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TECHNICAL ASSISTANCE TO THE PUBLIC WOOLLEN TEXTILE MILLS OF PAKISTAN INDUSTRIAL DEVELOPMENT CORPORATION (P.I.D.C.)

DP/PAK/85/006/11-01

PAKISTAN

Terminal Report*

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

Based on the work of Peter Ellis,
expert in woollen carpet technology

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United Nations Industrial Development Organization
Vienna

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ABSTRACT

The objective was to give technical assistance to the public woollen textile mill at Quaidabad in the Punjab. The assistance given was in four main forms:-

1. Training arrangements for spinning operatives and fitters, fellowships for the dyer and officer in charge of weaving and seminars relating to the project.

2. Specifying and cooperating in the ordering of quality control equipment and setting out the basis for a quality control scheme.

3. Specifying and cooperating in the ordering of a radio frequency drying machine and assisting in the planning for its use.

4. Recommending methods of improving product quality and mill efficiency.

The mission was 4½ months spread over the period April 1986 to March 1987 in 4 blocks i.e. 5½, 3, 5½ and 6 weeks roughly in the periods respectively in 1986 May, October(UK Study Tour), November and February 1987.

The neutral specifications were made and quotations obtained and ordering should proceed in the second quarter of 1987. Training was started for spinning and the Fellowships were arranged for the second quarter of 1987.

The several recommendations made were concerned mainly with improvements in (a) materials utilisation, (b) machine and operative productivity and (c) quality of products.

ACKNOWLEDGEMENTS

The assistance of UNIDO staff in Islamabad and Vienna has been very much appreciated.

The stay in Quaidabad was helped along considerably by the many kindnesses received from all levels of personnel. A debt of gratitude is particularly owed to Dr. S. Chaudhary, Managing Director of Quaidabad Woollen Mills, and his senior staff.

The effort put into the typing of the report by Mr. S. D. Sabir, Junior Officer/Personal Assistant to the Managing Director is gratefully acknowledged.

INTRODUCTION

The project document shows the project time for the expert as all Sept. 1985 at Quaidabad and 10 days in U.K. with a break until March/April 1986 and then a 3½ months period at Quaidabad. The actual operated project was specified in the job description as a 4½ months period with the same UK study tour occuring, as planned in the document, during the last 10 days of the first month. The study tour was delayed, however, and subsequently the 4½ months duration was split as follows:-

(a) 5 weeks - Quaidabad - April 28 - June 2, 1986.

(b) 3 weeks study tour - October 9 - 29, 1986.

(c) 5½ weeks - Quaidabad - November 12 - December 19, 1986 and

(d) 6 weeks - Quaidabad - January 21 - March 2, 1987.

This four and a half months project was designed to cover four main areas (A) training, (B) quality control, (C) radio frequency (R.F.) drying of textile materials and (D) improving processing techniques. Details on these are as follows:-

A. Training

There has been cooperation between the expert and Karachi based Textile Institute for Research and Development(T.I.R.D.C.) with the preparation of the in-plant spinning frame training programmes but a late start prevents assessment. There is one programme for fitters and another for operatives. Additionally, two Fellowships have been arranged. Finally three seminars based on the project's activities, were given and some further information on these is given ahead. (Annex 1)

The T.I.R.D.C. could not do the in-plant training for carpet loom duties since the loom and its processing techniques are very highly specialised. It is suggested that a U.K. expert, perhaps the only properly qualified one in the UK, should be used for this work. The person Mr. D. Smith, is based at Kidderminster Technical College,

Kidderminster, Worcestershire. The two Fellowships planned are for Weaving Shed Officer, at the above college over six weeks, there is another six weeks period for the Dyer, two weeks in the laboratory of Sandoz Ltd., Calverley, West Yorkshire, U.K. and a further in-plant training period of four weeks in the U.K. carpet yarn dyeing industry. These periods are estimated to start about April-May 1987.

B. Quality Control

The expert has drafted specifications for the quality control equipment and set out the basis for a quality control system.(Annex 4 Page 38) (Annex 5)

C. Radio frequency drying of textile materials

The specifications for the R.F. drying machine have been finalised after the visits to various manufacturers had been made in the U.K. during the study tour of the Managing Director, Quaidabad with the expert. International Wool Secretariat were visited since they have the well known Strayfield R.F. drying machine and were able to advise on this very suitable machine and the R.F. technique generally. Advice on the installation of the R.F. drying unit for loose wool and hanks has been given. The integration of the R.F. technique into processing cannot be done until late 1987 depending upon a delivery date for the machine and consequently any negotiation thought necessary for this part of the programme will have to be done after the end of this four and a half months project.

D. Improving processing techniques

There are several recommendations given ahead with some suggestions for post project activities to ensure further improvement of the mills viability. It is understood from discussion with S.I.D.F.A./U.N.I.D.O., Islamabad that the terminal tri-partite evaluation meeting for the project will be held late in 1987.

In the report chapters II & III are intended for giving only a suitable background to the recommendations. With the recommendations there will be direct and specific mentions of the technical and/or financial causes and symptoms relating to the recommendations.

I. MAIN DUTIES; OBJECTIVES

The main duties of the project at Quaidabad and the U.K. study tour were carried out in three main stages with the dates as listed in the Introduction. The activities in these three main stages will be examined below.

A. Initial visit to Quaidabad

During this period, after careful study of plant and processing techniques a work plan was drafted to cover the entire duration of the project with particular reference to improving processing techniques. In addition to the study of the processing, the quality control equipment and testing procedure was examined in order that specifications could be drawn up, at this first stage, for the equipment needed for this important aspect of quality. (Annex 2 & 3)

Additionally, programmes were prepared for the in-plant training of two, or possibly three, fitters to take over duties after training, as instructors of other fitters. Similarly, a programme was arranged for two fellowship holders and ultimately it was decided that these fellowships should be for face-to-face Wilton carpet manufacture and the dyeing of wool and other fibres for Wilton Carpet yarn.

Although in this initial stage there was a programme prepared for the in-plant training of carpet loom tuners this was later postponed. The reason for not pursuing at an early stage this in-plant training was because it was not possible to get a programme carried out by the Textile Institute for Research & Development at Karachi because of the extremely specialised aspects of carpet pile forming at the face-to-face loom. A suggestion on how to overcome this difficulty has been made at another place in this report. The plan, programmes for training and quality control specifications were handed in to UNIDO Islamabad at the beginning of June 1986. Copies were also sent to Vienna.

B. U.K. Study tour

A detailed report of the study tour was given at debriefing in Vienna December 1986 and photocopies of this document was circulated then by Vienna to the relevant places. Consequently, there is no point in repeating the details of the study tour here but a copy can be attached to this terminal report. (Annex 4)

Incidentally, the initial five weeks period spent at Quaidabad and not the original three weeks was due to the study tour authorisation being delayed.

C. Final stages of the work at Quaidabad

It was clear from the initial visit to Quaidabad that there was an urgent need to improve weaving efficiency as it was relatively low, at about 30%, for face-to-face weaving. There had been an early work study on the looms, during the first Quaidabad visit (handed in at Islamabad UNIDO June 1986), which showed that there was an unusual excess of loom stopped time for repairing warp breaks and replacing missing warp threads. There was also unnecessary stopped for the tying-in of pile warp beams. It was essential to concentrate on remedies for decreasing these forms of stopped time. There was also examination of the other separate parts of the full processing sequence and there were aspects of these which could be improved. A full sequence of processing at Quaidabad is shown at Annex [illegible]. There will be recommendations made for improving mill efficiency generally and with each recommendation there will be suitable explanation given why efficiency is less than it should be and how the recommendation can be effectively carried out.

At the very end of the final stage there was a start made to the in-plant training of spinning frame fitters but assessment could not be made because of the ending of the mission. Further, there was simultaneously a start made to the training of operatives who, like the fitters, would be become trained instructors so that the training could be given to others. This operative training for spinning frames was done instead of the carpet loom training, which,

for reasons already given, could not be done.

During the final period a study was made of certain aspects of materials utilisation. This is a very important matter with the production and selling of carpets because they are sold at a price per unit area . Consequently, if an excess or a deficiency of materials occurs per sq. metre, when compared with the specified amount, then the manufacturer or customer is unnecessarily the loser. Furthermore, if material is wasted through improper use or for any other reason during processing then the manufacturer's profitability is reduced. The question of materials utilisation will be discussed fully in Chapter 2.

A quality control scheme was set out bearing in mind the planned future purchase of testing equipment. The scheme will be dealt with at Chapter III together with certain aspects of the equipment to be purchased. (Annex 5)

It must be appreciated that owing to the changes in the timings of the three stages, contrary to the timings planned in the Project Document and the Job Description, some items in the latter could not be attempted. These were (i) evaluation of training abroad and (ii) supervising the integration of the R.F. drying into the production process.

The findings and the results of the activities will be dealt with when the recommendations are made later in the report. Similarly, the utilisation of the results of the activities will be dealt with. The results already utilised and the extent to which this has been done will be explained and future utilization will also be covered. Any factors affecting the effective utilisation of the results will also be pointed out.

The main conclusion to be drawn from the activity was that there was ample scope for improving processing techniques which would result in improved quality and Mill efficiency. This conclusion will be fully explained in the ensuing pages in terms of the nature and extent of the improvements.

II. MATERIALS UTILISATION

There are three forms that materials take up in the manufacture of carpets i.e. fibre, yarn and fabric. These three will be examined briefly here so that the recommendation may be more effectively set out and better understanding of them will take place. (Annex 6)

A. Fibre

At Quaidabad Woollen Mills the first stages of processing are involved in dealing with fibre in the form of loose wool, initially in a natural state and containing grease and dirt and then clean, after the scouring process. In the clean state it is dyed.

The purchasing of wool in the natural state entails an estimation of weight loss that will be incurred in scouring out the dirt and grease. At Quaidabad the risk of making too optimistic an estimation of yield and consequently having too low a net value of wool purchased, is avoided because wool is purchased after scouring. After scouring, however, it is necessary to ensure maximum utilisation, of the wool scoured and purchased, by avoiding faulty dyeings which could incur loss of materials. Fortunately, this is an occurrence that comes up only very occasionally.

Following dyeing the loose wool is opened, blended, oiled and then goes onto the scribbling/carding machine. In this process, which makes the individual carded slubbing slivers for spinning, the percentage yield (i.e. $\frac{\text{output weight} \times 100}{\text{input weight}}$) can vary according to the effectiveness of the carding operation. This effectiveness depends upon a few variables - moisture content of the air, the nature and extent of the lubrication of the blend, settings and rotational speeds of the scribbler and card rollers and swifts and production rate. There will be comment made in the recommendations on these factors.

It is after the slubbing has been produced and the yarn state reached that materials utilisation for carpets reaches a most important stage. Additionally, the jute yarns purchased for weft and stuffer warps and the cotton yarn for chain warps have to be used in the optimum form as will be explained below.

B. Yarns

It is essential to make the carpet in the loom with all yarns at the desired thickness according to the agreed specifications. If any yarn is thicker then an unnecessary use of extra material occurs and an avoidable financial loss occurs. Details of specified yarn counts used at Quaidabad is given at Annex 6 together with the carpet fabric specifications and weight and costs of components, in the carpet, per square metre.

It should be noted particularly that the pile yarn percentage cost is almost 80% of total materials cost so making pile yarn count a vital factor to be controlled.

C. Fabric

The carpet fabric is made up of the four components jute weft and stuffer warp, cotton chain and pile (warp) tufts. The spacing of the warp threads and tufts across the width is fixed rigidly by the reed which has 8 dents per inch. The double weft picks per row of pile and the tufts length way should be spaced at 8 per inch but this can be varied quite easily by changing a "pick" wheel.

The height of pile is governed by the amount of pile yarn positively fed in. There is also a "sandwich" thickness of pile yarn, at the pile cutting line, governed by the distance between two horizontal metal plates. The pile amount delivered and sandwiched can be varied quite easily by changing a wheel on the positive yarn feed gear system and adjusting the distance between the horizontal metal plates.

For optimum utilisation of pile yarn it is essential to control rows per inch and pile height. The former appears to be controlled adequately, as would be expected since there is only one specification used, merely 8 rows per inch. In the latter case, however, there is doubt on whether the height of pile made at the loom is optimum and similarly whether the shearing process, which gives the final shorn pile height, needs to be examined.

III. SOME IMPORTANT FACTORS AFFECTING MACHINE PRODUCTIVITY

Three factors affecting machine productivity at Quaidabad will be discussed below:- Yarn breakage rates, package size and quality control. It may not be appreciated readily that quality control is related to maintaining and improving machine productivity but its importance in this respect will be appreciated later if this appreciation was not present. It may be that the items of quality control affecting productivity would be better thought of as a section of quality control i.e. production control but by whatever name, the items involved in the testing procedure which lead to improved or maintained productivity must be effectively and promptly carried out at the right frequency and with the proper follow-up action.

A. Yarn breakage rates

Yarn breakage rate can be in units of breaks per clock hour or breaks per machine running hour and so on. Yarn breakage rates are unnecessarily excessive because, for weaving, the cotton chain yarns can be suitably strengthed as can the woollen pile yarn. There is reason to believe, too, that the jute yarn breakage rate for the stuffer warp and the weft can be reduced.

The loom is the machine at which repairs to yarn or insertion of missing threads should be kept to a minimum. If this is not done and kept up to then loom efficiency will be at an abnormal and unnecessary low value. As a consequence, apart from the most serious low productivity of the looms, the mill as a whole will tend to have all its production geared to that of the weaving shed. When loom efficiency is brought up to a better level, as it can be quite reasonably, then the whole mill with its several processes will automatically (or by extra care and planning with appropriate action) increase their productivity to keep pace with the looms.

B. Package size

If packages are produced as large as is possible then this will generally ensure 3 production/profitability advantages at little or no extra cost. These 3 are (i) reduced machine stopped time with increased machine efficiency and productivity (ii) reduced waste proportionately (iii) reduced handling time. A typical example is the wound cheese which is made with ½ kilogramme weight. The waste at the ends of the package account for 10 grammes of material. If the yarn weight could be increased to 1 kg. then the following occurs:-

(i) spindle filling and doffing is halved so that spindle productivity is increased with the resulting overall increase in machine efficiency.

(ii) percentage waste is reduced from 2 to 1%.

(iii) handling of packages tends to be halved; operatives have to be paid to handle packages.

Some of these benefits, usually, are passed on to the next stage, for example, in the case above if the cheese is used for beaming then the beamer changes half the cheeses he did previously and his waste is reduced proportionately as is his handling of cheeses.

The package sizes generally at Quaidabad are not as large as they could be. If they were made larger then the benefits above could follow without any loss of quality. Incidentally, in some cases a larger package does not necessarily mean dimensionally larger. A condenser bobbin could have a larger weight of slubbing on by merely increasing the density of the slubbing. At Quaidabad, however, the condenser bobbin sections could be both made denser, by a very slight draft at the condenser, and larger by running them an appropriately longer time before doffing.

C. Quality control

Quality control at Quaidabad is inadequate because they have not got got certain necessary items of equipment. Additionally some items that they have are not suitable for the range of materials

processed e.g. the yarn strength tester. Testing procedure and recording of results (with the appropriate and earliest action on the results) will improve when the mill is better fitted out with the testing equipment specified and to be ordered. The new laboratory being constructed will also help considerably; the present laboratory and office space is pitifully inadequate.

It must be stressed, however, that new equipment and laboratory must be backed up most firmly with the most effective recording of data. This data must then be used, to the maximum, to pin point causes of quality or profitability deterioration. Action must be taken promptly to minimise or eliminate this deterioration.

A scheme for quality control has been prepared which should cover all the main points at which testing can be suitably and effectively carried out. The frequency of each test must be based on sound principles and the method of procuring prompt action to stop quality or financial losses must be hammered out with all concerned so that unnecessary and costly delays are avoided. Frequency and action are vital and a suitable example on this could be the following one. A twist value is found to be low. If the cause is that the spindle producing this low twist is not rotating at the correct RPM then it will continue to produce low twist until the fault is notified to the spinning department and action taken. There may be a long run, through several pieces, of low twist yarn which could cause stripiness for an unnecessarily long run. Prompt action would quickly bring about checking of spindle speeds and the possible stripiness would be reduced to a minimum.

Quality control charts, showing inner and outer limits for the material being tested, should be used and openly displayed. Photocopies of the simple method of obtaining the inner and outer limits have been handed to the Quality Controller and other senior staff.

IV. RECOMMENDATIONS

The recommendations below will be set out in sections, according to the part of the processing sequence to which they apply. They start then with the first section as Wool Purchase and continue through Wool Scouring next and so on. There is a "General" section at the end for those recommendations which apply to more than one section. (Annex 7 and 8)

In order to indicate the sort of priority that should be given, in the experts view, to the list of recommendations the numbering sequence will indicate a descending order of priority. It must be stressed however that the main priority is to attend to these in the section "Preparation for Weaving" and "Carpet Weaving" so that the abnormally low efficiency of weaving can be raised as quickly as possible.

Reasons for the recommendation will be given briefly after each one with a suitable spacing between the recommendation and the reasons.

It will be clear, from the section headings, to whom the recommendation is addressed.

A. Wool purchase

1. There should be serious consideration given to adding a small percentage of a very good wool to the carpet blend in spite of the high cost of this addition. The extra cost can be cancelled out by the increased efficiency in the two sections carpet weaving and woollen pile carding and spinning.

It can be shown (Annex 9, that cost of about 5% addition of expensive wool will be cancelled out by only a rise of 8% in loom efficiency. Since the same kind of increased efficiency can be assumed for carding and spinning then it will need only about a 4% increase (half of 8%) in each of the two sections, weaving and carding and

spinning, to cancel out the cost of the 5% expensive wool added to the blend.

Additionally, there will be an increase in quality since ends down will decrease and also mending will reduce

8. Wool scouring & drying

2. The four bowl scouring machine should be used when only one machine is needed over a reasonably long period e.g. during the time when wool supplies are reduced.

A more effective scour can be obtained in the four rather than the three bowl machine. Even though hydro-extracting is arranged after the four bowls (i.e. a discontinuous scouring and drying) there will a saving in drying on the four bowls system because of some mechanical removal of water. A five bowl scour is very desirable for dusty wools so that extra rinsing can take place.

3. The pressure controls for the squeeze rollers should be made to operate. Two of the three sets do not operate on the three bowl scourers. There is one control not operating on the four bowl machine.

The lumps of wool can be more effectively broken down with high pressure and there is less liquor passed to the succeeding bowl. It has been said that wool wraps around the rollers when under high pressure but this can be avoided by having suitable roller surface cover.

4. Excessive over-drying should be avoided at both wool scouring machines.

It is understood that the purchasing of wool is done after scouring where as dry a material as possible will give the desired low purchase weight. Overdrying, however, can yellow the wool and

make it brittle with an ensuing performance reduction in future processing. Consequently, checks should be done to avoid going too low in regain. It must be emphasised that as soon as wool leaves the dryer it quickly gains a small percentage regain and certainly a few hours storage before purchasing weighings takes place gives ample time for a percentage regain. Consequently, it would be a waste of energy and a risk to wool quality to dry to bone dry state.

5. Temperature gauges should be replaced at the wool scouring and drying machines.

There are sturdy gauges made which will survive knocks. The easy and ready viewing of temperature from a gauge is far better than other forms of checking temperature.

6. A more effective test than the dry one used now, to judge the efficiency of scouring, should be considered.

A dry shaking test will not remove all the dust that could be left in the scoured wool. Consequently, a false impression that the wool is scoured adequately could be given. There is a lot of evidence at the cards that the wool is not always adequately scoured. Fettling time is thus increased and web quality with decreased yarn quality occurs more if the wool is not clean.

7. Consideration should be given to neutral scouring with reference to the ensuing wool quality.

Synthetic detergents may be used alone or with some additives.

C. Woollen carding & spinning

1. The optimum value of Turns per inch (T.P.I.) should be used to ensure maximum strength of yarn.

Tests carried out in May indicated low small changes from the T.P.I. being used could increase yarn strength. This gives a very valuable improvement in weaving efficiency because yarn breakage rate at the loom is reduced.

2. The slubbing density on the condenser bobbins and the diameter of the slubbing content should be increased.

This will reduce stopped time at the spindles, piecening and bobbin handling. Even through the sections of slubbing have to be taken off the condenser bobbin the surface of the wooden bobbin can be made sufficiently smooth to allow the tighter slubbing to be removed.

3. Slubbing drafting at the mules should occur between slubbing delivering rollers and spindles.

This will give a better yarn because the drafting along the full draw ensures thick and thin places are evened out during drafting. Twist runs into thin spots and strengthens them during drafting them causing more drafting at the thicker spots.

The increased breakage rate should be tolerated because it avoids breakages in the loom.

4. The opening and dust removal of the wool should be increased.

This will improve carding and so yarn quality and hence weaving efficiency. Neps and fettling will be reduced.

5. Settings in the earliest stage of carding should be opened up more to avoid fibre breakage.

Yarn strength and weaving efficiency will improve.

6. The amount of synthetic lubricants added to the blend should be increased to 3-5% from the 1½% used.

Yarn strength and weaving efficiency will improve.

7. The Relative Humidity (R.H.) in carding should be raised to a minimum of atleast 50%. Probably nearer 60% is optimum. The R.H. at present is about 40%.

There will better performance in the woollen yarn manufacture with consequent benefits to weaving efficiency. It may be necessary to examine the open doors in the yarn manufacturing section and the humidifying plant itself.

8. The automatic oiler should be brought into use.

Manual oiling is not as uniform.

D. Doubling

1. A strong scaffold thread could be used for one of the singles in the four fold cotton chain warp yarn. Conversely, a four fold 9's cotton or a thicker singles say 8's cotton to give an almost equivalent singles count to the present 4 fold 10's cotton yarn could be used.

Chain warp yarn will be considerably increased in strength and yarn breakage rate will decrease at the loom giving increased weaving efficiency.

Some work is being done at present on this suggestion and certainly a sample 4 fold 9's cotton yarn examined, in this development, was extremely strong.

2. Is the rewinding machine necessary?. It rewinds the single woollen yarn in preparation for folding and the folded cotton yarn

for use in chain warp beaming. It is recommended that with suitable creel arrangements at the woollen yarn doubler and chain warp beamer, both these initial packages could be used thus avoiding this rewinding. There could be over-end delivery from both these initial packages with simple modification of creels. In this respect see the cotton doubling frame creel and the Japanese beamer's creel.

E. Preparation for weaving

1. When a warp thread breaks or runs out it must be tied in to the end of the warp thread, relating to it, which lies on the beam. The practice of just throwing the replacement thread, untied, onto the beam should cease. This applies to cotton and jute beams as well as wool pile yarn beams. It is essential then, that the automatic stop motions for missing and broken thread should be operating, together with a beam braking device to give a very quick machine stop when the automatic stop motion operates.

If this tying-in is not done then the weaver has to stop the loom to tie in the warp thread that is not tied. This causes efficiency loss and there could be other warp breaks caused by the interference of the untied warp thread, from beaming, with adjacent warp threads which can be pulled down and broken. This decreases still more loom efficiency.

This action has been taken in the case of the Japanese beamer for woollen pile yarn and the automatic stop motions are now operating with an overend delivering of yarn.

From the work study data for warp thread breakage rate and loom efficiency it is estimated that the action taken should increase loom efficiency by about 1½ - 2%. When the jute and cotton beaming machine has brake and stop motions operating then a similar gain in efficiency will occur for jute and also for cotton beamers. Consequently, a total gain could be estimated at about 5-6% in loom weaving efficiency. There are other gains that can be made, as will be explained below.

2. A longer length of warp sheet should be beamed for all yarns i.e. woollen pile, cotton chain and jute stuffer yarns. In the case of the woollen pile yarn beam double the length (2 pieces of carpet) can be obtained with the largest flanges and this is now being done. Some extra tension is being applied to the yarn sheet as the beams were too soft.

The stopped time for tying in a new warp will be reduced to one half of what it was for the pile warp beam. From the work study data obtained on the looms it is estimated that there will be a 5 to 6% increase in loom efficiency when a loom operates with these large warps. Some larger flanges will be needed to make it possible to double the beamed length for all beams.

It needs to be pointed out that this relatively new machine (1981) was shown in the brochure as being suitable for fine materials e.g. polypropylene tapes not heavy carpet yarns. The motor is overheating currently at about 400 metres length of beamed warp. With a horse power of 7½ it seems reasonable to suggest that the wrong beaming machine was purchased - a much larger motor is necessary and even the framework of the machine may be too light weight.

The cotton and jute beams should also be beamed with as long a length of warp sheet as is possible. The increase in tension of the sheet during beaming can be done to help increase length since the beams are too soft. Weak spots in the yarn will also be taken out with this extra tension so reducing stopped time at the loom when the yarn repairs are made at the beamer. Work study shows that together these beams lose 6-7% loom efficiency for stopped time tying in. The increase in length of the beamed warp should decrease this proportionately to the increase in beamed length. If the beams are made, for example, one third longer then a 2% increase in loom efficiency would arise from this extra length.

3. "Splicing" should be done insted of knotting wherever possible

This will give smoother passage of repaired yarns through the heald eyes and reed wires, this will occur as well amongst the other warp yarns during warp crossing in the weaving actions since there will be no knot tails. An adhesive applicator has been brought from U.K. and special splicing adhesive is being sent on for trials. The "splicing" technique is now well established with more sophisticated methods than adhesives such as entanglement of fibres by pneumatic means or by the use of a very fine filament binding thread. It was thought best to use first the simple adhesive method.

4. "Magazining" (tying together 2 packages "top-to-tail") of packages on the beaming creels should be done.

This will enable the operatives to replace cheeses or cones at the spindle without stopping the machine thereby raising machine efficiency. As one cheese runs out yarn will continue to run from the other because of the "top-to-tail" tying. The empty cheese is replaced in a "top-to-tail" way with a full cheese. The winding of the cheeses for "top-to-tail" magazining entails leaving a "tail" on each cheese.

This magazining can be easily arranged at the Japanese woollen pile yarn beamer because there are more than twice the spindles at the creel than there are warp threads in the full beam width.

5. If the cotton and jute beaming creel is made to feed from the spindles with overend delivery of of yarn then the cotton twisting bobbins could be used directly without rewinding. The spindles may have to have spring clips to hold the bobbins firm.

This would cut out rewinding at the cheese-winder. This has been mentioned before in "Yarn Manufacture" section.

6. The stop motions for the woollen single threads at the doubling frame should be all kept in a satisfactory working condition.

If a stop motion is not operating then a faulty "thin" yarn is produced. This could cause a long "stripe" effect in the carpet.

F. Carpet Weaving

Automatic stop motions were installed on the looms for the purposes below. They have all been removed, even from the relatively new loom erected in the early 1980's.

AUTOMATIC STOP MOTIONS REMOVED FROM LOOMS

(1) Broken(or missing) weft automatic stop motions.

(2) Broken(or missing) warp thread automatic stop motions.

(3) Jute weft cop feeler automatic stop motion for detecting when jute weft cop reaches minimum size in shuttle.

These are all extremely useful weaving aids to help increase productivity and improve quality of carpet and are always used in all forms of weaving as a standard feature of processing. Indeed most weaving manufacturers could not survive without their use.

Every effort should be made to replace them and keep them in a satisfactory working condition when they have been put back on the looms. Some details on their effectiveness is given below:-

1. Broken(or missing) weft automatic stop motions.

There was one stop motion fitted at each side of each of the wide looms so that a more reliable detection of missing weft could be made. These automatic weft stop motions for missing or broken weft should be replaced.

Replacement of these stop motions would ensure that the loom stops automatically at the very first missing or broken pick. This means a very quick replacement of weft by the weaver and a rapid start-up of the loom. Without stop motions the loom may weave over a few picks before the weaver datects broken or missing weft. This then necessitates replacing the missing picks woven without weft

being present. This can be a time consuming operation and reduces weaving efficiency.

Furthermore, when there are a few picks missing, in this way, the weaver has to start up the weaving, after he has replaced the picks, with the fell of the carpet at the exact spot for proper beat-up. If he fails to do this, and it is notoriously difficult to do this in weaving, then there can a faulty "starting up" place i.e. the picks per inch are either slightly too large or too small.

An additional benefit from stop motions is that the two shuttles on a loom can then be made to run out of weft simultaneously, thereby reducing weft cop changes considerably and thus improving loom efficiency.

2. Broken (or missing) warp thread automatic stop motion.

These should be replaced for the following reasons.

The loom stops quickly when a warp thread is automatically detected by the stop motion, as broken or missing. This means that the dropped warp thread cannot entangle with and break down other adjacent warp threads which are constantly crossing one another through the action of weaving. This considerably reduces mending and the probability of visible faults because mending cannot make a perfect repair. These stop motions therefore improve loom efficiency, reduce mending and mending time as well as improving carpet quality.

3. Jute weft cop feeler for automatically stopping the loom when a jute cop is running out.

These should be replaced and kept in satisfactory condition.

The weaver has to stop the shuttle long before the weft cop reaches the smallest size it would be certain to reach when an automatic feeler operates. This means a large amount of unnecessary jute waste weft is made. Even if cop ends are rewound the rewinding has a cost. Furthermore, the loom is stopped more often than it should be for weft change and this has an effect on loom efficiency.

4. Splicing should be used wherever possible at the loom instead of weft or warp knotting.

This will give smoother passage of the repair joint, on the yarn, through the eyelets at the shuttle and healds and between the dents of the reed. There will be less contact between crossing threads and a spliced joint than there is for a knot with its tail ends. So the danger of breaking down other warp threads adjacent to a repaired warp thread is eliminated. Loom efficiency will be improved as should carpet quality to some extent.

With pile warp splicing, if white adhesive is used, it must be decided whether undesirable spots which occur, due to the adhesive colour at the repair joint, prevent the use of splicing for pile yarn.

5. Jacquard/s should be made to operate.

The marketing may demand design carpet.

There should be no difficulty in making them operate when technical instructions are studied and discussed. There is also the opportunity of using a U.K. expert, Mr. Derek Smith, who was seen during the U.K. Study tour. Some useful technical literature was brought from a few sources in U.K. and this will be given to the Managing Director (MD), Quaidabad. When spoken to in U.K. during December 1986, Wilson & Longbottom confirmed that the Jacquards could be made to operate quite satisfactorily by staff at Quaidabad; they have provided some of the literature handed to the M.D.

6. There appears to be a need in or near the weaving shed for a suitable work bench for loom tuners, with some necessary basic tools.

This could cut down stopped time for maintenance and improve loom efficiency.

G. Finishing

1. Six pieces were checked for the percentage weight of pile sheared away. These six gave an average figure of 7.3% with the related average weight loss per piece of 10.8 Kg. It must be pointed out that 2 pieces in the six were chosen entirely at random and the full and normal shearing was given to these two pieces, under observation. The percentage and actual weight losses for these two average out at 12.8% and 19.5 Kg. The other 4 pieces were not chosen entirely at random and they averaged out at 4.5% and 6.5 Kg.

It is appreciated that a smooth surface is essential for customer satisfaction. Nevertheless, it is extremely likely that a suitably smooth pile surface will be obtained with a reduced weight loss from shearing. Careful inspection will determine to what limit the depth of shearing should be taken in the 3 or 4 shearings that take place. If extra depth of pile is put in on the loom so that it can be excessively sheared off to over cautiously ensure a smooth pile surface then this is terribly costly. Profitability is lessened needlessly. Sheared pile waste is worthless.

A conservative estimate of a 1% loss in pile yarn on a yearly basis at the finished carpet stage gives a financial yearly loss of about 150,000 Rupees. (1985-86 figure were used for annual production in square metres).

The percentage sheared away in the samples examined was 7.3%.

It is essential that control ,rocedures for pile yarn use be adopted at the loom stage together with a suitable final inspection of finished pile surfaces. These can then give an assurance that no excess pile height is being woven so that an excessive shearing can be carried out, while still maintaining the correct specified weight of pile per square metre.

There should be a check weighing of each piece after shearing, not just before mending as is the case now. In this way the difference

between the two weights will give the shearing weight loss. At present, the finished pie ce store personnel appear to assume this weight loss is 2 Kg. for every piece, according to one statement made to the UNIDO expert.

H. Dyeing

1. The overdrying of loose wool stock and dyed hanks should cease. Wool can quite safely be stored with 18-20% regain.

The marked extent of the overdrying can be judged from the figures below for samples taken and immediately sealed and weighed and then allowed to regain naturally with a final weighing at equilibrium regain. The hank dryer was the worst, regaining 8.4% moisture whena totally random check was made; the dyed loose wool regained 2.4% when a check was arranged at the machine. Both should have lost regain if they had been dried to, say, at the very least 15% regain. With the temperature and humidity of Quaidabad the equilibrium regain will be about 13% at the most.

This means that the hanks were dried down to about 5% regain (13-8.4) and the dyed loose stock to 10%(13-2.4%). This shows that 10% more moisture was dried out of the hanks and 5% more than necessary for the dyed wool. These figures are based on a very conservative 15% very safe level of moisture that can be left in wool going to store. The waste of expensive heat energy gives reduced yearly profitability and the tendency for wool to yellow and become brittle with overdrying gives greater risk of stripiness in carpets and weaker yarn in weaving with reduced loom efficiency from unnecessary yarn breaks.

If an annual weight of hanks, scoured and dyed wool is taken as a total of 600,000 Kg. then an amount of 120,000 Rupees is the financial loss when 0.2 Rupee per Kg. is conservatively used for the extra heating of the material to the drier state.

2. Consideration should be given to doing some low temperature dyeing of loose stock wool. Chemical damage can occur with 2:1 metal complex dyes at pH 6.5 to 7.

There should be an improvement in yarn performance.

3. The power driven crane for the one vessel should be brought back into use.

The manual lifting is very slow and holds up processing There is also some danger to the operatives operating this manual system.

4. Hank dyeing is extremely common for carpet yarns and there is provision for a form of hank dyeing with the Japanese dye vats. There is a feeling, however, that unlevel dyeing could result from the use of the Japanese fitments. It is suggested that hank dyeing be examined as a possible future improvement to processing.

With hank dyeing the natural coloured undyed blends can be used which makes yarn manufacture less complex because separation of different coloured fibres has not to be considered in all stages of fibre processing. There could be, too, some improvement in carding and spinning performance.

I. Quality control

1. Some tests are not carried out on bought jute and cotton yarns.

In the latter case they would have to be done after purchase since they are bought on the spot market. In the former case the jute mill supplying the yarn has good facilities for tests which would ensure they keep up to our required specifications. They would let Quaidabad test also for those items which cannot be done currently

at Quaidabad. With both cotton and jute yarns the values of turns per inch, count and strength would be a useful guide as to whether value for money and required specifications are being met. This data will all help in maintaining suitable performance of yarn in beaming and weaving.

J. General comments

There is a marked tendency to leave unattended important imperfections on machinery where this leaving does not stop the machinery from being used. Examples have been quoted in the text on stop motions at the loom but there are others throughout the plant. If attention was given to put right quickly these imperfections then the machinery would function better e.g. temperature gauges are missing from scouring bowls.

Eventually, it seems as though this lack of attention to the imperfections has created such a backlog of repair and replacement work that only a very determined effort by all concerned will get the machines back to their normal state.

V. SUMMARY & CONCLUSIONS

The recommendations indicate that there is much that can be done now to improve mill efficiency and carpet quality. Some of this work has already started in the preparation department on the beaming machine; there has been a change made, too, in wool scouring. Nevertheless, there is a need for investigation into two important sections of the manufacturing.

These two are wet processing and woollen yarn manufacture. They play a major part in the manufacturing sequence and their efficiency can vitally affect the success in achieving top carpet quality and very efficient carpet weaving. There should be more time given to these sections and it is to be hoped that this will be done. It is felt that if it is allowed then a very comprehensive job, of putting

Quaidabad Woollen Mills even more to the fore in the Textile Industry of Pakistan, will have been carried out.

It has to be pointed out that no mention of reinvestment in costly equipment has been made. It would be easy to suggest expensive sophisticated equipment to replace the existing machinery and so improve mill productivity but it was felt that the purpose of the mission was not to do this but deal with Quaidabad, by and large, as it is. There is a need to mention one machine, however, and that is a tufter. Carpet, the same as Wilton plain carpet is being made on tufting machinery with considerably lower orocessing costs. Face-to-face Wilton weaving in developed countries is obsolescent. Quaidabad will have to face the fact since it is certain that competition will spring up around it, if it has not done so already, using the tufting technique for plain wool carpet very much like Wilton plain carpet. In developed countries, the request on purchasing plain carpets tends now to be for "plain wool carpet" rather than an insistence on Wilton plain carpet. The tufters have well now got over their image of making low quality carpet and they compete successfully "up-market" with the best of woven carpets.

It seems a pity that such a large capital expenditure was made in the early 1980's on a third wide face-to-face loom. At that time good reconditioned face-to-face looms obsolescent, and inactive also from the recession, were on the market. Better still, would not a new tufting machine alongside the two wide face-to-face looms have put Quaidabad in a very strong competitive position with the best of both worlds in carpet manufacture.

A tufting machine should seriously be considered. Eventually, its very high rate of production will make one or two of the present wide face-to-face looms obsolescent when the market accepts plain wool carpet.

One word of warning , however, on tufting wool carpet and that is that woollen yarn processing that goes with it must make a suitable yarn that can be tufted efficiently.

Seminars with Quaidabad staff

There were three seminars given towards the end of the mission. They included advice of a technological kind based on research, development and experience but there were a number of examples used in the seminars based on the work done at Quaidabad. The topics of the seminars are listed below. The seminar time was based on one hour, to be divided equally between speaker and staff discussion. In fact, the discussions went on a considerable time longer than estimated. The Managing Director took the chair and stimulated staff very well into very fruitful discussions.

Seminars

	Control of:-
Seminar 1	Materials.
Seminar 2	Production.
Seminar 3	Quality.

Processing Sequence

1. Wool pile yarn processing

Sorting.
Opening.
Scouring(loose wool).
Drying ------ To store.
Dyeing ------ From store.
Drying ------ To store.
Blending ------ From store.
Mixing and oiling.
Carding.
Spinning.
Winding for twisting (cheese).
Twisting (2 or 3 fold).
Reeling ------ To store.
Scouring(Hank) ------ From store.
Drying(Hank) ------ To store.

2. Preparatory processes prior to carpet weaving.

Winding jute (cop).
Winding folded cotton yarn for beaming(cheese).
Winding from hank for pile beaming(cheese) --- From store.
Warp beaming (a) cotton chain (b) jute stuffer (c) wool pile.

3. Carpet Weaving.

4. Finishing

Inspection, measuring length, weighing and numbering.
Light shearing and brushing.
Mending.
Final shearing.
Backsizing.
Inspection (followed by any necessary mending).

Number and items of processing machinery

2	Willows for opening up and dusting raw wool.
2	Scouring machines - one 3 bowl - one 4 bowl with drying machines.
1	Centrifuge after 4 bowl scouring machine before drying.
3	Loose stock dyeing machines (fitments are available in 2 machines for hank dyeing)
1	Centrifuge for dyed loose stock.
1	Drying machine for dyed loose stock.
2	Willeys for blended dyed or natural coloured darker wools.
1	Rag machine for hard waste.
1	Dust shaker.
3	Carding Machines.
2	Spinning Mules.
1	Ring Spinning Frame.
1	Woollen doubling frame.
1	Cotton doubling frame.
1	Rewinding machine for ring spun single yarn and folded cotton yarn.
2	Reels for hanks for scouring.
1	Hank scourer.
1	Centrifuge for scoured hanks.
1	Drying machine for scoured hanks.
1	Hank winding machine.
1	Jute cop winding machine.
1	Cotton Chain and Jute Stuffer warp beamer and creel.
1	Woollen Pile Yarn beamer and creel.
3	Wide 12 feet face-to-face looms(1 Jacquard, 2 creels)
2	Narrow face-to-face looms (1 Jacquard, 2 creels)
1	Narrow face-to-face loom under construction (NOT NEW).
1	Pile shearing machine.
1	Carpet back-sizer.

Technical report: U.K. Study Tour of Dr. Chaudhary and Dr. Ellis.

Refer to: DP/ID/SER.A/793
22 December 1986

Quality control; tests for carpet and components and some production variables

Wool loose stock

(a) Fineness
(b) Strength
(c) Fibre length and distribution
(d) Grease content
(e) Dirt content in raw and scoured state
(f) pH measurement
(g) Regain; just at end of drying
(h) Regain; at weighing stage for purchasing negotiations

Yarn

(a) Count - including slubbing
(b) Turns per meter (inch)
(c) Strength and extension
(d) Percentages of fibre components
(e) Grease content
(f) Levelness
(g) Faults present

Carpet fabric

(a) Yarn components; percentage and actual weight/sq.m.
(b) Pile height above base fabric
(c) Load of tuft with drawal
(d) Dye fastness; light, rubbing and others when required e.g. sea water.
(e) Tuft definition
(f) Wearability
(g) Recovery from compression
(h) Soiling resistance
(i) General appearance of pile surface; from inspection procedure.

Production variables

(a) Yarn breakage rates
(b) Relative humidity

ANNEX 6

Yarn and fabric specifications

Yarn

Yarn type	Count of yarn in traditional system	Resultant single equivalent(S.E.) count in traditional system	Tex count specifications R = Resultant S.E. count
Weft	2 fold 8 jute	16 jute	R 552/2 fold
Warp stuffer	2 fold 8 jute	16 jute	R 552/2 fold
Warp chain	4 fold 10 cotton	2½ cotton	R 236/4 fold
Warp(wool) pile	3 fold 4½ metric for plain carpet	1½ metric	R 667/3 fold
Warp(wool) pile	2 fold 3 metric for mottled carpet	1½ metric	R 667/2 fold

Fabric structure

Picks per row of pile	2
Rows of pile per inch height	8
Tufts per inch width	8
Dents per inch reed width	8
Cotton chain warp threads/dent	2
Stuffer warp threads/dent	2
Length of pile tuft mm.	22

Actual and percentage weights and costs of components per square metre of carpet

Component	Average Actual weight(Kg)	% weight	Average cost/ KILO (Rs.)	Cost per sq.m.(R)	% cost per sq.metre
Pile	1.43	61.8	53	75.8	79.9
Cotton chain warp	0.18	7.8	24	4.3	4.5
Jute Stuffer warp	0.35	15.2	21	7.4	7.8
Jute weft	0.35	15.2	21	7.4	7.8
Total:	2.31	100.0	-	94.9	100.0

Workforce and yearly output; Weaving efficiency

There are about 600 personnel at Quaidabad Woollen Mills working a three shift system; the machinery operating a full week.

The output for the financial year 1985-86 was as follows:-

Woven carpet	(Square metres)	- 196,187
Woven carpet	(Rupees)	- 25,939,251
Scoured wool	(Kilogrammes)	- 303,289
Dyed wool yarn	(Kilogrammes)	- 281,731

The efficiency of the weaving shed is relatively low at about 30% so that the other processing sections of the mill have only to keep up with this lower than desired output of carpet. There is overcapacity, for example, in carding & scouring of wool and hanks. As the efficiency of the looms increase, as it can, then the other processing sections will have to make greater efforts, in some cases, to keep up with weaving demand for materials.

Production rates of machines(Kg/hr non-stop)

2	Willows				
2	Scouring sets wool		44*4 ACTUAL		
1	Scouring set hank		1 Shift only.		
3	Dye vats		60.5 ACTUAL		
3	Cards		Japenese 63.8 vs)* Japenese 45.6 vs)	No.1 card 14.7	
1	Ring spinner		Japanese 65.6		
2	Mules		Mak 23.8		
2	Ring twisters		Woollen 90.7	Cotton 16.7	
1	Rewinding frame		177		
2	Reels		544.3		
1	Cop winder		43.6		
2	Beamers	Cotton 375.5 Jute 876.2	Pile has variable speed it is running at low speed for large beams.		
1	Hank winder		188.0		
3	Wide looms	Pile Jute stuffer	139.6 33.4	Jute weft Cotton chain	33.4 18.3
1	Narrow loom-	Pile Jute stuffer	14.6 3.5	Jute weft Cotton chain	3.5 1.9
1	Shearing machine.				
1	Back-sizing machine.				

ANNEX 9

Addition of some better wool to blends;

Calculation of higher loom efficiency needed to cover extra cost.

LIST OF VARIABLES, CONSTANTS AND RELATING FORMULAE

Wool price Pakistan (R per Kg) —— C_P

Wool price Natural (R per Kg) —— C_N

Proportion of C_P wool in blend —— $P_P = 1 - P_N$

Proportion of C_N wool in blend —— $P_N = 1 - P_P$

Wt. of wool, with & without change, per m^2 (Kg) —— W

Increase in cost (R) of wool / m^2 from blend change —— $W\left[P_P C_P + P_N C_N - C_P\right]$

Loom Efficiency with Pakistan wool blend —— E_P

Loom Efficiency with changed blend —— E_N

Total annual fixed costs for weaving (R) —— A

Total calculated actual output with Pakistan wool blend (m^2/year) —— N

Theoretically possible annual output " " " " at 100% efficiency (m^2) —— $\left(\frac{N}{E_P}\right)$

Total calculated actual output with changed blend (m^2/year) —— $\left(\frac{N.E_N}{E_P}\right)$

Fixed weaving cost / m^2 with Pakistan blend (R) —— $\frac{A}{N}$

Fixed weaving cost / m^2 with changed blend (R) —— $\left[A \div \left(\frac{N.E_N}{E_P}\right)\right] = \frac{A\,E_P}{N.E_N}$

Increase in fixed weaving cost / m^2 from change in blend $= \left(\frac{A}{N} - \frac{A\,E_P}{N\,E_N}\right) = \frac{A}{N}\left(1 - \frac{E_P}{E_N}\right)$

To break even :-

$$W\left[P_P C_P + P_N C_N - C_P\right] = \frac{A}{N}\left(1 - \frac{E_P}{E_N}\right) \therefore \frac{1}{E_N} = \frac{1}{E_P} - \left(\frac{W\,N\left[P_P C_P + P_N C_N - C_P\right]}{E_P A}\right)$$

$$\text{Break even } E_N = \frac{1}{\frac{1}{E_P} - \frac{W\,N\left(P_P C_P + P_N C_N - C_P\right)}{E_P A}}$$

$$\therefore E_N = \frac{E_p A}{A - WN\left(C_p(1-P_N) + P_N C_N - C_p\right)}$$

Actual input values to be put into formula above

$E_p =$ Table 1.38

$A =$ 2281821

$W =$ 1.45

$N =$ 146664

$C_p =$ 32-35 take 33

$C_N =$ Take 70

Then:- $E_N = \frac{0.38 \times 2281821}{2281821 - 1.45 \times 146664\left(33(1-P_N) + 70P_N - 33\right)}$

$E_N = \frac{867091.2}{2281821 - 212663\left(33 - 33P_N + 70P_N - 33\right)} = \frac{867091.2}{2281821 - 7858533P_N}$

Example of working the formula

Let P_N be 10%

When $E_N = \frac{867292}{522821 - 75553} = \frac{867292}{152968}$

$E_N = 5.7$ ie 57%

Let P_N be 5%

$E_N = \frac{867292}{228821 - 39427} = \frac{867292}{188894} = 0.46$

ie. 46%

Summary To break even when raising blend cost using a proportion of:-

(i) 10% of new wool* the wearing efficiency must be raised from 38% to 57%

(ii) 5% of new wool* " " " " " " - 28% to 46%.

* NZ estimated price / K_s has been used in calculations.

Brief report on Qaidabad Woollen Mills project

(1) Introduction

There are four main areas to be covered in the project:

(i) Productivity
(ii) Optimum use of materials
(iii) Quality
(iv) Training

The outstanding factor with productivity is the low efficiency of the looms, and this was given first priority. All four factors, however, have been studied, and remedies have, or will be, dealt with within the project period.

(2) Low efficiency looms

The very low efficiency of about 30%, is shown by the detailed study on loom performance, to be caused by mainly yarn repairs for all three components: cotton, jute and wool, together with the stoppage time caused by beam and cloth roller changes. The extent of these causes can be effectively reduced, and recommendations will be made for action to be taken. Some action is currently being taken, and the effect monitored, as will be explained below. Since the other main aspect of processing, i.e. yarn production is kept in balance with loom output, it should be noted, too, that it can be expected that when loom productivity is improved, the yarn making machinery will also become more productive.

(3) Yarn weakness and reasons

This obviously affects breakage rate, and studies have been carried out at the points in processing where fibre damage can occur - scouring, dyeing and carding - and there will be comments on these three points below.

(4) Failure to repair warp breaks at beaming

The system of beaming for both pile and backing fabric is a cause of loom stoppages because the broken or missing warp threads are not put into the warp in a weavable form. The weaver then has to stop the loom to repair or insert the affected thread. A way of avoiding this loss of efficiency has been studied and recommended, and action is being taken. This action should improve loom efficiency.

/...

(5) Beam size

The amount of yarn put on to beams could be increased according to the study made. The increase in yarn put on the beam will reduce stopped time per unit length of carpet woven, and consequently the loom efficiency will improve when this suggested technique is carried out. Hardness of beam should be increased to make extra length; studies show the beams are too soft.

(6) Automatic weft stop motion

These have been removed and studies show that loom efficiency is reduced because the weaver has to carry out more work on starting up the weft supply when the 'stop-onpick' action of the removed weft stop motion is not there. This has been discussed at length with the Managing Director (MD) and staff concerned, and action is to be taken so that loom efficiency can be improved. Quality can be affected by this repair work which is in excess of what it should be.

(7) Automatic warp stop motions

These have also been removed and broken ends are not detected early enough; these can bring down other ends so increasing stop time at the loom more than would occur with a warp stop motion present. Quality, as well as loom efficiency can be worsened. This again has been discussed with the MD and staff; action will be taken to improve loom efficiency.

(8) Scouring and Dyeing

Tests are being carried out to ascertain loss of fibre strength, and efforts will be made to improve these processing techniques from the point of view of obtaining minimum loss of fibre strength. Already, one trial has been carried out on one particularly bad colour which is known to give reduced fibre strength and hence pile yarn strength in the loom.

(9) Overdrying of wool and hanks after scouring

This is not only an unnecessary energy cost but can reduce fibre and hence yarn strength. Tests have been made to show that overdrying does occur, and the testing procedures to be recommended will include a way of keeping drying out of wool and yarn to the right level with reference to both energy loss and optimum fibre and yarn strength.

/...

(10) Blend Quality

Studies show that blend quality can be improved so that yarn strength can be increased giving a related increase in production, both at the yarn making stage and at the loom. A formula has been established relating added cost for blend improvement to gain in loom efficiency, so that a clearer idea of the implication to profitability when extra blend cost and quality is made. It is obviously desirable to improve blend quality and this can be done, it is felt, from the relationship established, with increased profitablity through improved productivity in yarn and fabric making.

(11) Yield of materials

A study has been made on the processing sequence to see where unnecessary reduction in yield occurs. Shearing in particular has been examined, and it has been suggested that yield can be improved without affecting quality if shearing loss is kept at a satisfactory minimum. Other points in the processing sequence are being examined so that recommendations can be made on how yield can be improved. Yarn counts particularly should be most carefully controlled and this is being very closely studied. It is essential that staff should realise that when selling by unit area of carpet, very severe financial losses occur if the weight of material per unit area is above that specified. If yarn counts are not carefully controlled, then the yarns which are thicker than specified cause excess material per unit area of carpet, and so financial losses occur with unnecessarily reduced profitability.

(12) Mule Spinning

There was a need to study the mule spinning since weaknesses in the yarns produced appeared to occur here to a greater extent than in ring spinning. The study showed that no drafting was being incorporated whilst the draft in ring spinning was about 1.3. This abnormal non-drafting procedure will not improve regularity of yarn thickness so that there could be weak spots unnecessarily left in the yarn causing unnecessary loom stops when mule pile yarn is used with the consequent reduction in loom productivity. This matter has been discussed but will be pursued further so that improvements in both carding and loom productivity can be obtained. The increase in carding productivity would follow from the thicker slubbing needed if drafting is introduced at the mules.

(13) Tuft bind

There has been a comment from a potential dealer in the United Kingdom that the samples of Qaidabad Wilton carpet received by them had a low tuft bind. A trial has been carried out for jute weft cop sizing where the drained cops are woven to give a better tuft bind. The results of this will be examined by comparing tuft bind values found by using the WIRA testing device for tuft bind with and without size in the weft. The technique was feasible at the loom.

(14) Quality control scheme

This is being prepared bearing in mind the new testing equipment which will be ordered for Qaidabad. It will cover all aspects of processing from fibre to finished carpet.

(15) Training programmes for in-plant trainees and Fellowship holders

Arrangements have been made with the organisations in the UK for two Fellowships, one for carpet loom practical training, and the other for dyeing techniques. The Textile Research Institute of Karachi has been used to produce an in-plant training programme for ring spinning. The in-plant training programme for carpet fitters has still to be arranged, and negotiations are proceeding with loom makers, Wilson and Longbotton, for the loom manual to be sent to Qaidabad.

Assessment of these programmes will be made at a suitable stage in their use.

(16) Seminars

These will be held during February 1987, and there will be at least three covering the important matters affecting profitability and quality. The kind of subject to be dealt with will be (i) yield of materials with reference to fibre and yarn (ii) the main causes of loss of productivity in carpet weaving and how they can be remedied, and (iii) the importance of testing procedures, and the nature and extent of these in fully vertical Wilton carpet production.

(17) Jacquard Weaving

It has been decided by the MD that the narrow Jacquard loom will be set up again to make Jacquard carpet. There were difficulties previously in making the Jacquard function properly, and the UNIDO advisor was asked to help wherever possible in this matter of starting up again. Consequently, the Jacquard has been carefully examined

for its drive and lifting board arrangements, and it is envisaged now that help can be given to Qaidabad staff to get the Jacquard operating satisfactorily. The staff can be given advice and instruction on the functions of the type of Jacquard with which they will be dealing so that their previous difficulties can be resolved.

(18) New machinery and testing equipment

A thorough examination of needs has been carried out, and a sound list of testing equipment has been got out. The Radio Frequency Drying machine has been examined in detail and a preference for one machine has been carefully established.

(19) Study Tour

This was very successful and the MD gained a great deal of experience from it about UK methods of Wilton production, and on the testing equipment and machinery matters for Qaidabad purchases. The planning for this tour was detailed and it had to be very carefully arranged, but it all proved to be very beneficial.

SUMMARY

There are numerous factors involved in the programmes for improving quality and productivity. The project will yield benefits to Qaidabad Woollen Mills because many of the factors involved which mitigate against productivity and quality can be remedied.

The MD and staff have given full support and co-operation to UNIDO throughout the project, and together with them there will be a successful outcome to the work undertaken.

P. Ellis
19/12/1986