.7%
Schweiter Winders	4,048	Nil
Warpers	1,068	73.6%
Sizing Machines	1,157	71.4%
Pirn Winders	165	95.9%

10.10 SUMMARY (PREPARATION)

The output of all machines in the preparation section (except Savio) is about 50 to 70% below the achieveable output. The manpower is more than 50% too high; in fact, a 4-shift operation could be run with the existing personnel.

For maintenance of all the machines there are no fewer than 48 mechanics available (30 mechanics and 18 overlookers). With such a lot of mechanics all machines should be in much better condition. Clearly, the work of this group is unsatisfactory and not exact and much stronger supervision and control is necessary.

It is recommended to order the required spare parts for the Schweiter cone winding machines at once. The cost will not be too much and then the spare parts for the Barber Colman machines will not be necessary.

The qualification of all workers needs to be improved. Retraining should be started at once. A stringent control and supervision executed by the Management is necessary and should be introduced with immediate effect. Housekeeping should be improved, to avoid damage to the work in progress.

After refurbishing, the Schweiter and Savio machines should work on 4-shifts (168 hours/week) in which case the Barber Colman Spoolers would no longer be required.

The present staffing level would permit 4-shift operation without hiring additional operators.

The reasons for stoppages are summarized in Appendix W1 from which it can be seen that the main problem is shortage of materials, followed by electrical faults.

10.11 DESCRIPTION OF WEAVING MACHINES

There are 850 operable looms as follows:-

Quantity & Make	Width	Picks/min	Shedding
286 Northrop	47" (120 cm)	180	Cam
222 Northrop	61" (155 cm)	165	Cam

12 Northrop	61" (155 cm)	165	Dobby
330 Draper	58" (148 cm)	190	Cam

10.12 PRODUCTION CAPACITY (FEASIBLE)

Assuming a modest efficiency of only 70% the total production of the 850 looms per month (22.5 hours x 21 days) works out at 3,032 million picks or, with an average of 1,700 picks/metre, 1.78 million metres of cloth per month.

10.13 PRODUCTION ACHIEVEMENTS (1985 - 1988)

The average figures for operating hours, monthly production and efficiency for the years 1985/86, 1986/87 and the first 10 months of 1987/88 were as follows:-

	1985/86	1986/87	1987/88
Looms operating	688	713	764
Production/Month (million metres)	0.72	1.08	0.97
Efficiency	57%	50%	60%

10.14 LOST PRODUCTION

In the period October 1987 to July 1988 there were 4,525 available hours but of these, 1,106 were lost so the working hours were only 3,418 or approximately 75%.

The average output per month was 0.97 million metres which compared with the practical achievable output of 1.78 million metres is only 54.5%.

10.15 PRODUCTION WEAVER

There were 513 weavers working during that period so the average output per weaver was only 1,900 metres/month!!

Given normal technical conditions, one weaver tending 12 looms operating at 180 picks/minute for one month of 21 days of 22.5 hours each should be able to produce

$$\frac{12 \times 180 \times 60 \times 22.5 \times 21 \times 0.7}{1{,}700 \times 3} = 8{,}405 \text{ metres/month}$$

At the present time, therefore, each weaver is only producing 22.6%

of his possible output.

10.16 LOOMS/WEAVER

The average machine allocation at present is 850 x 3/513 = 5 looms/ weaver.

An experiment is being carried out with only 3 looms/weaver in the hope that that will improve quality, but it is doubtful whether such a practice will have the desired effect in the long run.

At present there are only 642 looms running so the average allocation is only 3.75 looms per weaver!!

A list of the personnel in the weaving department is given in Appendix W1.

10.17 TECHNICAL CONDITION OF THE LOOMS

Of the 642 looms at present in operation not one is in an acceptable technical condition; the condition is more than bad!
One reason for this is the shortage of spare parts, but that is not the only reason. It is also caused by the unsatisfactory and incorrect work of the mechanics, weavers, greasers and others.
The real problem is the lack of sound advice and control by all the leaders in the department.

The main faults on the looms are:

- defective and missing parts of the shuttle change mechanisms; not one single loom is working with its change mechanism.
- very bad reeds.
- a lot of bent and/or dirty drop wires which cannot fall down if a warp end breaks; this is causing many faults in the fabric.
- defective weft stop motions which causes missing picks and other faults.
- temple cutters and shuttle-eye cutters not working or completely missing.
- let-off motions that are not working exactly.
- ratchet take-up motions that are not working exactly.
- badly adjusted temples.
- moving reeds.
- moving warp beams.

- faulty setting of the shuttle boxes.
- many crossed warp and surplus threads.
- defective warp beam bearings.
- very dirty looms.

10.18 MACHINE ALLOCATIONS

For maintaining the 850 looms (642 running) there are no fewer than 116 mechanics (10 senior overlookers, 80 overlookers, 17 mechanics and 9 maintenance workers) which works out at $\frac{642 \times 3}{116}$ = 16.6 looms/mechanic on average, compared with a normal allocation of 40 to 60 looms/mechanic.

With such an allocation the looms should be in tip-top condition.

As mentioned previously, the allocation to the operatives is only 3.75 looms/weaver which is exceptionally low.

10.19 QUALITY

The fabrics produced would be regarded as scrap by international standards. The bad quality is due to the bad condition of the looms, bad beams and bad weft material. An inspection of 588 metres of different fabrics revealed 813 faults which is equivalent to 138 faults/100 metres. Normal standards for grey fabrics are:-

Less than 10 faults	-	1st Quality
10-25 faults	-	2nd Quality
Over 25 faults	-	3rd Quality

The main faults are:-

- missing picks
- places without weft (20-30 picks missing)
- very long warp breaks
- thick places
- reed stripes
- very dirty cloth

In the cloth inspection section the many threads hanging from the selvedges of the rolls of cloth were being burned off using a blow torch. This is a very bad practice because sometimes the selvedges are damaged or even destroyed, which causes serious problems in finishing. This has now been stopped and the threads are being

removed by scissors but, really, a new shearing and cropping machine is required.

There is no routine recording of faults and no exact grading of the fabrics.

For the necessary improvement of the quality tighter inspection procedures are required and, for that purpose, a quality control section should be created which will require 3 new fabric inspection tables.

10.20 PRODUCT MIX

The following articles were produced from October 1987 to July 1988 in the quantities shown:-

Wide drill	0.23 %
Narrow baft	12.02 %
Wide baft	4.22 %
Godm duck	0.36 %
Bandage	1.10 %
Mock leno	0.01 %
Modified check	0.02 %
Stripe	0.01 %
Repp	0.38 %
Check	0.55 %
Shirting	31.40 %
Print Cloth	49.70 %
	100.00 %

The total production was only 9.75 million metres, so some of the articles represented very insignificant quantities. This wide range should be reduced to about 4 articles only, for example:

Print Cloth	50 %
Shirting	30 %
Baft	19 %
Bandage	1 %
	100 %

Such rationalisation will make the organisation of production easier and will result in higher efficiency.

10.21 QUALIFICATIONS OF THE WORKERS

The skills of the workers, especially the mechanics and the weavers, seem to be insufficient. Continual training and retraining should be given. The training centre is very good and should be used continually. After a period in the training school there should be follow up by the instructors to ensure that the work is carried out in accordance with the methods taught.

10.22 PAYMENT AND INCENTIVES

At present the wages of the workers are fixed which does not encourage high production nor good quality. A new system is required which will reward good workers and penalise bad workers and which will encourage better productivity and quality through incentive payments.

10.23 SPARE PARTS

The shortage of spare parts is now acute. A wide variety of parts are required urgently as, without them, more and more looms will stop. Especially pickers for the Northrop looms and shuttles should be ordered at once.

A visit to the stores revealed all the spare parts necessary for the shuttle change motions for 250 Northrop looms. These parts should be fitted as soon as possible when a further 80,000 metres of fabric per month could be produced.

The spare parts requirements are not elaborated in detail in this report as the stores are not organized and not all up-to-date prices are available. It is therefore not possible to give an exact figure for the value of the parts required for the re-habilitation of all 850 looms but it will be in the region of 1 million U.S. dollars.

10.24 SUMMARY (WEAVING)

- The condition of all looms is horrible.
- The production is less than 50% of the achievable output.
- The manpower is about 50% higher than necessary.
- The work of most workers is unsatisfactory and inexact. A strong and continuous control by the management is necessary.
- Introduction of new effective wage system is necessary to provide incentives for good quality and high productivity.
- Create a quality control section and check all produced fabrics.

- Order and cleanliness should be improved.

10.25 PLAN OF ACTION

To stabilize and then increase production as well as improve the fabric quality it is recommended to take measures in 3 phases.

PHASE I (up to 1 year)

- Immediate retraining of mechanics, weavers and other workers to achieve in a very short time a better condition of the looms and therefore a higher productivity and quality.
- Strong checks and control of all workers through all leaders (managers, supervisors, overlookers, mechanics etc.). Leaders who do not achieve their targets should be removed.
- Order as soon as possible the necessary pickers and shuttles for the Northrop looms, because 250 looms can be completed and the production increased by about 80,000 metres per month.
- For a correct quality control of grey fabrics 3 new inspection tables are necessary. Speed between 20-60 metres per minute. Value about 60,000 U.S. dollars.
- A new shearing and cropping machine is required. Value about 220,000 U.S. dollars.
- For increasing the production and making better use of the manpower the implementation of 4-shift working is recommended. In this way, the work time will be increased by about 40% and the production also. The current work time is 22.5 hours per day x 5 days = 112.5 hours per week. With 4-shift working the work time wil be 22.5 hours per day x 7 days = 157.5 hours per week which is an increase of 40%.

Phase I can be realised in a relatively short time and with very little investment, viz:-

Required Parts or Machines	Quantity	Value (U.S. Dollars)
Shuttles Northrop	1,000	21,000
Pickers Northrop	5,000	14,000
Inspection Tables	3	60,000
Shearing Machine	1	220,000
	Total Cost =	315,000

PHASE II (up to 3 years)

In this Phase it is envisaged that the 850 operable looms will be refurbished. For this purpose, a lot of spare parts will be necessary.

After the refurbishment has been correctly executed the output of fabrics will be approximately:-

Number of mechanics	850
Speed (average)	170 picks/minute
Worktime/day	22.5 hours
Worktime/month	21 days
Efficiency	75%
Picks per metre	1,700
Months/year	12

$$\text{Annual production} = \frac{850 \times 170 \times 22.5 \times 21 \times 12 \times 0.75 \times 60}{1{,}700} = \underline{21.7 \text{ million metres}}$$

The production would be further increased with 4-shift working to about 30 million metres a year.

When the spare parts are available the looms should be renewed as far as possible by qualified and well experienced mechanics. Time for overhauling should not be longer than 2 years.

The estimated cost of spare parts for Phase II is about 1 million U.S. dollars.

PHASE III (up to 5 years)

In this Phase, extension of the production is envisaged. Large investments will be necessary. The following calculations are based upon instaling 150 modern, double width, weaving machines and operating 4-shifts, together with supporting machinery.

Weaving Machines

Number of machines	150
Type of machines	Gripper or projectile looms
Width	280 cm (double width)
Picks per minute	300
Efficiency	85%
Worktime per year	8,500 hours
Weft density (average)	1,700 picks/metre

Theoretical Output = $\frac{150 \times 300 \times 60 \times 8500 \times 0.85}{1,700}$ = 11.5 million metres/year

But since the looms will produce 2 fabrics (double width) the total theoretical output will be 23.0 million metres/year or 3,450 tons assuming an average fabric weight of 150 gm/metre.

Cone Widing Capacity

Speed	1,000 metres/minute
Worktime/year	8,500 hours
Efficiency	80%
Material	Cotton (Ne 24)
Production/spindle	10.2 tons/year
Number of heads required	3,450/10.2 = 338
Number of machines required	6 machines of 56 spindles each

Warping Machine Calculation

Number of ends	600 (7 warp beams per sized beam)
Speed	800 metres/minute
Efficiency	80%
Worktime/year	8,500 hours
Production/machine	326 million metres/year

Sizing Machine Calculations

Number of ends	4,200 (7 warps beams x 600)
Speed	60 metres per minute
Efficiency	80%
Worktime per year	8,500 hours
Production/machine	24.5 million metres/year

The total cost of Phase III (for 150 looms, 6 cone winding machines, 1 warping machine and 1 sizing machine) is estimated at 14 million U.S. dollars.

The extra production will be 23 million metres or 3,450 tons per year.

If it is decided to replace the old warping and sizing machines,

one additional warping machine and one additional sizer will be required.

10.26 PERSONNEL IN THE WEAVING DEPARTMENT

A list of the actual personnel in the preparation for weaving and weaving departments (by job category) is given in Appendix Wi,

together with proposed staffing after Phase II firstly with 3-shift operation and then with 4-shift operation.

With 3-shift operation it should be possible to reduce the total staff from 1,127 to 829. Alternatively, a 4-shift operation could be implemented with no additional staff as only 1,103 persons would be required.

11. APPRAISAL - PRINTING AND FINISHING

11.1 ANALYSIS OF CURRENT PRODUCTION AND PERFORMANCE

In overall terms, the combined plants of KTL and NNTM are producing at a capacity utilization of less than 35% at the present time, although a two shift system is currently being worked!

Huge variations from month-to-month in the amount of cloth put into work, resulting in periods of intense production activity, preceded and superceded by periods of virtual inactivity and this is, of course, mirrored in large discrepancies in:-

a) average direct cost/metre of cloth produced;

b) low average operator productivity in terms of average metres/operator hour applied.

This is illustrated in the following table:-

	Lowest Production	Highest Production
October 1985 to July 1986		
Production/month (metres)	180,000	935,000
Direct cost/metre (Naira)	1.79	1.51
Production/operative hour (metres)	4.99	28.9
October 1986 to September 1987		
Production/month (metres)	557,000	1,689,000
Direct cost/metre (Naira)	2.81	2.11
Production/operative hour (metres)	14.3	50.5
October 1987 to March 1988		
Production/month (metres)	602,000	1,419,525
Direct cost/metre (Naira)	4.30	1.66
Production/operative hour (metres)	17.9	38.8

Contrary to the general consensus of opinion held by KTL management, this state of affairs is by no means due to lack of spare parts and poor maintenance procedures only; other factors play an equal, if not more important, role than the "spare parts problem".

Most machine stoppages are not due to mechanical/electrical faults, but to lack of goods for processing, although mechanical/electrical faults stops are high as shown in the Downtime Report for 1987 (Appendix P1).

If proper production scheduling and planning on a short-term/machine capacity basis were extant then the "peaks and valleys" syndrome in output levels would be, to a large extent, levelled out. This is not the case.

Maintenance procedures and general housekeeping and cleanliness are very poor. Maintenance appears to consist entirely of breakdown maintenance only; no evidence of a preventive maintenance system has been found. As a result, many of the key production machines are in poor condition.

11.2 ANALYSIS OF PROCESS FLOW DATA, PROCESSING RECIPES AND DYE AND CHEMICAL CONSUMPTION

The process flows are of a "classical" nature and not up-to-date, the processing speeds tend to be very much on the slow side, even takig into account the condition of the processing equipment.

The recipes both for bleaching and finishing are fairly standard, however some recipe optimisation needs to be done, in conjunction with process optimisation, to reduce overall dye/chemical costs, as well as energy inputs.

Printing is a large consumer of dyes and chemicals, here again optimisation of print paste formulations needs to be done, and newer systems of paste formulations, perhaps in conjunction with hydrophillic polymer impregnated cloth, prior to printing, could be applied to reduce the dyestuff cost in this area, yet still retaining the high quality of print, currently achieved.

These optimisation programmes, which could be started straight away, would effect a reduction in dye/chemical costs of approximately 20-25%, savings in energy inputs are estimated at 7-10%.

All data regarding process flows, recipes and dye/chemical costs can be found in Appendices P2 and P3.

11.3 WORKING METHODS, QUALITY OF SUPERVISION AND LABOUR COMPLEMENT

Working methods, as used by operators, exhibit a lot of bad habits and general laxness. On numerous occasions it has been noticed, on various production machines, that cloth has been running with creases and the machine operators have not taken any measures to alleviate or eliminate the cause. As has already been mentioned elsewhere, the equipment and work areas are dirty and disorded - normally it is the machine operators who should be responsible for the cleanliness of both machine and work area.

Based upon the findings in the above paragraph, it can be fairly stated that the quality of supervision, on the shop-floor, is poor, and needs to be greatly improved.

The current labour complement of 253 (working on day shifts 1 and 2) is too high by as much as 20% for this type of operation. It is, however, incorrect to compare this level of staffing under current conditions, with future staffing requirements because:

a) KTL and NNTM will be consolidated, eventually, into one plant;
b) some machinery will be phased out, new machinery bought and other machines refurbished;
c) large increases in production in this area are envisaged, and to cope with this increase, the major part of this plant will be put on to 4-shift working.

Details of the proposed labour complement may be found in Appendix P4.

11.4 RECOMMENDATIONS

In this report, a three-phase programme is recommended, as follows:-

Phase I:

Self-help phase, with no refurbishment of existing machines, but with a small amount of investment required for absolutely essential spare parts;

Phase II

Refurbishment of some existing equipment with gradual phase-out of the KTL facility;

Phase III

Investment in new capital equipment in order to realise full potential of the plan, coupled with consolidation in NNTM.

All capacity calculations are based on a four shift system of working, i.e. 24 hours per day, 7 days per week, for 50 weeks.

11.5 APPRAISAL OF PLANT, EQUIPMENT AND STRUCTURES

STRUCTURAL:

Both at KTL and NNTM the general fabric of the building is fair to good. A lot of space is available both within the plant and without. Transportation lanes and ways are wide with ample room also for in-process stock storage and most transportation ways and lanes within the outside are in fair surfaced condition.

Flooring in the production areas in KTL range from fair, in the grey inspection and finished inspection/packing/baling sections, to poor in the wet-processing area, where walkways are surface pitted and cracked, and where off-drainage of water and other liquors appears non-existent.

At NNTM's plant the overall condition of the production area is fair and more orderly than in KTL. Housekeeping and general cleanliness is, however, in both plants, appalling.

PLANT LAYOUT:

KTL

In terms of plant layout - the machine placing and distribution in KTL are very good.

NNTM

Because so much equipment has been removed/scrapped it is difficult to clearly assess the situation in this department. If all wet processing/finishing is to be concentrated here, in future, a detailed plant layout will have to be worked out prior to any transference of equipment.

APPRAISAL OF MACHINE CONDITION:

A thorough analysis of each machine and piece of equipment has been made and can be found in Appendix P5.

STEAM GENERATION:

KTL

There are two Steambloc Boilers of 10,000kg/ /Hr. steam generation

capacity. These boilers were installed in 1985 and are in reasonable condition.

There is also an older Boiler as stand-by, with a capacity of 30,000 lbs/Hr generation.

It is estimated that the actual capacity of the boilers is probably less than 75% of manufacturer's stated capacity.

NNTM

There are two Cochran Chieftain boilers (dating from the 1960's) installed in NNTM. Both are unfortunately in poor condition, due to:

- tubes blocked off;
- scaling;
- mercury switches burnt-out;
- oil flow control malfunction.

It is doubtful if these boilers are achieving much above 50% of manufacturer's stated capacity. If all processing is transferred here, then one newer steamblock boiler (from KTL) to be installed.

11.6 PRODUCT MIX - PHASE I

The Phase I Product Mix is as follows:-

Product Type	%	Metres/Annum
African Print	53.4	9,600,000
Shirtings	33.3	6,000,000
Baft	13.3	2,400,000
Total Production	100	18,000,000

11.7 TARGET PRODUCTION MIX - PHASE II

The expected target product mix would be as follows:-

Product Type	%	Metres/Annum
African Print	66.7	18,000,000
Shirtings	22.2	6,000,000
Baft	11.1	3,000,000
Total Target	100	27,000,000

The above product-mix breakdown reflects, in production terms, the capacity of the weaving mill after refurbishment, and with the installation of the new looms, whereas the overall balanced capacity of the bleaching/printing would be nearer three times the above mentioned target production figure.

The above mentioned percentages of production show a planned increase in the African Print and Shirtings styles at the expense of Baft. This is commendable, as these styles have a higher profit potential.

11.8 SINGEING MACHINE CAPACITY - PHASE I

The singeing machine, which is in poor condition (the burner jets do not function), is being used only to ipregnate goods for printing, with desize liquor, in this case H_2O_2 + NaOH. There is currently no singeing taking place. Normally a machine of this type, in good condition would be capable of approximately 75,000,000 - 80,000,000 metres/annum of fabric. The machine in its present condition, however, would only be capable of producing approximately 40,000,000metres/annum, but this is still far in excess of what is currently required.

If the printing production is increased up to its full potential a new singeing machine will have to be installed to cope with the demand (this will be in the NNTM plant and not in KTL - see paragraph "Plant Consolidation").

11.9 SINGEING MACHINE CAPACITY - REFURBISHMENT PHASE II

The singer will be transferred from KTL to NNTM's plant, and will be equipped with new burners in order to achieve a good singeing effect. The Nip Rollers will need grinding/recovering, and the free-running roller bearings will need re-balancing.
Bearing gaskets and nip-roller covering will need to be able to withstand hypochlorite in concentrations up to 12 gm/litre available chlorine. The capacity of the machine, after refurbishing would be approximately 55,000,000 metres/annum.

11.10 SINGEING MACHING CAPACITY - PHASE III NEW MACHINE

In this phase the old singeing machine would be replaced by a new unit.

Modern Singeing and Impregnation units operate, under normal con-

ditions, at speeds in excess of 200 metres/minute. A new machine has the potential to produce over 100,000,000 metres/year in 4 shift working - which would be greater than any requirement envisaged at this present time.

11.11 PRESENT MERCERISING CAPACITY AND CONDITIONS: PHASE I

There are two major factors governing the performance of the Benninger merceriser:

- the temperature of the caustic lye in the mercerising process;
- the tension of the cloth in the mercerising baths.

The present capacity of this machine is approximately 20,000,000 metres/annum under current processing conditions, which are:

(a) caustic lye solution in the merceriser is at room temperature (uncooled because the cooling unit is not operational). An optimum caustic lye temperature range would be 16 - 18°C (certainly no higher than 18°C) because between these temperatures the best mercerising effect can be achieved, and higher throughput speeds attained;

(b) the cloth being mercerised is being processed at "low" tension setting on the machine, this should be increased to "medium" tension setting thus allowing that the throughput speed be further increased by implementation as described in points (a) and (b).

It is estimated that the current capacity of the merceriser could be increased by approximately 40% equivalent to 8,000,000 metres/annum to give a total capacity of 28,000,000 metres/annum. The above capacity figure will be included under Phase II as the target capacity for this process, but there is no reason that the parameters cannot be changed at present, other than the linking-up of the caustic lye cooling system into the process. Once the cooling system is operational at say, 17-18°C, then the Beaume degree could be reduced to 23-24° Be thus giving a considerable saving in terms of reduced amount of caustic soda flake used. The overall mercerising effect could also be enhanced and the cloth made even more hydrophillic by the addition of small amounts of wetting agent to the caustic lye - such wetting agents, must of course be capable of withstanding mercerising conditions.

Examples of such products are:-

Precomercin B (C.S.S.R.)
Mercerol Types (U.K.)

11.12 TARGET MERCERISING CAPACITY - PHASE II AND PHASE III

Further to the statements made in paragraph "Present Mercerising Capacity and Conditions", the resultant target mercerising capacity of the Benninger merceriser would be approximately 28,000,000 metres/annum once the points discussed have been implemented.

In Phase III the Mercerising capacity would remain as in Phase II.

11.13 PRESENT OPEN-WIDTH SCOURING CAPACITY - PHASE I

The present open width scouring unit consists of a Goller Fixation Unit (Condition: Fair - Good), 7 open wash-boxes, the first five of which are badly corroded, although the guide and free-runnig rollers are in fair condition, as are the nip-rollers.

The No. 6 wash-box is not corroded, but there are no guide or free-running rollers, but just a take-up roller to the nip. The nip rollers on No. 6 box are in fair condition.

The No. 7 wash-box is not corroded, and the guide and free-running rollers are missing. The nip-rollers are in fair condition but the nip roller motor is missing.

At the exit-end of the machine there are 2 stacks of 10 cans each, which are in fair condition. The current capacity of this machine is approximately 35,250,000 metres/annum. (This takes into account that only five of the wash-boxes are functional.)

It should also be noted that the open-width scouring range is used for both washing-off after desize and washing-off after printing which restricts the printing capacity at the moment to approximately 17,500,000 metres/annum.

This is a bottleneck machine and if the full potential of the printing plant is to be attained the following steps need to be taken:

1. Invest in a new 8 box enclosed "Extracta" type washing range.
2. Refurbish the existing Kyoto washing range by replacing the first five wash tanks and by adding hatch covers to all boxes

(this could be done locally with V4A stainless steel, which needs argon-arc welding). Guide and free running rollers in boxes 6 and 7 should be built-in and a motor on the No. 7 nip should be installed. See Phase II "Target Open-width Scouring Capacity".

11.14 TARGET OPEN WIDTH SCOURING CAPACITY - PHASE II

The target open-width scouring capacity is based on two criteria:

(1) Refurbishment of the existing Kyoto washing range as discussed which would effectively increase the existing capacity from 35,250,000 metres/year to 45,300,000 metres/year.

Note: It is unlikely that the 2 x 10 can stacks would completely dry the cloth at this throughput, but this is not a hindrance because the goods which are being washed-out after desizing will go on to wet/wet impregnation either on the open width bleaching range or to wet/wet cold bleach on the Kusters padder, whereas the print goods (washed-out after print) could go to steaming and/or final stentering.

(2) A new Open-width, 8 box, "Extracta" type washing range needs to be installed.

(a) to acieve the potential printing capacity in Phase II, and

(b) to increase the overall flexibility of the plant.

(see notes under Phase III)

11.15 TARGET OPEN-WIDTH SCOURING CAPACITY - PHASE III

The new open-width washing range would have a target capacity of 60,500,000 metres/annum which would give an overall total open-width scouring capacity of approximately 106,000,000 metres/annum. On the other hand, under current process flow conditions, the capacity of the printing department would be restricted to approximately 53,000,000 metres per year, because of the double passage on the Scourers (once after desize plus once after printing). If, however, the process flows were modified, whereby the desizing would be a hypochlorite impregnation on the Singer, followed by an antichlor in the first impregnation box of the new O.W. bleaching range - then wet/wet impregnation of bleaching chemicals/boil-off chemicals in the 2nd impregnation box of the O.W. bleaching range, then the current process of washing-off after desize could be eliminated. In this way the total printing capacity could be achieved and s till leave flexibility in the form of excess capacity of approximately

12-15% in the C.W. scouring section.

11.16 BLEACHING CAPACITY PHASE I AND II - PRESENT EQUIPMENT

The bleaching capacities in Phases I and II are being discussed together, because no refurbishment of the bleaching facility in KTL, other than normal minimum level maintenance, is envisaged. Therefore in terms of KTL the bleaching capacity will remain the same in both Phases I and II. The current capacity of the J-box rope bleach range (taking into account the very poor condition of the unit) is approximately 24,000,000 metres/year.

Elsewhere in this report, mention has been made in conjunction with Phase II, that other bleaching options exist, in NNTM's plant, ie.

- Jig bleaching, which after refurbishment could produce approximately 38,000,000 metres/year, and
- Cold-pad-batch H_2O_2 bleaching on the Kuster's padder, is also another viable proposition, especially in Phase III to augment the new O.W. bleaching range and introduce new combination desize boil-off and combined bleaching systems.

11.17 BLEACHING CAPACITY PHASE III NEW EQUIPMENT

The plant will now have been turned-over from a rope bleaching to an open-width bleaching plant giving rise to more economical bleaching systems, better utilisation of energy resources, and giving a much higher quality level than at present.

Creased and surface damaged goods due to rope bleaching will be eliminated, width control will be optimal and in the case of goods for printing, the cloth will be more absorbent than at present.

For white goods the degree of whiteness will be at least the same as now, but more likely it will be marginally higher, perhaps by as much as one point on the S.D.C. whiteness comparison scale.

The type of equipment envisaged for bleaching is an open-width roller-bed combination steamer with 2 pre-impregnation units in front of the steamer, followed by an 8-box "Extracta" type washing range. The steamer is capable of holding 1200-1500 metres (KTL styles) of cloth at any one time - and the throughput speed is normally between 220-250 metres/minute for this type of cloth. Capacity of

system is approximately 100,000,000 metres/year.

11.18 PRESENT PRINTING CAPACITY PHASE I

The present printing department is basically functioning with the Stork RD4 machine only. The Stork RD2 can be made to run but can produce only in 4 colours as 8 of the 12 pumps are missing, as are other parts such as air cylinders and missing electrical components. The roller printing unit is not operational. This means that under current conditions only the Stork RD4 can be considered as a viable production machine, the capacity of which is approximately 28,000,000 metres/annum.

11.19 TARGET PRINTING CAPACITY AT KTL PHASES II AND III

The printing would consist of Rotary screen and Roller printed articles.

ROTARY SCREEN PRINTING CAPACITY:

The Stork RD4 8-colour printer has a capacity of about 80,000 metres/24 hours whilst the Stork RD2 12-colour printer has a capacity (after refurbishing) of about 70,000 metres/24 hours. Therefore the total Rotary Screen Printing capacity is about 150,000 metres/24 hours which means that over a year (basis 50 weeks, 7 days, 24 hour working) approximately 52,500,000 metres/year could be printed.

ROLLER PRINTING CAPACITY:

The Kyoto roller printing machine needs refurbishing, whereby the following parts need to be renewed, if this machine is to be brought back into production:

- printing blanket;
- print cylinder needs to be smoothed down due to cracks and corrosion;
- master control panel not functioning;
- one can missing on first stack of drying cans.

Once refurbished, the capacity of the Kyoto printer (with additional stack of 10 cans to complement the existing 2 x 10 stacks in place), would be about 87,000 metres/24 hours or 30,000,000 metres/year. Therefore the total printing capacity of the KTL facility would be in excess of 82,500,000 metres/year.

To achieve these high levels of production on the RD2 and RD4 Rotary Printers, it may be necessary to augment the drying capacity of the dryers by adding one stack of 10 Cans to the exit end (after the Stork drying chambers) of each machine. Before this is done, the correct water evaporation capacity in kgs/hour per chamber must be established (for the standard cloth weights printed), in order that the optimum printing speed can be deduced. It must always be borne in mind that, prints on 100% cotton should not be dried to less than 11% moisture content, and this must be built-in to the optimum speed calculation. The roller printer should not need additional can drying facility.

11.20 PRESENT DRYING/STENTERING CAPACITY - PHASE I

The total drying and stentering plant is split into two physical locations:

- KTL
- Northern Nigeria Textile Mill (NNTM)

In KTL the drying and stentering facilities are as follows:-

Machine	Type & Additional Units	Condition	Capacity/year (metres)
1 Stenter	Farmer Norton Steam Heated + 10 Cans pre-drying unit	Poor	20,000,000
1 Stenter	Mather & Platt, Steam heated + 8 Cans pre-drying unit	Poor	20,000,000
1 Can Dryer	4 x 10 Stack Cans - one stack not operational (Farmer Norton)	Fair	30,250,000
1 Can Dryer	3 x 8 stack Cans (Farmer Norton	Fair	22,700,000
Approximate Stentering Capacity			40,000,000
Approximate Separate Can Drying Capacity			53,000,000

Both stenters are in poor condition but Cans in front of the stenters are in fair condition.

The stenters are both clip stenters which handle cloth up to 50 inches wide.

In the NNTM plant the drying and stentering facilities are as follows:-

Machine	Type & Additional Units	Condition	Capacity/year (metres)
1 Stenter	Farmer Norton 4 Chamber Gas heated clip & pin stenter (Now no pins) max. finished width 152 cm	Poor	25,200,000
1 Stenter	Kyoto 2 Chamber steam heated. Clip Stenter with 2 x 10 stack Can pre-drying unit Max. finished width 180 cm +	Poor	- 0 -
1 Can Dryer	2 x 10 stack drying Cans Wakayama	Fair	20,160,000
1 Can Dryer with pad unit	2 x 10 stack drying Cans Wakayama. Rollers and drive motor missing	Fair Poor	20,160,000
Total Stentering Capacity			25,250,000
Total Separate Can Drying Capacity			40,300,000

When considered together the total stentering capacity of the two plants is approximately 95,500,000 metres/year.

The total separate can drying capacity of the two plants is approximately 93,300,000 metres/year.

So there is ample excess capacity in the Drying/Stentering area.

11.21 DRYING AND STENTERING CAPACITY - PHASE II REFURBISHMENT

In Phase II, the only equipment from the KTL plant which will be refurbished is the Farmer-Norton 4 x 10 stack Can dryng unit. After refurbishment the capacity on this unit will increase by approximately 25% to give approximately 40,300,000 metres/annum drying capacity.

The remaining drying and stentering equipment in KTL will be kept running at its present level of production via minimum level maintenance.

In the NNTM plant the following drying and stentering equipment will be refurbished:

- Farmer-Norton 4 chamber gas heated clip & pin stenter.
- Kyoto 2 chamber steam-heated clip stenter with in-line 2 x 10

stack pre-drying can unit.

- Wakayama 2 x 10 stack drying cans.
- Wakayama 2 x 10 stack drying cans (from pad/dry machine - the padder will be scrapped, because more parts are missing than are present).

The refurbished equipment in NNTM's plant will have the following approximate capacities:

Machine Description	Capacity (metres/annum)
Farmer Norton 4 chamber gas fired Stenter	35,200,000
Kyoto 2 Chamber steam heated clip Stenter with 3 x 10 stack Cans pre-drying unit (This unit will have been extended by 1 x 10 stack Cans)	35,000,000
Total Stentering capacity	70,000,000

This single stack of 10 Cans added to the Kyoto stenter will come from the Wakayama Can drying unit. The other remaining stack of 10 Cans from this unit will be used to increase drying capacity on the Stork RD4.

The remaining Wakayama 2 x 10 stack drying cans (from the pad/dry unit) will be split into two separate single 10 can stacks, one will be added to the Stork RD2, the other to the exit of the Benninger merceriser.

The 4 x 10 stack of refurbished Farmer Norton Cans from KTL would be split, with a single stack of Cans being added to the Kyoto roller printer to increase capacity of this facility.

A further single stack of 10 Cans will be added to the existing 20 Cans at the exit-end of the Kyoto open-width washing range, in order to increase throughput.

The remaining 2 stacks of 10 Cans will be set up as a back-up drying unit.

11.22 DRYING AND STENTERING CAPACITY - PHASE III - NEW EQUIPMENT

After closing-down of the KTL plant, the following drying Cans would be transferred to NNTM's plant:

1 x 10 stack of Farmer-Norton Cans (taken from scrapped Farmer-Norton Stenter in KTL)

1 x 8 stack of Mather & Platt Cans (taken from scrapped M & P Stenter in KTL)

The single stack of Farmer-Norton cans could be, if layout allows, added to Farmer-Norton 4-Chamber Stenter as a pre-dry unit, which would enable the machine speed (and, of course throughput) to be increased by 12-15%. However, this has not been included as new plant layout would have to be worked out before any decision could be taken.

The Phase III capacity of the individual older machines will remain as in Phase II. The new Stenter will, to all intents and purposes, be used solely for:

a) equalizing of goods prior to printing (crease removal, equalising of skewing/bow
b) final finishing prior to packing/despatch.

The capacity of the new 8-chamber pin/clip thermo oil fired Stenter will be approximately 65,000,000 metres/annum.

The Farmer-Norton refurbished gas-fired Stenter will also have plenty of capacity available for equalizing of goods prior to printing, and also for final finishing if and when required.

11.23 PLANT CONSOIDATION TARGET - PHASE II

At some still-to-be-determined future date, the bleaching and printing facilities at KTL and NNTM should be combined into one physical entity, based in NNTM.

It is, however, envisaged that the J-box bleaching range will continue to operate until completely run-down (2-3 years) after which time it will be scrapped and replaced by the open-width bleaching range (will be erected in NNTM).

It would, therefore, be logical to leave the Farmer-Norton and Mather

& Platt Stenters with their respective pre-dryer Can units in KTL.

The old Farmer-Norton 3 x 8 stack Cans should also remain in KTL as back-up for the two Stenters. The 4 x 10 stack Cans should be refurbished and erected as a single unit in NNTM. The above mentioned machines remaining at KTL should only have low-level maintenance, enough to keep them producing at current levels of production, as they will eventually be scrapped (envisaged, 2-3 years from now). Under no circumstances should this equipment be refurbished as, in terms of life-span, the point of no return has long since been surpassed.

Only cloth which is sold as white should be continued to be produced in KTL in this interim period, and the Singeing machine (which will eventually be replaced) should be re-sited in NNTM. This of course means that, all material for printing would be processed exclusively at NNTM in this interim phase and there are various viable process flow options available, e.g:-

OPTION 1

- Hypochlorite desize: (6-8 hrs rotation) — Singer
- Wash-out Hot + Dry: — Kyoto
- Cold pad H_2O_2 Bleach: (6-8 hrs rotation) — Kuster pad and/or Singer
- Wash-out Hot + Dry: — Kyoto
- Equalise on Stenter
- Print on RD4

This option gives a print capacity of 17,500,000 metres/year (due to Kyoto wash range bottleneck).

OPTION 2

- Hypochlorite Desize: (6-8 hrs rotation) — Singer
- Jig wash + bleach with H_2O_2
- Dry on Cans/or Stenter
- Print on RD4

With this Option, the Print capacity is not restricted. All 6 Jigs would need to be used (4 need to be refurbished). 6 Jigs x 6 rounds/24 hours gives 36 Rounds/24 hours. The average bath size is approximately 3,000 metres/round and therefore the Jig capacity is approx-

imately 37,800,000 metres/year. With this option, the Kyoto open-width washer would be washing-off printed goods only and the full capacity of the RD4 Stork printer could be utilized.

Other options of a similar genre are available but trials would be necessary to determine their efficacy on KTL's cloth for African Prints.

The following machines in NNTM should be refurbished:

- Farmer-Norton 4-chamber gas heated clip Stenter
- Benninger merceriser: link-up lye cooler and Kasag caustic reclamation plant.
- Kyoto 2-chamber steam heated pin/clip Stenter with pre-dryer can unit.
- Wakayama 2 x 10 stack Can dryer.
- 4 Farmer-Norton enclosed jigs.
- 1 Stork RD2 rotary printer.
- 1 Kyoto roller printer (if full capacity of the printing department is to be utilized).
- Kusters twin-roll padder.
- Kleinewefer's 8-Bowl calander.

11.24 SPARES REQUIREMENT FOR MAINTENANCE OF EXISTING BLEACHING/DRYING/STENTERING EQUIPMENT - PHASE I

A list of spare-parts has been compiled for the existing bleaching/drying/stentering ranges in KTL, and gives the number of each itemized spare-part/machine to keep the machines running at more-or-less their present performance, with minimum level maintenance inputs, for 2-3 years. After this time, it is envisaged that the machines will be phased out. (Appendix P6).

11.25 SPARES REQUIREMENT FOR REFURBISHING OF EXISTING EQUIPMENT - PHASE II

After an in-depth analysis of machine condition a list of spares per machine has been drawn up, for those machines which will be refurbished. This list, which details each part required, and the number of each item required, can be found in Appendix P7.

The figures given in the first column refer to the requirement for refurbishing, whereas the figures in brackets, in the second column, refer to the minimum number of spares required as future replacements (for stock).

11.26 CAPITAL INVESTMENT FOR NEW EQUIPMENT - PHASE III

The following items of capital equipment would be required for Phase III machinery.

1 "Extracta" type covered 8-box open-width washing range for scouring and print washing.

1 Open-width bleaching range consisting of:

2 Impregnation units, 1 rollerbed - combisteamer, 8 "Extracta" type covered open-width wash boxes.

1 Singeing machine with adjustable burners, quench box with nip-rollers and batching unit.

1 8-Chamber, pin and clip, thermo-oil heated Stenter frame supplied with "KONUS" type heater and circulation pumps.

As the Company has no chemical laboratory facilities at present, a list of laboratory equipment and reagents has been drawn up, and can be found in Appendix P8.

12. MANPOWER AND TRAINING

12.1 Summary

The training department is well equipped to undertake the necessary training and re-training courses to raise and keep the operators and management know-how to the required level.

The operator training will be the main objective of the centre, as a service to improve production, productivity and quality. It, therefore, should belong to the Production department rather than to the Personnel department as it is now. This would also ensure an improved feedback from the various sections to further improve and - if necessary - to modify the course contents.

Although the present staff of the centre seems to be capable to undertake the various courses, the only persons permanently assigned to the centre should be the training manager and a secretary. The prospective training instructors should be selected from the production department and undergo a special training instructor programme. Between the operator training programmes in their special fields, they have to fulfill their normal functions in the factory.

The present wage and salary system is based on a flat rate combined with seniority. Especially jobs which permit a performance evaluation should be based on an output and quality related incentive scheme.

Promotion by seniority should be abondoned and a system based on merits has to be installed. The course contents and course manuals should be reviewed and updated. The execution of the courses should consider more the rules of a modern analytical method training.

Thorough objective testing and screening of applicants should be applied prior to any training.

Disciplinary measures have to be taken if trainees and operators are executing their work not in conformity with the rules laid out and explained during the training.

A tight performance control and regular assessment of all personnel - from casual workers to top management - should be initiated with immediate effect. The "weeding out" of non or low performances as well as promotion of the high performers is an urgent necessity.

It is strongly advisable to secure the assistance of international experts to implement the recommended steps to be taken.

12.2 General

Training manuals and job desriptions for the various jobs were once prepared but unfortunately a complete set covering all operator tasks was not shown. However, the fragmented manuals indicate that the latest developments in training are not included. A thorough revision and updating is required. Emphasis should be laid upon:

- analytical training methods
- incorporation of target timers
- development and usage of audio-visual training aids
- course planning and control
- selection and screening of candidates
- clearly defined job descriptions

The installed machines in the training centre are well kept. They reflect the ability of the instructors to set and keep the machines according to the manufacturers instruction.

The training centre is capable to execute simultaneously courses for weaving and spinning. In addition courses not requiring specific machinery can be run at the same time in the lecturing rooms.

12.3 Training courses

Various courses are given to KTL personnel. The area of training is not restricted to productivity and quality training but includes courses in administration, first-aid, literacy, etc.

The conditions of the equipment, house keeping, working morale and quality of goods produced command that in the forseeable future any training - and re-training should be restricted to activities improving the production situation. As nearly all operators need to be re-trained, a re-training in shifts should be considered to decrease the time span until the factory is again in an acceptable and proper condition.

Training manuals for the main personnel groups (weavers, tacklers, spinners, drafters, etc.) are available. Although they are well elaborated, they do not consider the latest development in "analytical method training" procedures. No audio-visual training equipment is installed. It is, therefore, advisable to review and improve the exsiting manuals and incorporate means for the extensive usage of audio-visual training aids.

12.4 Training organization

The training centre of KTL is well designed and equipped. The staffing is presently:

No.	Names	Department	Title
1	Andrew M. Isah	Personnel	
2	Yakubu Pantuvo	Weaving	Technical Instructor
3	M. Abdul Abana	"	" "
4	Michael Dangali	"	Operative off-the-job Instructor
5	Tarama Jangalo	"	" " " " "
6	Gregory Kasheyim	"	" on " " "
7	Godwin Gotus	"	" on " " "
8	James O. Omilade	Spinning	Technical Instructor
9	Andrew Abdulahi	"	Operative Instr. Blowroom Open end
10	Godfrey O. Ogbanje	"	" " Ring Spinning
11	Nicholas C. Iyalla	"	" " " Doff.
12	Benedict E. Okih	"	" " Speedframe
13	Godwin A. Aklozi	"	" " Carding
14	Ibikunle Seriki	Mechanical	On-the-job Instructor
15	Muazu Maiwada	Electrical	" " " "
16	Wesley A'aron	Polypropylene	" " " " Weaving
17	Bitrus Audu	"	" " " " Winding

Their technological knowledge seems to be adequate. However, it is recommended that, in future, only the training manager and a secretary should be permanently assigned to the centre. The instructors for the various courses should work in the production departments and only for the duration of the courses being assigned to the Training centre. This organizational change should ensure a better awareness of the actual conditions in the production and subsequently changes in course content, course duration, etc. Furthermore, the interlinkage between training and production will be strengthened. As the main target of training is to increase productivity, quality and production, this department should report to the AGM Production.

KTL

INVENTORY OF MACHINES IN NO. 1 MILL - SPINNING

APPENDIX S1

QUANTITY	MACHINE	MAKER	MODEL	DATE	REMARKS
2	Blowroom lines each comprising:- 4 Blenders 1 Step cleaner 1 Crighton opener 1 Airsteam cleaner with beater 2 Scutchers	Platt	540/550	1967 1963	5 Cleaning points. Many inclined and evener lattices and feed rollers need repairing or replacing. New grid bars needed around Crichton. Evener rollers need new leathers. Spare parts shortage. Auto-doff not working.
35	Cards	Platt	600	1972	Card wire and some undercasings in poor condition.
16	Drawframes	Platt	Globe	1963	Poor condition but basically sound, could be reconditioned
7	Speedframes	Platt	MS2 MK3	1965	Some drafting rollers not true
49	Ringframes	Platt	Super Spinner	1963	Rings need renewing. Travelling cleaners mostly not working and in a dilapidated state.
5	Rotor Spinner	Platt	93	1977	One machine has never run. Shortage of parts. Rotors of various specifications being used together. Many rotors in bad condition. Wire and pinned heaters being used.

KTL

INVENTORY OF MACHINES IN NO. 2 MILL - SPINNING

APPENDIX S2

QUANTITY	MACHINE	MAKER	MODEL	DATE	REMARKS
2	Blowroom lines similar to Mill 1	Platt	K646	1961	Condition similar to Mill 1
51	Cards	Platt	663	1961	Slow running cards with doffer combs, some with flexible wire. All wires in poor condition. Not worth considering in future plans.
14	Drawframes	Platt	Globe	1963 1969	Basically sound. Shortage of spares. Could be re-conditioned.
8	Speedframes	Platt	MS2 MK2	1960/ 1964	In poor condition. Not worth considering in future plans
60	Ringframes	Platt	MR3 MK2	1961	In poor condition. Mostly with SKF PK220 drafting and skewer bobbin holders. 13 machines with PK211 drafting.
6	ringframes	Platt	Super Spinner	1967	All rings reed changing.

KTL

INVENTORY OF MACHINES IN NO. 3 MILL - SPINNING

APPENDIX S3

QUANTITY	MACHINE	MAKER	MODEL	DATE	REMARKS
2	Blowroom lines	Platt	N201E	1969	Memmingen Blender. Six-step cleaner. Course opener. Airflow cleaner Hopper feeder. Fine opener. 2 Lap end.
33	Cards	Platt	600	1969	All Cards need reclothing. Some undercasings need replacing. General reconditioning necessary.
20	Drawframes	Platt	Globe	1969	Poor condition. Shortage of parts. Basically sound and could be satisfactory with reconditioning.
10	Speedframes	Platt	MS2 MK3	1969/ 1971	Fairly good but some steel drafting rollers need attention. Broken-end stop motions not working.
99	Ringframes	Platt	Super Spinner	1969	Rings need replacing. Travelling cleaners are in very poor condition, the majority not working

SPINNING EQUIPMENT, PRODUCTION AND MANNING

EQUIPMENT	EXP. EFF. %	EXPECTED PRODUCTION KG/DAY	WASTE % NON-USABLE/ USABLE	FLOOR SPACE	OPERATIVES 3-SHIFTS	POWER KVA
3 Blowrooms	80	47,127	7.0/0.5	3,023	44	326
68 Lapfed Type 600 Cards	87	25,728	3.0/1.0	1,434	60	308
50 Lapfed Conventional Cards	87	7,344		1,940		300
25 x 2 Globe Drawframes	75	54,788	0.25/0.5	1,809	43	110
17 MS2 MK III Speedframes	75	30,600	0.25/0.5	1,897	69	158
8 MS2 MK II Speedframes	75	9,199		600		36
154 Platt Super Spinner Ringframes	90	27,750	1.0/0.5	7,374	288	1,955
60 Platt MR 3 Ringframes	90	9,446		2,147		762
5 Rotor Spinners	95	3,243	0.5/0.5			

Total non-usable waste: 11.5%

Total reprocessable waste: 3.0%

KTL PLANNED AND ACTUAL MAINTENANCE APPENDIX S5

ITEM	PLANNED CHANGE	LAST CHANGED
Card wire	2 years	1979
Card flats	2 years	1979
Cardmaster tops	-	Only when damaged
Scraper blades	1 year	Only when damaged
Drawframe cots	9 months	1987
Roving cots	9 months	1987
Ringframe cots	9 months	1987
Spindle tapes	-	When broken
Spinning rings	2 years	1977
Travellers	Weekly	
Ring spindles	-	Never
Top/Bottom aprons	3 months	1987

KTL TESTING INSTRUMENTS APPENDIX S6

MATERIAL	TEST	INSTRUMENT
Raw Cotton	Micronaire value	'Wira' cotton fineness meter
	Shirley analysis	Shirley analyser
	Moisture content	Moisture Meter
	Staple length	Manual
Lap	Yd/Yd lap check	Weighing balance
	Lap gross check	Weighing balance
	Shirley analysis	Shirley analyser
	Moisture content	Moisture meter
Card Web	NEP Count	
Sliver	Sliver hank	Wrapping block
	Regularity	Uster tester
	Moisture content	Moisture meter
Roving	Roving hank	Wrapping block
	End break check	Stop watch
	Regularity	Uster tester
	Moisture content	Moisture meter
Yarn	Yarn count	Yarn wrapping m/c
	End break check	-
	Regularity	Uster tester
	T.P.I.	Twist tester
	Single yarn strength test	Single yarn strength tester
	Speed test	Tachometer
	Waste Control	-

KTL QUALITY STANDARDS APPENDIX S7

TEST	KTL STANDARD	REMARKS
RAW COTTON		
1. Trash content (Shirley Analyser)	Nigerian 5.0% max	Very high (bad ginning)
	Cameroun 2.6% max	Satisfactory
	Chad 4.3% max	Fairly high
BLOW ROOM		
2. Total lap weight	± 0.5 kg on 33.3 kg	Should be ± 0.25 kg
3. Weight/unit length (2 yard lengths)	4.0% CV max	Should be 2%
CARDING		
4. Nep count in web	15/100 cm^2 max	Should be 5 - 6
5. Weight/unit length	.21gm/5 yards	-
6. Sliver regularity	% u	Should be 3.5%
DRAWFRAMES		
7. Weight/unit length	± 1.36%	Satisfactory
8. Sliver regularity	4.5% u (max)	Should be 3.0%
ROVING		
9. Weight/unit length	± 1.85%	Satisfactory
10. Regularity	7.0% u (max)	Should be 5.0%
YARN		
11. Count	± 3%	Satisfactory
12. Regularity - Ne 10.5	17.8% u (max)	Waste yarn
Ne 13	16.5% u (")	All far too high
Ne 20	16.8% u (")	
Ne 24	17.2% u (")	
13. Strength (LSCP)-Ne 10.5	1200 (min)	Could be improved
Ne 13	2000 (")	given better settings
Ne 20	2000 (")	and maintenance
Ne 24	2000 (")	
14. Extensibility (Single thread)	1.5% (min)	Very low will cause problems in weaving

KTL ACTIVITIES DURING PHASE I APPENDIX S8

ACTIVITY	TIME TO COMPLETE
BLOWROOM	
Thoroughly clean all calender rollers, cages (inside and out), feed rollers and pedals	2 months
CARDS	
Remove undercasings and segments, clean, replace and reset.	
Reset feed rollers, taker ins, flats or segments, doffers and doff-masters.	2 months
DRAWFRAMES	
Grind all top roller cots and replace as necessary.	1 month
ROVING FRAMES	
Grind all top roller cots and replace as necessary.	1 month
RING FRAMES	
Service top rollers.	3 months
Replace 4,000 rings on the machines with the oldest rings.	2 months

At the same time all machines should be thoroughly cleaned.

If possible, this work should be supervised and checked by an ex-patriate consultant.

KTL — LIST OF PERSONNEL - SPINNING — APPENDIX S9

JOB CATEGORY	ACTUAL					PROPOSED									
						3 - SHIFT					4 - SHIFT				
	D	1	2	3	Tot	D	1	2	3	Tot	D	1	2	3	4	Tot
Manager	1				1	1				1	1					1
Deputy Manager	1				1	1				1	1					1
BLOWROOM																
Maint/Supervisor(BR&C)	1				1	1				1	1					1
Prod.O/Looker (BR&C)		2	2	2	6		2	2	2	6	2	2	2	2	2	8
Mechanics		2	2	2	6		2	2	2	6		2	2	2	2	8
Feeders		5	5	5	15		4	4	4	12		4	4	4	4	16
P.I.V.	1				1	1				1	1					1
Oiler	1				1	1				1	1					1
Cleaner	6				6	6				6	6					6
Lap Weigher		3	2	3	8		2	2	2	6		2	2	2	2	8
Spare	2	1	1	1	5	2	1	1	1	5	2	1	1	1	1	6
TOTAL BLOWROOM	11	13	12	13	49	11	11	11	11	44	11	11	11	11	11	55
CARDS																
Mechanics	2	3	3	3	11	2	2	2	2	8	2	2	2	2	2	10
Card Tenters		6	9	8	23		10	10	10	30		10	10	10	10	40
Lap Carries		2	3	2	7		2	2	2	6		2	2	2	2	8
Strippers		2	2	2	6	2				2	2					2
Maint.O/Looker	2				2	2				2	2					2
Flat Maintenance		1	1	1	3	1				1	1					1
P.I.V.	1				1	1				1	1					1
Oiler	1				1	1				1	1					1
Cleaner		2	2	2	6											
TOTAL CARDS	6	16	20	18	60	9	14	14	14	51	9	14	14	14	14	65
DRAW FRAMES																
Draw Tenters		8	7	7	22		18	18	18	54		18	18	18	18	72
Sliver Carriers		1	1	1	3		1	1	1	3		1	1	1	1	4
Spare Operatives (C& DF & SF)		6	6	6	18		6	6	6	18		6	6	6	6	24
TOTAL DRAWFRAMES	-	15	14	14	43	-	25	25	25	75	-	25	25	25	25	100

	D	1	2	3	Tot	D	1	2	3	Tot	D	1	2	3	4	Tot
ROVING																
Tenters		9	11	10	30)		24	24	24	72		24	24	24	24	96
Speed Doffers		3	1	2	6)											
Roving Layers		4	2	3	9)											
Prod.Supervisor(BR-RF)	1	2	2	2	7	1	2	2	2	7	1	2	2	2	2	9
Mechanics	2	2	2	2	8	2	2	2	2	8	2	2	2	2	2	10
Oilers	2				2	1				1	1					1
Cleaners	2				2	2				2	2					2
Roving Waste m/c		2	2	1	5		2	2		4		2	2			4
TOTAL ROVING	7	22	20	20	69	6	30	30	28	94	6	30	30	28	28	122
SPINNING																
Sweepers (C-RF)		4	6	6	16		3	3	3	9		3	3	3	3	12
Doffers (5 teams)		23	25	30	78		30	30	30	90		30	30	30	30	120
Head Doffer		3	2	5	10		5	5	5	15		5	5	5	5	20
Spinners		47	45	40	132		74	74	74	222		74	74	74	74	296
Overlookers	2	4	5	4	15	2	2	2	2	8	2	2	2	2	2	10
Asst. Manager		1	1	1	3		1	1	1	3		1	1	1	1	4
Mechanics	1	3	3	3	10	1	2	2	2	7	1	2	2	2	2	9
Supervisor		2	2	1	5											
Oiler	1				1	1				1	1					1
Spindle Setter		2	2	2	6		2	2	2	6		2	2	2	2	8
Ring Taper		1	1	1	3		2	2	2	6		2	2	2	2	8
Cleaner	1				1	2				2	2					2
Electricians	2	2	2	2	8	2	2	2	2	8	2	2	2	2	2	10
TOTAL SPINNING	7	92	94	95	288	8	123	123	123	377	8	123	123	123	123	500
QUALITY CONTROL																
End Break Checker	2				2	2				2	2					2
Uster Operator	1				1	1				1	1					1
Lap Checker	1				1	1				1	1					1
Wrappers	1				1	1				1	1					1
TOTAL QUALITY CONTROL	5				5	5				5	5					5

CLERICAL	D	1	2	3	Tot	D	1	2	3	Tot	D	1	2	3	4	T
Supervisor	1				1	1				1	1					
Overlooker	1				1	1				1	1					
Waste Baler		4	4	4	12		2	2	2	6		2	2	2	2	
Waste Collector		5	5	5	15		4	4	4	12		4	4	4	4	1
Head Waste Collector		1	1	1	13		1	1	1	13		1	1	1	1	
Sample Collector	1				1	1				1	1					
Production Clerk	6				6	6				6	6					
Roller Grinder		1	1	1	3		1	1	1	3		1	1	1	1	
TOTAL CLERICAL	9	11	11	11	42	9	8	8	8	32	9	8	8	8	8	4
GRAND TOTAL	47	169	171	171	558	50	211	211	209	681	50	211	211	209	209	89

KTL

LIST OF PERSONNEL - WEAVING DEPARTMENT

APPENDIX W1

JOB CATEGORY	ACTUAL					PROPOSED AFTER PHASE III										
	3-shift					3-shift					4-shift					
	D	1	2	3	Total	D	1	2	3	Total	D	1	2	3	4	Total
A Weaving Preparation	40	89	89	89	307	4	83	83	83	253	4	83	83	83	83	336
B Drawing & Knotting	17	6	6	6	35	15	7	7	7	36	21	7	7	7	7	49
C Weaving	17	244	244	244	749	5	164	164	164	497	5	164	164	164	164	661
D Greyroom	3	15	15	3	36	1	14	14	14	43	1	14	14	14	14	57
Summary	77	351	354	354	1127	25	268	268	268	829	31	268	268	268	268	1103
A - Preparation Section																
1 Deputy Manager	1	-	-	-	1	1	-	-	-	1	1	-	-	-	-	1
2 Supervisors	1	1	1	1	4		1	1	1	1		1	1	1	1	4
3 Overlookers	3	5	5	5	18											
4 Spooler Operative	10	14	14	14	52											
5 Pirn Winder	-	8	8	8	24		12	12	12	36		12	12	12	12	48
6 Cone Winder	-	8	8	8	24		15	15	15	45		15	15	15	15	60
7 Warpers	-	3	3	3	9		6	6	6	18		6	6	6	6	24
8 Sizers	-	6	6	6	18		8	8	8	24		8	8	8	8	32

	D	1	2	3	Sum	D	1	2	3	Sum	D	1	2	3	4	Sum
9. Yarn Services	6	4	4	4	18		5	5	5	15		5	5	5	5	20
10. Tablemen (B.C.)	-	6	6	6	18											
11. Truckmen	-	2	2	2	16		2	2	2	6		2	2	2	2	8
12. Mechanics	15	4	4	4	27		8	8	8	24		8	8	8	8	32
13. Sweepers	-	4	4	4	12		3	3	3	9		3	3	3	3	12
14. Starter Makers (B.C.)	-	2	2	2	6											
15. Oilers	-	1	1	1	3		1	1	1	3		1	1	1	1	4
16. Weft Collectors	-	2	2	2	6		2	2	2	6		2	2	2	2	8
17. Empty Pirn Collectors	-	4	4	4	12		4	4	4	12		4	4	4	4	16
18. Battery Fillers	-	4	4	4	12		4	4	4	12		4	4	4	4	16
19. Pirn Stripper	-	3	3	3	9		3	3	3	9		3	3	3	3	12
20. Creelers	-	2	2	2	6		2	2	2	6		2	2	2	2	8
21. Sizer Mixers	-	2	2	2	6		2	2	2	6		2	2	2	2	8
22. Yarn Twisters	-	2	2	2	6		2	2	2	6		2	2	2	2	8
23. Yarn doublers	-	1	1	1	3		1	1	1	3		1	1	1	1	4
24. Waste Collector	3	-	-	-	3		-	-	-	3		1	1	1	1	4
25. End break checkers	-	1	1	1	3	2				2	2					2
26. Production Clerks	1	-	-	-	1	1	1	1	1	4	1	1	1	1	1	5
Summary	20	89	89	89	307	4	83	83	83	253	4	83	83	83	83	336

	D	1	2	3	Sum	D	1	2	3	Sum	D	1	2	3	4	Sum
(b) Drawing & Knotting																
1. Overlooker	1				1	1				1	1					1
2. Mechanic	-	1	1	1	3	1	-	-	-	1	2	-	-	-	-	2
3. Drawers	14				14	10				10	14					14
4. Knotters		4	4	4	12		6	6	6	18		6	6	6	6	24
5. Cleaners	2				2	2				2	3					3
6. Reed Repars		1	1	1	3	1	1	1	1	4	1	1	1	1	1	5
Summary	17	6	6	6	35	15	7	7	7	36	21	7	7	7	7	49
(c) Weaving Section																
1. Manager	1				1	1				1	1					1
2. Deputy Managers	2	1	1	1	5		1	1	1	3		1	1	1	1	4
3. Supervisors	1	3	3	3	10											
4. Overlookers	1	26	26	26	79		24	24	24	72		24	24	24	24	96
5. Mechanics		6	6	6	18											
6. Head Weaver		5	5	5	15											
7. Weavers		142	142	142	426		72	72	72	216		72	72	72	72	288
8. Spare Weavers		24	24	24	72		11	11	11	33		11	11	11	11	44
9. Battery Fillers		3	3	3	9		14	14	14	42		14	14	14	14	56
10. Weft Carrier		4	4	4	12		4	4	4	12		4	4	4	4	16
11. Beam Gaiter		4	4	4	12		16	16	16	48		16	16	16	16	64
12. Oiler/Cleaner		12	12	12	36		6	6	6	18		6	6	6	6	24
13. Sweepers		5	5	5	15		4	4	4	12		4	4	4	4	16
14. Electrician	2	2	2	2	8		2	2	2	6		2	2	2	2	8
15. Fitters		4	4	4	12		8	8	8	24		8	8	8	8	32
16. Maintenance	8	-	-	-	8											
17. Production	2	2	2	2	8	1	2	2	2	7	1	2	2	2	2	9
18. End Break Checkers	3	-	-	-	3	3	-	-	-	3	3	-	-	-	-	3
Summary	17	244	244	244	749	5	164	164	164	497	5	164	164	164	164	661

	D	1	2	3	Sum	D	1	2	3	Sum	D	1	2	3	4	Sum
(D) Greyroom																
1. Overlooker	1	1	1		3		1	1	1	3		1	1	1	1	4
2. Cloth Inspector		3	3		6		5	5	5	15		5	5	5	5	20
3. Cloth Sewer		2	2		4		2	2	2	6		2	2	2	2	8
4. Cloth Cropper	1	4	4	-	9		3	3	3	9		3	3	3	3	12
5. Cloth Cutter		3	3	3	9											
6. Cloth Services		1	1		2		2	2	2	6		2	2	2	2	8
7. Sweeper		1	1		2		1	1	1	3		1	1	1	1	4
8. Production Clerk	1				1	1				1	1					1
Summary	3	15	15	3	36	1	14	14	14	43	1	14	14	14	14	52

KTL

PRINTING/FINISHING DEPARTMENT - DOWN TIME REPORT 1987

APPENDIX P1

MACHINE	No Goods	No Inst.	No Men	No Steam	No Water	No Elect.	No Screen	Heating Up	Change Water	Sewing Cuts	Mech. Fault	Elect. Fault	Start Up	Closing	No Waggon	No Dyes	Total Down Time
Plaiters (6)	92445	6	296	18		40		2	2	505	895	156	198	100	126	10	94799
Singeing m/c	1259	49	69	164	9	13		63	10	60	232	70	39	68	38	84	2237
Bleach Range	611	16	8	367	8	18	3	95	59	42	248	88	71	22.7	2.6	226	1774.3
F.N. Stenter	463	2	0.2	47		19	2	25	30	255	321.3	113	16		12	6.7	1372.5
Damper	1936		12	6			3	4	2	7	34	13	2	0.8	10	0.9	2031
Folder	3086		121			55											3262
Calender 1-3	9335	5	3	3		44	4	4	6	60	215	1958	8	0.9	48	6.4	11702
Ranges 1 & 2	1695	2	16	120		35	6	10	59	93	221	168	14	13.1	20	165	2637
M&P Stenter	470	3		35		35		8	4	226	166	130	19	1	3	5.2	1105
Water Mangle	1910					10		1	1	42	8		5		5	2.1	1984
Kuster Padder	3629	25									3						3656
Baker	2490	14	28	58				21	0.5	5	19	11	11	13	91		2762
Calender	1591		112	2		2	2	0.6		3	1681	2	6	4	5	0.6	3412
R.S. Printer	1356	120	38	119	0.6	38	74	18	18	19	21	11	59	47	25	108	2072
Steamer II	2281	4	131	85		14		8		20	91	9	14	4	19	23	2727
F.N. Stenter	799	67	3	10		72	1	117	6	11	496	15	60	20		6	1684
O.Washer	877	18	2	184	0.2	4	14	251	112	18	37	23	14	13	19	0.8	1588
Mercerizer	1961	173	21	130		42	3	31	17	38	81	38	6	7		21	2568
Jigs	8969	273		25		2					25	4			42	2	9342
Stork 1											4000						4000
Steamer 1												4000					4000
Calender 1												4000					4000
C.R. Printer	4000																4000
Nakayama Printer											4000						4000
Pads & Cans											4000						4000

KTL PROCESSING PROCEDURES APPENDIX P2

(a) PRINT CLOTH - 100% cotton, 120g/sqm, 145.3g/lm, grey width 128cm, finished width 119cm.

MACHINE	PROCESS	M/MIN	M/HOUR
Singer/Desizer	Singeing & Desizer	30	1800
Washer	Washing	31	1830
Scouring/Bleaching m/c	Scouring & Bleaching	26	1560
Stenter Dryer	Drying & Open To Width	32	1890
Mercerizer	Mercerization	30	1800
Wakayama Driver	Drying	28	1680
F/N Stenter	Naphtolation	30	1800
Printer (Stork)	Printing	36	2160
Steamer	Steaming	26	1560
Washer	Washing	31	1830
F/N Stenter	Stenter to Width & Apply A Finish	30	1800
Calender	Calendering	35	2100
Plaiter	Plaiting	40	2400
Hand Fold	Hand Fold Stitching	-	-
Baler	Baling	-	-

(b) BAFT 2 - 100% cotton, 168g/sqm, 169g/lm
grey width 99cm, finished width 69cm.
BAFT 3 - 100% cotton, 168g/sqm, 169g/lm
grey width 124.6cm, finished width 121cm

MACHINE	PROCESS	M/MIN	M/HOUR
Range Dryer	Drying & Starching	45	2700
Calender	Calender	35	2100
Plaiter	Plaiting	40	2400
-	Hand Folding	-	-
-	Stitching	-	-
Baler	Baling	-	-

(C) SHIRTING - 100% cotton, 139g/sqm, 130g/lm
grey width 96cm, finished width 90cm

MACHINE	PROCESS	M/MIN	M/HOUR
Scouring & Bleaching Range	Scouring & Bleaching	26	1560
M & P Stenter	Stentering to Width & Applying A Finish	36	2130
Calender	Calendering	35	2100
Plaiting M/C	Plaiting	40	2400
	Hand Folding	-	-
	Stitching	-	-
Baler	Baling	-	-

KTL

PROCESSING RECIPES

APPENDIX P3

(a) Desizing using enzyme

Desizing Machine, capacity 600 litres stock tank.

CHEMICALS	QUANTITY	QUANTITY/LITRE
(1) Biolase Pcl	1.5 litres	2.5cc
(2) Common Salt	9 kg	15 gm
(3) Erkantol NA (Wetting)	1.2	2cc

Processing Instructions

No. of Pieces : 1

Total metres: 3000

Desizing with enzyme at 60°C

Pick up = 95%

Batch-up, rotate for 3 hours

Wash and dry

(b) Continuous scouring of print cloths and shirtings

Farmer-Norton J-Box, 725 litres capacity

CHEMICALS	QUANTITY	QUANTITY/LITRE
(1) Caustic Soda (48°Be)	61 litres	85cc
(2) Erkantol NA	2.9 litres	4cc
(3) H_2O_2 (50%)	10 litres	14cc

Processing Instructions

No. of Pieces: 1

Total metres: 12000

Saturation temperature 60°C

Pick up 100%

Heated under pressure in a J-Box at about 125°C for 2½ hours.

(c) Continuous Bleading Of Shirtings

Farmer-Norton, J-Box, capacity 725 litres.

CHEMICALS	QUANTITY	QUANTITY/LITRE
(1) H_2O_2 (50%)	19.5 l	27cc
(2) Sadium Silicate (50° Be)	13 l	18cc
(3) Sodium Carbonate	543 gm	0.75 gm
(4) Uvitex 2BT	1.1 kg	1.5 kg
(5) Mg SO_4	36 gm	0.05 gm

Processing Instructions

No. of Pieces: 1

Total metres: 12000

Saterator temperature 60°C

Pick up 100%

Heated Under pressure in a J-box at about 120°C for 2 hours.

(d) Naphtolation Prior to Printing with An Azoic Base

Farmer-Norton Stenter, capacity 400 litres.

CHEMICALS	QUANTITY	QUANTITY/LITRE
(1) Naphtol AS	80 kg	20 gms
(2) Naott (24°Be)	60 litres	15 cc
(3) Remol AS-N (Wetting)	8 kg	2 gm

Processing Instructions

No. of Pieces: 8

Total metres: 35000

Pad Naphtol AS at 80% pick-up, dry in the oven and batch.

Temperature at impregnation 90°C

Gm/kg of material (add on) = 20gm/kg x 80% = 16 gm/kg.

(e) Printing of Diazotised Primary Aromatic Amine

Printing capacity: 1500 kg

CHEMICALS	QUANTITY KGS	QUANTITY/KGS
(1) Fast Red B Base	15	10 gm
(2) Ofnapon ASN	3	2 ml
(3) Hydrocliloric Acid (20^{V}Be)	25.5	17 cc
(4) Sodium Nitrite (98%)	7.5	5 gm
(5) Sodium Acetate	12	8 gm
(6) Acetic Acid (50%)	30	20 ml
(7) Polyprint (5% stock)	52.5	700 gm

Processing Instructions

No. of Pieces: 15

Total metres: 35,000

Print Fast Red B Base alongside Reactive dyestuff

(eg Bocion Yellow P 3R)

Print - dry - Soda print (to neutralise excess Hcl) - dry - steam - wash

(f) Reactive Dyestuff Printing

Printing, capacity 2400 kg

CHEMICALS	QUANTITY KGS	QUANTITY/KGS
(1) Procion Yellow P 35	72	30 gm
(2) Procion Orange P2R	24	1 gm
(3) Sodium bicarbonate	60	25 gm
(4) Polyprint (5% stock)	84	700 gm
(5) Matexil WA - KB (Wetting)	24	10 gm

Processing Instructions

No. of Pieces: 24

Total metres: 35,000

Printing of reactives alongside diazotised aromatic primary amine, and on naphtol. As prepared cloth. Print - dry - soda print (to neutralise excess Hcl) - dry - steam - wash.

(g) Dyeing of Shirtings using Reactives

Jig Dyeing M/C, capacity 550 litres.

CHEMICALS	QUANTITY	QUANTITY/LITRE
(1) Procion Turg Blue H - A	6.6 kg	12 gm
(2) Common Salt	16.5 kg	30 gm
(3) Sodium bicorlonate	8.25 kg	15 gm
(4) Erkantol NA (wetting agent)	1.1 l	20cc
(5) Industrial detergent	0.275 l	0.5cc

Processing Instructions

No. of Pieces: 1

Total metres: 2,000

Produce 3% shade of turquoise blue, 2000 metres (110 gm/metre) of bleached shirting at LR = 2.5:1

Dye at 60°C adding (3 g/l) salt over a 40 minute period before adding sodium bicarbonate 15 gm/l. Dye for a further 20 minutes. Rinse, soap, rinse and dry.

(h) Starching/Softening Finishing Application of Dyed & Printed Articles:

Farmer-Norton, capacity 650 litres.

CHEMICALS	QUANTITY KGS	GRAMS/LITRE
(1) Fixa prect CPN	6.5	10
(2) Perustol UVB	2.6	4
(3) Uvitex 2BT (for articles with high prop. of white)	1.3	2
(4) Fumexol AS (anti-foam)	0.325	0.5

Processing Instructions

No. of Pieces:

Total metres: 6,000

Cold Pad impregnate washed printed articles at 80% pick up. Add on 10 gm/kg x 80% = 8 gm/kg material.

KTL LIST OF PERSONNEL - PRINTING APPENDIX P4

JOB CATEGORY	ACTUAL					PROPOSED 4-shift System					
	D	1	2	3	Tot	1	2	3	4	Tot	
Manager	1				1	1				1	)
Supervisory	4	3	3		10	1	1	1	1	4	) (1)
PRINTING UNIT:											)
Overlookers		1	1		2	1	1	1	1	4	)
Printers		1	1		2	3	3	3	3	12	) (2)
Operatives		7	7		14	4	4	4	4	16	)
DYEING:											)
Overlookers			1		1						)
Operatives		4	4		8	2	2	2	2	8	) (3)
PREPARATION:											)
Overlookers		1	1		2						
Operatives		12	13		25	6	6	6	6	24	
COLOURSHOP:											
Overlookers		1	1		2	1	1	1	1	4	
Mixer		1			1	1		1		2	
Operatives		5	4		9	2	2	2	2	8	
Maintenance	9	5	5		19	4	4	4	4	16	
Services	7	2	2		11	2	2	2	2	8	
Tractor		2	2		4	2	2	2	2	8	
Laboratory	6				6	1	1	1	1	4	
Effluent	1				1						
Sweepers	2				2	1	1	1	1	4	
Electricians	1	3	3		7	2	2	2	2	8	
BLEACHING:											
Overlookers		1	1		2						
Operatives		5	6		11	3	3	3	3	12	
FINISHING SECTION:											
Overlookers		1	1		2						
Operatives		17	17		34	7	7	7	7	28	

	D	1	2	3	Tot	1	2	3	4	Tot	
MAKE-UP SECTION:											
Overlookers		1	1		2	1	1	1		3	)
Plaiters		7	6		13	4	4	4		12	)
Bailers		5	4		9	3	3	3		9	)
Cutters		4	3		7	2	2	2		6	) (4)
Stampers		5	4		9	2	2	2		6	)
Sewers	3	4	5		12	3	3	3		9	)
Checkers		2	2		4	2	2	2		6	)
Packers		2	2		4	2	2	2		6	
Fent Sorters	1	2	2		5	1	1	1		3	
Handbailers		2	2		4	2	2	2		6	
Folders		3	5		8	2	2	2		6	
				Total		68	66	67	26	227	
				+ 15%		10	10	10	4	34	
Summary	35	109	109		253	78	76	77	30	261	
Total					253					261	

Notes: (1) After consolidation of KTL and NNTM

(2) RD2 + RD4 + Roller Print Operational

(3) Dye + Jig Bleach + Pad-Batch

(4) Only 3-shift operation envisaged

KTL

APPRAISAL OF MACHINES - PRINTING

APPENDIX P5

MACHINE (year)	WIDTH (cm)	SPEED (m/min)	CHARACTERISTICS	CONDITION
FN Stenter/Dryer	450	28-35	10 Drying cylinders in on compartment. Fin clip rolls out 6 chamber	Cans fair Stenter poor
M & P Stenter (1966)	395	30-41	8 Drying cylinders in one compartment Pin clips	Cans fair Stenter poor
FN Range dryer	360	56-75	2 Bowl mangle. 40 drying cylinders in 4 compartments. Roller and plaiter devices.	Fair
FN Range dryer	340	40-55	2 bowl mangle. 24 drying cylinders in 3 compartments. Plaiter	Old machine but fair
FN Damper	237	25-40	Plaiter	Poor
FN Water Mangle	300	20-28	3 bowls, 2 nips	Poor
FN Bleaching range	390	20-30	2 end, 2 J-boxes, 4 washing compartments. Capacity 12,000 m	Very poor
FN Calender	444	32-38	8 bowl, air pressured plaiter end	Fair
FN Calender	469	30-40	3 bowl, air pressured plaiter end	Fair
FN Stenter	290	27-35	4 gas-fired burners	Poor but refurbishable
Kyoto Squeege mangle and Cans (1964)	300	27-30	Mangle, 20 drying cylinders in 2 compartments. Steam heated	Mangle scrap Cans fair
Kyoto Open Washer	243	26-35	Goller box, 8 boxes, 20 cylinders in 2 compartments, steam heated	Wash boxes poor
Benninger Mercerizer	340	28-35	2 ends, 8 compartments - 2 caustic, 6 hot	Reasonable
Kyoto Copper roller printer	333	25-30	Rotary drum. 20 drying cylinders in 2 compartments. Plaiter end.	Parts missing but refurbishable
Kyoto Stenter	400	Obsolete	Pin clips. 20 drying cylinders in 2 compartments. Mangle	Fair. Refurbishable
Kuster padder	172	30-45	Pressure tank, 200 l capacity	Good
6 FN Dyeing Jiggers	289	21-36	Closed, steam heated 1000 l capacity	4 out of commission 2 refurbishable

MACHINE	WIDTH (cm)	SPEED (m/min)	CHARACTERISTICS	CONDITION
Arioli Steamer	340	2 - 6	2 end electrically powered steam chamber, horizontal loops.	Generally fair but electrical problems Refurbishable
Stork printer (1985)	250	27-45	8 screen printer; modern devices, horizontally looped in steam closed chamber. Plaiter	Very good
Stork printer (1968)	274	10-20	12 screen printer. Horizontally looped in steam closed chamber. Plaiter	Parts missing Refurbishable
Kyoto pad and cans dryer (1964)	0	Obsolete	20 drying cylinders in 2 compartments	Cans fair
Kleinewefer Calender	510	Obsolete	2 ends feed. Plaiter end. Air pressure operated.	Fair
Steamer	271	20-32	Vertical loops	Good(Assembled out of scrap)
Hindle Baler	275	-	-	Fair
Scapa Baler	275	-	Starkstrom electric press	Fair
Winch	400	-	-	Good
FN Calender	240	28-38	3 bowl, air pressured, plaiter end.	Fair
Cooper Plaiter	230	30-45	Adjustable plaiting length	Fair
Cooper Plaiter	188	30-37	Adjustable plaiting length	Fair
Turner Singeing m/c	270	27-34	Gas flame nozzles. Desizing box/saturator (1000 l capacity)	Poor. Burners do not work
Toyo folder	165	15-20	Single and double folding devices	Fair
4 Cooper Plaiters	222	30-46	Adjustable plaiting length	Fair

KTL | SPARE PARTS REQUIRED FOR PHASE I | APPENDIX P6

1.	FARMER NORTON BLEACHING RANGE	
1.1	Mechanical:	
	Scouring Tank. Badly corroded wash-box	1
	No.1 & No.2 'J' Box badly top head	2
	Body needed renovation	2
	No.1-4 Washer rubber top bowl	4
	No.1-4 Washer rubber down bowl	4
	No.1-4 Washer rubber top bowl bearing	8
	No.1-4 Top nip rubber bowl	4
	No.1-4 Down nip rubber bowl	4
	No.1-4 Nip roller timing belt	4
	H2028 Courator squeeze bowl bearing	2
	Badly corroded wash boxes	4
	3/8 air pressure regulator	9
	Badly air cylinder for nip roller	8
	Badly air cylinder for wash roller rubber bowl	8
1.2	Electrical:	
	Star Delta Starter, type SD5, Volt.400V, HP40, frq 50cs	5
	BH1 Control panel, generator field regulator	1
2.	WATER MANGLE	
2.1	Mechanical:	
	Cotton bowl	2
	Badly air pressure cylinder	2
	3/8 air pressure regulator	2
3.	MATHER & PLATT STENTER	
3.1	Mechanical:	
	Air pressure compensator	2
	Cans bearing	16
	Lubrication to chain rail pump	1
	Lubrication to heating fan	1
	Air lifter cylinder for batching roller	2
	Heater fan bearing	6
	3/8 air pressure regulator	1

3.2	Electrical:	
	Cans Compensator	1
	Berco motor drive rheostat potentiometer	3
	Type ML 1000, 600 ohms, 1.6 60 0.28 amps	5
	Cylinder driving wheel (mechanical)	8
	Driving chain (mechanical)	30 metres
4.	FARMER NORTON STENTER	
4.1	Mechanical:	
	Chain rail lubricator pump	1
	Hydrolic power jack	1
	Air lifter cylinder for batching roller	2
	Cans driving wheel	10
	Cans ball bearing	20
	3/8 air pressure regulator	3
	Heater fan	6
	Air compensator	2
	Pad mangle ball bearing	4
4.2	Electrical:	
	Compensator	3
5.	FARMER NORTON DRYER	
5.1	Mechanical:	
	3/8" air pressure regul-	2
	Pad mangle ball bearing	4
	Cans ball bearing	30
	Air lifter cylinder for batching roller	2
	Cans driving wheels	15
	Driving chain	90 metres
	Compensator	3
	Pad mangle air cylinder	2

KTL SPARE PARTS REQUIRED FOR PHASE II APPENDIX P7

	DESCRIPTION	QTY NEEDED
1.	KYOTO 8-BOX WASHING RANGE WITH GOLLER FIXATION UNIT	
1.1	Mechanical:	
	Badly corroded wash boxes	4 (2)
	Rusted expander rollers	3 (3)
	Brass bearing for the brass bottom roller	6
	Washing machine bearing No. UC2010	40
1.2	Electrical:	
	2.2Kw DC motor	1
	0.75Kw DC motor	3
	Complete Electrical Control panel (Goller Unit) Magnetic contractor coils (110V, DC)	
	Sizes (a) 55 by 62 mm	2 (1)
	(b) 78.5 by 81mm	1 (1)
	Cloth guiders	2 (2)
2.	FARMER NORTON STENTER	
2.1	Mechanical:	
	Top squeeze rubber bowl	1
	Expender rollers	2
	Clips/Pins	240 (60)
	Tension rollers	2
	Clips opener 12	4
	Bearings 2220K	4
	Rubber covered bowl 16 x 60 face (F.N.)	4
	Clip opener for entry end	6
	Rubber covered bowl 16" dia. x 44½	6
	Flexible steam pipe ½" x 16" B.S.P.	20
	Tufnol for left and right clips opener for delivery end (F.N.)	10
	S.K.F. bearing No. 22220K	8
	S.K.F. bearing No. 1210K	10
	Oil seals	15

2.2	Electrical:	
	Gas/burner control units	6
	Stenter antistatic system/panel cloth guiders	2
3.	ARIOLI STEAMER	
3.1	Mechanical:	
	Dancing roller	1 (1)
	Chain rollers	80 (20)
3.2	Electrical:	
	Control timer unit	1
4.	WAKAYAMA STENTER	
4.1	Mechanical:	
	Complete rail unit	1
	Gear wheel unit	1
	Clips U.C.210	200
	Bearings	20
	Rubber bowl	2
4.2	Electrical:	
	Cloth guiders	2
	Main drive motor	1
	Rheostat	1 (1)
5.	KYOTO CYLINDER DRYER	
5.1	Mechanical:	
	Complete set of cylinders with fittings	5
	Top squeeze rubber bowl	1
6.	WAKAYAMA PAD MANGLE AND DRYER	
6.1	Mechanical:	
	Squeeze rubber bowl (two nips)	2
	Tension roller	2
	Expender roller	1

6.2	Electrical:	
	2.2Kw DC motor for mangle	1
	1Kw, 110V motor generator set exciter	1
	Magnetic contactor coil, 110V DC	
	Size 55 x 62mm	3
	Cloth guiders	2
7.	WAKAYAMA CYLINDER DRYER	
7.1	Gear wheels	2
8.	RD 2 STORK PRINTER	
8.1	Mechanical:	
	Blanket	1
	Blanket supporting rollers	30
	Gum roller	1
	Pumps	12
	Screen holder	24
	Complete set of blanket washer 12.S.M.920.150	1
	Air cylinder long SPNL/6867/SM	3
	920/20SP	14
	Air cylinder short 12.L.S6-22-N	2
	6 308-2.Z	12
	Bearings 6204-2.Z	6
	1208	8
	6206.2RS	4
	6205-Z	2
	Ball bearing 6205 - 2RS	20
	Ball bearing 6206 - 2RS	15
	Gear wheel part No.3R.220256	4
	Kaydon bearing 003434 - 253 JU/C5 043500	8
	Ring B.42408	10
	Spring washer (Storks Printer)	10
	Lock washer SW160	15
8.2	Electrical:	
	Speed regulators (front/back)	2
	Pump Cam switches	12 (8)
	Pump timer relays	12 (8)
	Pump starter with overloads	12 (8)

	Pump motors	8
	Pump control electrode/cable	12 (8)
	Cloth guiders	2
	Speed regulator motor	1
9.	JIGS (6 Jigs)	
9.1	Mechanical:	
	Top nut bushing	24 (10)
	Tension roller	8
9.2	Electrical:	
	Control panel	3
10.	KUSTER PADDER	
10.1	Mechanical:	
	Air cylinder MP 952 ABC.D	1 (1)
11.	KYOTO COPPER PRINTING MACHINE	
11.1	Mechanical:	
	Cracked printing drum	1
	Drying cylinders with fittings	11
	Brush roller	1
	Complete air system	1
12.	KLEINEWEFERE CALENDER MACHINE K30/1	
12.1	Mechanical:	
	Tension shoe indicator chain	2
	Upper tension lever	2
	Conical wheel face	4
	Gear box unit	1 (1)
12.2	Electrical:	
	Complete control panel	1
13.	BENNINGER MERCERISER	
13.1	Mechanical:	
	Mercerizing machine roller 240cm x 31cm	1 (2)

14.	CHIEFTAIN BOILERS, TP 309; TP1120	
14.1	Mechanical:	
	Boiler fuel water pump	2
	Oil burners	2
	Steam pressure gauges	2
	Oil heaters	2
	Gear boxes	2
	Boiler fans	2
14.2	Electrical:	
	Mercury switches	2 (2)
15.	ERNEST TURNER SINGER M/C (PAREX)	
15.1	Mechanical:	
	Badly gas burner	2
	Mixture control type 3	2
	Control valve type 688735	1
	3/8" air pressure regulator	1
16.	MATHER & PLATT CALENDER	
16.1	Mechanical:	
	Cotton bowl	1
17.	FARMER NORTON CALENDER	
17.1	Mechanical:	
	Cotton bowl	1
18.	FARMER NORTON CALENDER	
18.1	Mechanical:	
	Badly cotton bowl	4
	3/8" air pressure regulator	2
	Air lifter cylinder	2
18.2	Electrical:	
	Allen West starter for slip ring motor	2

	DESCRIPTION	PART NO.	QUANTITY
19.	RD 4 STORK PRINTER		
19.1	Mechanical:		
	Stork pump S.B.V.	4R 811722	8
	Anti-slip tape	09.1450.200	3
	Anti-slip tape	09.1450.559	2
	Diaphragm cylinder	4R 427666	4
	Spare parts for air cylinder	4R 356288	6
	Spare parts for air cylinder	4R 356290	4
	Spare parts for air cylinder	4R 356289	2
	Overhaul set for wormgear box	4R 328033	1
	" set for reducing valve	09.0250.404	5
	" " " Air cylinder	4R 48594	3
	" " " S.B.V.	4R 811728	6
	" " " Valve	4R 328028	6
	" " " "	4R 408592	6
	" " " Air cylinder	4R 407999	10
	Bearing	00.3434.209	12
	Overhaul set S.B.V. pump	4R 811727	10
	Set sealings for S.B.V. pump	4R 811726	12
	Squeeze holder	3R 800194.360	4
	Squeegee holder	4R 335430.360	4
	Blanket		2
	Squeegee	4R 809443	6
	Sleeve	4R 336492	20
	"	4R 336492	Tubeless 4
	"	4R 228511	30

19.2 Electrical:

TYPE	DESCRIPTION	RATING	QUANTITY
4R304514	Regulator		1
AEG-SH'	Contactor		2
AEG-LS2	Contactor		2
AEG-LS47	Contactor		3
AEG-B67	Over load	22-32A	2
AEG-B17	Over load	8-12A	1
AEG-B17	Over load	28-4A	1
AEG-B17	Over load	0.5-0.8A	1
AEG-B17	Over load	4-6A	1
AEG-B17	Over load	1.2-1.8A	4
4R248270	Micro-switch		1

4R3000500	Rectifier		2
4R304282	Cam switch		5
4R304110	Timer relay		5
AEG-NT00-GZ	Fuse	80A	10
" "	"	63A	10
" "	"	50A	10
" "	"	35A	10
	Daized fuses	25A	10
	"	16	10
	"	10	10
	"	6	10
	"	2	10
TF	Fuse	200A	20
TCP	"	100A	20
TC	'	100A	20

20. BOXMEER COATING MACHINE

	DESCRIPTION	PART NO.	QUANTITY
20.1	Mechanical:		
	Toothed belt		2
	Guide rails		4
	Air supply unit and lubricating unit		2
	Rubber sleeve		4

21. DEVELOPING & COPY M/Cs

21.1	Mechanical:		
	Bearing Bush	4355.017	4
	Bearing bush	4355.017	4
	Connecting Rod	3681.006	2
	Gear 18T	3834.012	4
	Gear 32T	3834.013	4
	Bearing	3427.044	10
	Spring	4841.040	4
	Cable Chain L & R		4
	Bearing Bush	4355.017	4
	Pump unit 220/240v.50Hz	5561.831	3
	Pump unit 220/220v.60Hz	5561.832	4
	Pump shaft assy.	5354.001	2
	Bearing	3427.044	4
	Pressure spring	3863.012	4

Valve pin	3565.050	4
Leaf Spring	4834.021	2
Roller	3582.016	2
Collar Bush	3431.001	2
Hexagon nut	2211.008	4
Cogged washer	2235.028	5

21.2 Electrical:

TYPE	DESCRIPTION	RATING	QUANTITY
M2	Vacuum pump		1
K1	Contactor		2
N2	Exposure clock		1

21.3 SCRN 74 CONTACT COPYING MACHINE

1	Steering relay	2 Nos
3	Magnetic valve	2 "
13	Relay	2 "
14	Rectifier	1 "
15	Relay	1 "
22	Start	

22. LUCOP 11M CAMERA

22.1 Electrical:

6-5	Pin plug	1
30	Main switch on distance measuring device	1
39	Programme control panel	1
66	Multi-pin plug	1

23. EXPOSURE MACHINE

23.1 Electrical:

Phillips bulb, 57205E/99, HPR 125W 4

KTL PROPOSALS FOR PRINTING LABORATORY APPENDIX P8

1.	DYESTUFF APPLICATION EQUIPMENTS		
1.1	Amospheric Dyemaster		1
1.2	Laboratory Jig		1
1.3	Laboratory Steamer/dryer		1
1.4	We fixation unit		1
1.5	Baking Oven		2
1.6	Laboratory Padder		1
1.7	Timer/Stop Watch		10
1.8	Laboratory which Dyeing machine		1
2.	COLOUR FASTNESS TESTING EQUIPMENTS		
2.1	Xenotest 150	(for fastness to light)	
2.2	Launder-Ometer	(for fastness to washing)	
2.3	Crockmeter	(for fastness to rubbing)	
2.4	Pespirometer	(for fastness to perspiration)	
2.5	Viewing cabinet		
3.	TEST REAGENTS/CHEMICALS		kg
3.1	Sodium chloride		10
3.2	Sodium Carbonate		10
3.3	Sodium Bicarbonate		10
3.4	Sodium Perborate		10
3.5	Monosodium Phosphate		10
3.6	Disodium Phosphate		10
3.7	Potassium Iodide/Iodine		10
3.8	Hydrochloric Acid		10
3.9	Sulphuric Acid		10
3.10	Nitric Acid		10
3.11	Glacial Acetic Acid		10
3.12	Histidine Hydrochloride		10
3.13	Congo Red		10
3.14	Methyl Blue		10
3.15	Methyl Orange		10
3.16	Filter Paper		25 packets
3.17	PH indicator papers		20 rolls/ packets

4.	OTHERS	
4.1	Pipettes (100 ml)	10 pieces
4.2	Pipettes (50 ml)	10 pieces
4.3	Pipettes (25 ml)	10 pieces
4.4	Cylinders (50 ml)	10 pieces
4.5	Cylinders (25 ml)	10 pieces
4.6	Hydrometer 1-10°Be	10 pieces
4.7	" 1-25°Be	10 pieces
4.8	" 1-50°Be	10 pieces
4.9	" 1-70°Be	5 pieces
4.10	Thermometers	10 pieces
4.11	Microbalance/Scale	4 pieces

Notes:-

Kaduna Textiles Limited has no laboratory for recipe formulation/trials and colour fastness assessment.

OTHER CAPITAL EQUIPMENT REQUIRED AS FOLLOWS:

NO.	DESCRIPTION OF EQUIPMENT
2	High speed-multivane mixers to bring existing new colour kitchen into operation.
1	Industrial Refrigerator capable of producing 1500kg ice/24 hours for Azoic Printing.

KTL LIST OF PERSONNEL - ENGINEERING APPENDIX E1

	D	1	2	3
Chief Engineer	1			
Asst. Manager (W/Shop)	1			
" " (Electrical)		1	1	
Supervisor (Maintenance)	1			
" (A/c plant)	1			
ELECTRICAL				
Technicians	12			
Generator operators		2	3	1
Rewinders	9			
GENERAL				
Clerk/typist	1			
Cleaner	1			
Masons	2			
Painters	2			
WASTE & STEAM				
Boiler Technicians	2	2	2	1
Boiler Operator (Printing)		2	2	
Boiler Operator	1			
Plumbers	4			
AIR CONDITIONING				
Plant Mechanics	2			
Plant Technician	2			
R & A Technician	2			
Apprentices	2			
Plant Operators (Mills 1 & 2)		1	1	1
" " (Mill 3)		1	1	1
" " (Printing)			1	1
MACHINE SHOP				
Supervisor		1	1	1
Fitters		2	2	2
Turner		1	2	1
Welder		1	1	1
Capstan Operator		1	1	
Maintenance Technicians	1			
Fitter/Machinist	1			
Turners	2			

		D	1	2	3
Welders		4			
Miller		1			
Tinsmith		1			
Carpenters		5			
MOTOR MAINTENANCE					
Motor Mechanics		4			
Generator Technician		2			
Forklift Operator		1	1	1	
Tractor Operator		1			
CASUAL					
Quantity Surveyor		1			
Generator Operator			1		1
Electrician's Mate		4	3	1	1
Apprentice (R & A)		1			
Boiler Operative					1
Carpenter's Mate		1			
TOTALS	132	74	20	20	13