OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

FS 464 A

08957(1)

UNIDO:Project No.IS/ETH/73/006

DRAFT FINAL REPORT ON CORPORATE ANALYSIS OF THE DEBRA BERHAN WOOL FACTORY S.C. IN ETHIOPIA

VOLUME I CHAPTERS I to IV

submitted by WERNER INTERN'L

WERNER INTERNATIONAL
MANAGEMENT CONSULTANTS

FS [redacted] A
464

Reference : Project No. IS/ETH/73/006.

08957

DRAFT FINAL
REPORT ON
CORPORATE ANALYSIS
OF THE
DEBRE BERHAN WOOL FACTORY S.C.
IN ETHIOPIA.

S/F

C/F

Volume I - Chapters I to IV.

P. 136

Submitted to : United Nations Industrial Development Organisation

Vienna, Austria.

Submitted by : Werner International
Managements Consultants
New York, U.S.A.

November 1974.

Werner Associates Inc., 1450 Broadway, New York, N.Y. 10018, Tel. (212) 565-1260
Telex 223399 Cable: Wernercons

WERNER INTERNATIONAL
MANAGEMENT CONSULTANTS

United Nations Industrial
Development Organisation,
Lerchenfelderstrasse 1
A-1070 Vienna, Austria.

November 8, 1974

Dear Sirs,

Re : No. P-74/12, Req.No. IS/ETH/73/006.

In compliance with our contractual arrangements, we are submitting our Draft Final Report.

During the course of our work we have tried to keep the management of the Debre Berhan Wool Factory fully informed of our activities.

The sincere and full co-operation to which we referred in our interim report continued throughout the remainder of the project.

We would like to express our appreciation for the hospitality and co-operation which we received. The management of the Debre Berhan Wool Factory have worked diligently toward achieving a successful and profitable company and we sincerely hope that our efforts will benefit the company to some substantial degree.

WERNER INTERNATIONAL

Werner Associates Inc., 1450 Broadway, New York, N.Y. 10018, Tel. (212) 565-1280
Telex 223399 Cable: Wernercons

S Y N O P S I S .

The following report covers the findings, conclusions, activities and recommendations relating to a corporate analysis of the Debre Berhan Wool Factory S.A. The aim of the project was to furnish assistance to the management of the Debre Berhan Wool Factory S.A., which would result in improving the efficiency of its operations.

The present management is capable and competent and have made commendable progress during the past year to the point where the company is on the verge of making a profit. The lack of working capital is, however, hampering the progress of the company. The infusion of sufficient working capital can move the company into a modestly profitable operation provided most of the numerous recommendations contained in this report are carried out. Capital investment for new machinery, plant expansion or export activities is not required at this time. The present equipment, if properly repaired, is satisfactory for the product lines. There is equipment installed which is idle but this equipment should be ignored for the immediate future.

The blanket market is strong and there are good indications that it will continue to be so for a long period. The management should use the immediate future (18 months) to implement the recommendations and establish a record of profitability. Confidence by the Board of Directors in the future and the viability of the Debre Berhan Wool Factory S.C. is warranted.

TABLE OF CONTENTS.

I. INTRODUCTION.

I. INTRODUCTION.

The Debre Berhan Wool Factory is a Government-owned textile spinning, weaving and finishing mill, employing approximately 400 persons. It produces blankets and carpets. The primary raw material is wool/man-made fibres waste.

Production began in the year 1964/65. The company has incurred losses annually although for a short period during 1967/68 a profit was achieved. Under new management during the past 18 months the company again reached a break-even or marginal profit this summer (1974).

Prior to the recent improvements which have taken place, it was decided to have a corporate analysis conducted of the total company with the aim of furnishing assistance to the company which would improve the efficiency of its operations.

In greater detail, the objectives of the analysis were :

- To examine in detail the manufacturing facilities and production methods, the marketing organization and methods, the financial controls and cost accounting and the management organization, their functions and their effectiveness.

- To identify the ways in which profitability can be improved.

- To analyse the problems which confront the company and determine the inter-relating effects on the total company operations.

- To develop a detailed programme of activities which can be applied in a practical manner which will result in the financial improvement of the operations.

The following report reveals our findings, our conclusions and our recommendations relating to the numerous items which were examined. The report also includes the work which was implemented in the manufacturing and costing during the period of our stay in Ethiopia plus an outline of procedures to follow to continue the implementation work.

After conducting our preliminary survey, we decided that, in addition to fulfilling our objectives, we could actually implement, with the co-operation of the company management, some of our recommendations. The two areas, Production Standards and Standard Costing,were selected because we felt jointly with management that the installation of these two programmes would provide the greatest benefit to the company.
Consequently, the implementation of this work was initiated and outlines of procedures to follow were drawn up. Instruction time was applied to selected personnel so that the programmes as outlined could be completed in due time by the Debre Berhan Wool Factory Personnel.

There are numerous recommendations made throughout the report accompanied by reasons for our conclusions and recommendations. An index to these recommendations has also been compiled in the appendix in summary form.

II. EXECUTIVE SUMMARY.

II. EXECUTIVE SUMMARY.

1. Capital Investment.

An estimated capital investment of E.£. 630,000.- in working capital is required to bring the company to its full potential. This is required principally to purchase raw material and machinery supplies.

2. Short range Plan - 18 months.

Concentrate on blanket production and secondarily on carpets. Do not invest in any new production equipment or new products. Work toward the goal of achieving a solid and continuous profit for a period of time before making new basic changes.

3. Exports.

We do not recommend any investment be made during the next 18 months to develop exports. If requests are received at profitable prices, they should be considered, but never to exceed 3% of productive capacity to one client and over 5% to exports without having your own export marketing organisation.

4. Manufacturing Division.

a) Uniformity of Equipment.

With the exception of carding and spinning, the equipment is reasonably uniform and is considered suitable for the products made.

b) Maintenance.

The quality of maintenance in general is poor. No preventive maintenance is in existence.

c) Utilisation of Equipment.

The following equipment is idle :

raw wool scouring range (scouring section),
Hacoba pirn winding equipment,
10-Lenz looms,
2 inspection perchs,
milling machine,
two blade shearing machine,
rotary press,
Montfort semi-decatising machine,
rolling stand.

d) Balance of production and imbalance of equipment.

There is an imbalance of production between the spinning and weaving. The carding and spinning run three shifts, the blanket weaving runs two shifts. The remainder of the equipment in finishing is reasonable well balanced on a two shift basis with the weaving.

We do not recommend the purchase of additional processing equipment at the present time.

e) Obsolescence.

None of the equipment can be considered as being obsolete. We do not recommend that any of the equipment be scrapped as obsolete. Even the equipment which is idle may, in future, have some use.

The only machine that appears to have no value whatever for the future of the mill are portions of the wool scouring machine and even here the first part of the machine the hopper is planned to be used in the blending process. The latter part of the machine, the dryer, is presently being used to dry the dyed raw material. The only part of the machine which is not being used, is the scouring area. We see no advantage in dismantling and scrapping this machine at the present time. It has virtually no commercial value in the country and none abroad.

f) Spare-parts and supplies.

The number of spare-parts on hand are in general insufficient. In some instances the lack of supplies is adversely affecting production. This applies to carding, spinning, weaving and carpet weaving.

g) Production programme.

The production programme must be handled by factory management. This is being done presently on a day to day basis due to the low raw material inventory position. This should be done on a weekly basis but can only be done when there is sufficient raw material supply to plan for this period of time. The manner in which the planning is done is satisfactory.

h) Raw material.

The primary raw material as mentioned, is in very short supply. It must be recognised that for this type of work the raw material is extremely varied and cannot be otherwise. It is necessary for a good running mill to have a large stock of raw material from which to draw in order to maintain a steady flow of material and as consistent a blend as possible.

The United Kingdom is the best source of supply for this type of raw material. However, we recommend that at least 15% be purchased from Belgium, because of the constant threat of strikes and late delivery from the UK.

Dyestuffs and raw materials. The supply of dyestuffs is intolerably low. It is impossible to operate efficiently with so little dyestuffs. It is recommended that a year supply of these important materials be kept in stock.

ij Raw material Store.

Some of the area which should be used for raw material store is being used for spare-parts, chemicals and old waste. All of this should be removed to other locations. Plans have been made to do so.

k) Pulling.

This process is operating reasonably well. The machines must however be maintained with more care and greater frequency. The stoppage of the main machine in this department would be drast for the mill.

lm) Blending.

There is insufficient blending bin capacity. Plans have been made to construct additional blending bins. There is no buffer stock between the blending and carding. We concur that six additional bins behind the cards would be very advantageous.

The hopper-feeder already mentioned is planned to be installed as a feeder to the blending machines. This is a good plan and should be carried out.

n) Carding.

The carding machines have been given a great deal of attention by the present factory management. This process is not only the bottle-neck of the mill, it is also very vulnerable. In spite of the tremendous attention which has been given these machines, they still are in rather poor shape due to the fact that there are many replacement parts which are not in stock. These machines need to be completely overhauled and repaired where necessary with new parts. An estimate of E.Ø. 100,000.- during a two year period is required.

Calculations show that when the machines are properly maintained and properly supervised that an efficiency of 71% can be achieved.

The production for August '74, which was the highest production in recent years, was about 20% below this figure.

It has been agreed that it is possible to reach 10% below the 71% figure, i.e. 63.9% which would give 21.343 kg per week of Nm. 1.5, in quality 1800.

op) Carding/Spinning Balance.

The spinning machinery is not in exact balance with the carding. One side of one of the spinning machines balances one of the cards.

Improved material handling at doffing and more condenser bobbins and spinning bobbinsare required to bring the efficiency of this operation up to an acceptable level.

Considerable time was spent in the carding and spinning processes and many calculations were made since this is the crucial point of the mills potential productivity.

It is essential that the maximum amount of production be put through the carding process. The spinning process has a slight excess in capacity to the carding.

q) Cops winding.

These machines are in need of maintenance. The capacity is adequate on a two-shift basis. Improvement can be made in some instances by reduction of speed.

r) Cotton twisting.

This department should be the least troublesome in the mill. However, it is a bottle-neck process and attention to the working method must be given.
The efficiency can be definitely improved. Because this is a simple process, very little supervisory attention has been given to it and sometimes the poorest workers have been placed on this machine.

s) Warping.

These machines also require maintenance. The machine only runs one shift and has ample capacity.

t) Weaving.

The blanket looms are old but satisfactory for the work required. Maintenance could be improved. The most important productivity items are that additional shuttles are required, the supply of weft is not well organised, and the warps are poor.

u) Nappage. (Mending).

A completely new method of inspection is being planned in the Nappage Department. We concur with this new method. The mending of single warp yarn will be eliminated. This will reduce the number of workers. The quality of the fabric will not be reduced.

v) Finishing.

The scouring, suction, dyeing, hydro-extracting, thermo-f raising, tentering are all running reasonably well. There is excess capacity at each process. These machines are generally maintenanced at break-down only and they are in reasonably good condition with the exception of the raising machine which requires constant attention and maintenance of the wire clothing.

w) Making-up.

The making-up department is almost all handwork. In the area of sewing we recommend that an additional sewing machine be purchased so that corner making which is presently done by hand

can be done by machine, both better and at lower cost.

x) Carpet making.

The productivity is very low due to only one shuttle being used and the employment of poor quality cotton binder yarn. Most of the loom stops resulted from yarn breaks in the cotton yarn.

We recommend that the highest quality yarn available be purchased. This would increase the productivity and lower the cost of the manufacture of carpets.

y) Woollen cloth making.

The Lenz looms and some finishing equipment are idle. There are future possibilities for this equipment via the purchase of yarns. However, we do not recommend any action be taken for the next 18 months until the company has been able to digest all of the recommendations and changes which can be made.

Acrylic type dress and drapery fabrics can easily be produced on these looms.

z) Work-shop.

The work-shop is equal in importance to any other section of the mill. It is essential that Debre Berhan Wool Factory have a good work-shop. Two new expensive machines estimated at 40.000.-E.$. to 45.000.-E.$. each are required. These are a lathe and a milling machine.

Two additional well qualified men are required in the work-shop for maintenance and machine making.

aa) Supervisory Training.

Operator and supervisory training is required throughout the entire mill. However, supervisory training has a priority and must precede any system of training of the workers. The supervisory personnel seem to have good mechanical and technical background, but they lack the training and tradition of supervision. They are not fully aware of their duties and responsibilities.

bb) Organisation Structure.

The changes which are proposed relate to :

- the separation of the Material Preparation Mill from the Spinning Mill,
- the transfering of the Napping (mending) Section from the Finishing Department to the Weaving Department,
- the transfering of the Raw Material Stores Section from the Administration to the Manufacturing.

5. Standards Department.

It has been strongly recommended that a Standards Department be established in the mill. In the chapter entitled "Standards Department" an outline of the functions of this department is given. These cover the establishment of standards in :

processing,
raw material,
waste,
maintenance,
labour unit cost,
productivity.

Details of the work involved in the Standards Department are included in a form which can be utilized as a work programme for installation for the Standards Department.

6. Marketing Division.

a) General Background.

Debre Berhan Wool Factory markets the following products all of which are sold in Ethiopia :

- Blankets - raised wool type manufactured from long fibre waste material,
- Carpeting - woven - pile yarn manufactured from long fibre ,
- Handicraft yarns - from local woollen selected fibres.

Until a year ago the products were not selling well. Today all of the blanket inventory has been sold and the blanket market is firm, absorbing all of the present production of Debre Berhan.

There is still a large inventory of carpeting in various widths and piece lengths. The carpeting market, however, is in reality in the embryo stage.

The handicraft yarn market is very strong. The production limitation is related only to the raw material supply which is very small.

The company markets its own carpets through its own sales organisation.

The marketing of blankets is done through a distribution company called Ethiopian Distribution Company "EDISCO".

b) Organisation Structure.

It is recommended that Debre Berhan Wool Factory market their own blankets via the company sales division. It is our opinion that it is better to own a market than to own a mill, and if you do own a mill then it is essential that you control your own market.

c) Blankets.

The market being strong absorbs all of the present production. Due to the bright colours and designs in the latest range of blankets, Debre Berhan Wool Factory has moved from a position in which it trailed behind its competitors to one where it has become the leader.

Although Edisco were not selling blankets too well up to a year ago, because of a wage incentive which was inspired by the Debre Berhan Wool Factory management, the branch managers of Edisco have managed to sell all of the inventory of the previously unwanted goods.

Edisco have 19 distribution depots of which Addis Ababa sells more than 65%, Asmara more than 12%, Dire Dawa more than 5% and Nazareth almost 4%.

The range of the blankets has been reduced by eliminating some of the non profitable articles.

There are 4 other companies producing blankets. Only one of these produces a similar type of blanket to Debre Berhan. This company, Lazaridis, is producing about the same number as Debre Berhan Wool Factory at the moment. The quality of the Lazaridis blankets is somewhat inferior.

All of the other blankets are made of cotton waste in various forms. Debre Berhan Wool Factory are the most expensive blankets on the market and the best.

From all indications, Debre Berhan Wool Factory could sell all of the 300,000 blankets which could possibly be produced out of the present capacity.

The imports of blankets have declined mainly because of the sharp increase in import tariffs in 1971-72.

The consumption of blankets is over 1,100,000 per annum.

There is a constant increase in the Gross National Product and in the population. The consequence of this is that there is an estimated increase in textile consumption of 4% per year. It is our opinion that it will be higher than this figure and consequently there appears to be a very good continued potential growth in the Debre Berhan Wool Factory type of blankets. Moreover, since this is a higher quality blanket, than the cotton blanket, its potential for growth is greater than the other types.

d) Recommendations.

i) We repeat that we recommend that Debre Berhan Wool Factory market their own blankets.

ii) We recommend a minimum of two designs and a maximum of 4 to be introduced per annum.

iii) A system of market reporting should be instituted so that management is kept informed of all sales activity and market conditions. This is essential when marketing your own blankets. Presentation of the products could be improved. It does not seem to be a problem at the present time but is an area where sales can be maintained when the market conditons become more competitive.

iv) Long range planning. When the mill has reached its maximum capacity of around 300.000 blankets a year and the company is operating at a healthy profit, expansion should be considered in the form of additional carding and spinning in order to balance the weaving capacity.

For very long range planning we recommend that a needle punch machine be considered. This will produce a more fluffy but warmer blanket. It will be necessary to make extensive tests before purchasing such equipment.

e) Carpets.

There are two types of carpets made. One has a 4 mm. pile, the other is 6 mm., which is then cut.

The present selling policy is to manufacture on speculation.

The type of carpeting produced is primarily for the contract sector. It has very little appeal for the domestic market.

The pricing policy is based on 25. E.g.per sq.m. for the 4 mm. loop pile and 35. E.g.per sq.m.for the 6 mm. cut pile. This price remains regardless of how the roll of carpeting is cut. The result has been a large inventory of cut pieces which are very difficult to market. In the year ending August '74 production was almost twice the quantity of sales.

7. Management/Cost Accounting.

a) Organisation.

Only a minor change relating to the raw material store is recommended. This should be placed under the Factory Management.

b) Effectiveness of Management.

The improvements which have taken place during the last year clearly manifest the ability and effectiveness of the current management. The present team of the General Manager and Factory Manager is unusually well balanced, competent and progressive.

c) Management Reports.

The General Manager receives a number of very useful reports relating to :

- sales
- production
- raw material
- cash on hand
- personnel
- transport
- overdue accounts.

d) Recommended changes to Management Reports.

Sales Reports - Additional comparisons.

Overdue account report - Broken down by age of deliquency.

Cost Distribution Report - This report should be greatly condensed.

Product cost Report - Recommend that this report be replaced by a new standard cost report.

e) Recommended new Management Reports.

i) Raw material graphs.
The raw material report in graph form be drawn up. As per the illustration in this report.

ii) Waste report.
A waste report be instituted as per the form illustrated in this report.

iii) Production Reconciliation report.
A reconciliation report similar to the one illustrated in this report be put into operation.

iv) Budget controls.
Budget controls do not at present exist because there is no standard costing which has been set up. When standard costing come into being it is essential that budgets be established.

f) Administration Reports and Records.

i) There are numerous reports in the mills and between the mills and administration. Nearly all of these adequately serve their purpose. In general the reports and records are good. The most important are as follows :

payroll
production
input to process
waste
finished goods
inventory record of supplies
finished goods record of inventory
raw material inventory
consignment delivery notes
credit invoices and cash invoices
personnel

(The personnel reports and records are singled out for commendation. Some of them are excellent).

ii) Recommendations.

- Payroll - salaries and production report.

It is recommended that all production and payroll reports be established on a two week basis instead of monthly and semi-monthly. All staff employees also should be paid every two weeks.

- Supply records.

Perpetual inventories are maintained of each item in stock. However, minimum quantities are not market on the record. It is recommended that a person be assigned the task of examining each type of supply item, review the historical volume and estimate the required minimum.

Such a programme would require the attention of one man for a period of approximately six months.

g) Financial Analysis.

i) A reputable accounting firm audits the books. Consequently, the records are in proper order.

The company has consistently lost money on an annual basis since its conception. However, during the year July 1st 1967 - June 30th 1968, the company did reach either a break-even point or a modest profit for a few months.

ii) Working capital.

The company clearly lacks working capital. Main capital requirements are raw material, dyestuffs and replacement parts for the equipment.

iii) Overdraft interest rate.

The overdraft has been reduced from about 2,000,000 E.£ down to less than 1,000,000 E.£. during the past 14 months. Nevertheless, at 9,5% interest, this is a very onerous financial burden for the company to bear.

iv) Inventory levels.

The inventory level of finished goods in carpets is too high. Inventory level of blankets is phenomenally low.

v) Primary raw material.

Primary raw material is too low. The actual inventory of raw material is not sufficient for the type of operation in which Debre Berhan Wool Factory is involved. This type of production requires a blend of many types of waste raw material. In order to achieve the proper blend the raw material must be carefully selected It is very easy to have an adequate supply of one type and an insufficient supply of a balancing type. We recommend that a minimum of five months supply is maintained. At present, the volume is approximately three months.

vi) Dyestuffs.

The market demand for coloured goods requires that the mill have many dyestuff colours on hand.

We recommend that a full year supply be maintained.

vii) Replacment parts.

The replacement parts in the plant on the operating machinery is much too low. Items which are in daily use and replacements such as bobbins, shuttles, spools are much too low. This leads to inefficiency, waste of time in trying to obtain the parts from the stores and costly running conditions.

h) Purchasing.

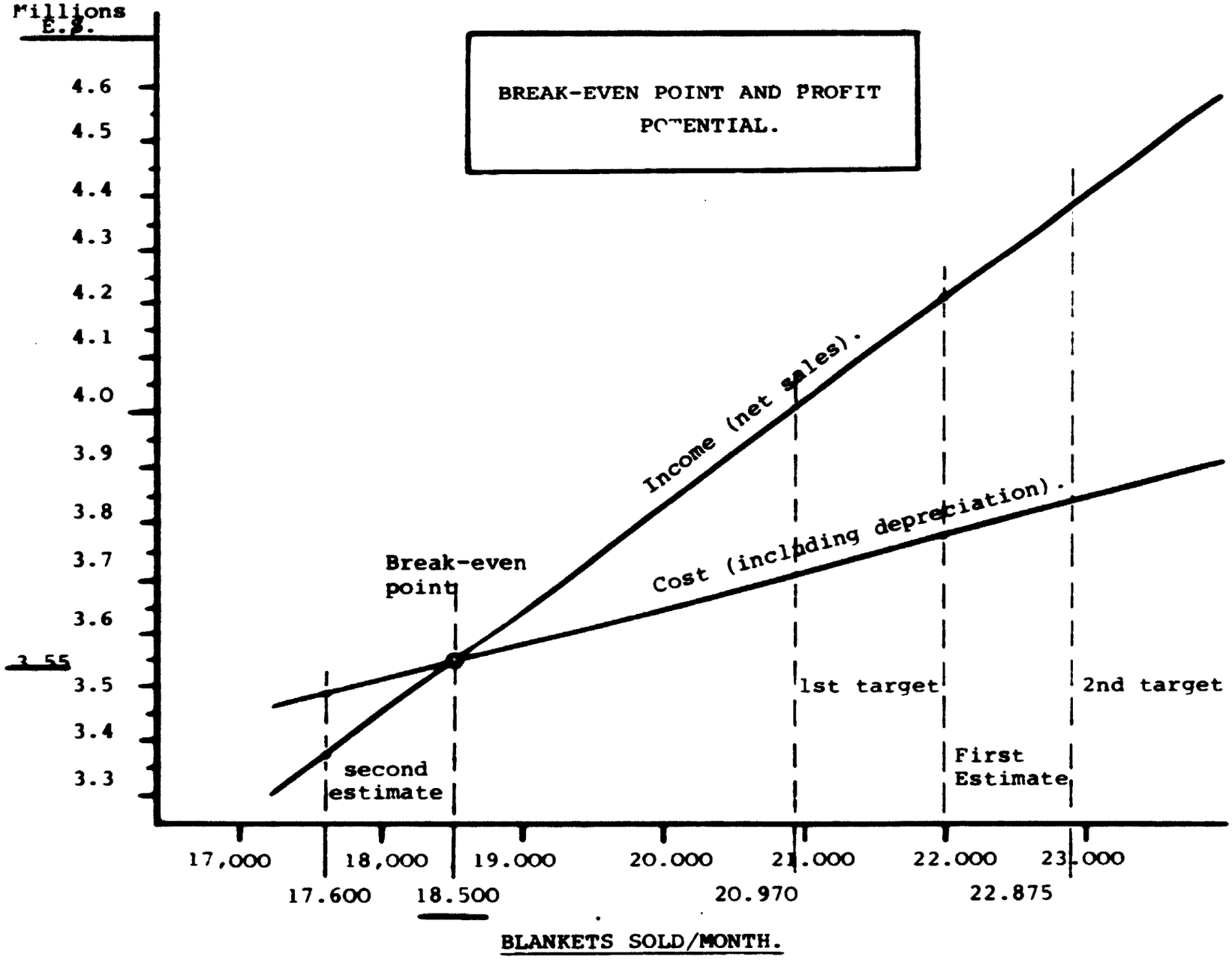
The method and control of purchasing is quite good. The follow-up on raw material on order and in transit is excellent.

Recommendation - There are two clerical staff members maintaining the records relating to purchasing, one for domestic purchases, one for foreign purchases. The total work could be done by one person.

ij) Break-even point and profit potential calculations.

A series of calculations were made to determine if the company could be profitable or reach a break-even point. The result of these calculations showed that the current volume at the current selling prices would produce a profit picture.
Furthermore, a break-even point could be reached at approximately 18,500 blankets of quality 1805 per month.
The capacity of the mill at its first target would be 2097.

Attached is a graph illustrating the break-even point and potential profit.



h) Analysis of cost System.

Prior to the fall of 1973 there was no proper cost system established whatsoever. Since that period a historical cost system has been installed which is most commendable. The system however is very detailed. It is recommended that this system be replaced by a more simple standard cost system which is outlined in this chapter on Standard Cost System.

lm) Relationship of costs to prices.

It is recommended that the present system of historical cost be replaced by a more simple Standard Cost System, as illustrated in the chapter on Standard Cost System.

n) Analysis of premium payment system.

The present set up of where some workers are receiving higher wages than others on the same work is inherited.

There has been a new system which has replaced a very loose and unorganised method.

We do not recommend any quick moves regarding the change of incentives or the alteration of the pay rates. We recommend that a very simple approach be taken to the wage inventive system. We suggest that approximately 65% of the production target which is expected from the employee be used as a base pay. Over the base pay an incentive wage would then be applied. New employees would come under the 65% base pay system. Old employees would initially remain at their present actual base pay.

8. Standard Cost System.

a) Present Cost System.

The present cost system is very detailed and based on historical data. This system, however, is a vast improvement over the records which existed a year ago.

b) Recommendation.

A Standard Cost System is recommended which would be based on the standard data which is being established by the Standards Department.

c) Production Standards.

Production standards are based on the bottle-neck process of carding. The calculations of the other processes are placed in balance with the carding.

d) Labour Standards.

This figure has been established and is used for costing purposes. The labour complement can definitely be reduced via training and improved management controls.

e) Waste Standards.

Temporary waste standards have been established.

f) Construction Sheets, Cloth, Blankets, and Carpets.

These vital calculations have now been made on 1805 and on 4 mm. carpets. The company personnel are now able to calculate the remaining styles.

g) Cost Centres.

Only five cost centres will be calculated on the cost distribution sheet.

Material Preparation Mill
Spinning Mill
Weaving Mill
Finishing Plant
Carpet Mill.

h) Cost Calculation Sheets.

A complete set of calculations has been compiled for one quality. The Financial Manager assisted in the compilation of this data and can complete the work for additional styles.

ij) Product Cost Calculations.

The product cost formats for spinning, weaving, finishing, blanket making and carpet manufacturing have been drawn up.

k) Cost Distribution Sheets.

Recommendations have been made for a reduction in the amount of work required to compile this report. It will be greatly condensed.

III. DETAILED ANALYSIS OF THE MANUFACTURING DIVISION.

III. DETAILED ANALYSIS OF THE MANUFACTURING DIVISION.

A thorough analysis of the entire manufacturing division was made. In the following sections each process is analysed. In some instances detailed production calculations are included in order to clarify particular points and to identify the areas to which attention should be given. Recommendations accompany each process.

Reference is made to the important items in each section where they apply, such as "Utilisation of Equipment, "Balance of Production".

Consequently, the following remarks relating to general topics are sometimes elaborated upon in the separate sections on each process.

1. Uniformity of Equipment.

As with most textile mills there are many processes where there are only one or two machines, and consequently, uniformity of equipment is not a particular problem.

a) Weaving.

This area has the greatest number of machines. There is a reasonable uniformity of equipment. In this department there are three types of looms suitable for blanket weaving, and only one type which was purchased specifically for apparel cloth. The distribution of looms is reasonably good.

Loom Type.	Width.	Number.
Schonherr - dobby 4x4	200 cm.	29
Snoeck - dobby 4x4	200 cm.	6
Lainière de Sclessin - jacquard 4x4	250 cm.	6
Lenz - dobby 4x1	180 cm.	6
" " "	" auto.	4

The present equipment is suitable for the type of goods being produced.

b) The Cop-winding equipment was selected to service the looms and consequently there are two different types of cop-winders. This is quite proper and they are suitable for the purpose.

c) Carding and Spinning.

There is a lack of uniformity in the carding and spinning equipment. Furthermore, there is an imbalance between the carding and spinning processes. The three cards are each different from the other and the three spinning frames are different. One side of one frame is in balance with one of the cards. The remainer of the cards and spinning do not balance properly. However, the machines cannot be made more uniform without a significant investment in modifications and such action is not recommended. Modifications to the cards are recommended but this is only on a basis of re-conditioning and overhaul.

d) Other processes.

With the exception of minor alterations which are itemised in the sections on each process, no recommendations are made for expenditures which would result in more uniform equipment.

2. Maintenance.

The quality of maintenance is not uniform throughout the mills. In general it is poor. Furthermore, there is no preventive maintenance programme in operation in any department. Much of the major maintenance is left up to the work-shop personnel. As well all major replacement and repair jobs are done by the work-shop personnel. There is a definite lack of proper equipment in the work-shop which does effect the quality of the

maintenance being done. The chapter in this report on work-shop provides a more elaborate review of this problem.

There is no preventive maintenance program for the work-shop to check any machinery. There are no written instructions. The electrical shop do the checking of the electrical installations and the oiling of motors on their own. They have no checking schedule.

The production departments have no order books to order the services of the mechanical shop.

There are differences in the mill between the various departments :

a) The carding spinning sector.

The major effort in the mill should be put to this department - particularly to the cards.

According to the spare-parts store records, very little was done during the last 3-4 years.
The waiting until a Breakdown occured and then repairing of things became too much a way of life in the department.
The spare-part catalogs and the drawings of the cards were always kept in the Factory Office.
The General Foreman cannot read the drawings and catalogs because they are in French. (Machinery made in Belgium and in France).

b) Weaving.

The maintenance of warping machine was neglected.

The looms were taken care of by the floor management. The weaving General Foreman follows the conditions of the looms and writes up lists of spares and accessories to be ordered.

The maintenance in the weaving is not so critical because the department always has extra capacity compared to the spinning.

There are normally always spare looms available. If a machine breaks down the operator is transferred to another machine and no man time or production is lost.

One loom represents only 2,4% of the capacity of the weaving but the break-down of a loom does not mean 2,4% loss in production because there is spare capacity.

In the carding a break-down stops one third of the production and all the kilos are lost because there is no spare capacity and the department is working in three shifts .

c) Finishing.

There is no maintenance programm in the department.

d) Maintenance of other equipment varies. Cop-winding and other preparatory equipment is not well-maintained. In almost every area, the maintenance is done when the machine mal-functions, never maintained on a routine basis to prevent break-down.

e) Preventive Maintenance Programme.

Such a programme is strongly advocated, except for the looms for reasons explained above.

3. Utilisation of Equipment.

Incomplete utilisation of equipment is brought about in two ways :

a) equipment which is idle due to lack of orders or not necessary for the current products,
b) imbalance of machinery.

Idle equipment : there is idle quipment in various parts of the mills.

Type of Equipment.	Remarks.
Raw wool scouring range.	This equipment as a full range is not suitable to the current or foreseeable future production of the mill. However, the Hopper is planned to be used to provide an improved feed to the Blending Process. We endorse this plan. The dryer section is being used to dry the raw material which is being dyed. As an even higher percentage of material is being planned for dyeing in the future, this drying capacity becomes more and more important. Certainly to purchase a dryer for this purpose when the scouring range exists is not wise. The fact that there is a portion of the machine which is idle does not warrant dismantling it. It is very unlikely that such a machine could be sold in Ethiopia, and it certainly has no interesting market value outside the country.
Lenz Looms.	These looms were purchased for the manufacture of cloth. We recommend in the marketing section that in a period of 1-1/2 to 2 years that development of acrylic-type cloths be considered. Until the management has had

time to absorb and adjust to the numerous changes which should be made during the next two years, there should be no attempt made to utilise these looms. We do not recommend they be sold unless a very good price was received and the corresponding finishing equipment was sold as well. They do not restrict the flow through the mill and the space they occupy is not required immediately.
It is conceivable that a new company could be formed for the purpose of producing apparel and other cloths and these looms could form the nucleous of such an organization.

Finishing equipment.
- Inspection perch.
- Rope scouring machine.
- Milling machine.
- Tentering frame.
- 2-Blade shearing machine.
- Rotary Press.
- Montfort semi-decatising machine.
- Rolling stand.

These machines were purchased primarily for cloth finishing. There is no current demand for these machines in the country and the external resale value is very low. There is no advantage in dismantling this equipment The space is not needed and there may be future opportunities when such equipment could be used.

Much of the idle equipment is almost completely written-off. Its value is relatively low, and in most cases nil. We recognise that it is a wise fiscal policy to try to utilise all the equipment wherever possible. However, only if such utilisation is profitable. At the present and for the next full year the management of Debré Berhan Wool Factory will be fully occupied with other problems of much greater importance than the idle equipment. Consequently, for this period of time we recommend that management ignore the annoying existance of idle machinery.

4. Balance of Production.

This important factor is directly related to the Imbalance of Equipment. Maintaining a proper balance of production throughout a textile mill is a constant struggle. The numerous changes which can take place all tend to upset the balance of production even in the most scientifically planned mills. The present balance of production is three shifts in carding and spinning, and two shifts in cops-winding and weaving. Clearly, the looms could absorb the production of another card and spinning frame, which is our recommendation for the first stage of expansion.
Most of the finishing equipment has excess capacity which can also easily absorb the production of another card. However, there is a potential bottle-neck in washing equipment. Further expansion in washing will demand additional equipment. At the moment there is no necessity to contemplate such additional equipment.

The balance of production and utilisation of equipment is calculated at almost each process in this report and shown in detail in the individual process section.

We do not recommend the purchase of additional processing equipment at the present time. We do recommend that an additional sewing machine to supplement the present machines be made.

5. Obsolescence.

None of the equipment which is being utilised can be considered as obsolete under the present production programme. A machine is obsolete only when it fails to perform satisfactorily, does not give the required quality, or becomes so costly to operate that it can be replaced with a less costly machine. None of the equipment which is utilised falls under this category.

The idle equipment is obsolete only because there is no demand for their usage. The machines are quite suitable for certain products.

The only machine that could be considered for scrap is the washer section of the scouring range. We see no advantage in spending money on such an exercise when neither the scrap has any real value nor the space made is required.

6. Spare-Parts & Supplies.

The number of spare-parts on hand are in general insufficient. It is recommended that the mill purchases the following items as soon as possible :

- 120 shuttles, cost approx. E.£. 2,400.-
- Spinning frame bobbins for frames 1,2 A and 2 B. Now at least 50% are damaged. Optimum size packages cannot be made and as a result the efficiency in spinning and cops making is lowered. Total number of bobbins required :

  344 in frames,
  2,000 night shift reserve (spinning 3 shifts, cops 2 shifts)
  344 empties for doff.
  2,688
  + 50% extra = 4,000

Half of this 2,000 needs renewing during the next 2 years at an estimated cost of E.£. 8,000.-

Recorders for cards, at an estimated cost of E.£.1,000.-

All 3 cards should have counters that record the machine stopped time and the running time.
The incentive scheme for the carding department can be based on the counter readings.

Pick counters for Schönherr at an estimated cost of E.£. 4,000.-

20 counters are broken and there are no spares available. Second hand counters can be used.

Condenser bobbins for the cards.

For all three cards card clothing belts, chains, bearings.
Estimated overhauling of all 3 cards approx. E.£.100.000.--

It is recommended that the minimum stock level for spare parts be one year.

Action to be taken.

a. For all items check the consumption per year,
b. This figure will represent the "order point",
c. write the order points in the cards,
d. Have the store keeper report all order points reached.

Spare-parts store.

The spare-parts store is in good order and the records are well kept.

7. Production Programme.

Any production programme is effected by the market demand, the type of goods produced, the delivery promises and the variety of products. In the Debra Berhan Wool Factory a very desirable yet difficult situation exists. All of the blankets are produced on speculation. Consequently, there is no requirement to co-ordinate the production with the sales. The production programme becomes one which the marketing feel can be sold. Specific production orders are not sent to the mill. The production plan is reviewed periodically by the General Manager and the Factory Manager and production continues as capacity permits. The exceptions are orders for military use.

Furthermore, it is not possible, even in the production planning to decide in advance upon the colours. The volume of each colour is decided upon by the colours available in the raw stock. Consequently, this normally important and difficult work is eliminated in Debré Berhan Wool Factory.

The general overall plan is decided upon periodically as mentioned above. The detailed planning is done on a day to day basis according to what is available in the raw stock and the yarn store. This planning can be vastly improved by having a larger raw stock from which to select material. At present the Factory Manager is obliged to spend a considerable part of each day occupied in this task. The job could be reduced to a couple of hours once per week with an adequate supply of raw stock.

It is necessary for the planning to be done by the factory management of the mill on a daily or weekly basis. We recommend however, that the Assistant Factory Manager be trained in this task. This work requires a considerable degree of experience and this can only be transmitted over a period of time.

8. Raw Material.

a) Primary raw material.

Frequent references are made to raw material in this report. The reason is that the raw material in the Debré Berhan Wool Factory type of blanket mill is of much more relative importance than most mills. The variety of the raw material is almost infinite. The combination of raw materials varies even under the best of supply materials. The maintaining of as constant a blend of materials as possible becomes very important. The running conditions throughout the mill are affected by the blend. There is nothing which can affect a mill so adversely as improper blending. Consequently, we strongly advocate a larger stock of raw material in order to maintain as consistant a blend as possible.

The present sources of raw material, the United Kingdom, is to our knowledge the best. However, it should be recognised that the labour unrest in the shipping and transport in the UK can create great difficulties for Debré Berhan Wool Facotry if all the raw material is being supplied from that source. We therefore, recommend that Belgian sources be developed and that approximately 15% of the supply be purchased from this country, even if the price is somewhat higher.

b) Dyestuffs and Chemicals.

The supply of dyestuffs is intolerably low. It is impossible to operate efficiently with so little dyestuffs. Most of the dyestuf and chemicals are imported from Europe.

It is recommended that a years supply of imported materials and 4 months supply of local materials be kept in stock.

Following is an estimate of the dyestuffs and chemicals required.

DYESTUFFS AND CHEMICALS TO BE STORED IN THE MILL.

Dyestuffs or Chemicals	Source	Consumption per year/kg	Price E.£. per kg.	Price per year E.£.	Value of storage kept in mill. E.£.
Direct dyestuffs	Import	3,000	8.00	24,000	24,000
Union dyestuffs	Import	500	10.50	5,250	5,250
Cathionic Dyes	Import	2,000	25.00	50,000	50,000
Acetic Acid	Import	3,000	3.00	6,000	6,000
Levelling Agent	Import	2,000	3.00	6,000	6,000
Common Salt	Local	30,000	0.20	6,000	2,000
Soda Ash	Import	3,000	0.50	1,500	1,500
Ammonium Sulf.	Local	1,000	0.40	400	400
Teepol/Detergent	Import	3,000	2.00	6,000	6,000
Total		47,500		105,150	101,150

9. Raw Material Storage.

a). Present floor space utilisation.

The floor space is poorly utilised. 50% of the floor space in the area originally built as a raw material store, is occupied as follows :

1. Spare parts store occupies bays 1 and 2 (see attached floor plan).

2. Old spare parts occupy bays 8 and 9.

3. Chemicals occupy bay 10.

4. Bays 11, 12 and half of 13 are occupied by old waste.

b) Recommended action to be taken.

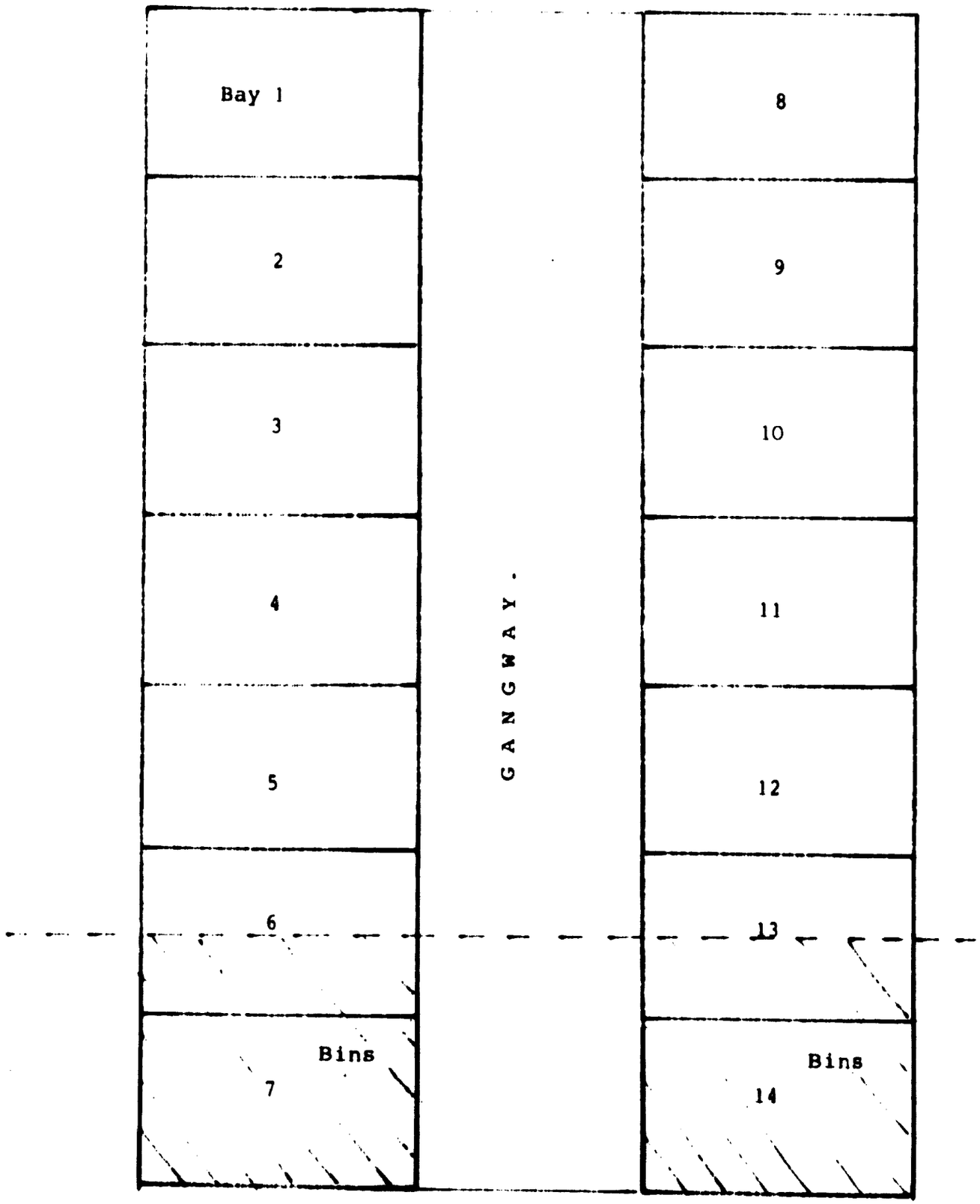
- Move out old spare parts store,
- Move out spare part store,
- Move out chemical store,
- Gradually sell or move the old waste off the premises.

New locations for the above stores were discussed with the management.

Management have a feasible plan to employ the shower rooms and other facilities which have never been utilised for the spare parts and supply stores.

The raw material storing capacity per bay is ca. 40.000 kg The actual storing capacity can be calculated as 50% of the total since new material cannot be stored until the old lot is used. Consequently, the additional new storing capacity (0.5 x7.5 bays x 40.000 kg = 150.000 kg which is sufficient for the increased raw material quantity recommended.

Loading Door.



10. Pulling.

a) Present Production.

The pulling production of August was analysed in detail. There are two pulling machines :

- Autefa (two cylinders) which is used to pull imported material,

- Duesberg/Bosson (one cylinder) which is used to pull own yarn waste only (mainly weaving returns).

Material pulled.	Imports.	Own waste	% of total input.
Carpet thread	5,408		14.00
Tricot	9,219		23.90
Blanket ends	13,137		34.10
Weaving returns		9,003	23.40
Blanket cutting		1,622	4.20
Nappage returns		161	0.40
Total	27,764	10,786	100.00
Grand Total	38,550		
Percentage	72%	23%	100%

Kilograms produced in August 1974	38,550
Machine hours	
- worked	336.4
- idle	117.7
- total	454.1

b) Productivity.

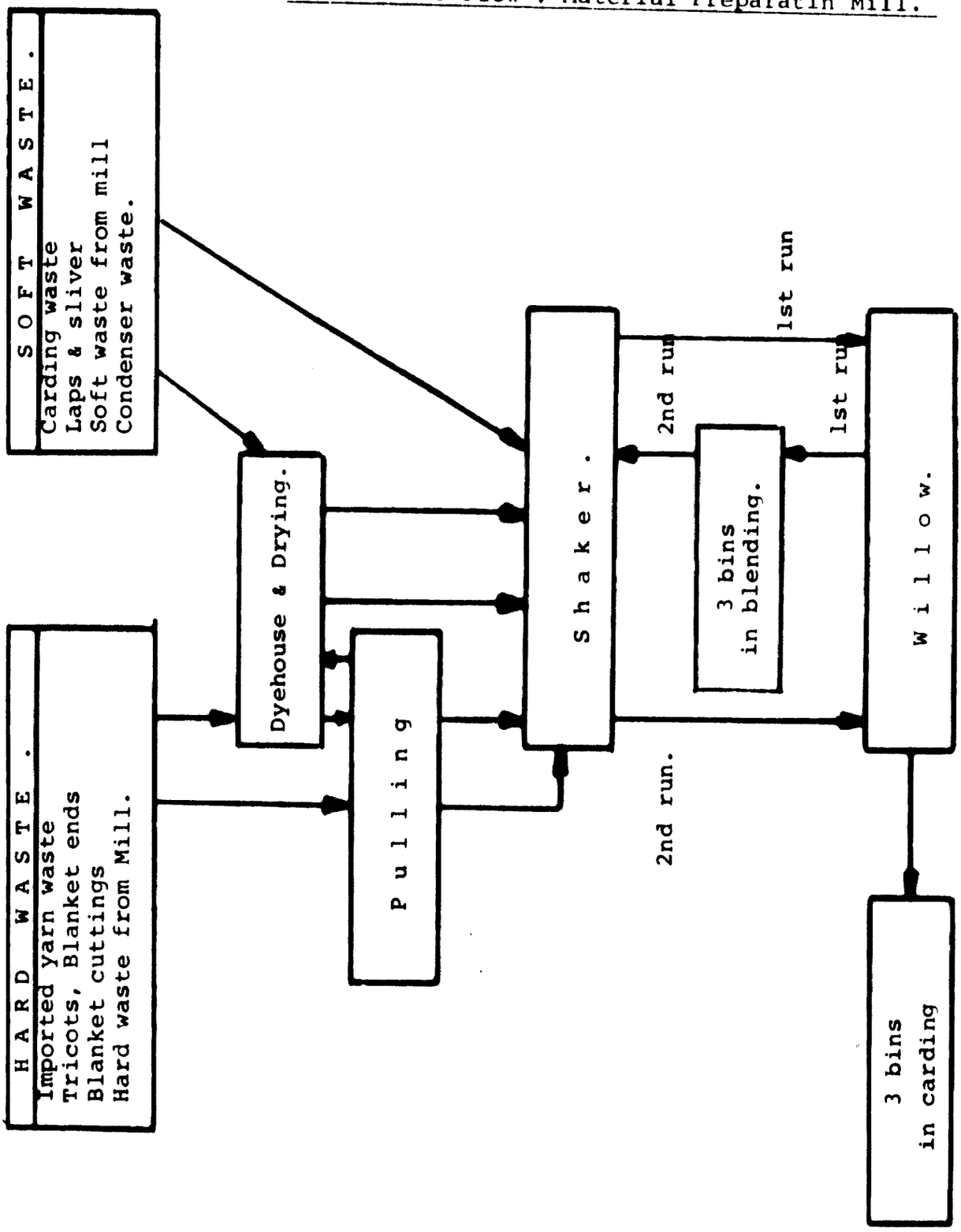
Kilograms pulled per machine jour worked 114.6

The operators are transferred to the cards when the pulling machine is idle, where they perform the card stripping operation. This is a good arrangement.

c) Recommendation.

60 to 80% of the raw material needs pulling. The pulling operation is a key point in the production flow. The machine is relatively simple to maintain. The cylinders, however, must be kept in good condition since a badly maintained pulling machine will damage fibres and cut them to shorter lengths. It is recommended that this machine be stopped and maintenanced on a routine basis of once every two months.

11. Process Flow : Material Preparatin Mill.



i. The raw material is packed in bags after pulling.

ii. The bags are transported to the shaker and the blend fed into the shaker manually.

iii. The first run is :

- manually to shaker,
- through shaker to willow (oil and water emulsion given here),
- to bins in the blending.

iv. The second run is :

- manually from bin to shaker,
- through shaker to willow,
- to bins behind the carding.

v. The blend size is 2,500 kg (determined by the size of the bins).

The blend size is satisfactory.

12. Blending.

a) Present Production.

The blending production of 1st to 28th of August 1974, was analysed in detail. The materials blended were as follows :

Material		kg.	%
X-bred sorted	import	9,075	12.9
Carpet thread pulled	"	6,795	9.6
Sliver laps, sorted	"	11,565	16.4
Condenser waste	"	3,460	4.9
Weaving returns	own	7,931	11.3
Tricot pulled	import	11,903	16.9
Blanket ends	"	12,155	17.4
Spinning returns	own	2,021	2.9
Undercard waste	"	3,128	4.4
Blanket cuttings	"	1,439	2.0
Viscose sorted	import	966	1.3
Total		70,438	100.0

New stock to blends		79.4%
Own waste		20.6%
Machine hours worked	499.4	90%
Machine hours idle	57.8	10%
Total machines hours	557.2	100%

Productivity: 141.0 kg per machine hour worked.

b) Planned New Process Flow.

The factory management has two plans to which we agree which will improve the process and obtain a :

1) better carding efficiency,

2) improved blend production.

i. Additional blend reserve bins behind the cards.

The carding operation is the bottle-neck in the entire manufacturing process. Operations before and after carding have extra capacity. The carding therefore has to be run as effectively as possible.

At present, there is no buffer stock between blending and carding. There are six bins behind the cards and these bins can only hold the running blends.

In case of any disturbance in the pre-carding processes, the lack of spare blends causes idle time in the carding.

Management plans to construct an additional four bins with pneumatic feeding a reserve for the blends to carding. Adequate space near the blender is available.

ii. Install hopper feeder.

The hopper feeder from the scouring range to be attached to the shaker. In addition, by improving the present ducts, the second feeding from the bins could be made pneumatic. The result will be better material handling and improved blending production.

c) Capacity.

The capacity of the blending unit is 350 to 400 kg/hour. The material goes through the machine twice, the actual output of the machine being 175 to 200 kg per hour.
1 to 1.5 hours daily must be deducted for beating the undercard waste.

Actual capacity in 3 shifts :

22.5 x 175/200 kg = 3,938 - 4,500 kg.

A safe figure for production planning is 4,000 kg per day. The blending is able to feed the 3 cards even in improved carding conditions.

13. Carding.

a) Machinery.

Card No.	MAKE.	No.of condenser bobbins.	Cakes per bobbin	Yarn Nm.	Speed Nm/min.
1	Duesberg & Bosson	8	12	1.5	20
2	Alexander & Antoine	8	14	1.5	18
3	Alexander & Antoine	16	10	2.8	15
		16	5	1.5	20

Cards 1 and 2 were originally bought for coarse counts and are suitable for the purpose.

Card No. 3 is built for finer count produce but most of the time is used to produce slubbing for Nm. 1,5. In this purpose two ends are run on one cake and the actual output is 80 ends only. In the present circumstances this is the best solution, but the card is really not suitable for this work.

The cards are badly maintained. The following items need complete overhauling :

- card clothing to be changed,
- feed lattices need changing,
- belts need replacing,
- peraltas to be put back to operation. Repairing has become "a way of life " in the carding department. According to the spare part records, very little replacement parts were used during the last 3-4 years.
  A long list of replacement parts is needed. The value is estimated at E.$.100,000 during a two year period.

b) Present production.

The carding production from 1st to 12th of August 1974 was analysed in detail.

The machine hours were utilised as follows :

- machine hours worked	576	70.6 %
- machine hours idle	240	29.4 %
- total machine hours	816	100.0 %

Main reasons for idle time were :

Reasons.	Hours	%	Sub-totals	%
1. Blend shortage	62.7			
2. Condensor bobbins full	29.6	11.7		
3. No tubes	2.5			
			94.8	40
4. Stripping	5.5			
5. Cleaning	40.4			
6. Pack under card waste	5.8			
7. Blend change	13.1	10.0		
8. Crinding	16.0			
9. Clean breast cylinder	1.0			
			81.8	34
10. Maintenance	8.0			
11. Machine blocked	1.0			
12. Trouble in transfer roll	2.0			
13. Broken belts	6.5			
14. Adjustment	5.3	7.7		
15. Feed lattice broken	2.5			
16. Adjust stripper	2.0			
17. Change bearer roll bearing	5.5			
18. Repair	24.0			
19. No power	6.2			
			63.0	26
Grand Total		29.4	239.6	100

Divided into three main groups, the reasons for idle time can be expressed as follows :

- organisational	94.8 hrs	40%
- cleaning & maintenance	81.8 hrs	34%
- mechanical	63.0 hrs	26%
Total	239.6 hrs	100%

Carding is the bottle-neck operation and the organisational idle time must be reduced to a minimum. This can be improved by :

- better raw material control - having sufficient raw material in storage.
- ordering early enough to guarantee an even flow,
- building spare bins to form a buffer stock as described,
- having additional condenser bobbins made. The supply of condenser bobbins at present is quite unadequate. If the spinning frames have a break-down the cards will be stopped in less than one hours time.

Calculation of number of condenser bobbins required.

100% output ca. 80 kg per card/hour,
8 condenser bobbins per doff = 48 kg,
per doff equals 1.7 doff per hour.

4 hours reserve of condenser bobbins required :

4 x 1.7 x 8 = 55 bobbins per machine as buffer stock.
8 in the card,
10 in the spinning frame,

73 per card.

c) Present efficiency and productivity.

The actual carding production was not previously known since the process does not include weighing of the slubbing produced and the cards have no recorders.

The carding production always is higher than the spinning production because of recycling of material from the spinning frames to the hopper feeder.

This recycling mainly consists of the following :

- condenser waste from condenser bobbins. The bobbins are doffed before they are completely empty,
- suction pipe waste. This is waste that is collected to the suction pipe from broken down ends,
- floor waste and under card rolls.

Weighings were made in the spinning mill to determine the quantity of recycled waste. The weighing results showed that there was approximately 7% waste on the condenser bobbin and that the weight of suction and floor waste was approximately 13%.

Analysis of production 1st to 12th August'74.

- 12 blends fed into carding all Nm.1.5	30,409
- recycling condenser waste 7%	2,128
- recycling suction floorwaste 13%	3,953
Estimated carding production:	36,490

d) Expected carding production.

Calculations were made to establish the new standard for production. During a discussion with management, the following standard production targets for carding were established.

1.- the ultimate or second target efficiency of 71%,

2.- immediate or first target was set 10% below this figure at :

$$0.90 \times 71 = 63,9\%$$

The first target will be achieved with better control and raw material flow.

The second target - 71% overall efficiency - will be reached after the reconditioning of the cards. The calculations for the second target standards are shown on the following table.

The target production for the first stage will be : 21,343 kg/week in 3 shifts.

e) Recommendations.

Complete re-conditioning and overhaul of the cards. A detailed list has been started by the Factory Manager. The cost is estimated at E.$.100,000 over a two year period.

Debre Berhan Wool factory.	CARDING EFFICIENCY CALCULATION.							Werner International	
Card No.	M a k e.	No.of cond. bobbins	Cakes per bobbin	No. of outputs.	Speed m/min.	Slubbing g/m.	100% kg per mach.hr.	100% output : 1st-12th Aug. Tot. Hrs.	Hrs.wkd.
1	2	3	4	5	6	7	8	9	10
1	Duesberg Bosson	8	12	96	20	0.70	80.6	21,923	16,120
2	Alexander & Antoine	8	14	112	18	0.70	84.7	23,038	19,159
3	Alexander & Antoine	16	10	160	15	0.38			
		16	5	80	20	0.70	67.2	13,278	10,127
				448				63,239	45,406

The efficiency can now be calculated as follows :

- over all efficiency 36,490 ÷ 63,239 x 100 = 57,7%
- running efficiency 36,490 ÷ 45,406 x 100 = 80,4%

Column.

1.- Card No.
2.- Make of Card.
3.- No. of condenser bobbins.
4.- Cakes per bobbin
5.- (3) x (4)
6.- Speed of machine
7.- Weight of slubbing
8.- 100% output kg per mach. hour.
9.- 100% output of total hrs. 1st to 12th August.
10.- 100% output of hrs.Worked ist to 12th August.

Card	Hrs 1st to 12th Aug.		
	Wkd.	Idle.	Total
1	200	72	272
2	226.2	45.8	272
3	150.7	121.3	272
Total	576.9	239.1	816

DEBRE BERHAN WOOL FACTORY			EXPECTED CARDING OUTPUT (Nm.1.5)										WERNER INTERNATIONAL	
Card No.	Make	100% output per m. hr.kg.	Total hours per week	Lost mach.hrs. per week. strip 7%	Maint. 2%	Blend change 1.4%	Break down 4%	Wait blend 2%	Total hrs.	Mach. hours wkd.	100% Prod. mach. hrs.wd kg	Running eff. 85%	100% output of 144 hrs.	Over all eff. %
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	D & B	80.6	144	10	3	2	6	3	24	120	9,672	8,221	11,606	
2	A & A	84.7	144	10	3	2	6	3	24	120	10164	8,639	12,197	
3	A & A	67,2	144	10	3	2	6	3	24	120	8,064	6,854	9,677	
Total		232,5	432	30	9	6	18	9	72	360	27900	23,714	33,480	71

COLUMN.

1.- Card number
2.- Card Make D & B - Duesberg Bosson, A & A Alexander & Antoine.
3.- 100% output per machine hour, kg.
4.- Total hours per week 3 x 48 = 144.
5.- Stripping (fettling) cards 5 hrs every 72 hrs 7%.
6.- Maintenance 3 hrs per week. Most of the maintenance will be done when the card is stopped for stripping.
7.- Blend change twice per week, one hour per change.
8.- Break downs reduced from the present 7.7% to 4%, due to better spare parts service.
9.- Waiting blends will be eliminated, allow.2% since interference cannot be always totally avoided.
10.- (5) + ... + (9)
11.- (4) - (10)
12.- (3) x (11)
13.- 0.85 x (12) Time allowed for breaks, small stops and cleaning.
14.- (3) x (4)
15. Sum of (13) ÷ Sum of (14) x 100 %

14. Spinning.

a) Machinery for blanket weft Nm. 1.5

Machine No.	1	2A	2B
No. of spindles	2 x 60	112	112
No. of spindles in use	96 or 120	112	80
Ring diameter	150 mm.	130 mm.	130 mm.
Bobbin length	455 mm.	455 mm.	455 mm.
Weight of package	0.5 kg.	0.42 kg.	0.42 kg.
Spinning m/min.	18-20	18-20	18-20
Slubbing count	1.4-1.45	1.4-1.45	1.4-1.45
Spinning count	1.5	1.5	1.5
Draft	3.5-7%.	3.5-7%.	3.5-7%.

Notes : Card 1 has 96 output units, the spinning frame 120 spindles.
Card 2 has 112 output units, the spinning frame 2A 112 spindles.
This unit is in balance.
Card 3 only produces from 80 output units when processing, Nm. 1.5.
The frame has 112 spindles.

b) Present Production.

The Spinning Production 1st to 12 th Aug. was analysed in detail.

Machine hours worked	590.1	72%
Machine hours idle	225.7	28%
Total machine hours	815.8	100%

The main reasons for idle time :

Reason.	Hrs.	%	Subtotals.	%
1. No tubes	5.5			
2. No condenser bobbins	19.1			
3. Card idle	123.1	18.7		
4. Waiting blend	4.8		152.5	68
5. Card stripping	10.2			
6. Blend change	15.7	3.2		
7. Cleaning	0.5		26.4	12
8. Tin drum broken	37.6			
9. Electrical fault	0.8			
10. Oiling	0.5			
11. No power	5.9	5.7		
12. Adjust tension roller	1.0			
13. Adjust shaft	1.1			
			46.8	20
GRAND TOTAL :	225.7	27.6	225.7	100

Main groups :

- organisational 68%
- stripping & blend changes 12%
- mechanical faults 20%

The main reasons for idle time are :

- imbalance between carding and spinning,
- lack of proper material flow,
- lack of condenser bobbins.

SPINNING PRODUCTION COMPARISON.

(1st to 12th August - Only Nm. 1.5 yarn was spun during this period).

Frame No.	No. of Spind.		Yarn count Nm.	kg. per bobbin	Kg. per conds. bobbin effective	Kg. per cake effective	Speed m./min.	100% output kg p. sp.hr.	100% output kg p. machine.	100% output :		Actual output 1-12th. August.
	Actual	Effective								Total hours	worked hours	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	120	96 or 120	1.5	0.50	5.1	0.425	18	0.724	86.9	23,984	18,258	10,128
2A	112	112	1.5	0.42	4.0	0.295	18	0.724	81.1	22,384	18,240	10,791
2B	112	80	1.5	0.42	4.0	0.285	18	0.724	57.9	15,980	8,992	6,077
Total :										62,348	45,490	26,946

Columns.

1. Frame No.
2. No. of actual spindles
3. Spindles in effective use
4. Yarn Nm.
5. Kg per spinning bobbin
6. Weight of condenser bobbin less recycling waste.
7. (6) ÷ number of cakes per bobbin.
8. Speed m./min
9. (8) ÷ (4) x 60 ÷ 1,000
10. (9) x (3)
11. Total machine hours per frame 1st to 12 th Aug. x (10)
12. Machine hours worked per frame 1st to 12 th Aug. x (10)
13. Actual output of spinning 1st to 12th August.

The overall efficiency can now be calculated

26,946 : 62,348 x 100 = 43.2 %

Running efficiency :

26,946 ÷ 45,490 x 100 = 59.2 %

c) End break testing.

It is virtually impossible to make a thorough analysis of the spinning operation without making an analysis of the end breaks.

A form was designed (see following form) to record end breaks in the spinning.

The end break testing is of primary importance when calculating the :

- expected output of a spinning frame,
- the labour hours required to operate the frame at a certain efficiency.

The following operations on a frame are constant and can be calculated mathematically :

- doffing,
- creeling,
- cleaning,
- patrolling.

The cycle times and frequencies for these operations are fixed for a certain type of yarn.

The variable work content comes from the end breaks - the more the operation is under control the higher the efficiency and the lower the waste, which affects the re-cycling in the carding process and thus the carding production.

DEBRE BERHAN WOOL FACTORY ETHIOPIA

END BREAKS SPINNING

WERNER INTERNATIONAL

SEPTEMBER '74

Sheet No. Date : Tester :

Type of Break	Mach.: Yarn : Blend : Color : No.of sp.: Started: Finished:	Mach.: Yarn: Blend : Color : No.of sp.: Started : Finished:	Mach. : Yarn: Blend : Color : No.of sp.: Started : Finished:	Mach. : Yarn Blend : Color : No.of sp.: Started : Finished:
Back Roller to condenser bobbin. 1.				
Front Roller to Suction Pipe 2.				
With Lapping 3.				
Breaks 1				
2				
3				
Total				
Time elapsed				
B/1000 sp.hrs				
REMARKS:				

RESULTS OF THE END BREAK TESTS.

(Tests taken 10 to 19 september)

Test No.	Yarn Nm.	NUMBER OF END BREAKS IN TEST.							Time elapsed hours	No. of spin-	End breaks per 1000 spindle hours
		Back roll to conds. bobbin	%	Front roll. to suction pipe	%	With lapping	%	Total.			
1	2	3	4	5	6	7	8	9	10	11	12
1	1.5	7	88	1	12	-	-	8	0.20	24	1,670
2	1.5	25	68	6	16	6	16	37	0.32	60	1,946
3.	1.5	8	32	10	40	7	28	25	0.133	60	3,125
4	1.5	29	37	39	50	10	13	78	0.50	40	3,900
5	1.5	28	37	29	38	19	25	76	0.50	40	3,800
6	1.5	22	35	26	42	14	23	62	0.50	40	3,100
7	1.5	37	33	48	43	27	24	112	0.50	40	5,600
8	1.5	39	40	36	37	22	23	97	0.50	40	4,850
9	1.5	24	42	23	40	10	18	57	0.50	40	2,850
10	1.5	25	38	24	36	17	26	66	0.50	40	3,300
Total		244	39	242	39	132	22	618	172 sq.hrs.		3,593

Columns.
1. Test No.
2. Yarn Nm.
3. Breakes in condenser bobbin
4. (3) ← (8) x100
5. Break to suction
6. (5) ← (9) x 100
7. Break with lapping
8. (7) ← (9) x 100
9. (3) + (5) + (7)
10. Test Time
11. Spindles observed
12. Breaks/1000 spindle hours.

Analysis of end breaks.

39% of the end breaks in the spinning are directly caused by the cards. (These are the breaks in column 3).

The end break rate is too high and should be reduced at least by 35%. The main factors giving this improvement will be :

- replacing the card clothing to improve quality of slubbing
- putting the peraltas back into operation (spares have been ordered to complete the job).
- better raw material mix. In the past lack of certain type of raw material resulted in poor blends.

For the present conditions, 4,000 end breaks per 1,000 spindle hours was used in the work load calculations.

d) Time studies.

The spinning and carding processes are closely dependent on each other, since the carding process is the "bottle-neck" in the mill. We decided to provide the management of Debré Berhan Wool Factory with more detail so that improvement in this process would be made. Consequently, we conducted some brief time-studies in order to determine the unit times for various tasks in the spinning.

The work methods also were checked. Machines 1, 2A and 2B were in operation during these studies.

Results of the time-studies.

	BMS.
- End break back roller to condenser bobbin	0.35
- End break to suction pipe	0.14
- End break with lapping	0.30

Weighted average 0.26 BMS.
0.30 BMS allowed in calculations.

- Creeling : Frame 1 — 2.00 BMS for 8 bobbins
  1.20 BMS the 2 extras.

Note : Card No. 1 is supplying spinning frame No. 1. The card produces 8 condenser bobbins but the frame needs 10. Consequently, either 20% of the spindles remain stopped or the frame has to be stopped twice for creeling.

Frame 2A 3.00 BMS
Frame 2B 2.33 BMS

- Doffing : Frame 1, Frame 2A, : 3.00 BMS
  Frame 2B, : 2.40 BMS

- Cleaning : 2 BMS per machine hour.

c) Proposed production.

From the measured observations and checks the expected production per machine hour was calculated :

EFFICIENCY AND PRODUCTION.

	Machine No.		
	1	2A	2B
Stopped time/hr-creel	5.44	7.62	3.38
-doff	4.35	5.16	4.13
-end breaks	1.21	1.20	1.20
Total :	11.00	13.98	8.71
% Efficiency	81.6	76.7	85.5
GMS/Spindle hour at 100%	724	724	724
GMS/Spindle four at 81.6%	591	555	619
Expected production/machine hour-kg	71	62.2	49.5

- do not have equipment to take away full bobbins. Time is lost when the full bobbins are carried to the cops-making by operators.

d) Carding/Spinning Balance.

Comparison of the balance between carding and spinning.

Card No.	Expected Prod.per hr at 71%	Corresponding spinning frame No.	Expected eff. %	Output kg per made hr.
1	57.2	1	81.6	71.0
2	60.1	2A	76.7	62.2
3	47.7	2B	85.5	49.5

i. The efficiencies of the spinning frames 1st to 12th August 1974 were :

Frame	Over all Eff. %	Running eff. %
1	42.2	55.5
2A	48.2	59.2
2B	37.7	67.0

ii. Card 3/Frame 2B actual imbalance is actually bigger than these figures show since only 80 of the 112 spindles are calculated to be producing.

iii. The spinning frames in all cases will have excess capacity compared to carding but they both must be run in three shifts.

iv. Work methods in creeling and mending end breaks are satisfactory. Doffing takes too long because the operators :

- have to carry empty bobbins from the cops making,
- do not always carry them in advance and prepare the doff. Sometimes the machine is waiting idle while they get the bobbins,

e) Recommendations.

- Purchase additional spinning bobbins. Many of the present bobbins in use are worn and sit too low on the spindle. The lift of the machine is thus shortened and the efficiency of both the spinning and cops-winding is reduced.

- Purchase or make additional condenser bobbins. The lack of condenser bobbins causes idle time.

- Replacement of worn and damaged parts such as drums at an estimated cost of E.£.35,000.-

- Material handling equipment (truck) for full bobbins. Time is lost when the full bobbins are carried to the cops making by the operators.

15. Cops winding.

a) There are the following machines :

i. OVEMAG horizontal cops winder for the Snoeck looms.

- 10 spindles (3 out of order),
- 2 operators,
- cops weight 152 gr.
- time to produce a cops : 1.65 min.,
- the operators use tail ends to avoid idle spindle time between supply packages.

ii. Two D. DELERUE & Cie vertical cops winders for the Schönherr and Jacquard looms.

- one machine 15 spindles, (2 out of order),
- one machine 10 spindles (1 out of order),
- production time per cops : 0.91 min. change over stoppage 0.09 min., total time per cops.
- cops weight 110 gr.
- there are yarn feeders who creel in the feed yarns for the cops makers.

b) Present production.

The cops winding production of one week was studied in detail. Timing and stoppage tests were taken and compared to the performance of the cops in the looms.

The cops winding production 26th to 31st August 1974.

Date	PRODUCTION IN KILOS.						Efficiency %.	
	Small cops Delerue.			Big cops Ovemag.				
	Shift		TOTAL	Shift		TOTAL	Small	Big.
	A	B		A	B			
26.8	870.2	1,001.5	1,871.7	108.3	177.7	286.0	80.6	45.9
27.8	1,288.3	1,286.8	2,575.1	191.4	203.3	394.7	110.8	63.3
28.8	1,033.7	1,003.4	2,037.1	217.8	202.0	419.8	87.7	67.4
29.8	1,126.2	1.015.8	2,142.0	238.5	226.7	465.2	92.2	74.7
30.8	897.8	917.0	1,814.8	217.3	247.8	465.1	78.1	74.7
31.8	813.6	736.2	1,549.8	230.6	179.1	408.9	66.7	65.6
			11,990.5			2439.7	86.0	65.3

The Department is now working in two shifts and producing sufficient yarn.

i. Small cops
   - 22 spindles, 16 hrs, 960 min., 100% production 110 gr/min., 105.6 kg/day per spindle.
   = 2,323.2 kg/day.

ii. Big cops
   - 7 spindles, 16 hrs, 960 min., 100% production 92.7 gr/min., 89.0 kg/day per spindle,
   = 623 kg/day.

iii. Total : 0.86 x 2,323.2 kg = 1,998 kg
0.65 x 623.0 kg = 405 kg

Total per day = 2,403 kg
per week =14,418 kg

Notes : When the carding production reaches the first target standard of improvement the cops winding will become very tight.
When the second target standard is reached the department will have to work approx. 118 hours per week.

c) Proposed Machine Speeds.

Speeds of the vertical cops winding machines.

The vertical machines operate at a high speed - up to 230 m per minute for yarn Nm. 1.5

Most of the blends seemed to be able to take this speed. Certain "poorer" blends run very badly at this speed. There were 5-6 end breaks per cops.
In these cases the operators could not keep even 3 spindles producing and tried to keep down the spindle speed by holding the start lever.

A preliminary testing programme showed :

i. with high breakage rate the knots are not made satisfactorily in the cops making,

ii. this type of blends also causes loom stops and the biggest single cause of loss of weaving efficiency,

iii. bad cops can stop a loom 10 times during a one hour. If the weaver has to strip back yarn every time the efficiency loss can be as high as 16%,

iv. tests were taken on the Snoeck looms too and showed that big cops perform much better in the weaving. Weft breaks are greatly reduced. The winding speed for the Snoeck cops in approx. 25% lower than for the small copses.

d) Recommendation.

i. obtain a pulley to reduce the speed of the 10 sp. winder by 25%.

ii. test "poorer" blends as both speeds, by taking end breaks

in cops winding.

iii. Weave these cops in the same loom and take a loom stop test.

iv. If a considerable improvement in the weaving is achieved start running "poorer" blends at lower speed. The reduction in speed would mean an increase in efficiency. It is possible that the same production can be achieved without going on to three shifts.

16. Cotton Twisting.

a) Machinery.

Pfenningsberger 2 x 96 spindles = 192.

- bobbin length 300 mm.
- ring diameter 70 mm.
- bobbin weight 80 gr.
- yarn speed 12.3 m/min.
- yarn count Ne.2/21 = Nm. 17.8

Approx. 5% of the production is lost because there are idle spindles due to various mechanical faults.

There are two operators on the machine.

The creeling and mending end breaks, methods are satisfactory.

Rings have to be oiled manually with a rag.

b) Present Production.-

- The mill has received single Ne 21 cotton yarn on one kilo cones.

  N.B. The mill receives 16, 18 and 21 and these are used for the same purpose.

- Yarn twisted to Ne. 2/21 to be used for blanket warps. After twisting yarn wound on 3 kilo cones.

- Part of the Ne. 2/21 is used for carpet cotton warp. It is twisted over the large cops then cabled to 6/21. The process for carpet yarn is twist 2-ply, wind on cones, twist 6-ply.

- The operators are not on incentive and there are no weights produced on the production sheets.

- From the yarn store records it was established that the production was 140 kg per day 3 shifts.

c) Proposed Production.

Machine stopped time.	Mins. Per shift.	Per hour.
- oiling rings	10,00	1.25
- doffing cycle mins. 80 x 17.8 : 12.3 = 115.8		
- doffing time 4 mins./doff		2.07
Total stopped time/hour		3.32
Running time 94.5%		56.68

Allow 5% efficiency loss for creeling, endbreaks and idle spindles.

Expected efficiency 89%.

Expected output :

$$\frac{12.3 \times 60 \times 192 \times 0.89}{17.8 \times 1000} = 7.1 \text{ kg/mach. hr.}$$

$$= 170 \text{ kg/day/3 shifts.}$$

The weight of cotton yarn per blanket is approx. 155 gr.

The production rate of 170 kg per day equals to approx. 1,000 blankets per day.

This represents the first stage standard production target and at that stage there would not be any capacity left for the carpet manufacturing.

There are several possibilities to overcome this problem.

i. Try to buy part of the cotton yarn twisted,
ii. Do sunday work for the time being - one day is 16.6% additional output.
iii. Convert spinning frame 3B for a twisting frame.
iv. Buy an additional twister for 2-ply cotton.

d) Recommendations.

To get the efficiency up the following is needed :

i. Place operators on incentives.
ii. Idle spindles to be repaired.
iii. Have a doffing trolley made for the machine - see drawing I.
iv. Train the operators to doff properly.
v. Shorten ring oiling time
   - both operators should work simultaneously from different ends of the machine on the same side.

e) Doffing method.

i. Prepare empty bobbins for the side to be doffed in advance.
ii. Before starting the doff have the trolley ready at the side of the machine.

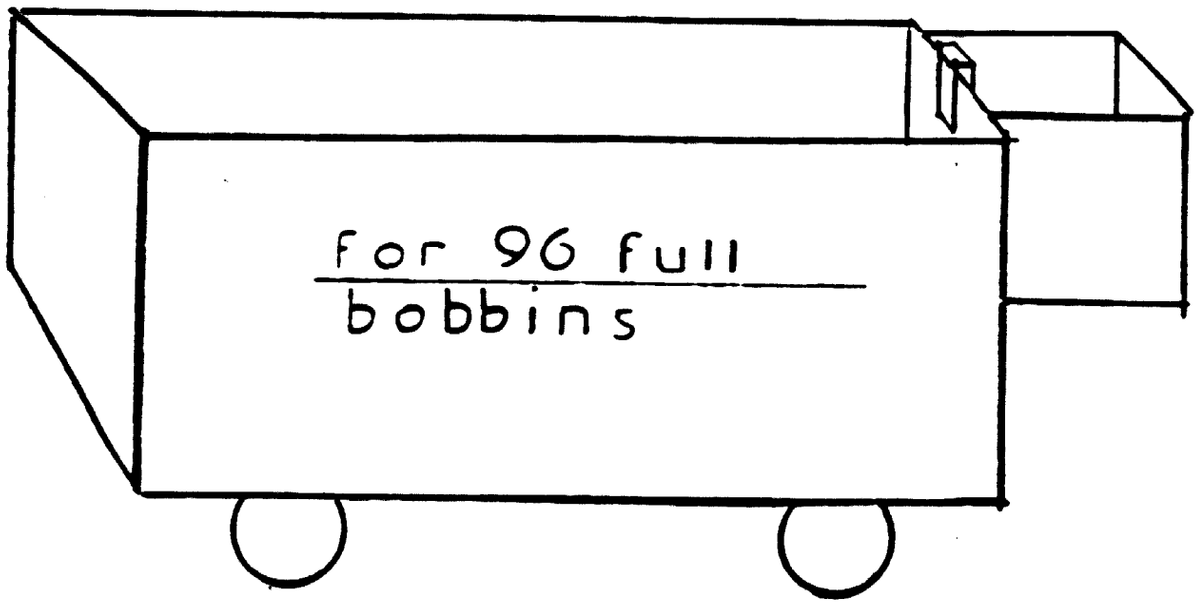
iii. Stop the machine and wind down.

iv. Work as a team of two.

- one goes first and pulls up the full bobbins from the machine (two in one hand) and places them in the doffing box,
- the other operator follows pushing the trolley with her knee so that the trolley stays between the operators,
- the second operator takes empty bobbins from the compartment on the trolley and pushes them firmly into place.
- start machine,
- repair broken ends,
- transport away full doffing trolley,
- prepare trolley for next doff.

DOFFING TROLLEY

drawing I



17. Warping: Blankets.

a) Machinery.

There is one S.A.C.F.E.M. sectional warping machine, year 1964.

- drum width 235 cm.
- present warping speed 140 m./min.
- machine moving on rails,
- single creel opens manually,
- electric stop motions,
- creep package 3 kg,
- No. of cones in creel 155 x 7 sections = total 1080 ends.

There are several mechanical faults in the machine.

The machine is suitable for this type of warping, but the creel is too lightly built. Present 3 kg creel packages are too heavy for the machine design.

i. In several locations there are 1 or 2 break discs and some locations have 3 discs. The tension becomes uneven.

ii. Several creel pegs are badly centered, they are not in line with the guide eye. This can cause pulling of yarn and additional end breaks.

iii. There is no start-stop button in the creel. Thus two operators are needed to run the machine : one at the stop button in the machine end and the other watching the creel and shouting stop signals.

iv. The stop motions are defective. This machine, however, is not a bottle-neck and after the adjustment of the creel pegs the reconditioning becomes secondary in priority to the yarn manufacturing.

b) Time & Method studies.

Operator work methods and unit times are acceptable, taking the mechnical condition into consideration.
The danger point in the work method is that the broken end runs out to the drum and the operator is not pulling the warp back to obtain the broken end. The practice is proven by the many cones on the floor behind the looms. This has been pointed out and there is now a plan to tackle this defect using a quality bonus. We concur with this approach.

The results of the time studies.

i. Preparatory work per section — 1.80 BMS

- measure,
- adjust carriage,
- tighten screw of carriage,
- tie in the leace band,
- cut and knot,
- start drum.

ii. Creel. — 0.40 BMS

- remove old cone
- creel in new cone
- tie a knot,
- start drum.

iii. Repair end breaks, without pulling — 0.25 BMS

iv. Repair end break, pull back — 0.80 BMS

v. Preparation work for warp — 5.00 BMS

c) Production calculation.

	BMS
i. Preparatory work for warp	5.00
ii. Preparatory work per section 7 x 1.80 =	12.60
iii. Creeling	
- warping continuously from the same creel bank	
- one cone running :	
3,000 gr x 17.8 = 52,500 m.	
equals to 7,500 warp meters	
equals to 4.17 warps	
- 25% of the cones needs creeling during one warp	
- stopped time per warp 40 x 0.4 +	16.00
iv. End breaks	
- per section 3 short x 0.25 = 0.75	
7 long x 0.80 = 5.60	
Total : 6.35	
- per warp 7 x 6.35	44.45
v. Actual running time	
- 7 x 1,800 m. + 140 m./min	90.00
Total time per warp	168.05
+ add 5% miscellanecus and 15% rest allowances	33.61
TOTAL BMS :	201.66
	≈ 3.4 hrs
vi. Beaming speed 50 m./min., 1,800 m.	≈ 0.6 hrs
- beaming preparatory and finish up	≈ 0.3 hrs
TOTAL TIME WARPING & BEAMING	4.3 hrs

vii. Expected production 11 warps per week 48 hrs = 19,800 m. 8,250 blankets.

viii. The warping will only be 60-65% occupied on one shift.

18. Weaving : Blankets.

a) Machinery.

There are the following looms in blanket production :

No. of looms	Make	Picks min.	Type of loom.	Reed width/cm.
29	Schönherr	98	4x4	2.00
6	Snoeck	90	4x4	2.00
6	Jacquard	75	4x4	2.60
41				

The Snoeck looms are suitable for blanket production. The loom has a shuttle and cops large enough for this type of work.

The Schönherr looms are satisfactory for the purpose. Shuttle and cops size are on the small side but with one loom per weaver the job load and quality can be maintained.

i. The looms are old, they were bought second hand but they run with very little mechanical down time.

ii. There are relatively few spare-parts that must be imported from Europe.
Most of the repairing work can be done in the mill.

iii. Both Schönherr and Snoeck are amongst the best known in heavy non-auto looms, generally well and ruggedly built.

iv. The looms are weaving blankets where the raising covers minor faults and irregularities which might be caused by the loom.

v. It is quite normal to run this type of equipment with "break down maintenance only".
This means to keep the machines going and repair what breaks down rather than do preventive maintenance. Reconditioning and preventive maintenance in this instance

would be too expensive.

vi. The looms can easily be run for another 5 years, possibly stripping a few looms for spares and running the remaining looms in three shifts.

vii. These looms are almost fully depreciated.

viii. New machinery is expensive and must be run at optimum efficiency and with good labour utilisation.
This needs effective management controls and competent floor management.
It is more advantageous to first establish controls and train floor management before considering new machinery.

b) Present weaving Production.

The weaving evaluation of B-shift, 16th to 20th of September was studied in detail (Schönherr looms).

Day	Picks produced.	Loom Hours			Idle %	Running eff. %.
		Wkd.	Idle	Total		
16.9	738,667	190	10	200	5.0	66.1
17.9	637,424	174	18	192	9.4	62.3
18.9	657,482	175.5	8.5	184	4.6	63.7
19.9	619,844	163.5	12.5	176	7.1	64.5
20.9	678,693	179	13	192	6.8	64.5
Total	3332,100	882	62	944	6.6	64.8

Hrs worked (loom hr = man hr)	882	93.4%
Hrs idle	62	6.6%
Total	944	100.0%

Running efficiency achieved 64.8%

Over all efficiency achieved 60.6%

Separate study of idle time :

	Hrs.	%
Mechanical fault	35.0	38.6
Repairs in work shop	20.5	22.7
Warp thread cut	31.0	34.3
Put in new warp	4.0	4.4
Total :	90.5	100.0

Mechanical down time was approx. 4%.

c) Proposed weaving production.-

i. Loom stop testing.

An analysis of the loom stops was made. The results were converted to stops per 10 M.picks for the work load calculation.

Type of Break.	Breaks per 10 M.picks	%
Warp	6.83	23.2
Weft	21.30	71.3
Mechanical	1.61	5.5
Total :	29.74	100.0

Note : High number of weft breaks (see cops winding).

ii. Time studies.

Time studies were taken, the following BM values were established. They compare well with established international standards.

	BMS.
Prepare shuttle	0.22
Repair and break, behind	0.90
Change shuttle	0.10
Strip backs	0.60
Take off piece, 2 operators	4.00

Work method acceptable except shuttle changing.

There are normally three colors in the loom. The weavers only have one spare shuttle and when preparing the shuttle they do not always know which color runs out first. Very often they have the wrong color in the shuttle and instead of only a shuttle change (0.10 BMS) they also have a preparation (0.22 BMS).

0.22 BMS is lost per occasion, 46 shuttle changes per hour equals to 46 x 0.22 = 10.12 mins. per hour = 17% loss in efficiency if weaver misses all changes.

Need of new shuttles.

- one extra per color, 2 new shuttles per loom, + 50% extra = 120 new shuttles.

iii. Weft Supply.

During the studies, it was observed that the weavers too often run out of weft. Upon investigation it was found that the weft was in the yarn store but the supply had simply not been delivered. In most cases the weavers went to the yarn store to pick up their own weft.

This was discussed with the Factory Management and they have a plan of action to correct this matter.

d) Recommendations.

- Purchase additional shuttles. See section c.ii above.

- Organise the work so that a man is responsible for the control of the supply of weft from yarn store to looms and is paid on incentive of loom output.

19. Nappage : Blankets.

a) Present work method.

i. Piece transported to the door of the napping room.

ii. Operators measure the length of the piece on the floor.

iii. Piece put behind menders table.

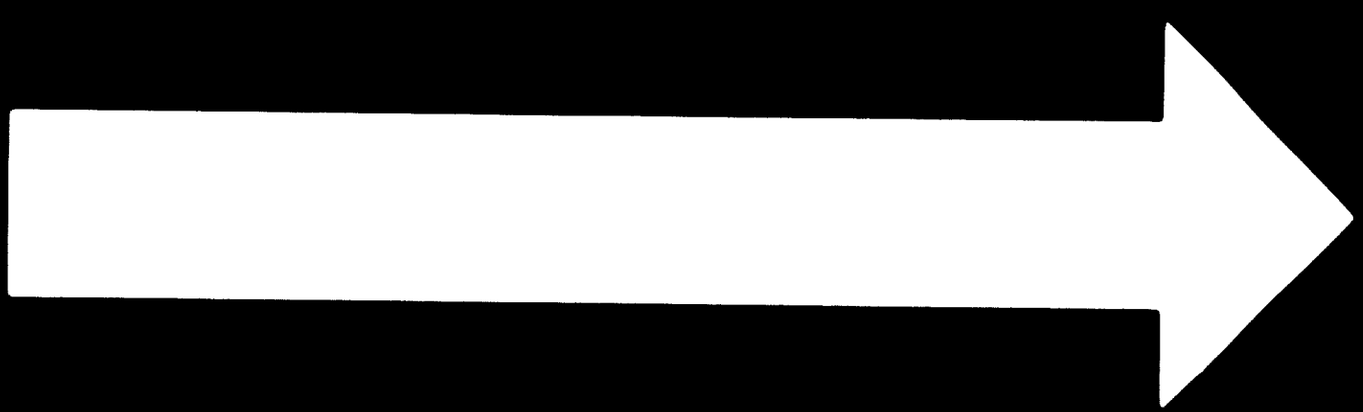
iv. Mender pulls the piece over the table, first pull.

1) Scissor work, cutting
   - trim selvedges,
   - pull out jerk-ins,
   - pull out slough offs,
   - pull out thick slubs,
   - remove bad knots,
   - remove double weft,
   - cut weft loops.

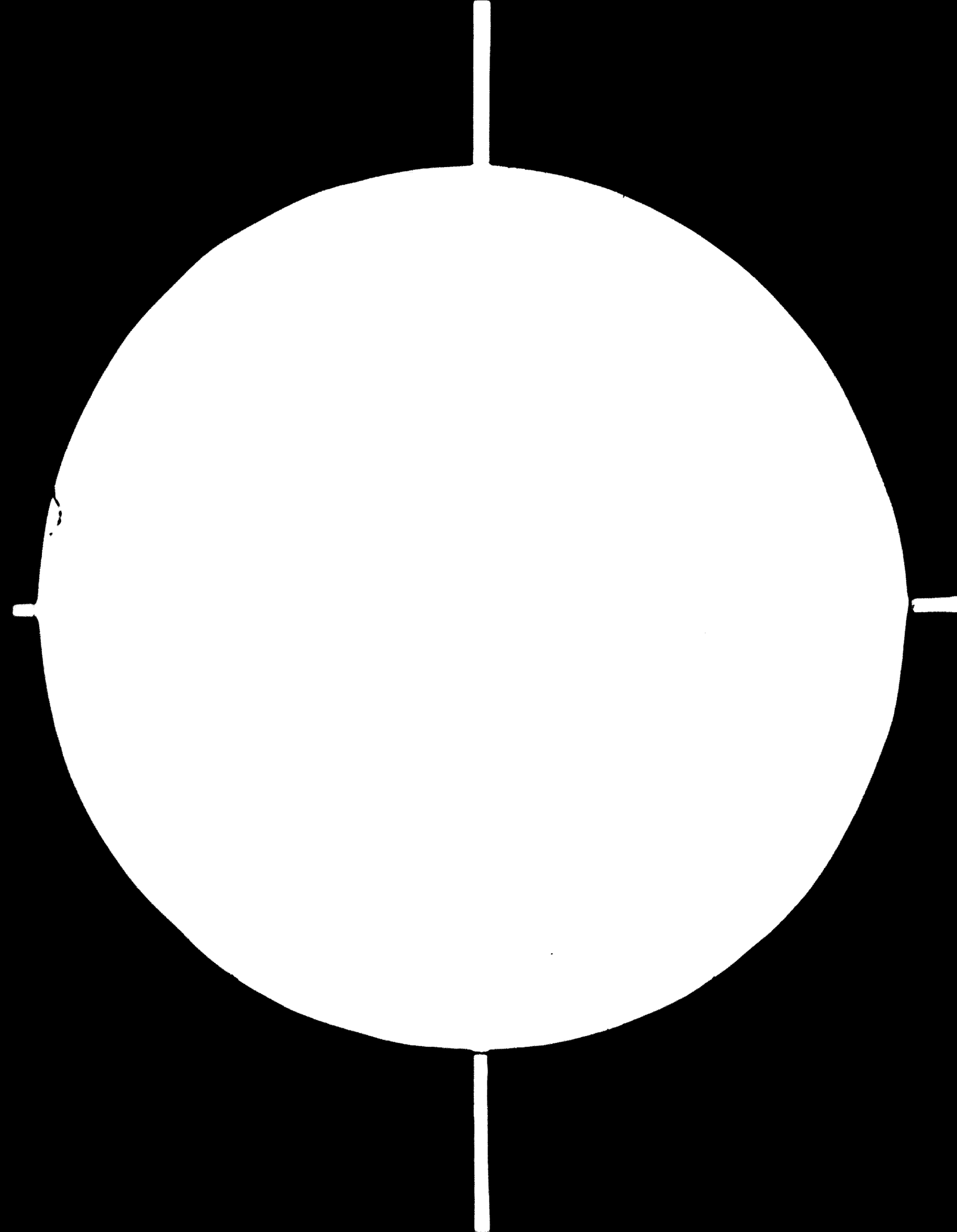
2) Needle work, mending.
   - mend-in missing warp ends.

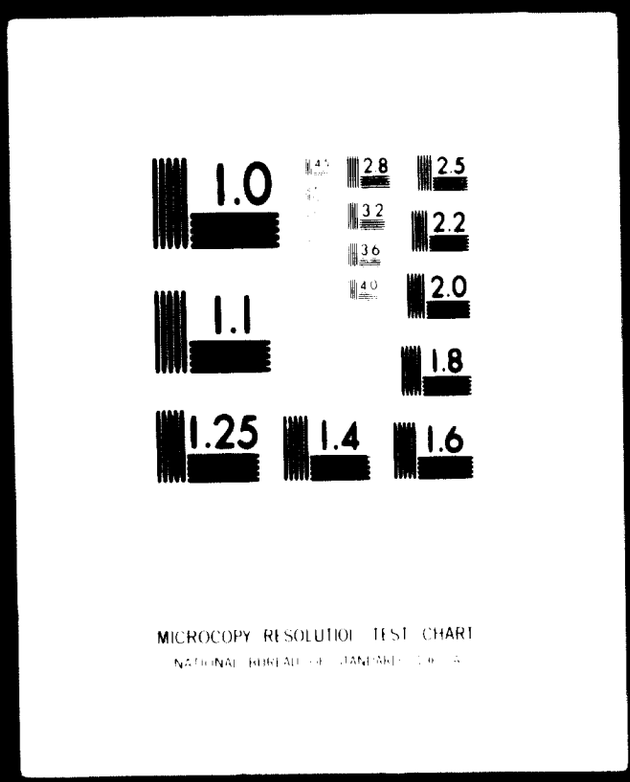
v. Mender turns the piece and pulls it over the table for the second time.
   - burl other side of cloth,
   - mend-in ends which were missed in the first inspection.

B-109



80.02.25





iv. Average production is 3 pieces per 8 hours.

b) New Work Method.

The Factory Management has a plan to change the process in this department, to which we gree.
The plan was discussed with the Management and quality tests were successfully made to eliminate the mending in of single warp ends.

In the new method :

i. Roll the pieces over an inspection perch which has a trumeter and scale attached. The length and the weight of the piece will then be recorded.
ii. Load pieces over a table approx. 2-3 meters wide and 4-5 meters long.
iii. 4 operators (2 per side) work to burl and trim the piece.

This method will produce a great saving in labour.

20. Finishing : Blankets.

a) Process flow and machine utilisation.

Product.	Scour	Dye	Hydro	Suction	Dry	Tenter	Thermo	Raise
Raw Mater.		x	x		x			
Carpet Yarn	x		x		x			
Fam.Blanket	x			x			x	x
Norm.Blanket						x		x

Machine hour required.

Raw material	dye & hydro	250 kg/4 hrs
	dry	1,000 kg/8 hrs
Carpet Yarn	scour	35 kg/1.5 hrs
	hydro	35 kg/0.5 hrs
	dry	35 kg/0.5 hrs
Fam. Blanket	scour	1 pc/1.5 hrs
	extract	1 pc/0.25 hrs
	thermo	1 pc/1.2 hrs
	raise	1 pc/0.5 hrs
Norm. Blanket	raise	1 pc/0.5 hrs
	tenter	1 pc/0.3 hrs

Man hours required.

Raw material	250 kg	6 man hours		
Carpet yarn	35 kg	2.5 man hours		
Fam. Blanket	1 pc scour	1.5	" "	
	extract	0.5	" "	2 m
	thermo	2.4	" "	2 m
	raising	1.0	" "	2 m
		5.4	" "	
Norm. Blanket	1 pc raise	1.0	" "	2 m
	tenter	0.6	" "	2 m
		1.6	" "	

Add 5% miscellaneous, 15% R.A. & 10% handling time.

b) Scouring.

There is one rope scouring machine used for scouring family blankets and carpet yarn.

Family blanket, one piece per batch.

- scour with soap	15 mins.
- 2nd scouring add soap	15 mins.
- rinse with cold water until clear	30 mins.
- handling, fill and take out sew piece	30 mins.
Total cycle :	90 mins.
	1.5 hrs.

Capacity in two shifts = 10.7 pieces. The Jacquard capacity is 10.6 pieces in the same period.

Carpet yarn,

Hanks tied to form a rope are scoured in the rope scouring machine.

The scouring capacity is sufficient for the present production.

c) Suction.

- speed 7.5 m./min. - capacity sufficient,
- family blankets are put through this machine to reduce the water content because the hydro extractor is too small for the purpose.

d) Dyeing.

- There is one open vat for loose material dyeing.
- Batch size 250 kg.

Standard procedure for dyeing.

i. Load in material
ii. Fill vat with water, steam to boil
iii. First scouring 20 mins.
iv. Empty vat and rinse
v. Fill vat with water, steam to boil
vi. Add dyestuff and chemicals,
vii. Boil 1.5 hours
viii. Empty vat
ix. Fill with water and steam
x. Scour second time, short scouring only
xi. Rinse
xii. Empty vat
xiii. Unload material.

Cycle time 4 hrs
Capacity in two shifts 1,000 kg is sufficient
The second scouring is required for quality reasons.
i. The blankets are not scoured
ii. Dyestuffs are used which are not guaranteed for color fastness,
iii. There have been complaints in the past about color bleeding.

e) Hydro extracting.

Capacity 1,000 kg in 8 hrs. The operator can extract the old batch when the new one is in the machine.

f) Thermofix.

- There is a thermo-fix machine that originally was bought to set synthetic mixtures.

- The machine now is used to dry family blankets because the tentering machine does not have the width.

The machine is not suitable for this work. Speed is low (2.8 m./min.), the cloth needs three runs and the heating system uses light oil.

At the moment, however, it is the only machine that can dry the family blankets.

Capacity.

- drying 2.8 m./min., three runs, speed 0.93 m./min. = approx. 50 m./hour (i.e. 7.7 pieces/shift. The weaving capacity is 5.3 pieces/shift).
- The dry run after raising can go with high speed.

g) Raising.

There are two machines :

- heavy raising machine Mariocrosta,
- speed 14.8 m./min.
- both sides of the piece are raised in the same pass.
- total time per piece 30 mins
- maximum production per 8 hrs is 15 pieces.

The second machine Tessiltechnica was not in operation during the study - major overhaudling was being made.
The machine, anyhow, is a lighter type of a raising machine than the first one and is estimated at the maximum production of 10 pieces per day.

Capacity.

The capacity of this section is sufficient.

h) Tentering.

The tentering machine is used only to straighten out the normal blankets and stretch them to the correct width.

The speed is 4 m./min., 240 m./hr. approx. 1,800 m./8 hrs, 865 blankets/8hrs.

Capacity.

The capacity of this machine is sufficient.

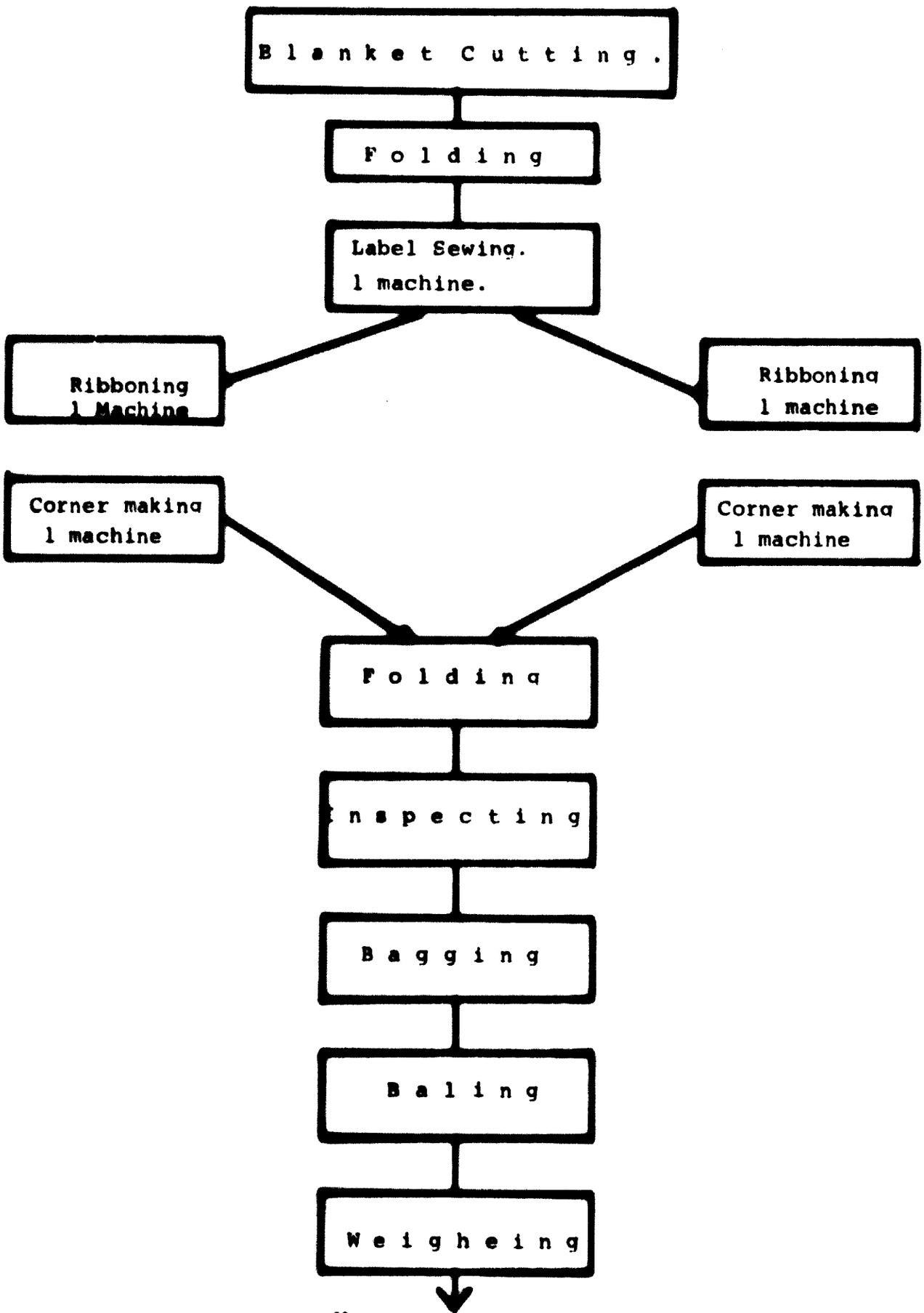
21. Making-up : Blankets.

a) Present Situation.

The present flow is perfectly logical. There is one major process which can be greatly improved and which management have plans to correct. The corners of the blankets are finished manually. This can be done by a sewing machine.

b) Planned process-flow.

We subscribe to the use of sewing machines for the finishing of the corners of blankets. This change will result in a reduction in labour. The process flow would be as follows :


Blanket Cutting.
Folding
Label Sewing.
1 machine.
Ribboning
1 Machine
Ribboning
1 machine
Corner making
1 machine
Corner making
1 machine
Folding
Inspecting
Bagging
Baling
Weigheing

Process Flow.

1. Cut blankets with blade
2. Fold
3. Sew label in the corner
4. Sew ribbon around the blanket
   (family blanket and children's blanket) or at top and bottom (normal blanket)
   Cut with scissors cq. 2 cm over the edge
   Push blanket over to corner making
5. Turn in corners and stitch twice
6. Fold blanket 8-fold and hand over to inspection
7. With scissors trim the yarn ends sticking out and inspect the making-up
8. Put blankets in plastic bag and lay on desk
9. Lay 25 blankets on the bale cloth, push into the press
10. Press the bale
11. Sew bale
12. Fasten straps
13. Wheel bale over to the scale

22. Carpet Manufacturing.

a) Machinery.

One only tapis à verge type MV,
Make : M. Van de Wiele,
Width : 4 meters,
Speed : 42 picks per minute.

b) Present Production.

The carpet weaving production of August was studied in detail.

Item.	Shift A.	Shift B.	Total.
Hrs wkd.	190.5	170	360.5
Hrs idle	71.5	38.0	55.5
Total Hrs	208.0	208.0	416.0
m2 produced	1,316	1,124	2,440
m2/hr. wkd	6.91	6.61	6.8
Top daily prod	68 m2	74 m2	

Calculating from the loom speed 42 PPM and the 500 picks per meter the 100% output is 5.04 m. = 20.2 m2 per hour. Over all efficiencies achieved

Shift A	34.2%
Shift B	37.7%

c) Carpet Construction.

	Count Nm.	Yarns per m.	Kg / m2.	
			4 mm pile	6 mm pile
Wool warp	0.90	290	0.994	1.100
Jute warp	1.80	870	0.495	0.495
Cotton warp	6.00	600	0.155	0.155
Jute weft	1.80	500	0.288	0.288
Total			1.932	2.038

d) Loom stop tests and time studies.

4 loom stop tests were taken each of the covering 2 m. woven carpet = 1,000 picks.

Results of loom stop tests (total 4,000 picks).

Type of stoppage	Test No. :				Total to 4	%
	1	2	3	4		
Warp breaks						
- jute	4	3	3	1	11	11
- wool	3	5	7	7	22	22
- cotton	11	12	6	8	37	37
Subtotal	18	20	16	16	70	70
Weft breaks	2	3	6	3	14	14
Strip backs	3	3	2	4	12	12
Mechanical	1	1	1	1	4	4
Grand total	24	27	25	24	100	100

Cotton breaks is biggest single reason.

Results of time studies.

	BMS
i. Prepare and change shuttle	1.10
ii. Repair cotton break, warp	2.00
iii. Repair jute break, warp	1.00
iv. Repair wool break, warp	0.50
v. Strip back (remove one wire)	1.50
vi. Weft break (weaver catches)	0.50

Stopped time per 10,000 picks and efficiency.

	UT.	Freq. 10,000 Pix.	Total time
i. Repair warp breaks			
- wool	0.50	88	44.00
- jute	1.00	44	44.00
cotton	2.00	148	396.00
ii. Repair weft breaks	0.50	56	28.00
iii. Strip breaks	1.80	48	86.40
iv. Mechanical	0.20	16	8.00
v. Change shuttle - reed width 4.00 m - cops 375 gr. picks per cops 164			
vi. Total stopped time per 10 M.Picks			571.30
vii. Time to produce 10,000 picks			238,10
viii. Total cycle time			809.40
ix. Expected efficiency (7) : (8) x 100 = 29.4%			

These studies clearly show that low efficiences 32.2 and 37.7% in August are caused by two major factors : cotton yarn and shuttle changing.

Cotton yarn.

The cotton warp causes nearly 50% of the machine stopped time.

The price of cotton yarn per one sq.meter of carpet is Eth. ฿ 0.726. The total sq.meter cost is ;13.12.E.฿. The cotton is only 5.5% of the total cost.

It is totally unsuitable to use cheap cotton yarn for the carpet and bring the efficiency down.

Even doubling the cotton yarn price would only add E.฿.0.72(to the total cost but could produce greatly increased square meters per hour, which would lower the labour cost.

Shuttle change.

The loom was operating with only one shuttle. The changing of shuttle is a lengthy one :

- stop loom
- take out shuttle
- open shuttle lid
- take out waste yarn and foam cloth
- place foam cloth on shuttle
- place new bobbin on cloth
- operate press at the side at the machine to press bobbin into location.
- lead yarn through shuttle eye
- put shuttle into box
- start loom.

The whole procedure takes 1.10 mins. When two shuttles are used the preparatory work becomes inside time (machine running) and the stopped time is only 0.15 mins.

e) Projected productivity.

Reduction in stopped time,

- cotton breaks to 25% of the present, from 296 mins to 74 mins.

- shuttle change 0.15 BMS instead of 1.10 BMS. from 64.9 mins to 8.85 mins.

	BMS
New stopped time/10 m. picks	293.25
time to produce 10 m. picks	238.10
CYCLE TIME	531.35

Expected efficiency 44.8%

Improvement in productivity 52.4%

f) Recommendations.

- Purchase top quality cotton yarn.
- Use two shuttles.

23. Woollen Cloth Making.

a) Machinery.

There is machinery available which can produce woollen type. Acrylic cloth as proposed in the marketing section of the report can be manufactured on this equipment.

i. The sectional warping machine is only needed in one shift for the blankets, and is suitable for this type of work.

The mechanical defects in the machine which were previously mentioned under blanket production must be repaired. Quality requirements are higher for warps on woollen cloth than on blankets and a defective warper causes excess mending and seconds cloth.

ii. Pirn winder Hacoba with 2 spindles. Different types of pirns are available :

- for automatic change,
- for manual change,
- cones for cops.

iii. 10 Lenz looms of which :

- 4 automatic 4 x 1 boxes
- 6 non-automatic 4 x 1 boxes
- 140 PPM
- suitable for cloth width 140-150 cm.,
- all looms with dobby.

There is an adequate supply of drop wires, shuttles, beams and cloth rolls.

The following accessories are missing. They have been used to the blanket looms :

- shafts,
- heddles,
- reeds.

iv. Inspection perch with lights available to inspect cloth from roll.

v. The present mending tables are suitable for burling and mending of the cloth.

vi. Finishing machinery available :

- rope, scouring machine,
- milling,
- tentering frame,
- 2-blade shearing machine,
- rotary press,
- Monforts decatizing machine,
- rolling stand.

b) Expected production.

Woollen cloth 10 picks per cm.
Loom speed 140 PPM
Over all efficiency 75%.

$\frac{140 \times 60}{1000} \times 0.75 = 6.3$ m./hr = 50.4 m./8 hrs

10 looms in 3 shifts 9,000 m./week

24. Work-shop.

The mill needs a good work-shop for the following reasons :

- remote location, delivery time for spare-parts is long, many of the parts have to be made,
- remote location, no possibilities to have mechanical work done in town,
- some of the textile machine makers have gone out of business and parts are not available. They have to be made.

a) The following machines need replacing.

i. Lathe P.420, Le Progrès Industriel, Belgium,
Bought second hand, over 40 years old.
Condition very poor :
- guide bed worn out
- drive spindle out of center
- all travelling guides and carriage are worn out
- no spares available
- needs constant repairing
- can probably be used for some rough work

ii. Milling machine, Parkson, England
Made 1930.
The machine is incomplete,
- no arbors and cutters,
- no spares available,
- maker gone out of business,
- cannot be used.

The specifications for the new machinery recommended :

UNIVERSAL LATHE.

- distance between centers 3 m.
- height of center 20-25 cm.
- automatic gear box
- removal gap, size of gap must be specified.

UNIVERSAL MILLING MACHINE.

- clamping table size : width 300-400 mm.,
  length 1400-1500 mm.
- built in driving mechanism for rotary table with power feed, including universal dividing head, vertical milling head, etc...

The price of these machines is approx. Eth.$ 40,000.- to 45,000.- each.

b) Personnel.

The mill requires very capable mechanics. The chief of the work-shop is the only man reputed to be well qualified. It is essential that the mill have two additional well qualified mechanics. The valuable new work-shop equipment recommended should only be used by good mechanics. The major overhauling of the cards and spinning frames should be done by good mechanics. As each year passes the need for well qualified mechanics increases.

We strongly recommend that two well qualified mechanics be hired to replace the less capable men in this department.

25. Supervisory Training.

a) Present capacities.

The training of the floor management is the top priority in the mill training programme.

Most of the supervisors have good mechanical and technical background but they lack the training and tradition of supervision. They are not fully aware of their duties and responsibilities.

They have a problem in identifying themselves. They do not clearly feel themselves as part of the management. Neither are they accepted as fellow workers by the operators. They are acting as middlemen who pass on the orders from top management but do not initiate orders and indeed do not like to issue orders.

b) Recommendations.

i. Establish their levels of authority,

ii. Grade them and establish the caracteristics of each grade,
Grade A, General Foremen,
Grade B, Foremen,
Grade C, Assistant Foremen,
Grade D, Shift Leaders.

iii. Write a job specification for all supervisory staff.
It is proposed that the following procedure to followed :

- The Assistant Factory Manager will be made responsible for writing up the programme,
- He first will discuss with the Factory Manager and write up the specifications for each job as to what the management expects each Supervisor to do.
- He then will interview each Supervisor separately telling them the purpose of the exercise which is to establish the status of the Supervisors and to prepare them proper job specifications.
- He will <u>not</u> show the Supervisor the job description made together with the Factory Manager but will try to get the Supervisor's own idea of what he is supposed to do.
- After interviewing all Supervisors, he will summarise the information and present it to the Factory Manager.
- They will then combine the information and prepare all job descriptions.
- The job description will then be reviewed by the General Manager.

iv. The job description must include the maintaining of the production and quality standards.

v. The Assistant Factory Manager, under the direction of the Factory Manager should hold a meeting of the Supervisors at which he explains the concept of industrial engineering methods and the function of the technical controls.

vi. The Factory Manager should explain the concept of budgetary controls.

c) Illustration of levels of authority._

i. Authorities.

The functions a supervisor may be expected to perform without consulting his superior are these :

- maintaining equipment,
- assigning work,
- requisitioning routine supplies,
- imposing limited disciplinary actions for violation of company rules (excl. warning and suspension notes, discharges),
- temporarily transferring employees within his own jurisdiction where no promotions or demotions are involved,
- inspecting and passing on the quality of work done in his own unit,
- granting time off to employees with the responsibility to check the clocking out. Short absence of up to one day,
- disposing of routine grievances,
- minor changes in established production or work methods,
- taking emergency actions in the absence of a superior

ii. Authorities with report to superior prior to action.

The reason for such reports are usually that the action will have some effect on the work or the working force in other departments or on the company's planning.

The following list shows these functions :

- requisitioning of additional labour,
- regulating working hours in the event of excess or shortage of work,

- signing and handing out warning and suspension notes in agreement with superior,
- requisitioning or ordering special tools or equipment.

iii. Responsibility for recommendations.

Floor management should make recommendations on the following:

- Promoting, demoting and transferring personnel,
- Discharges,
- Applicants for employment,
- Major changes in production methods or machinery,
- Changes in company policies.

d) Illustration of Job Desciptions.

Job Description.

Position : Weaving Supervisor.
Responsible to : Production Manager
Responsible for : Weaving shed staff.

Responsibilities :

1. Supervise loom fixers and weavers,
2. Ensure that optimum efficiency is maintained and costs are kept to a minimum. Maintain productivity standards.
3. Issue priority when different jobs are to be done at the same time,
4. Ensure that looms are well maintained,
5. Issue the loom cards, check that they are properly filled in (spot checks to be made),
6. Order spare-parts well in advance. Keep stock.
7. Handle defective loom reports.
8. Maintain high standard of quality.
9. Check with weaving preparation foreman that warps are coming through.
10. Check with the weft man that weft is available.
11. Keep the place clean and tidy.
12. Report any warps that are going to be delayed in weaving.
13. Training operators on the job.
14. Dealing with operators that are persistently below department standards,
15. Discipline in the department.
16. Responsible for security within the department.
17. Authority to grant special short term leave of absence.
18. Dealing with employee problems : queries, complaints, requests for transfers.

19. Responsible for maintaining work identification through the department.
20. Participation in selection of personnel required.
21. Signs in agreement with superior warning and suspension notes with copies to personnel department and trades union.
22. Responsible for any other duties as delegated by superior.

Job Description.

Position	:	Weftman Chargehand
Responsible to	:	Production Manager
Responsible for	:	Pirn winders
		Weft yarn man
		Pirn stripper.

Responsibilities :

1. Keep all looms supplied with correct weft.
2. See that weft is wound in advance for the night shift during the 8 hour working day,
3. Oversee the pirn winders, yarn man and the pirn stripper,
4. Get weft order slips from the warp man.
5. Order weft according to the instructions.
6. Organise the work for the weft winders to ensure maximum efficiency.
7. See that the packages are large enough.
8. Give work to the weft winders so that yarns cannot be mixed.
9. Keep weaker yarns on slower spindles.
10. Report to production manager if expected production cannot be achieved.
11. Discipline in the department.
12. See that place is kept clean and tidy.
13. Responsible for any other duties as delegated by supervisor.

26. Organisation Structure.

a) Present Organisation.

The present organisation is shown on the following chart

b) Proposed organisation.

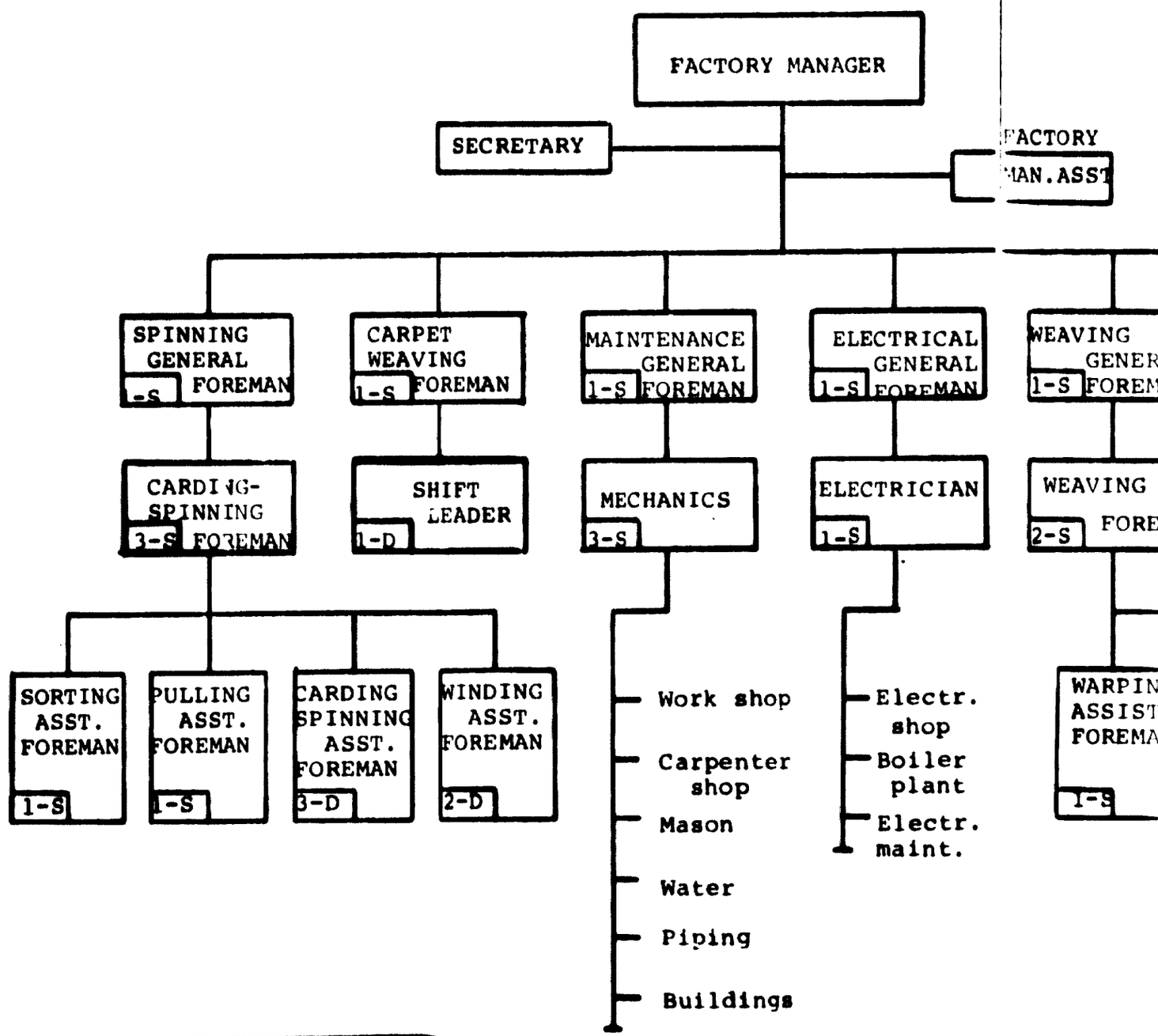
The proposed organisation changes have been discussed with management. The changes relate to the Preparatory Department. At present, the Spinning General Foreman is required to supervise over 180 persons many of whom are hand-work such as sorting and who require considerable attention. It is proposed to separate the Preparation from the Carding and Spinning.

The Raw Material Store can at that time be placed under the jurisdiction of the Head of the Preparation Department.

The Nappage Department is recommended to be moved from the Finishing General Foreman to the Weaving General Foreman. This organisational structure change does not conform to classic guide-lines, wherein the party who is responsible for manufacturing the goods should not be responsible for inspection. In this instance, however, the problem of reporting defectively woven goods warrants the necessity of lacing the inspection under the Weaving General Foreman so that the reporting need not be attributable to specific inspectors.

The Standards Department must now be included in the organisation structure.

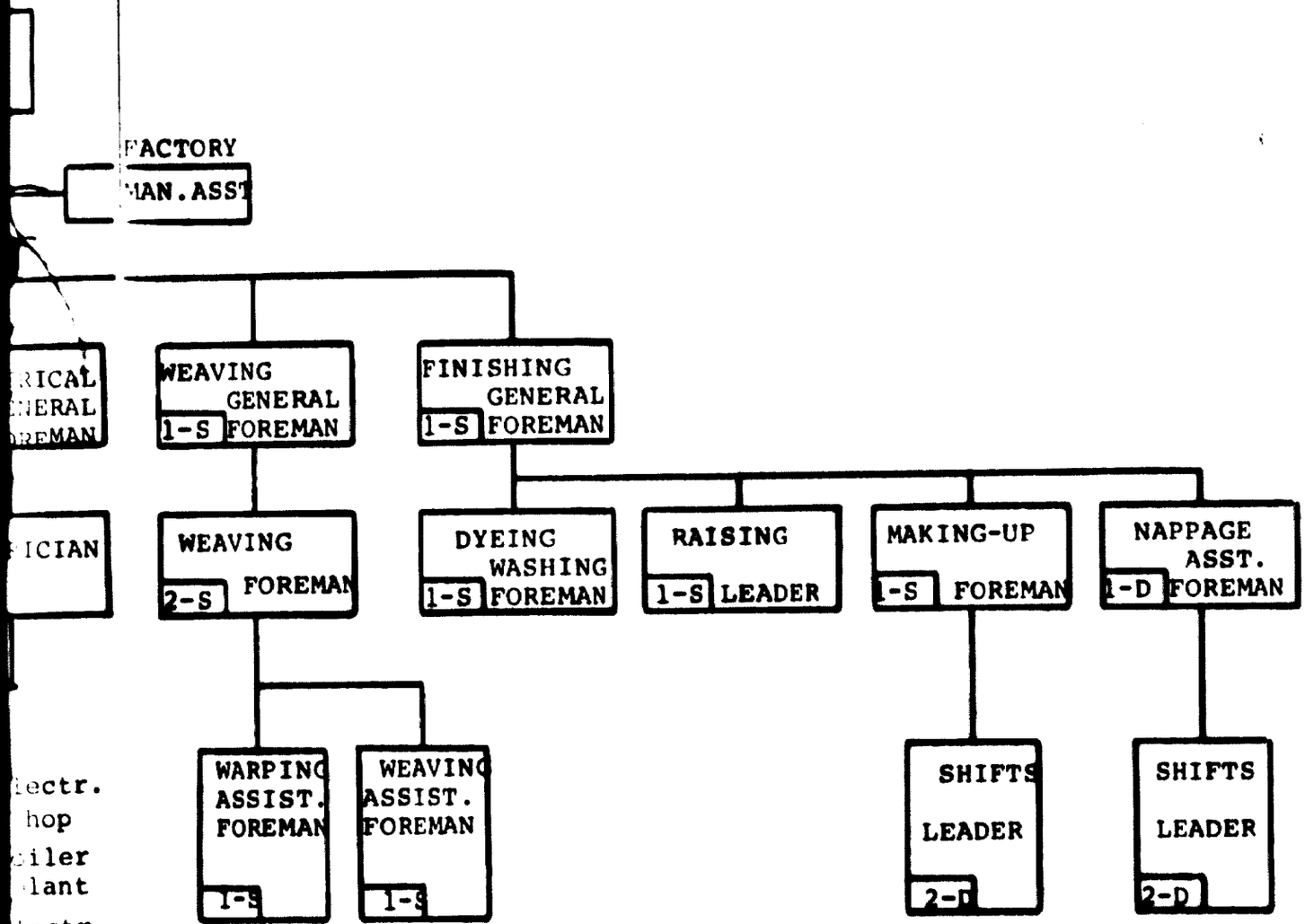
Following is the chart illustrating the structure of the proposed organisation.


FACTORY MANAGER
SECRETARY
FACTORY
MAN.ASST
SPINNING GENERAL FOREMAN
-S
CARPET WEAVING FOREMAN
1-S
MAINTENANCE GENERAL FOREMAN
1-S
ELECTRICAL GENERAL FOREMAN
1-S
WEAVING GENER
1-S FOREM
CARDING-SPINNING FOREMAN
3-S
SHIFT LEADER
1-D
MECHANICS
3-S
ELECTRICIAN
1-S
WEAVING
2-S FORE
SORTING ASST. FOREMAN
1-S
PULLING ASST. FOREMAN
1-S
CARDING SPINNING ASST. FOREMAN
3-D
WINDING ASST. FOREMAN
2-D
Work shop
Carpenter shop
Mason
Water
Piping
Buildings
Electr. shop
Boiler plant
Electr. maint.
WARPIN
ASSIST
FOREMA
1-S

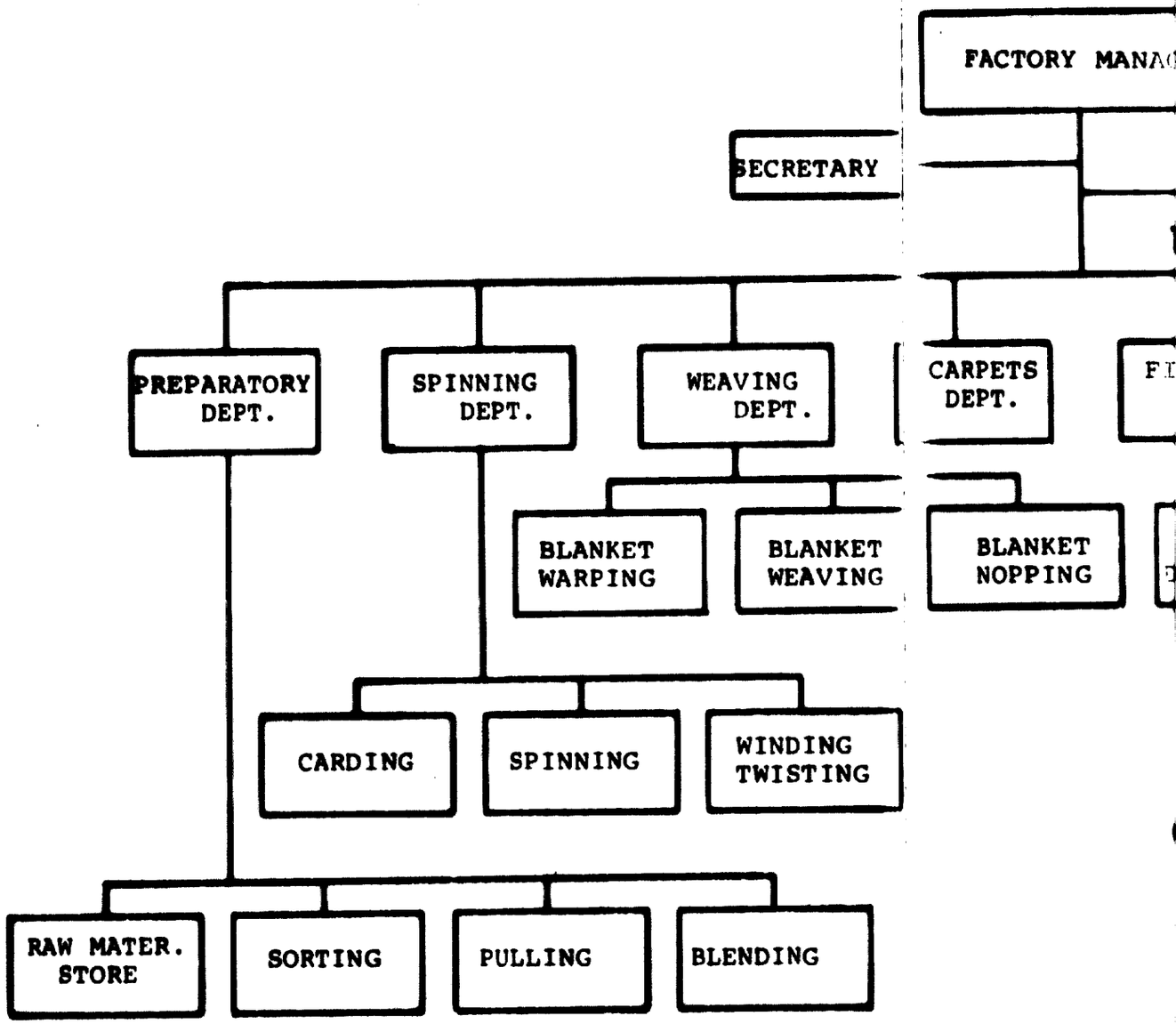
SECTION 1

ORGANIGRAM OF THE

PRESENT ORGANISATION.



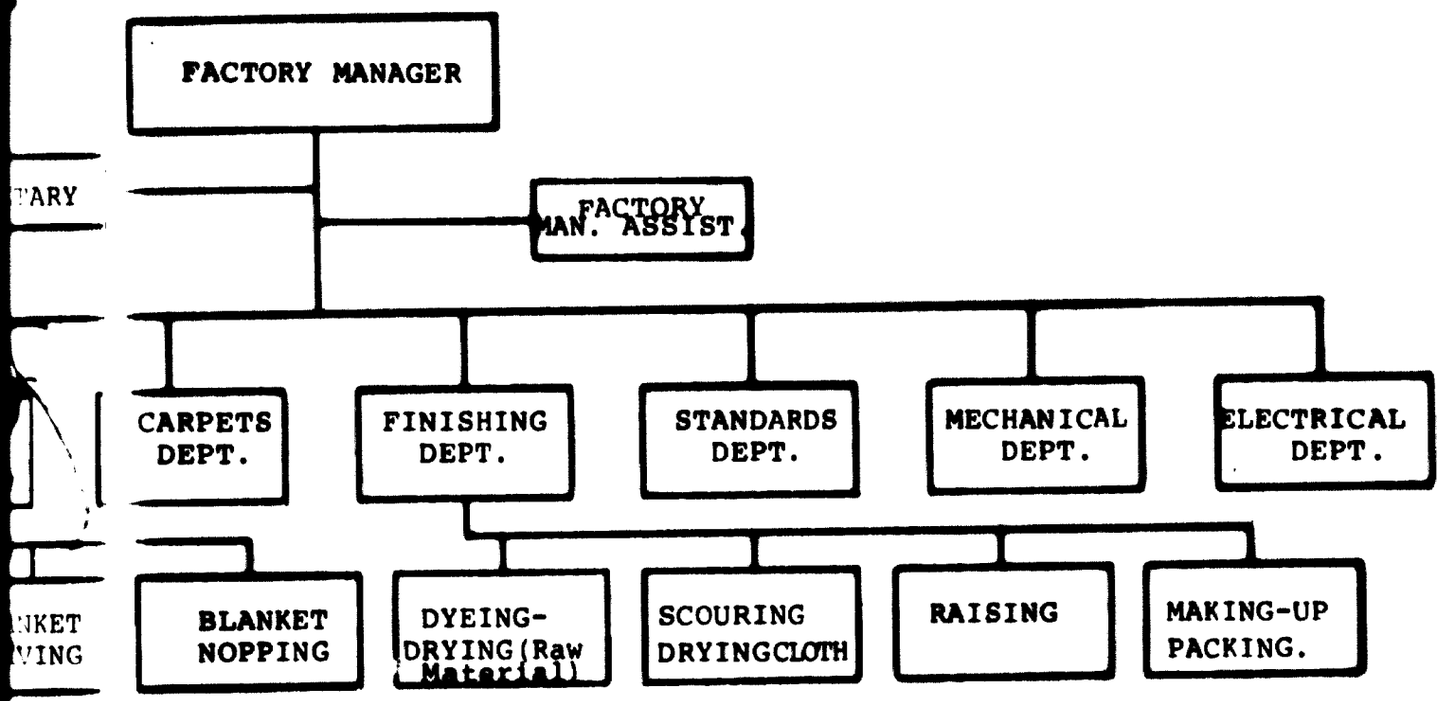
SECTION 2


FACTORY MANA
SECRETARY
PREPARATORY DEPT.
SPINNING DEPT.
WEAVING DEPT.
CARPETS DEPT.
BLANKET WARPING
BLANKET WEAVING
BLANKET NOPPING
CARDING
SPINNING
WINDING TWISTING
RAW MATER. STORE
SORTING
PULLING
BLENDING

SECTION 1

ORGANIGRAM OF THE

PROPOSED ORGANISATION.



SECTION 2

IV. STANDARDS DEPARTMENT.

IV. STANDARDS DEPARTMENT.

A great amount of time was spent in giving the Assistant Factory Manager instructions and explanations regarding the operations of the mill. All of the calculations which were made in the manufacturing analysis were done with the Assistant Factory Manager in attendance. The purpose was to provide him with as much working knowledge and experience as was possible to give during the analysis period. He was enthusiastic and responded admirably.

We decided that among the many areas where improvements could be made, the one which would provide the greatest benefit to Debre Berhan Wool Factory was the installation of a Standards Department. Consequently, a large proportion of our time was spent in getting such a project underway and providing illustrations to the Management as to how a Standards Department functions.

Following is an outline of the functions of the Standards Department in the form which can be employed as a work programme.

1. Function.

The function of the standards department is to advise management of the operating condition of the mill vis-à-vis established standards. Consequently, management are better able to exert control over the operations and to implement improvements.

2. Establishment of standards.

- The Standards Department develops proposed standards via tests and observations.
- During this development stage the Standards Department personnel work closely with the mill supervision.
- The proposed standards and test data are reviewed by management and ultimately standards are established.

3. Routine testing and reporting.

The Standards Department conducts numerous tests and compile reports on a scheduled basis. The reports are submitted to management.

4. Areas which are standardised.

The Standards Department can ultimately be developed to cover many controllable items in manufacturing :

processing,
raw material,
waste,
quality,
maintenance,
labour unit cost,
productivity

We have strongly recommended that Debré Berhan Wool Factory establish a Standards Department and management have already proceeded to do so.

The Assistant Factory Manager has been given instruction on the functions and operations of a Standards Department. He has participated in the analysis of the manufacturing division and is familiar to some degree with the setting up of a Standards Department. Initially it will be his task to organise the Standards Department and to get it functioning.

We recommend that after the department has established processing and waste standards and routine testing, that he be sent to the United Kingdom to be trained in work study. He will then be in a position to train one of the men in the Standards Department to conduct this important work.

5. Staffing.

The department should initially employ a Standards Officer and a tester.

Following is a job description for the Standards Officer.

JOB SPECIFICATIONS.

Standards Officer in charge of the Department and responsible to the Factory Manager.

Duties : i. Responsible for carrying out the standard labour hour and standard labour cost control.

Responsibilities :

- every pay-roll obtain the wages paid and hours worked from the pay-roll officer,
- obtain the production figures from departmental production sheets,
- calculate the cost per unit,
- distribute the information,
- in case of any irregularities find out the possible reasons and report them in connection with the control data.

ii. Responsible for carrying out the departmental efficiency and idle time control.

- every period get the departmental production statistics and calculate the percent of idle time and record the reasons.
- get the regular hours worked and the overtime worked from the labour officer,
- calculate departmental efficiency,
- distribute the information,
- in case of any irregularities find out the possible reasons and report them in connection with the control data.

iii. Responsible for carrying out departmental processing control program and overseeing that the tester performs his duties properly.

- keep graphs and charts to control the frequencies of the testing program;
- make sure tests are carried out and the results calculated and recorded,
- in carrying out the processing control program be in close co-operation with the supervisory staff to ensure the optimum flow of information through various stages of manufacturing,
- make quarterly summaries showing the development of processing conditions in the various departments.

iv. Responsible for checking operators work-loads and renewing production standards as required.

(This work is to commence after the Standards Officer has been given basic work study training).

- when observations and processing tests indicate that there has been a change in the process, the Standards Officer will :

  a. report the condition to the Factory Manager,
  b. take necessary frequency and time studies,
  c. prepare calculations,
  d. present the results to the Factory Manager.

v. Follow up the performance and premium earnings of the operators.

- every pay-roll period check the performances and premiums earned by the operators,
- in case of continuous below-standard performances, study the reasons and give recommendations to the Factory Manager,
- check if the below-standard operators are using right methods,

iv. Own initiative.

- make recommendations to Factory Manager as how to improve conditions in the various departments.

6. Efficiency Control.

a. Terminology.

The following terminology is used :

i. theoretical production, calculated directly from speed

Example : Schönherr loom.
60 x 98 = 5,880 Pix per hour.

ii. overall efficiency.

$$\frac{\text{actual production}}{\text{theoretical prod.}} \times 100$$

Example : Schönherr production
33,500 picks per shift.

overall efficiency

$$\frac{33,500}{8 \times 5,880} \times 100 = 71.2\%$$

iii. total machine hours,

The hours the machine was available for production : normally always 8 hours per shift.

iv. Machine hours "idle".

The hours the machine was stopped for the following reasons :

- mechanical break down,
- change-over
- lack of material
- lack of bobbins (spools, etc...)
- no. of operators,
- power failure
- etc...

v. Machine hours worked.

Total machine hours (iii) less machine hours "idle".

vi. Running efficiency.

$$\frac{\text{Actual Production}}{\text{theoretical prod. per hr.} \quad \text{machine hrs worked.}}$$

b) Calculations.

In each process section of the text of this report there are illustrations, where applicable, of the efficiency calculations.

The Standards Department should calculate every quality for each process in the same manner as has been illustrated. Summary reports for each period should be drawn up and submitted to management. The standards must be established via approval by management.

7. Processing controls.

The purpose of the processing controls is to guarantee optimum running conditions by carrying out a routine testing programme in the mill.

In carrying out these duties the Standards Department should work very closely with the Foremen and Mechanics and lend them all possible assistance in keeping the quality of the product and process under control.

The initial Processing Controls should include :

- percentage of waste in blending
- percentage of re-cycled waste in carding,
- end-break testing in spinning,
- end-break testing in cops-winding,
- idle spindle test in spinning,
- loom stops in weaving-blankets,
- loom stops in carpet weaving.

Each of these tests has been illustrated in the text of this report. These tests should be initially established on a weekly basis.

8. Waste Report.

The Standards Department should issue a Waste Report every period. The records should be reviewed with management every six months and new standards established. Following is an illustration of the Waste Report.

Debre Berhan Wool Factory	WASTE REPORT - SPINNING MILL.	WERNER INTERNATIONAL

PERIOD :

Blend Input weight + 1.5% oil -

PROCESS	TYPE WASTE	RETURNABLE OR NON-RETURN	WEIGHT	PRODUCTION	% Waste on blend input.	
					Actual	Standard
Shaker	Under mach.	non-return				1.0
	Suction	non-return				1.0
	Fly	non-return	estimated		0.5	0.5
Card	Under card	non-return				1.0
		returnable				9.0
	Stripping & Peralta	non-return				2.0
	Fly	non-return	estimated		0.5	0.5
Spinning	Condenser	re-circu-lated to card proc.				20.0
	Suction waste	immediate-ly				
	Floor waste					
	Fly yarn	non-return	estimated		0.5	0.5
		returnable	included	with cops	yarn	
	Lot run out	returnable				3.2
Cop making	Yarn	returnable				2.7
Sub-total		returnable				14.9
		non-return				6.5
						21.4
		re-circu-lated				20.0
TOTAL :						41.4

DEBRE BERHAN WOOL FACTORY	WASTE REPORT - WEAVING & FINISHING	WERNER INTERNATIONAL

PERIOD :

Input weight to weaving -

Process	Type Waste	Returnable or non-return.	Weight	Production	% Waste			
					On input to weaving		On blend input to spin.	
					Actual	Stand.	Actual	Stand.
Weaving	Yarn	return.				9.7		8.6
	Sweeps	non-ret.				1.13		1.0
Raising	Suction	non-ret.				8.3		7.4
Last touch	Blanket cutting	Return.				3.36		3.0
- Sub-total Returnable						13.06		11.6
Non-return.						9.43		8.4
								20.0
- Grand total Spinning and weaving	Returnable							26.5
	Non-returnable							14.9
								41.4

Composition of blends.	Weight.	% Blend.
New Raw Material		
Returned Waste		
Oil - 1.5%		

% Yield on blend input :

% Yield on new raw material :

REMARKS.

9. Standard Labour Hours and Labour Cost.

A complete record of the standard number of persons required to produce the standard production must be drawn up by the Standards Department.

The following forms should be used for this purpose. The Standards Department must calculate the labour requirement and obtain approval from management before the standards are established.

Debre Berhan Wool Factory	STANDARD LABOUR COMPLEMENT.	Werner International

Department : -

Code	Job Classification.	Day Only.	Shifts.			TOTAL
			I	II	III	
	Direct :					
	Indirect :					
Total						

REMARKS :

I. O.

Debre Berhan Wool Factory	STANDARD LABOUR HOURS.	Werner International

Department :

CODE	JOB CLASSIFICATION.	OPERATOR HOURS PER DAY.					Hrs per Departm. Hour.
		Day only.	Shifts I	Shifts II	Shifts III	TOTAL	
	Direct :						
GRAND TOTAL							

REMARKS.

10. The Labour Cost per Unit of Production.

From the labour complement the labour cost per department must be calculated. Since the labour complement is based on the standard of production established for each department, the standard cost per unit of production can readily be determined. These calculations must be given to the Costing Department for the establishment of the Standard Costing.

The actual labour cost vis-à-vis the actual production must be calculated each period in order to determine the actual labour cost per unit of production. This figure must be compared to the standard, these comparisons must be reported to management each period.

Following is an illustration of a comparison report.

DEBRE BERHAN WOOL FACTORY	LABOR COST AND PRODUCTION PER LABOUR HOUR	WERNER INTERNATIONAL

Department :
Section :

Period No.	Period from to	Prod. Unit / Units Prod.	Labor cost Eth. $.	Total oper. hours	Std.Labor cost and prod.		
					Cents per Unit	Units per Op.hr.	Cents per Op. hr.
					ACTUAL RESULTS.		

11. Liaison with Costing Department.

The Standards Department must inform the Costing Department of every change in standards so that accurate costings can be calculated. This applies to the following :

- Production & Efficiency Standards,
- Waste percentage Standards,
- Labour Cost Standards

12. Production targets for the Mill.

a) Base for the Standard Production Target.

The carding production is the bottle-neck that determines the spinning and blanket production.

The overall efficiency of the carding 1st to 12 Aug. was 57.7% (August was selected, because it was the best in 1974). Based on Werner calculations, the standard was set to 71% overall efficiency to be achieved after the reconditioning of cards. In the meeting on Sept. 16 it was decided that the first target would be 10% below this figure, and after reconditioning is completed it would go to 71%.

CARDING STANDARD PRODUCTION - BLANKET YARNS.

Card No.	100% output kg per m/c hr	71% output kg pr m/c hr	90% of the 71% output kg/m/c hr	Product. kg per 144 kg hr work
1	80.6	57.2	51.5	7,416
2	84.7	60.1	54.1	7,790
3	67.2	47.7	42.9	6,178
TOTAL	232.5	165.0	148.5	21,384

The first target represents 63.9% overall efficiency which is 10.7% improvement on the 1st to 12th August 1974.

b) Production Balance for the first standard production Target.

Basis : - carding capacity of 21,384 kg/week
- recycling spinning-carding 20%
- new material required from blending
0.80 x 21,384 kg = 17,107 kg
- waste before carding output

shaker	: under mach.	1.0%
	: suction	1.0%
	: fly	0.5%
card	: under card	10.0%
	: stripping & Peralta	2.0%
	: fly	0.5%
TOTAL :		15.0%

Blending : input 20,126 kg per week (15% waste)

Bland as follows 26.5% returned waste
1.5% oil
72.0% new stock

New stock needed 0.72 x 20,126 = 14,491 kg/week.

Pulling : 70% of the raw material going into blends is pulled.
Input to pulling 0.70 x 14,491 = 10,144 kg/week

Carding : carding capacity 21,384 kg/week.

Spinning: recycling 20% production
0.80 x 21,384 = 17,107 kg/week
less 6.4% waste 1,288 kg Prod. 15,835 kg/week
yarn for cops making.

Cops making & weaving waste :

Waste from cops making	2.7%
Weaving (yarn 8.6%, sweeps 1.0%)	10.83% (of input weaving).
Yarn from cops making	15,392 kg
Yarn used for blankets 13,636 kg	
Waste 1,656.12 kg.	

Yarn weight per blanket : $\frac{1086 \times 179 \times 52}{15 \times 25} = 2.696$ kg

No. of blankets per week : $\frac{13,636}{2.696} = 5,058$

843 per day.

Weaving requirements : Picks per blanket 2,390

M.Pix per week required 5,058 x 2.390 = 12,089

Weaving capacity :			
Schönherr	29 x 96 x 5,880 =	16,370	M.Pix
Snoeck	6 x 96 x 5,400 =	3,110	"
Jacquard	6 x 96 x 4,500 =	2,592	"
Total :		22,072	M.Pix

The weaving has to run at 54.8% overall efficiency if all looms are used.

22 Schönherr in operation	22 x 96 x 5,880 =	12,419 M.Pix
Snoeck	6 x 96 x 5,400 =	3,110 M.Pix
Jacquard	6 x 96 x 4,500 =	2,592 M.Pix
Total :	34 ∿ 68 weavers =	18,121 M.Pix

With 22 Schönherr looms, overall efficiency required is 66.7%.

Cops winding : production divided in proportion to loom picks.

big cops Snoeck - 3,110 Pix - 17.2%
small cops Sch.& Jac. 15,011 Pix - 82.8%

Yarn to cops winding 15,835 kg - 2,724 kg big cops
- 13,111 kg small cops

Small cops 2,186 kg per day/2 shifts 94% eff. on 22 spdls.
Big cops 454 kg per day/2 shifts 73% eff. on 7 spdls.

Twisting (cotton 2 ply) yarn Ne. 2/21 = Nm 2/35
speed 12.3 m./min.

Production at 89% eff. $\frac{12.3 \times 60 \times g. \times 0.89}{\text{min.} \times 17.8 \text{ m.}}$ = 37 gr/sp/hr.
= 7.1 kg/mach.hr.

Expected production per week 1,022 kg

Warping : Expected production 11 warps/48 hrs
Required production 7 warps/48 hrs
with full cones the department is 64% occupied.

Man hours per product/finishing.

	Unit	Basic	Total hours
Raw material	250 kg	6.00	7.80
Carpet yarn	35 kg	2.50	3.25
Fam. blanket	1 pc	5.40	7.00
Norm.blanket	1 pc	1.60	2.10

Example :

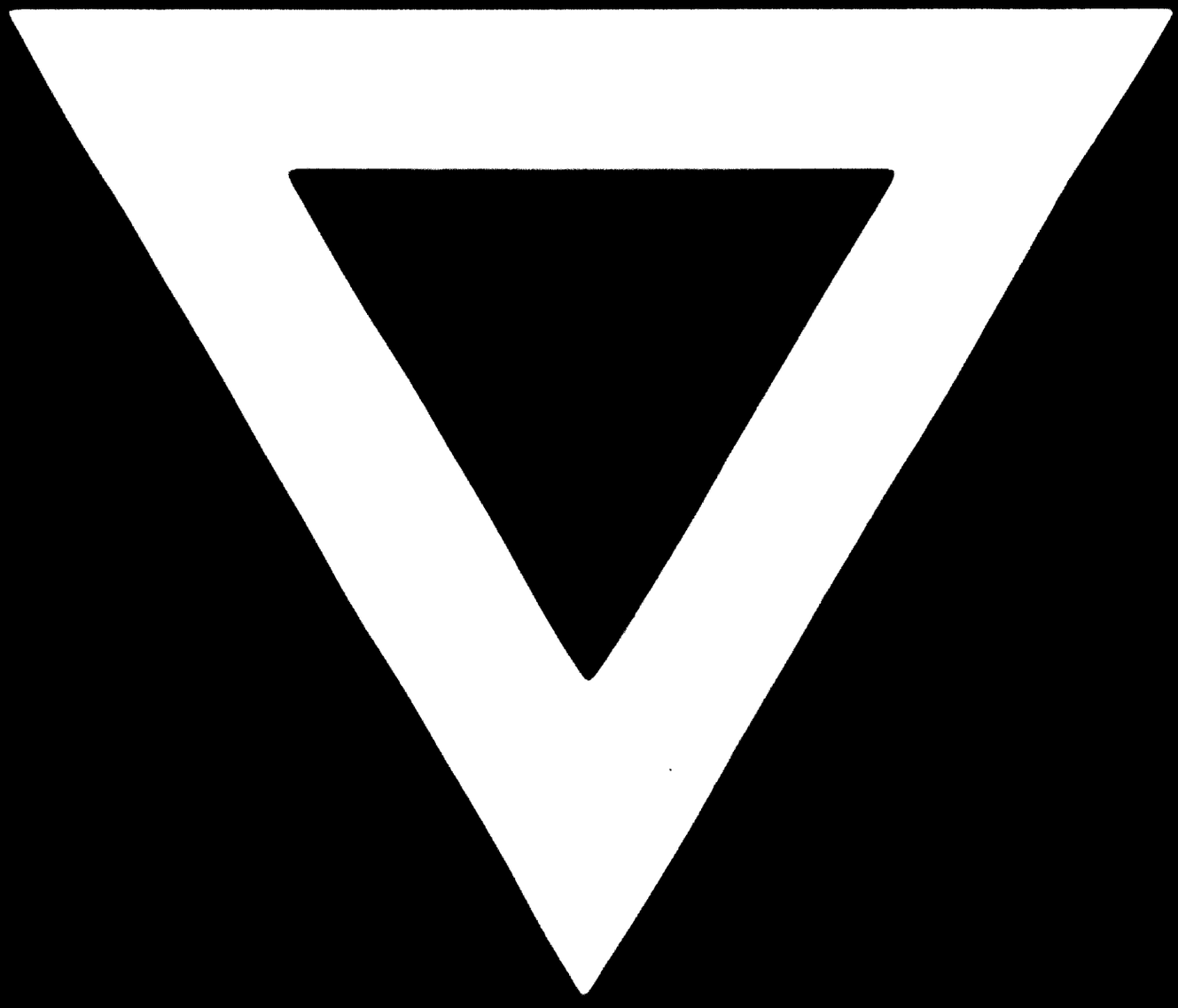
Actual prod. raising 1 dyeing week XY.	Production	Man hours required
Raw material	5,000 kg	20 x 7.8 = 156
Carpet yarn	200 kg	5.7 x 3.25 = 18.5
Fam. Blanket	30 pcs	30 x 7 = 210
Norm. Blanket	150 pcs	150 x 2.1 = 315
Total std. man hours		699.5

The Department has 20 operators.

Actual man hours 20 x 48 = 960 man hours

Dept. efficiency 699.5/960 x 100 = 72.8%

B-109



80.02.25