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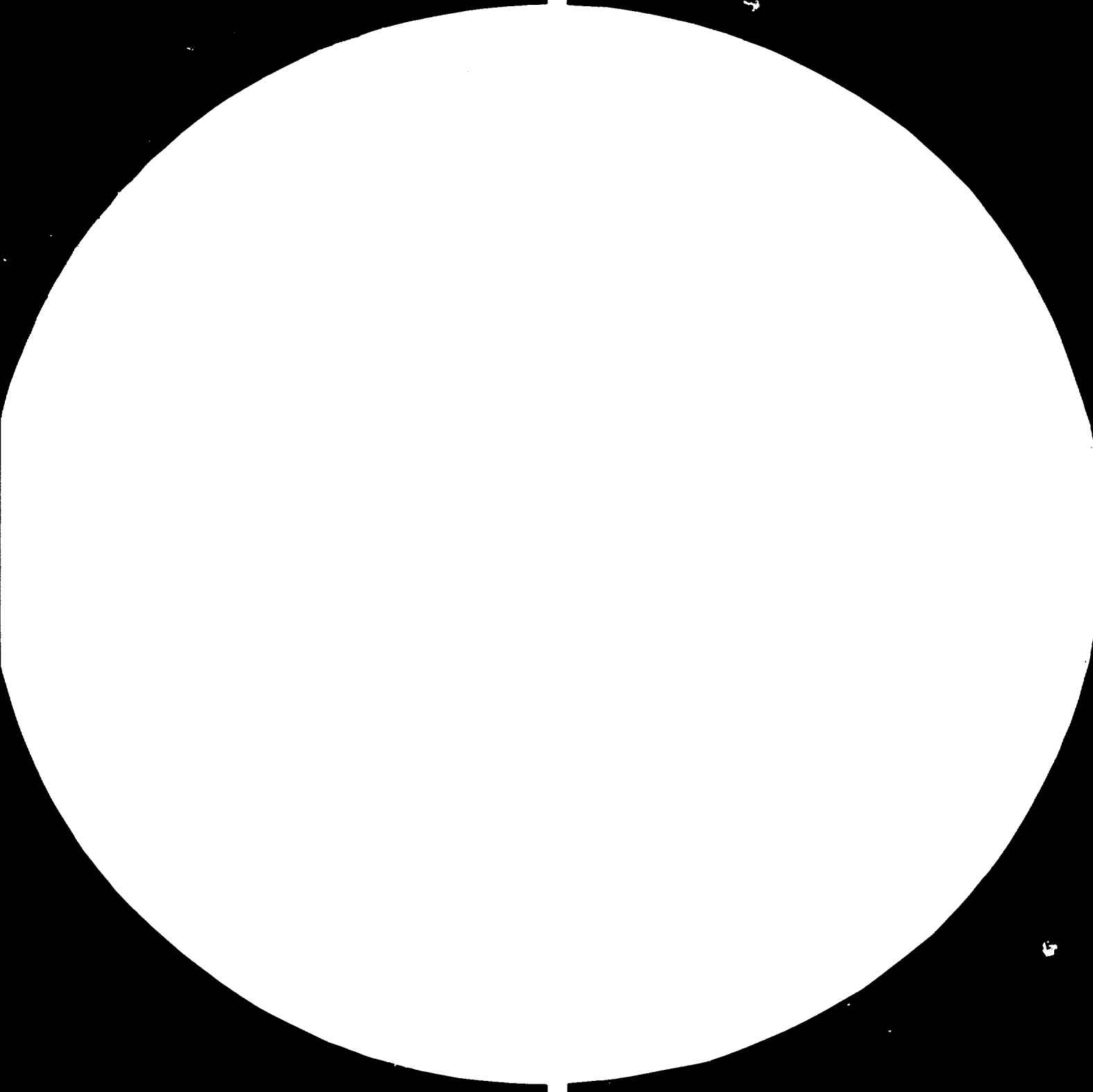
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UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANISATION

PROJECT NO. DP/LIB/77/001.

INDUSTRIAL RESEARCH CENTRE

SOCIALIST PEOPLE'S LIBYAN
ARAB JAMAHIRIYA

RESTRICTED

-5. 11. 1982

FINAL REPORT

OF

J.L. ISLES

Libya. EXPERT IN QUALITY CONTROL FOR TEXTILE MATERIALS.

DP/LIB/77/001/11-04/08

November 1982

398

CONTENTS

ACKNOWLEDGEMENTS.

1. SYNOPSIS.
2. INTRODUCTION.
 - (a) Background
 - (b) The textile industry
 - (c) Job description
3. EXISTING FACILITIES AND EQUIPMENT
 - (a) Description of textile laboratory accommodation
 - (b) Equipment
4. LABORATORY ORGANISATION AND WORK PROGRAMME
 - (a) National Counterpart staff
 - (b) Work programme
5. TRAINING
6. LABORATORY INVESTIGATION AND ANALYSIS
 - (a) Synopsis of an investigation into the "Brambach" fibre (Calotropis Procera), June 1979.
 - (b) An investigation into the wool of the fat tail Barbary Sheep.
7. FACTORY SURVEYS AND TECHNICAL CONSULTANCY.
 - (a) The National Establishment for Spinning & Weaving, Zanzour.
 - (b) The Tripoli Traditional Garment Establishment.
 - (c) The Social Establishment for Textiles & Spinning, Benghazi.
 - (d) The Weaving Factory for Traditional Garments at Misurata.
 - (e) The Misurata Carpet and Leatherwork Craft Training Centre.
 - (f) The Wool Washing & Spinning Complex, Al Marj.
 - (g) The Blanket Factory, Al Marj
 - (h) The Ready Made Garment Factory, Derna.
 - (i) The Control of Quality.
8. PARTICIPATION IN FEASIBILITY STUDIES.
9. RECOMMENDATIONS
 - (a) The future role of the Industrial Research Centre.
 - (b) Training for national staff.
 - (c) Quality control and the textile industry.

LIST OF APPENDICES

- Appendix A. Draft Preliminary Report and Work Programme.
- Appendix B. Organisation chart for the I.R.C.
- Appendix C. List of instrument at 12 December 1978.
- Appendix D. List of instruments at 21 March 1982.
- Appendix E. Laboratory Reorganisation.
- Appendix F. Laboratory I.R.C. report of test, example.
- Appendix G. Memorandum for Survey and Work Plan.
- Appendix H. Traditional garments, Fault analysis report.
- Appendix I. Recommended list for textile journals.
- Appendix J. Recommended list for textile books.
- Appendix K. List of draft reports submitted to I.R.C. during assignment.

List of abbreviations used in this report.

- IRC = Industrial Research Centre
- UNIDO = United Nations Industrial Development Organisation.
- S.P.L.A.J. = Socialist Peoples Libyan Arab Jamahiriya.
- T.N.O. = Synthetic Fibre Institute. Delft. Holland
- A.S.T.M.S. = American Society for Testing and Materials
- B.S. = British Standard.
- LINRA = Linen Industry National Research Association.
- C.V. = Coefficient of variation.
- c.c. = Cotton count (banks of 340 yds).
- ppm = Picks per minute.
- ppi = Picks per inch.
- N.O.C. = National Oil Corporation.

ACKNOWLEDGEMENTS.

I wish to record my sincere thanks to all the staff of the Industrial Research Centre for assistance and co-operation during my assignment, particularly to the General Director of the I.R.C. Mr. Mohammed Aburkis also to Mr. Tahir Bishti, Techno-Economic Director and Mr. Lamin Hawisa, Director of the Laboratory Section, who helped to organise visits to the textile factories.

I gratefully acknowledge the help and co-operation of my senior counterpart Miss Aisha El-Braiky. Head of the Textile Quality Control and Testing Laboratory.

I have enjoyed assistance and co-operation from Dr. O.P. Misra, UNIDO project co-ordinator and all the members of the UNIDO project at the IRC.

1. SYNOPSIS

- 1.0. This report covers a period of four years and three months during which the UNIDO expert for Quality Control of Textile Materials carried out his duties in accordance with his Job Description and the Draft Preliminary Work Plan agreed with the Project Co-ordinator and the Director Laboratory Section IRC. The expert commenced his assignment on 8 October 1978.
- 1.1. The first part of this report describes the work of the textile testing laboratories of the I.R.C., at the beginning of the assignment and how the programme was expanded, it describes the training given to counterparts, students and other members of the national staff of the I.R.C. Later in the assignment extension work was carried out on behalf of the textile laboratory of the Jamahiriya and surveys of the textile factories made by an I.R.C./UNIDO team.
- 1.2. The basic objectives of this expert's assignment have been to develop a regular and effective testing service to the textile industry and to assist with the development of attainable standards on behalf of the national textile industry. Such a testing service to be available to all branches of the textile industry including wool growers, raw material importers, yarn manufacturers, wool and cotton and blends, weavers, knitters, carpet manufacturers, dyers and finishers, importers, garment manufacturers and distributors.

- 1.3. In this last respect some progress has been made, but communication between the different branches of the industry, government departments, and manufacturers generally has not been easily established. Bridges still have to be built before complete confidence is established.
- 1.4. At the beginning of the assignment it was seen that whilst there was a good demand for testing services the requests were made for comparability or to establish the proportions of the different fibre content of imports for customs duty levels. Quality standards was not the main consideration. Following complete public ownership of the textile industry the demand for testing services by the I.R.C. diminished although the service was free of charge. Recently the expert was asked by the I.R.C. to submit a draft basis for a costing system for textile testing. The tempo of requests for acceptability testing, mainly for government services is again increasing.
- 1.5. A series of visits was made to the National Establishment for Spinning and Weaving, Zanzour, in connection with quality problems. In 1980 the first complete programme of surveys was initiated to the traditional garment weaving factories in the Benghazi area and the Tripoli factories, the wool washing and spinning complex at Al Marj, the garment factory at Derna, the new blanket factory and the hosiery industries. This programme was repeated in 1981 with a larger team which examined all aspects of each enterprise and a full report has been published using contributions from all members of the team, including the UNIDO expert for textile quality control.

- 1.6. Alongside the extension work institutional activities have included the regular testing of fibres, yarns and fabrics. Major investigations into the Calotropis Procera fibre & the indigencus Barbary fat tail sheep of Libya. The training of counterparts and training programmes for certain students selected to join the textile industry.
- 1.7. The industry is gradually being expanded and strengthened in accordance with the policy of the Jamahiriya for self reliance in industrial productivity and reduced reliance on imported consumer goods. Coincidentally with this policy a new centre for the IRC is almost complete at Tajura near Tripoli and the IRC will shortly transfer to the new premises where the textile laboratory and work shop area is fifteen times larger than at present and the expert estimates that a minimum staff of textile graduates and technicians in the regions of twenty four would be required. The new centre includes accomodation for textiles, food technology, building materials, instrument laboratory and geology, all of similar dimensions and with new laboratory furniture and all services. There are special rooms for certain processes, complete controlled atmosphere, offices, lecture theatre, library, etc.
- 1.8. In consideration of the above, draft proposals for new testing instruments have been recommended by the expert for purchase during the current five year economic period. A previous list purchased from the 1979 budget was also submitted by the expert, these instruments have been purchased, installed in the textile lab and are in use, in the present laboratory.

- 1.9. The future role of the I.R.C. in relation to the textile industry of the Jamahiriyah should be to provide the services listed under Appendix E and the full co-operation of the industry and a working relationship which will allow for the realisation of the common goal for an efficient, profitable textile industry always achieving an acceptable level of quality on behalf of the consumer. And it is the satisfaction of the consumer with the goods manufactured that is the ultimate test of quality.

2. INTRODUCTION

A. Background.

1. The Industrial Research Centre (I.R.C.) is in a semi-independent status with the Secretariat of Light Industry, formerly the Secretariat of Industry and Mineral Wealth.

1.1. The I.R.C. is organised under three major divisions, Economic, Technical and Laboratory, each division is headed by a Director and the whole organisation is administered by a Director General. See Appendix B.

1.2. Under the three major divisions described in para 1.1. are departments:-

Laboratory Division. Textiles

Food Technology

Technical Division

Instrumentation Laboratory.

etc.

2. The I.R.C. is housed in a complex of buildings estimated at being about sixty years old. The buildings are on a spacious site overlooking the sea and comprise one floor housing mainly administration offices, the Economic Division, library, Food labs and the Geological Division.

- 2.1. The cellars below ground are laboratories for Food Technology, Instrumentation, Classical Chemical Analysis and Textile Quality Control and Testing Laboratories.
- 2.2. It is anticipated that the planned move to the new purpose built premises will take place shortly when the whole I.R.C. will be completely rehoused in a much more spacious complex just outside Tripoli.
- 2.3. In consideration of the deteriorating condition of the present accomodation and its detrimental effect on the instruments this move will be of significant benefit.
- 3.0. The responsibilities of the I.R.C. cover a broad field and are intended to assist the Jamahiriya towards industrialisation. The I.R.C. has the responsibility for certain industrial techno-economic feasibility and market studies.
- 3.1. The second part of the I.R.C. activity is concerned with technological research and development and technical consultancy service to industry.
- 3.2. Thirdly the I.R.C. provides administration and management services to industry and to other government organisations.

- 4.0. UNDP assistance has been provided since 1972 to strengthen I.R.C. and assist in carrying out its functions.
- 5.0. The expert arrived at the duty station on 8 October 1978 and took up his duties with the UNIDO/IRC Project as expert for Quality Control and Testing of Textile Materials. The initial contract being for six months with the possibility of extension.
- 6.0. A list of recommended books and journals for textile technology have been given under Appendices I and J .
- 7.0 A list of the Main draft reports submitted to the I.R.C. is given under Appendix K'.

B. The Textile Industry

1.0. The government owned textile industry in the Socialist Peoples Libyan Arab Jamahiriya is a small, but varied industry destined to play a significant part in the economy of the nation. During the past ten years the industry has expanded bringing employment and a wider range of textile goods onto the domestic market. It now employs about 3000 people and further expansion is planned for the next economic period, 1981-1985. See Fig.(i).

1.1. The industry is located in different parts of the country, such products as cotton fabric, traditional garments and carpets being manufactured in the Tripoli area, and the manufacture of woollen yarns, blankets and some knitwear in Al Marj on the Jebel Akhdar. A new woollen carpet factory is being erected at Bani Walid and there are plans for further expansion of the textile industry.

1.2. The modern industry is soundly based on many years of traditional cloth and carpet manufacturing to a very high standard of quality such as, hand woven fabrics of pure silk, richly embroidered traditional garments and the hand knotted carpets using the natural colours of the indigenous wool. These traditional industries are still perpetuated and encouraged.

I. The Diversity of the Product and End Uses.

2.0 An important characteristic of the textile industry of the Jamahiriya is the range and variety of product for many uses, this includes traditional garments and floorcoverings and the more conventional products in the woven, non-woven and knitted categories such as fabrics for dresses, household textiles, furnishing fabrics, floor coverings and industrial cloths. The traditional garments are manufactured in the loom as complete finished garments in regional designs and colours for ladies, in small groups of powerloom weaving factories in the Tripoli and Benghazi areas. The more conventional cotton fabrics are manufactured and finished on automatic looms at the textile factory at Zanzour which has dyeing and finishing facilities.

2.1. Distribution is through government departments with head offices in Tripoli and Benghazi. These offices are responsible for local purchase and/or importing of garments and fabrics, etc. and for organising the making up of fabrics domestically or overseas and then for distribution to the national retailers throughout the country.

II. Raw Materials.

3.0. The Jamahiriya is fortunate in having a valuable raw material such as the wool from the indigenous Barbary sheep, this wool is a good carpet quality and has served as the foundation for the hand knotted carpet industry and encouraged the development of a modern tufting and woven carpet industry. This same wool is now being used to blend with other fibres for blankets and knitted garments and will be used extensively for the future expansion of the national textile industry.

3.1. An indigenous vegetable fibre is the "Brambach" or Calotropis Procera of the milkweed family. In 1979 a research programme carried out by the textile laboratories of the Industrial Research Centre in Tripoli and the Shirley Institute, Manchester investigated the commercial possibilities for this fibre and reported that subject to certain constraints it could be used to manufacture fabrics on the non-woven principle.

3.2. At present all other fibres or yarns have to be imported but consideration is being given to the manufacture of synthetic fibres or filaments as a by-product of the petro-chemical industry of the National Oil Company of the Jamahiriya.

III. Future Plans

4.0. Knitwear is manufactured in the east of the country by two small foreign owned companies which are now part of the national textile industry, they manufacture outerwear and underwear. A tripoli factory has recently installed circular knitting machines to manufacture dress materials, these are now in production. Blankets are being manufactured in the form of woven and non-woven types. Uniform cloths, household textile such as sheets, upholstery fabrics, curtains and plain towels are manufactured by the National Establishment for Spinning and Weaving at Zanzour near Tripoli and made up by the Ready Made Garments Factory, Derna, and other places.

4.1. Planned expansion for the future includes a factory for the manufacture of bags and sacks from polypropylene extruded tape. A factory to recycle cotton waste by condenser spinning for the manufacture of textiles for medical uses such as cotton wool and gauze dressings. Under consideration is a factory for the manufacture of knitted socks, stockings and ladies polyamide hosiery. The new wool carpet and knitwear factory at Bani Walid is expected to be in production in the near future. Plans are in hand for more garment factories.

4.2. It is the intention of the S.P.L.A.J. to be as self supporting as possible through investment in industry for the manufacture of products for the domestic market and subsequently for export. Inevitably such a policy will involve a wide diversification of textiles.

Organisation Chart for the Textile Industry of the
Socialist People's Libyan Arab Jamahiriya

The National Company for Textiles
of the S.P.L.A.J.

The Social Establishment for Textiles & Spinning Benghazi	Ready made garment factory. Derna	Traditional garment factory Misurata	National Estab. for Spinning & Weaving, Zanzour	Traditional Garment Estab. Tripoli.	Wool washing and spinning El Marj.
Six branch factories with total 345 looms	Target 225,000 pieces garments per annum.	Total looms 22 + 36 new looms	Total looms 576 + Finishing, dyeing & printing.	9 Branch Factories total 449 looms. 13 Circular Knitting Machines.	Target 765 tonne yarn per annum. Blanket Factory El Marj. Target 500,000 Nos Woven and 400,000 No. Non-Woven per annum.

C. Job description

DP/LIB/77/001/11-09/C/31.3.A.

POST TITLES: Expert in Quality Control of Textile Materials

DURATION: 6 months with possibility of extension

DATE REQUIRED: January 1978

DUTY STATION: Tripoli, Libya

DUTIES: The expert will be a member of a professional team of international experts assigned to the Industrial Research Centre (IRC), where he will be attached to the Laboratory. He will work in close co-operation with the national staff, under the administrative guidance of the Project Co-ordinator. Specifically, he will be expected to:

1. Help in the organisation and working of the textile testing laboratory.
2. Train local staff in all aspects of physical and chemical methods of testing textile materials.
3. Help in selection and adaptation of proper test procedures, as well as in the evaluation of quality control standards.
4. Assist in carrying out quality control related measurements.
5. Give assistance in completion and selection of equipments and instruments in the field.
6. Assist and advise the library on information sources for appropriate subjects.

QUALIFICATIONS: University degree with extensive experience in applications of test methods for textile materials and in laboratory techniques related thereto.

See Appendix "A" for Draft Preliminary Report and Work Programme of 26 October 1978.

5. EXISTING FACILITIES AND EQUIPMENT

A. Description of textile laboratory accommodation.

1. The textile testing and quality control laboratories at the present I.R.C. site consist of a physical testing laboratory of 100 metres square with a small annexe containing one porcelain sink and two sets cupboards. This annex is used as a chemical lab. Recently a third room was allocated, about 22 metres square, to house the Shirley Analyser and the Flammability Tester. All these laboratories are in the cellar part of the I.R.C.

2. The physical testing laboratory has no controlled air conditioning system, only a domestic type appliance to cool the lab in summer and heat it in winter, nor, initially was there any instrument to record temperature and humidity. Bench cupboard and drawer accommodation is satisfactory, there are two large tables and two metal desks. Lighting is inadequate and there is a fluorescent daylight lamp.

- 2.1. The laboratories are not purpose built and have only very small non-opening windows high in the walls, large quantities of dust still find its way inside. Another major problem is the water supply which has to be supplemented by deliveries from tankers. As a result work in the labs is curtailed and distilled water supplies inadequate. Powercuts can be frequent.

2.2. As an interim measure a draft proposal for a reorganised textile testing laboratory was submitted by the expert to the Directors of the I.R.C. in 1979, see Appendix "E". A plan was drawn to scale showing the instruments in place. In consideration of the eventual move to new premises this plan was partially adopted.

2.3. The third small room mentioned in para 1 was adopted in 1981 and the Shirley Analyser installed. The flammability tester was housed in a new all metal fume cupboard with extractor fan. This third laboratory has helped to contribute some useful work in testing and demonstrations using both instruments.

B. Equipment.

3. The instruments already installed in the laboratory when the UNIDO expert took up his appointment with the I.R.C. project are listed in Appendix "C". Most of the twenty three instruments were in working order other than a Spencer microscope, a J. Heal pillin tester, the fibre strength tester and the Xenotest 150, light fastness tester. These instruments after receiving maintenance and repairs are in working order. At the time there was no formally appointed staff member responsible for instrument maintenance.

3.1. The expert gave recommendations for supplementary chemicals, glass ware to broaden the scope of chemical testing and, at the request of the Director Laboratory Section submitted draft proposals for the purchase of additional testing instruments from the 1979 budget, see Appendix "D" for the full list now installed and in use.

3.2. With the prospect of moving the textile testing and quality control laboratory into new premises of nearly 15000 square feet area, or fifteen times larger than the present laboratory. Lists for further instrument purchases to be made during the current economic period to 1985, have been drafted, for chemical, physical and workshop equipment. Certain testing instruments as well as all the bench tops, sinks and fume cupboard furniture are to be provided by the contractor on a "turn key" agreement basis.

4. LABORATORY ORGANISATION AND WORK PROGRAMME

A. National Counterpart Staff

On the 3th October 1978 the staff of the textile testing laboratories of the I.R.C. consisted of:-

1. Miss Aysha EL-Braiky, B.Sc (Indust. Chemistry), El Fatch University
Tripoli, S.P.L.A.J.

Head of the Textile Testing & Quality Control Laboratories of the I.R.C.

Other training courses attended include, T.N.O. Delft, Holland
Textile Technology & Fibre Identification 1974 (3 months).

2. Mr. Hussein Tumi. Senior Laboratory Technician, Twelve month
Technical training U.K. 1976. In-laboratory
training I.R.C.C
3. Mr Alo Solah Senior Laboratory Technician. In-Laboratory
training I.R.C..

Unfortunately Mr. H. Tumi and Mr. Alo Solah were drafted for
military service in 1979 and their service is not yet complete.

Miss Aysha EL-Braiky is now a member of the Committee for the Study
of Quality and Development of the National Textile Industry of
the Jamahiriya.

She is also a member of the Committee for Textile Standards and
Specifications.

In November 1981 Miss El-Braiky attended the Synthetic Fibre Symposium at UNIDO, Vienna (one month).

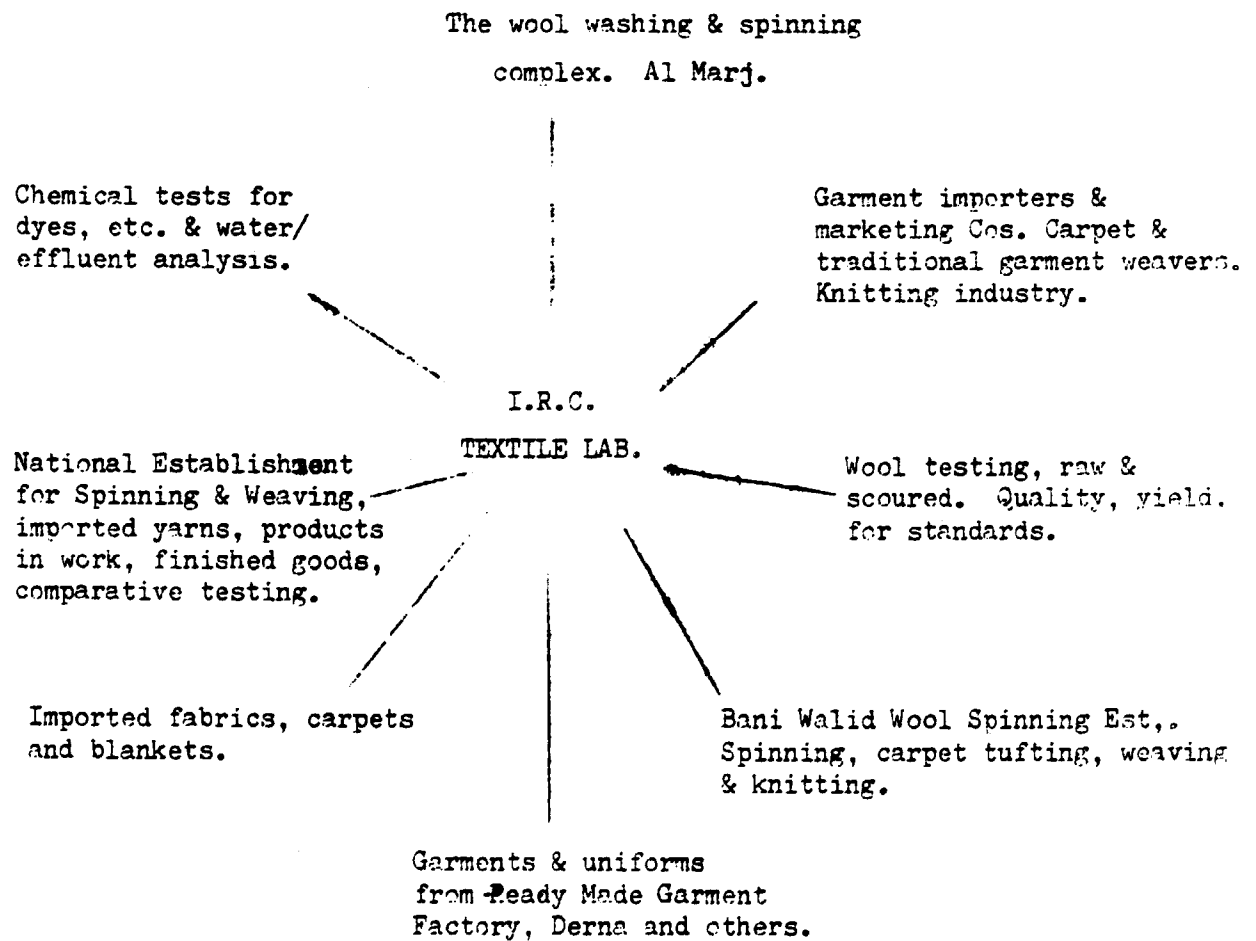
In consequence of losing Mr Tumi and Mr Solah the expert had only one counterpart throughout most of his assignment, but this situation was subject to being supplemented by other I.R.C. staff for symposiums, lectures and the training courses for textile students.

B. Work programme.

- 1.0. The routine work programme for the textile aquality control and testing laboratories of the I.R.C. consists mainly of application testing on behalf of other government departments such as, Customs, Defense, Police, etc.
- 1.1. The range of different fabric weights and types is quite extensive particularly on account of having winter weight clothing required for temperatures near to freezing point and summer weight clothing designed for temperatures up to 40 deg C. Sometimes more specialised fabrics are submitted for investigation such as protective clothing and fabrics for industrial use. See example, Appendix F.
- 1.2. The variable composition and specification of the fabrics submitted for test has required experience in chemical and physical methods of test based on international standards, most of the tests practised by the textile laboratories of the I.R.C. are based on British Standards, A.S.T.M.S. and the standards being developed by the government of the Jamahiriyah.

- 1.3. The textile testing instruments purchased by the I.R.C. from the 1979 budget have enabled a more comprehensive testing service to be given, particularly for fibres and yarns.
- 1.4. The procedures for reporting, analysis, conclusions, maintenance of records and laboratory management have been the subject of considerable attention by the UNIDO expert.
- 1.5. The frequency of applications for test has been variable, sometimes as many as forty fabrics are submitted at one time for comparability testing, but there can be variable time gaps between samples being submitted. More than three hundred applications for tests have been received by the textile laboratory during period 1979 - present day (Nov 1982) involving more than four thousand tests.
- 1.6. Communication between the I.R.C. and the factories of the National Textile Industry is not close and in spite of the surveys and extension work that has taken place with the help of the UNIDO expert the sample material received for testing has been brought from the factories by the I.R.C. team and only rarely have the factories submitted their material for testing independently. See Appendix G.
- 1.7. Problems under this heading have mainly been due to the unsatisfactory premises and services (water supply, etc.). The lack of counterpart staff and the urgent desire for quick results by many of the clients who find it difficult to understand that proper tests require adequate time.
- 1.8. The chart on the following page Fig.II, illustrates the potential sources of regular requests for tests, standards and other technical services, as suggested by the UNIDO expert in his reports to the I.R.C.

Chart to show anticipated sources of requests for testing
and standardisation



5. TRAINING

- 1.0. Training has been mainly concerned with the experts senior counterpart, Miss Aisha El-Braiky she being the only national staff member. appointed to the Textile Quality Control and Testing Laboratories. Other members of the national staff of the I.R.C. have been available for some of the lectures. On two occasions students from the Industrial Bank and the Medical Cotton Wool factory have attended the textile section for lectures, initially for 3500 student hours (1980) and recently for 2000 hours (on-going).
- 1.1. The training programmes have included textile technology, physical and chemical testing of textiles, fibre identification and statistical reporting. Other lectures have been given on atmospheric control for testing laboratories, moisture content and moisture regain for textile materials. Cloth analysis for construction of woven fabrics. In almost all cases "hand-out" notes have been prepared and distributed to the students.
- 1.2. The training has been given in the textile and quality control laboratories of the I.R.C. and has included a high proportion of practical work and demonstrations in test procedures and the use and purpose of the instruments.
- 1.3. Formal lecturing has been minimised in favour of practical work on account of the difficulties for translating into Arabic, also the lack of a lecture room and any visual aid equipment.

- 1.4. The most effective method for training has been by the personal example and participation of the UNIDO expert in the day to day testing programme of the textile laboratory. The experts advice and guidance during the investigations into the "Brambuch" (Calotropis Procera) and for the investigations into the wool of the Libyan sheep.
- 1.5. Two formal training programmes have been developed, one at a first grade level and the other at a more advanced level, also a complete training manual designed to assist with the training in testing procedure used regularly in the textile testing laboratory. All have been found useful and submitted to the I.R.C. for translation into Arabic.

LECTURE HAND-OUT NOTES

- (a) A process flow chart for cotton spinning with description of operation.
- (b) A process flow chart for weaving, dyeing and finishing with description of operations.
- (c) A process flow chart for woollen spinning.
- (d) A process flow chart for the weaving, dyeing and finishing of woollen fabrics with descriptions of operations.
- (e) A list of typical commercial polyester/cotton blend proportions, the characteristics of polyester and methods for identification using physical and chemical tests.

- (g) Notes on tests for colour fastness to bleaching.
- (h) Hand out notes for a seminar on "Atmospheric Control in Textile Testing".
- (i) Notes and diagrams for a lecture on the properties of natural, man-made and synthetic fibres.
- (j) Notes and diagrams for a lecture on "Recent Developments in Synthetic Fibres".
- (k) Method for the construction of a staple fibre diagram.
- (l) Notes on the method of test for fibre strength and elongation.
- (m) Method of calculation to obtain the size of a microscopic image for accurate measurement of fibre cross sections.
- (n) Method for calculation of standard deviation and co-efficient of variation. Example based on fibre diameters.
- (o) Notes on the construction of frequency diagrams and histograms.
- (p) "A Manual for Textile Quality Control & Testing".

TEXTILE TECHNOLOGY TRAINING

Textile Quality Control and Testing
Laboratory. I.R.C. Tripoli. S.P.L.A.J.

- First Grade. 33 week course, 4 sessions per day (20 per week).
- Part I. (a). Fibres and fibre identification.
- See (cellulose), Leaf & Stem.
- Animal. glandular. Mineral.
- Regenerated cellulose, Polymer synthetics. Protein.
- (b) Fibre testing.
- Microscopic.
- Moisture content & regain.
- Statistical reporting.
- Fibre count, (staple), diameter.
- Conditioning.
- Staple length. Tensile strength.
- (c) General yarns & threads.
- Principles of yarn count.
- Tensile testing of yarns.
- Twist testing for yarns.
- Evenness testing by Uster, result evaluation.
- (d) Cloths & fabrics.
- Types of fabric, commercial descriptions.
- Tensile testing, bursting strength, wear(abraison) tests.
- Pilling tests, drape tests, insulating, air & water permeability.
- Colour fastness, Linitest, Xenon test, light & washability.

Part II. Weaving

- (a) Fundamentals. Cloth design/loom motions, shedding, etc.
 - (b) Cloth analysis and calculations. Identification, raw materials, yarn count, setting, weave, colour plan. Prepare all details for reproduction.
 - (c) Fundamental weaves.
 - (d) Weaves developed from twills, plain weave, sateens, etc. etc.
Other weaves, honeycomb, shepherds check, etc.
 - (e) Designs and colour plans.
 - (f) Methods for fabric setting in the loom, calculations.
 - (g) Cord weaves and strong weaves, ribs, etc.
 - (h) Double cloths & backed cloths.
 - (i) Complex weaves, gauze, doupe, crepe, lace effects, jacquard.
 - (j) Embroidery and other effects.
 - (k) Terry fabrics, velvets, types of carpets.
- Summing up.

Part III. Laboratory Testing.

- (a). Laboratory weighting, use of balance.
Knowledge of different types of balance.
- (b) Microscopic tests. Practice in use of microscope.
Preparation of slides for longitudinal and cross-sections.
- (c) Fibre identification.
Identification of undyed fibres by reagents and shirtstains.
- (d) Testing for damage to wool.
Allworden reaction, (normal fibres form bubbles when placed in chlorine or bromine water, bubble formation is retarded in damaged fibres).
- (e) Solubility of wool in alkali, (B.S.3568), a measure of damage caused by acid or alkali treatments can cause changes in degrees of solubility.
- (f) Testing for damage to cotton (cellulose).
Caustic soda swelling test for fibre maturity.
Determination of solubility number (LINRA test),
strong caustic soda treatment followed by results expressed as a solubility number in accordance with procedure outlined by British Standards Inst.
- (g): Quantitative determination of fibre raw material blend composition by :-
 - Microscopic observation.
 - Determination of selective solubility.
- (h) Use of conditioning cabinets.
Use of drying ovens and desiccators.

Part IV. Fibre Fineness Testing.

- (a) By air-flow instruments, for quick results.
By gravimetric fineness method, (cut to known length and weight 3 x 200 fibres).
- (b) Count testing of fibres by Micrometry (500 fibres).
- (c) Fibre length measurement, making a fibre diagram mounted on black cloth board, the use of statistical methods to obtain mean staple length, sigma and C.V. of sample.
- (d) Use the tensile strength test for a sample of fibres, (Pressly method), Calc average of results.

Part V. Measurements for Yarn Fineness

- (a) Reeling of a given length and weighing on quadrant balance to obtain yarn count.
- (b) Analysis of fancy threads, untwist, measure respective lengths, the amount of twist in each of yarn components.
- (c) Measure resultant count, resultant twist and direction of twist, Calculate standard deviation and C of V % for fancy yarns.
- (d) Measure single yarn strength and elongation, use automated continuous strength tester (Uster type) and single tester (Goodbrand) for tensile tests. Calculate the results statistically, make 50 tests on each instrument with mean, standard deviation and C of V %.

- (e) Yarn abrasion tests. Ten reels, measure changes in yarn strength due to wear. Measure ultimate tensile strength after wear tests of different time periods.
- (f) Twist test 10 spools. Using untwist/retwist method and the complete untwist method. 30 specimen x 2.5 cms. Calculate the av number turns/metre, twist direction variance and C of V percentage.
- (g) Yarn levelness testing, using Uster Levelness Tester. By electronic capacitance principle. Measure linear unevenness per spool (U %). Analyse graphs for amplitude and wavelength variations.

Part VI. Fabric Testing

- (a) Tensile testing of fabrics.
Samples 3 x warp direction.
" 3 x Weft direction.
Result determined by breaking load in LP.
Average elongation at rupture %.
Statistically report results.
- (b) Surface abrasion test for fabrics.
Measure weight loss by wear. Give percentage loss in relation to weight of original sample.
- (c) Measure angle of drape, use the Cusick Drape Testing instrument, practise on wide range different fabrics for co-efficient of drape qualities.

- (d) Measure pilling formation, use pilling tester and pilling standards.
- (e) Air permeability test. Measure resistance of fabric structure to the rate of air sucked through (litres per hour), make about five tests.
- (f) Water permeability test. Measure resistance to fabric against penetration by water, test until three drops form on surface of fabric.
- (g) Quantitative determination of fabric composition.
 - 1. Remove all additives by soxhlet extraction.
 - 2. Examine under microscope.
 - 3. Make chemical analysis using reaction of certain reagents on one of the blend fibre components, filter out other component, weigh and calculate percentages of each part of whole blend.

6. LABORATORY INVESTIGATION AND ANALYSIS

Two main investigations were made and were the subject of draft reports submitted to the Directors of the I.R.C.

- a. An investigation into the properties of the "Brambach" fibre (Calotrois Procera). June 1979.
- B. A draft report on a programme of investigation into the properties of the indigenous Libyan wool. First report 19/8/79.

Subsequent reports were made in 1981 and 1982.

- C. The expert co-operated with Mr. L.Haweisa. I.R.C. and Dr. Zoltan Halmos. UNIDO for a paper on the thermo analytical properties of a sample of indigenous Libyan wool.

- A. Synopsis of an investigation made into the "Brambach" fibres (Calotropis Procera), June 1979. From UNIDO/IRC Report.
- 1.0. "The Brambach plant grows in a warm dry climate such as Africa, Asia and parts of South America, it belongs to the Calotropis Procera family. In some countries it is reported as being cultivated and used for upholstery filling in the same way as Kapok. The fibres grow in a pod which, in Libya, open about Nov/December to allow the seeds to be carried by the fibres over large areas of the country".
- 1.1. "The fact of having these plants growing naturally in the more arid parts of the Jamahiriya has encouraged an investigation into the possibilities of processing the fibres for textiles. A programme of investigation has been drafted to try and evaluate the possible uses for "Brambach".
- 1.2. "Experience in collecting the fruit and removing the fibre has shown this operation to be labour intensive, but with the help of compressed air the speed and efficiency of the fibre collecting was improved. It was also established that the fibres must be dry otherwise bacteria quickly develops damaging and discolouring them".
- 1.3. "Laboratory sampling was carried out in accordance with ISO 1130. Two kilos of "Brambuch" were sampled for the I.R.C. textile laboratory in addition to the six kilos sampled for the research programme to be carried out by another international institute".

- 1.4. "Brambach" has a highly cellulose content comparable with cotton, tests showed that lignin is also present. Dye affinity tests and dye fastness tests produced a reaction similar to cotton and the man-made fibres derived from cellulose. The reaction of "Brambach" to chemical tests was similar to other natural and regenerated cellulose fibres".
- 1.5. "Microscopic measurements and observations of the fibre in full mount and cross-section aform have helped to demonstrate its smooth friction free surface, thin walled construction, and enabled its physical characteristics to be measured".
- 1.6. "Tensile strength tests demonstrated the brittle and fragile nature of "Brambach" which together with the friction free surface characteristics make it difficult to spin conventionally. The physical structure of the fibre having thin walls cannot support its length under stress."
- 1.7. "The bouancy tests demonstrated the ability of the "Brambach" to retain some air due to the hollow construction of the fibre and that it could be dried out and still support itself above water for a prolonged period, but by comparison with Kapok it quickly becomes saturated and can only be considered as an inferior substitute".

- 1.8. "It has been concluded that the "Brambach" fibre has good possibilities for upholstery filling and for blending with stronger fibres or with Kapok as a filling for bouancy, but only as a last resort in this latter instance. The fibre is a good white colour with characteristics of a soft handle and good white colour. It has been shown to respond to wet treatment, dyeing and bleaching in the same way as other cellulose fibres. Accordingly, it could be blended with other cellulosic fibres for fabric manufacture where its softness and lustre could contribute to the handle and appearance, but due to the lack of physical strength it is assumed that its contribution to the blend could only be small. However, another possibility is for manufacturing on the non-woven principle by needling, batt-on-base or adhesive bonding".
- 1.9. "An important factor will be the economic harvesting of "Brambach" bearing in mind that under the present circumstances of taking the pods of fibre from the natural, as opposed to cultivated environment, it is a labour intensive operation".
- 1.10. "It is recommended that further tests should be carried out using the "Brambach" in various amounts as a blend with other fibres. Tests for hand spinning the "Brambach" as a 50/50 blend with Libyan wool have demonstrated that a stronger yarn can be spun. More tests using a pilot spinning plant or under actual mill conditions so that an accurate assessment of its performance can be measured would be conclusive. Also it is recommended that tests should be made for "Brambach" as a blend component in a needlefelt manufacturing method to measure its potential for use in this manufacturing medium".

1.11. A full programme of physical and chemical tests was carried out by the textile testing and quality control laboratories of the IRC. In order to make tests of a more practical nature samples of the "Brambach" fibre were sent to the Shirley Institute, Manchester, UK where tests for spinning and non-woven trials were made. Shirley Institute made a report to the I.R.C. which confirmed the weakness of the fibre for the spinning process, but made a range of entirely successful bonded fibre trials using 100% "Brambach" and blends with viscose rayon fibres. The fact remains that the commercial possibilities for this fibre are very remote, particularly on account of the harvesting problem.

B. AN INVESTIGATION INTO THE WOOL OF THE FAT TAIL BARBARY SHEEP.

2.0. The wool of the indigenous Libyan sheep has good potential and in the past has been the source of a significant proportion of the national income due to overseas demand. The development of a woolen industry in the Jamahiriyah for carpets, blankets and knitwear has given new impetus to wool growing and recognised the importance of wool to the economy. The report in section "B" describes the results of tests made and the main physical characteristics of the Libyan wool fibres. The figures quoted in this report are from the most recent testing programme.

- 2.1. Although there is now a wool washing and spinning complex at Al Marj, a new blanket factory and the prospect of a wool washing, spinning and carpet and knitwear manufacturing enterprise coming on stream at Bani Walid in the near future, the organisation for the surveillance and management of the sheep population is inadequate. The present sheep population is approaching six million and covers different parts of a large country. Facilities for dipping, shearing and the collection of wool require to be much improved to allow for better quality by sorting and classifying and to avoid waste.
- 2.2. On 20 March 1980 this UNIDO expert together with Mr. Abida, UNIDO, attended a meeting with the Secretariat of Industry to consider investment plans for the next economic period. At this meeting recommendations were made for five wool collecting centres and two more wool washing centres. Messrs Batelle S.A. as consultants retained to survey the Jamahiriyah textile industry have made similar recommendations in their 1982 report.

A Report on the Wool of the Libyan Barbary Sheep, by the Quality Control and Textile Testing Laboratories, the Industrial Research Centre, Tripoli, Socialist People's Libyan Arab Jamahiriya

Introduction

This report has been compiled from data used in an earlier report, "Methods of Wool Fibre sampling and Testing from Raw Material Identifiable to Source "(1/12/81).

This revision has condensed and revised certain aspects of the previous report in such a way as to improve the accuracy of the measurements taken (by repeating some of the tests) and cutting out a certain amount of repetition.

The Shirley Analyser tests are reported separately and it is suggested that this line of investigation of wool cleaning by the Shirley Analyser merits a more detailed study.

I.R.C. Tripoli

14/4/1982

Some Physical Characteristics of the Libyan Barbary Wool

The Raw Material Source.

Executive Authority of Gefara Plain. Aziziya.
Food & Agriculture Organisation, Range and
Livestock Development. Gefara Plain - TF/LIB
10. United Nations.

Samples supplied :-

All the wool is obtained from typical examples
of the Libyan Arab Barbary Fat Tail Sheep
indigenous to the S.P.L.A.J.

1. 6 month clip lambswool (Nov 1980) 3 Kg - 225 gms greasy wool.
2. 1 year clip wool (April 1981) 4 kg - 175 gms greasy wool.
3. 2 year clip wool (April 1981) 5 kg - 950 gms greasy wool.
4. Older wool, various mixed amounts.

The sampling method used to obtain representative specimen for testing was based on the B.S. 2545 zoning principle. To obtain a representative numerical sample from each of the above clips of wool (apart from 4, "older wool"), the method is to remove small sub-samples from different parts of the bulk and to reduce these to a more convenient number of fibres by repeated halving. For the purpose of this programme it is suggested that the sampling of the greasy wool is carried out with the initial

objective of obtaining a bulk representative sample from each category for scouring.

A draft wool testing programme :-

1. Loose wool scour.
2. Loose wool drying.
3. Calculate yield for scoured wool.
4. Fibre fineness test.
5. Measure fibre staple length.
6. Make calculation for mean & C.V.
for 4 and 5.

The programme for loose wool scouring and drying is in five stages :

1. Steep greasy wool in a bath of water at 35 deg C for 15 minutes to remove loose soil and dirt.
2. Scour the wool in water of 55 deg C with 0.5 % soap/soda detergent for ten minutes, move gently.
3. Scour wool in water at 50 deg C with 0.5 % soap/soda detergent for ten minutes, move gently.
4. Wash off in water of 35 deg C for about ten minutes, rinse off all soap thoroughly, squeeze gently.
5. Dry slowly, initially in oven, then in air, allow to condition.

After drying and conditioning the scoured wool should be weighed and the yield of clean wool calculated as a percentage of the original weight of unscoured greasy wool.

Sample 1. "A". 6 months lambswool, 22 gms in grease.

"B". " " " 22 gms in grease.

Steeped, scoured and dried in accordance with the programme described above.

Clean weight of sample "A" = 12.537 grms = 57% yield clean wool.

" " " " "B" = 13.764 " = 62.6% " " "

Mean of the two results = 59.8% " " "

Sample II. "A", 12 month wool clip, 22 gms in grease.

"B", 12 months wool clip, 22 gms in grease.

Steeped, scoured and dried in accordance with the programme described above.

Clean weight of sample "A" = 10.15 grms = 46.12% yield.

" " " " "B" = 11.88 " = 54.0 " "

Mean of the two results = 50.6% yield

Sample III. 6 months lambswool, 200 grams in grease.

Steeped, scoured and dried in accordance with the procedure previously described.

Clean weight of sample = 110 grams, given yield of 55%

Sample IV. 12 month wool clip, 200 grams in grease.

Steeped, scoured, in two lots, in accordance with the procedures previously described. Yield of clean wool after scour :-

= 95 grams = a yield of 47.5% clean wool (Mean).

Sample V, 6 months lambswool, 200 grams in grease.

Steeped, scoured, in two lots, in accordance with the procedures previously described. Yield of clean wool after scour :-

= 125 grams = a yield of 62.5% clean wool (Mean).

Sample VI. Two year wool clip, 200 grams in grease.

Steeped, scoured and dried in accordance with the procedure previously described.

Clean weight of sample = 108.5 grams, gives yield of 54.25%.

It was observed that this two year sample contained a higher proportion of hair and dead fibres and that the colour of the wool was generally more yellow.

Wool Fibre Length Measurements

Sample III. Wool from the 6 month old Libyan Barbary Lamb.

Number of specimen,	562
Fibre length,	25-70 mm.
Variance,	429
Standard Deviation,	20.7
Co-efficient of Variation	40.85%

Sample IV, Wool from the one year old Libyan Barbary sheep.

Number of specimen,	826
Fibre length,	50-105 mm.
Variance,	730.5
Standard Deviation,	27.02
Co-efficient of Variation	40.0%

Sample VI. Wool from the fleece of the two year growth of the
Libyan Barbary Sheep.

Number of specimen,	543
Fibre length	65-125 mm.
Variance,	1254.9
Standard Deviation,	35.42
Co-efficient of Variation	41.6%

The wide range of staple length and the wide range of fibre diameters created by this breed of sheep is due to the presence of two very different qualities of wool in the one fleece. The long coarse surface wool and underneath this, the shorter and much finer wool of the undercoat. This situation contributes to a high C.V. of 40%.

It is estimated that the coarser surface wool corresponds to grades coarser than 36's, and the finer fibre underneath corresponds to a grade of about 48's.

WOOL FIBRE DIAMETER MEASUREMENTS

Sample III. Wool from the 6 month old Libyan Barbary Lamb.

Presence of kemp fibre	5%
Medulated fibres	9%
Number of specimen in sample	130
Variance	87
Corrected mean fibre diameter	35.53 micron
Standard Deviation	9.32
Coefficient of Variation	26.25%

Sample IV. Wool from one year old clip of Libyan Barbary Sheep.

Presence of kemp fibre	8%
Medulated fibres	19%
Number of specimen in sample	145
Variance	258
Corrected fibre diameter	40 Micron
Standard Deviation	16.0
Coefficient of Variation	40%

Sample VI. Wool from two year clip of Libyan Barbary Sheep.

Presence of kemp fibres	10%
Presence of medulated fibres	21%
Number of specimen in sample	140
Variance	327
Corrected mean fibre diameter	43 Micron
Standard Deviation	18
Coefficient of Variation	42%

All samples were conditioned in the prevailing laboratory atmosphere, which is not controlled, conditions averaged about 56% R.H. & 20 deg C., during this period.

7. FACTORY SURVEYS AND TECHNICAL CONSULTANCY

- 1.0. Two surveys of the whole of the National Textile Company of the Jamahiriyah have been made. The first began in Benghazi in April 1980 and the second began in Benghazi in June 1981. In both cases the complete industry was visited in both areas of the country.
- 1.1. The 1980 survey included a party visiting the food factories under the leadership of Mr. L. Haweisa who also led the 1981 team to both industries and for 1981 included management and cost accountants in order to study accountancy and management problems affecting the industry.
- 1.2. The UNIDO expert was responsible for all technical aspects during both the above surveys of the textile industry and has published reports with recommendations describing the individual factories, plant layout, productivity, quality and process control, raw material, maintenance and cleanliness, inspection, warehouse and packing, Samples were always taken during visits, representative of the products being currently manufactured. The samples were tested by the I.R.C. textile laboratories and reports made to the factories from where the samples were taken. Unfortunately follow ups on these test and other recommendations made in the reports have not always been possible..

- 1.3. One of the biggest problems encountered in all the textile weaving operations is that of uncorrected weaving faults, in traditional garments (4.5 running metres), as many as fifty faults per garment. The commonest being starting faults causing weft bars, another is "drag-ins", loose weft being pulled into the cloth due to faulty scissor action at the pirn change. See Appendix H.

- 1.4. Productivity seems to be the main concern of the factory management and in all the smaller weaving factories quality control hardly exists ("we can sell all we make") is the attitude. Recommendations have been given in the reports to the I.R.C. for better training for the factory personnel from highest to lowest. I.R.C. national staff should be encouraged to visit factories more often and to remain in the factories long enough to obtain a better knowledge of the process and to understand what constitutes acceptable and non-acceptable quality standards.

THE NATIONAL ESTABLISHMENT FOR SPINNING & WEAVING. ZANZOUR, TRIPOLI

A modern factory commissioned in 1976 and made up of a complex of separate building separated by broad roads, all buildings very accessible but involves long distances between the various departments.

Total number of looms 576, made up as follows :-

120 cms reed space, Ruti, Unifil weft supply, 552

170 cms " " , Ruti, " " " " 24.

Equipped, 4 x 1 box motion.

Underpicking.

Warp and weft protection.

Auto pirn filling and change, from large weft package.

Auto warp tension control.

Auto pick finder and "no stops mark" device.

120 cms reed space have tappet shedding motion.

170 cms reed space have dobby shedding motion.

Loom speed about 241 picks per minute.

Work load 12 looms per weaver.

Products manufactured :

Uniform cloths,

Dress goods,

Sheetings,

Flannelettes

Shirtings,

Plain towels

Denim,

Curtain fabrics,

Yarns used :-

100% cotton carded,	10's/1 c.c.
" " "	20's/1 c.c.
" " "	30's/1 c.c.
100% combined cotton,	40's/1 c.c.
65/35; carded cotton,	20/1 c.c.
" combed "	40/1 c.c.
" " "	50/1 c.c.

Weaving production, 1980, 7,857,678 running metres unfinished cloth.

Working hours, weaving dept, two shifts of 8 hrs = 16 hrs x 275 working days per annum.

Finishing dept imported 4 million metres unfinished fabric to supplement the above weaving production making a total of nearly 12 million metres in 1980. This fabric was marketed through two outlets :-

1. Domestic market as cut lengths through government retail stores. About 9.5 mill metres.
2. The Ready made Garments Factory, Derna. About 2.0 Mil Metres.

Auxiliary equipment.

For rewinding white cones. 72 spindles, Mettler. 5 yrs old, good cond.

For rewinding colour cones. 36 spindles Mettler " " " " "

Pre-beamer. Two machines, Schlarfhorst, speed 4-600 mtrs/min, 5 yrs, good cond.

Slasher/sizer. Two machines, Zell-Ate, speed 40/60 mtre/min, 5 yrs, good cond.

Magazine creels with stop motion for pre-beamers and section warper.

Generally good condition.

Beam storage on floor, no racks. 50 broad beams, 350 narrow beams, good cond.
Heddle storage & drawing. No special dept only floor area, not satis.

Finishing & Dyeing Dept. Production figures for 1980.

	Planned throughput.	Actual throughput.	Hrs worked.
Desize &	15 mil metres.	11 mil metres.	275 x 10 hrs.
scour	15 " "	9 " "	
Bleach	15 " "	9 " "	
Dry Finish	15 " "	9 " "	
Dyeing	4.6 mil metres	5.3 mil metres.	
Printing	5.5 " "	5.5. " "	
White goods	4.7 " "	1.2 " "	
Special Finish		1.5 " "	

Activity sample in weaving dept. about 50% of looms stopped. No obvious reason, some looms had isolated side ends coming off beam. Some weavers appeared to have difficulty in controlling twelve looms.

Problems being experienced relate to a shortage of good weavers and technicians. All weavers and weaving technicians are foreign, mainly Asian or from another African country. Difficulty is being experienced in recruiting Libyan nationals. It is reported that about two hundred are recruited annually, but the turnover is high in spite of having a good training school, many prefer to work in the town centres.

QUALITY CONTROL.

This factory carries out routine inspection of all pieces coming off the looms, there is also a well equipped physical testing laboratory for yarns and fabrics and a well equipped chemical testing laboratory for the dyeing and finishing operations.

The physical testing lab samples thirty cones from each batch delivered, for moisture regain, count, strength, twist and levelness. Substandard yarn is accepted at a discount and used for selvages, headings, etc.

The grey cloth inspection showed there is to be frequent faults such as thick and thin places, holes and heavy picks and ends, the impression gained was that weavers were not correcting faults and that some standards for acceptable fault levels should be set.

The National Establishment of Spinning and Weaving, Zanzour, Tripoli.

Comments on a visit to the Dyeing & Finishing Dept.

No piece in singeing & washing at time of visit.

Rope form fabric in scouring and bleaching (Hydrogen Peroxide).

Washing, calendaring. (Poly/cotton wrinkled up one side).

Many skips of cloth waiting for dye & print.

Circular printing working with single design.

Circular printing working for check shirt designs.

Flat "Stock" printing machine, nine roller capacity, waiting for colour paste being prepared in adjacent room.

Further washing and drying processes to remove surplus dyestuff.

Poly/cotton blend passed through high temperature steamer quickly, to improve handle and remove creases.

Two stenters to clamp cloth to finished width and pass through heated chambers to improve handle and set width.

Cloth dyeing by exhaust process in dyeing jigs.

D.C.D. dyes, solophenyl VAT, etc.

About half of jigs in use.

Yarns pressure dyed by perforated centres.

New dept for examination and repair of "negatives" for printing roller designs.

Q.C. process control check point for chemical test for residual starch after scour and before bleach.

Q.C. process control inspection point for inspection of finished goods, most common fault reported as printing errors.

The National Establishment for Spinning and Weaving. Zanzour

This latest factory survey has resulted in the following visits taking place :-

1 April 1981

8 April 1981

15 April 1981

22 April 1981

A brief account has been written describing the information and conclusions reached after each of the above visits. This can now be summarised.

From information received in reply to the I.R.C. questionnaire it is understood that there are no records of production costs for the previous four years and no balance sheet has been issued since 1976.

For the weaving production target set for 1980, 11,180,000 running metres from a 12 hour day shift (72 hour week), over 16 items, the actual output achieved was 7,857,678 running metres grey cloth, a shortfall of 69% of the target production figure.

The weaving production target for 1981 is 11.8 mil running metres from two shifts (16 hrs/day) for 275 days, to be manufactured from a yarn range of five counts of 100% carded cotton and 65% polyester with 35% cotton.

A comprehensive and well equipped finishing, dyeing and printing plant has been designed to balance the production potential of 21 mil running metres from three shifts of the weaving section. Full details of the whole manufacturing plant together with a process flow chart have been included in earlier

reports. There is no doubt but that the condition of the plant is such as to enable the full production potential to be achieved. At a quoted, and checked, loom speed of 240 ppm this amounts to 21.5 mil running metres at 85% production efficiency per annum from three shifts x 275 working days. On two shifts = 14.4 mil running metres.

The Establishment weaving production target for 1981 of 11.8 mil running metres from two shifts represents 69% of the production potential.

@ 100% production from 3 shifts = 25,281,328 running metres per annum.

" " " 2 " = 16,854,279 " " " "

To date this year the productivity level from the weaving is estimated at a level of about 10.0 mil running metres for the years production, or 59% of annual production potential.

As a result of the shortfall in weaving production the finishing and dyeing plant, designed for a total throughput of about 21 mil metres per annum from three shifts working requires to have the 11.8 mil target production from the weaving dept supplemented by a further 8.0 mil metres of unfinished fabric from Korea or Pakistan so that altogether the cotton and polyester/cotton fabrics available for finishing add up to about 19 mil running metres. From the retail clothing industry there has been a strong demand for printed fabrics in all weights widths and qualities causing a certain imbalance in the fabric finishing.

In the course of two visits to the weaving department of this factory a brief activity sample was taken each time giving 50% and 60% activity respectively. In the short time available it was not possible to analyse the reasons for this low level of activity, but it was seen that some looms had problems with outside ends on the warp beam. Regarding other looms the impression gained that the workload of twelve looms might be beyond the capacity of the weaver although this is not excessive for fully automatic looms by most standards.

Without resorting to a detailed investigation the weaving plant appears to be balanced and full warp beams in good supply although it has not been established if the correct beams coincide with the looms that become empty.

This factory has a well equipped quality control laboratory capable of testing yarns and fabrics. Samples are taken for testing from each consignment of yarn received also the "grey" cloth and finished cloth. Process control is carried out in the factory at pre-designated inspection points. Just how effective the quality control set up is proving is not known due to an absence of records for amounts of seconds and wastes. So far no records for stopped time analysis have been found.

The findings of this report are subject to further investigation in much more detail and more information will require to be made available if beneficial results are to be achieved from this analysis and report.

Draft proposals for a programme of investigation are provided herewith.

1. In depth Activity Sampling Matrix for weaving and all finished processes.
2. A study of the plant balance throughout.
3. Carry out Variety Control exercises on the basis of relative weights of fabric throughput to relative production costs ratio. Cut out uneconomic lines.
4. Investigate existing methods for Production Control, the calculations used, methods for planning, programming and routing of orders.
5. Make Time Studies for weaver work loads, combine time studies with activity sampling in the weaving department.
7. Investigate Plant Maintenance policy. Take time studies for all plant down-time, describe reasons.
 - 7.1. Take time studies for each maintenance task.
 - 7.2. Make out job cards and maintenance check sheets with time estimates.
 - 7.3. Check validity of any existing Scheduled Maintenance scheme.
 - 7.4. Investigate spare parts store, inventory system i.e. "Kardex". Shelf lives and ordering and replacement methods.
8. Training. Investigate present policy for recruitment and training for all employees of the company. Check Job Specifications, ongoing training and retraining schemes, both in-plant and institutional.

9. Investigate the Control of Quality and Process Control for each textile company :-
 - 9.1. Sampling methods.
 - 9.2. Laboratory testing and reporting.
 - 9.3. Shop floor testing and inspection routines. Reporting and action instructions.
 - 9.4. Levels for acceptable quality standards and controls.
 - 9.5. Plant inspection routines.
 - 9.6. Laboratory chemical tests.
 - 9.7. Statistical reporting and "seconds" and waste level monitoring.

To be commercially viable an enterprise has to be cost conscious and so contemporary management sciences, which include all the nine previously described proposals, are designed on the basis of improving the economy and profitability of the enterprise concerned. The fact of the entire textile industry of the Jamahiriya being government owned will require a management organisation of particularly high calibre due to the absence of the incentives normally associated with the management of private enterprise companies.

In the circumstances it is suggested that initially a Joint Venture type of agreement should be made with suitable foreign textile companies or organisations to provide a management team in return for a minority interest in the company, to manage the company and to train their Libyan national counterparts for a pre-determined period of time.

The Tripoli Traditional Garment Establishment

This company was previously known as the Green Light Company and was recently amalgamated with the 7th October Textile Company to form The Tripoli Traditional Garment Establishment, a group of nine factories administered by the National Company for Textiles of the Socialist People's Libyan Arab Jamahiriah.

<u>Name of factory</u>	<u>No. of looms</u>	<u>Traditional garments</u>
Jezirah	112	Reda, Farashia, Shoula
Yamamah	142	Reda
Jamahiriyah	32	Reda, Farashia, Jerd
Rim	50	Reda, Shoula
Khoms	16	Jerd
Gurgi	32	Reda, Farashia
Fellah	21	
Soukh Talat	24	Reda, Shoula
Soukh Jumah	20	Reda, Foula
	<u>449</u>	

Make and type of looms :- Mostly "Omita", or "Officine Galileo"

Reed space 150 - 250 cms.

Equipped, "Staubli" doobby,

4 x 1 box motion

Warp and weft protection

Auto pirn change from battery

Loom speeds, from 120 to 160 ppm according to size, make and age of looms.

Work load, mostly 4 looms per weaver,
very old looms 2 per weaver.

Production about one garment per loom hour.

Working hours, one 12 hour shift per day x 300
working days per annum.

Auxiliary equipment :-

"Comet" section warp mills with creels & beamers.

Auto pirn winders, "Hacoba" or "Muschamp-Omita".

Pirn strippers.

Cone winders, but mostly not used (damaged).

Activity samples taken in each factory have shown an average number of looms to be stopped in each factory to about 50% of all looms. Mostly for repairs, waiting for warps or to tie up broken warp ends.

Workforce. All male other than warehouse and despatch.

Weavers and technicians foreigners from Asia or other African countries. Supervisors mainly Libyan nations.

Warehouse. Rarely properly exercised control of stocks, manual ledgers used,
(Yarns) no "Cardex" systems. Large quantities of redundant stocks and small remainders on cone seen at most factories, urgent need for rewinding of small lots and fabrics to use up remainders.

Plant maintenance. Mainly "break-down" system, no scheduling. One or two mechanics per branch factory, electricians serve more than one branch. Spare parts stores mostly bin system, adequate spares, but future method of having one central main store for spares and for raw materials requires daily indent to head office.

Raw materials. Mostly imported from Italy in the form of spun yarn or synthetic filament yarn of 335/56 Decitex.

i.e. 100% Pure Silk.

Silk and synthetic fibre blends.

100% cellulose acetate filament yarn.

2 ply acrylic staple fibre.

Metallic coated decoration yarn.

Production. Reda, pure silk quality (weight about 850 grams each)

silk & acrylic quality. 145 cms x 4.5 cms.

Jerd, synthetic/acrylic quality 150 cms x 5 cms

Farashia. Synthetic quality and

acrylic quality. 175 cms x 3 metres.

Shoula.

Note. Some silk garments are sold starch stiffened.

Quality Control. Only practised in warehouse where some garments are inspected by the packers, but generally there are many weaving faults and oil stains and there is no proper control of the quality.

The Social Establishment of Textiles & Spinning, Benghazi

This is a group of six factories for the manufacture of traditional garments, together with the Tripoli Traditional Garment Establishment and the National Establishment for Spinning and Weaving, Zanzour, it is administered by the National Company for Textiles of the Socialist Peoples Libyan Arab Jamahiriya.

The Social Establishment for Textiles and Spinning has a new administrative office in the town of Benghazi which handles centralised yarn purchases, accounts, purchasing of spare parts, recruiting of personnel and the marketing of finished products. The secretary of the establishment committee was present at a meeting on the 18th June 1981. This establishment was previously visited by the I.R.C. team in April 1980 and a report published on 19 April 1980, since that time a number of detail changes have taken place and this latest report supplements the previous survey.

The present establishment consists of six factories :-

<u>Name of factory</u>	<u>No. of looms</u>	<u>Traditional garments</u>
Shoula factory	152 looms	Reda, Shoula, Farashia
Fonduk factory	56 looms	Reda, Shoula, Mohar
Zeraya factory	49 looms	Reda, Farashia
El Horria factory	40 looms	Reda, Farashia, Mohar
El Marj factory	30 looms	Reda
El Kaleefa factory	18 looms	Reda, Mohar, Jerd, Farashia
Total	345 looms	

This establishment manufactures traditional garments in the looms from clean dyed yarn, the garments are in two or three qualities, the first quality being 100% pure silk, sold starched or unstarched. The garments are used as dresses, sashes or head covers and are manufactured in traditional colours and designs. After weaving the pieces are taken from loom to the warehouses, cut up where there is a fringe between garments without weft, folded and packed in paper or plastic bags.

Make type of looms :-

Mostly Italian "Omita", or "Officine Galileo".

Reed space 150 cms to 250 cms.

Equipeed "Staubli" dobby

4 x 1 box motion.

Under picking motion.

Warp and weft protection.

Auto pirn change by electrical contact and

fed by circular or vertical pirn battery.

Loom speeds, from 120 to 160 ppm according to size, make and age of loom.

The older looms include the Diedericht manufactured in France and a few others of unknown make.

Work load, mostly 4 looms per weaver.

Old looms 2 per weaver.

Production, one garment per loom hour.

Working hours, one shift of 12 hours per day for 300 working days/annum.

Most of the newer looms are from ten to fifteen years old and generally in good condition, but there is always room for improvement, particularly regarding details :- Strap connectors to the pirn change scissors are sometimes missing, this can cause "drag-ins" from the weft yarn. Weft waste containers are seen to be missing, full or broken. Excessive oil is used when lubricating and generally the looms are not clean sufficiently well or frequently. A common problem is oil dripping onto the cloth from the overhead harness during weaving, due to excessive lubrication.

Auxiliary equipment. Section warpers, one or two per factory according to number of looms, either "Comet", "Muzzi" or "G.Salvatore".

Auto pirn winders by "Omira-Muschamp".

Cone winders, mostly damaged.

One pirn stripper per factory.

A brief activity sample showed some of the factories to have up to 50% of the looms stopped during the sampling period.

Workforce. In the Benghazi area female weavers are being employed. these are mainly Libyan nations and have only about six month training so far. Foreign male weavers are also employed, most weaving and maintenance technicians are foreign. The factory supervisors and managers are Libyan nations.

Yarn Warehouse. Only for buffer stocks, all yarn is now delivered from the establishment warehouse on daily request.

Spare parts store. Drawn from the central parts store on daily indent.

Raw materials. All imported, mainly from Italy.

100% acetate filament yarn, 335/56 decitex.

High twist.

Low twist.

Acrylic staple fibre, 2 ply, in 14-15 colours.

Resultant count 90.0 Tex, "S" on "Z".

100% pure silk multi filament, warp and weft.

Metallic coated synthetic tape yarns.

Quality Control.

The work load in most of the factories is only four looms per weaver, where the looms have no warp protection or automatic pirn supply the load is only two looms per weaver. By contemporary standards for this class of work two or four looms per weaver is a small work load and cannot be economic. On this account there can be no excuse for a large number of weaving faults per running metre, but this is the case. It has been seen that all the traditional garments from all the factories have warp and weft faults, many are avoidable and could be corrected by the weaver in the loom, e.g.

Missing and double ends.

Wrongly drawn or tied up ends.

Missing and double picks.

Frequent "drag-ins".

Thick and thin weft bars.

Temple marks, etc.

In some cases as many as fourteen faults were identified in garments already packed for sale.

One factory was prepared to seel pure silk Reda with bad stains for more than thirty Dinar each.

Training and retraining would help to improve the weaving standard and quality and productivity. A strict system of quality control inspection in the loom as well as in the warehouse before packing is recommended. Small faults can be repaired by women trained for this work. Steam relaxation would remove creases and give a better appearance to the garments.

Future policies.

It is planned to expand and rehouse the whole of this industry in the Benghazi area in one new building if a suitable site can be found, most of the existing factories have poor standards of buildings with little room for expansion. Between 84 and 100 new looms will be commissioned for additions or replacements. Offers are

being received and these include Galileo Meccantex, 182 cms reed space or the 175 cms Manea with selvedge device. All the new looms will have the fully automatic warp tension control and open shed finder. Automatic pick finding will be by push button and obviate all stop marks. Positive warp let off and take up and a rapier cleaner. It is planned to have 12 to 16 looms per weaver in consideration of this range of automatic weavers aides.

The Weaving Factory for Traditional Garments at Misurata

At present this factory is equipped as follows :

Total looms 22 of which,

20 = 140 cms.

2 = 100 cms reed width.

Make "Omita" (Italian).

Staubli dobby with punch card.

Automatic weft pirn change from circular battery.

Box motion, 4 x 1.

Weft protection only. (no warp protection)

Looms per weaver 4.

Loom speed 150 ppm, (physical check)

Works, one 12 hour shift per day, six days per week.

Auxiliary plant :-

Section warper with creel and beamer. 1.

"Omita" pirn winders 2 x 8 spindles each.

Ditto, one not in use.

Small cone/cheese winder, not in use.

Bobbin stripper 1.

Activity sample, 12 looms stopped, two under maintenance.

The weaving shed has a good floor, but only fair lighting.

The yarn store is large with high ceiling, yarn in boxes stacked on pallets, all clearly labelled, yarns used include :-

Pure silk,

Acrylic staple fibre,

Acetate rayon filament lustre yarns.

The finished goods warehouse is furnished with an inspection table, large capacity shelving for stacking finished garments. All products had a good appearance and very few faults. The products are :-

"Reda" and "Farashia".

Housekeeping was of a good standard, little excess waste and rubbish. A new building is ready to house 27 new "Officine Galileo" looms. A further nine looms are to be added to the existing twenty two. The total will then be 53 looms. This factory is not affiliated to any other enterprise it is well managed and has good potential.

The Misurata Carpet and Leatherwork Craft Training Centre

This centre does valuable work in training about 130 school girls and young women in the traditional crafts of the Jamahiriya such as hand knotted carpets, Fleem manufacture and leather work. The building is pleasant with spacious rooms providing good working conditions, all students wear a neat green uniform. Training starts at about twelve years old, lasts for about four or five years. Afterwards the student may remain working at the centre or work at their own home.

The carpets are manufactured in three qualities according to the density of the knots per square metre :-

40,000	knots	per	square	metre.
60,000	"	"	"	"
90,000	"	"	"	"

The weaver works from a plan of one repeat of the pattern by interwining the wool weft with the cotton warp and knotting it into place. The amount of carpet woven is recorded by the weaver each day. Most design are traditional and include many beautiful colours.

The carpet yarn is two ply and the finer counts are used for the carpets with the higher density of knots. The yarn is spun from Libyan wool at the spinning mill in Al Marj. The yarn is well stored in the cellar of the centre, clearly identified. The colour range is large and includes stock dyed colour mixtures and some with "nep" decoration.

The "Kleem" is exclusive to Misurata and consists of a cotton warp with intertwined woollen weft yarns which are beaten into place by a heavy wooden comb, the threads are not knotted. The "Kleem" is woven back to front it is about 4 metres wide and as many as three girls may work on it at the same time.

The leather dept uses soft upper leather tanned at the Tajura tannery. Fittings and buckles are imported otherwise all raw materials come from the Jamahiriya. Products consist of purses, handbags, wallets and waist belts, the trainees are taught to design, cut out, sew, press and finish each type of product.

The Al Marj Wool Washing & Spinning Complex

Raw Material.

The Barbary sheep wool of the Libyan Arab Jamahiriya. A hard wearing crossbred wool suitable for carpets, blankets and tweed type fabrics. It has a specification of,

mean fibre length, 86.45 mm.
Mean fibre diameter, 32.39 micron.
Equiv wool quality, 46,s to 50,s.
Av fleece weight, 2.0 to 2.5 Kg.
An yield of clean wool, 40 - 60%.

Wool sorting and washing.

The wool is sorted on delivery to the factory mainly for colour.

Plant specifications..

- 1 x "Fearnought" pre-opener and dust remover.
- 1 x "Shake-willey" pre-opener and dust remover.

Wool scouring line :-

- 1 x 5 bown "Moroni" scourer, 6 ft width, 1500 Kg per hour.
- 1 x 3 bowl U.K. make, 4 ft width, 750 Kg per hour.

Working schedule.

- 5 bowl machine, morning, 6½ hrs & clean 1 hour.
- 3 bowl machine, morning, 7½ hrs.
- 5 bowl machine, evening, 7½ hrs.
- 3 bowl machine, evening, 6½ hrs & clean 1 hr.
- A hot air dryer succeeds each scouring line.

Current reported production rate :-

- 5 bowl set 200 Kg/hr or 13 1/3 % capacity
- 3 bowl set 100 Kg/hr or 13 1/3 capacity.

Mean operating time, each machine is 2 x 7 hrs = 14 hrs per day.

Total production for both lines on 2 shifts/day = 4200 kg/day.

On basis of a 40% yield the wool scoured per hour can only be :-

for the 5 bowl 500 Kg per hour greasy wool.

" " 3 bowl 250 Kg " " " "

The wool dyeing department.

This department has the following equipment :-

- 2 hand pressing tanks.
- 1 pressure dye vat.
- 1 squeezer to remove moisture after dyeing.
- 1 hank dyer.
- 2 hot air dryers.
- 1 200 Kg capacity overhead crane to help lift the cake of dyed wool from the vat and also to remove the dye vat lid.

The blending operation.

The woollen mill spins two standard qualities of yarn :-

- 1st quality. 90% wool (Libyan)
 - 10% Polyamide staple fibre.
- 2nd quality. 60% wool (Libyan)
 - 30% soft waste
 - 10% Polyamide staple fibre.

The great majority of this yarn is intended for the woollen blanket factory, for the woven blankets.

The original method of blending by feeding the blend components from four automatic hopper feeds onto a travelling lattice to a pre-opener with oiling device, has long since been abandoned. The method of blending has reverted to floor stacking whereby three bays have been designated on the floor of the blending area where the blend components are put down in layers of a thickness according to their various proportions. After all the layers have been put down the blend is cut down vertically and fed into an underground duct which blows the blend round a duct until it emerges from an overhead feed which sprays it onto the floor again. An oiling device sprays oil (50/50 mineral oil and water emulsion), onto the fibres as it is sprayed onto the floor. The blend is then fed to another duct which blows it into storage bins.

This method of blending is slow, inefficient and costly. The method of oiling is wrong and will result in much broken fibre on the card. A modern efficient blending system is urgently needed.

Carding Machine Specifications.

No. 1 "SACFEM", (Italy).

Large capacity hopper feed with centre opening scale pan and lattice feed sheet with pusher board.

Two part scribbler with five sets workers and strippers over cylinder.

Cylinder widths 98" or 250 cms. Circumference 5000 mm.

One set burr crushing rollers apparently not working.

Intermediate feed is continental type lap former.

Single part carder, cylinder width 98" or 250 cms, circ 5000 mm.

Five sets workers and strippers over cylinder.

Tape doffer with doffing comb.

Four height condenser.

Sixteen condenser bobbins each of eleven ends = 176 total ends.

Full width Pirelli type synthetic rubbing aprons.

Production per shift (7.5 hrs) 400 kilo = 53.3 kilo/hour

or 117.5 lbs/hour.

The counting meter on the condenser appears to be working.

No. 2 "SACFEM", (Italy)

Large capacity hopper with centre opening scale pan and lattice feed sheet with pusher board.

One part scribbler with five sets workers and strippers over cylinder.

Intermediate feed is continental type lap former.

One part carder 98" cms wide, 5000 mm circ.

Five sets workers and strippers over cylinder.

Tape doffer with doffing comb.

Four height condenser.

16 condenser bobbins each of 12 ends = 192 total ends.

Full width Pirelli type synthetic rubbing aprons.

Production per shift 450 kilos in 7½ hrs == 60 kilo/132.3 lbs per hour.

No. 3. "SACFEM", (Italy)

Large capacity hopper with centre opening scale pan and lattice feed sheet with pusher board.

One part scribbler with five sets workers and strippers over cylinder.

Cylinder width 98" or 250 cms. Circumference 5000 mm.

Intermediate feed is continental type lap former.

One part carder, 98" or 250 cms wide, circumference 5000 mm.

Five sets workers and strippers over cylinder.

Tape doffer with doffing comb.

Four height tape condenser.

16 condenser bobbins each of twelve ends = 192 total ends.

2 waste ends each side returned to hopper.

Full width Pirelli type ribbed synthetic rubbing aprons.

Production per shift 450 kilo in 7½ hrs or 60 kilo/hour = 132.2 lbs/hr.

Meter counter working on condenser.

The three carding machines are of a specification more often associated with the shorter and finer wool blends incorporating such components as French combed noils, the specification of card clothing and disposition of workers and strippers, as well as other features of these machines do not favour the successful carding of coarse carpet and blanket wools of long

staple coarse characteristics (44/48's). The appendices to this report discuss this important matter in more detail.

The spinning machinery.

Four ring spinning frames, all "Gecchi" (Italian).

Three of the frames are double sided, one is single sided.

Frames No.1 & 2	4 & 5	6 & 7	Reserve
300 Kg/shift prodn.	250 Kg/shift prod.	340 Kg/shift.	
240 spdls.	220 spdls.	312 spdls.	110 spdls.

Spindle speed about 4000 a revs pm. Front roller delivery speed,

25 - 30 metres per minute

The design of the frames is more appropriate to the character of the material than the cards, the frames are high lift, large ring dia and use nylon travellers.

Condensed count is Nm 2 and Nm 4 (Tex 500 and Tex 250).

Draft is 1.4 to 1.6, (15 - 25%, which is high and will contribute to a lean character of yarn, not the best for blankets).

1980 production figures.

Raw material used	2230.53 tonnes.	
Nylon staple fibre	69.84 "	
Scoured wool	861.35 t (38.61% yield)	
Spun yarn	659.48 t (68.55% yield)	This figure for yield incl 10% nylon.
		indicates that about 30% waste has been made between carding and spinning.
Doubling and twisting production, 2 frames,	148.22 tonnes	
Cone winding	" "	584.47 "
Hank reeling, 3 months only	" "	$\frac{33.26}{617.73} = 93.66\%$ yield

The above figures illustrate clearly the excessive amount of waste being made. Yield of spun yarn from a parcel of raw material should be nearer to 90% and be the subject of continuous monitoring with excessive waste the exception rather than the rule.

The wound cones are not of a good standard, many have soft centres, are multicoloured and cobwebbed. The plastic or paper cone centres are worn and damaged, new ones are urgently needed. All frames require proper maintenance for settings and clearers.

The Quality Control Laboratory.

The Wool Washing and Spinning Complex.

During a visit to this laboratory it was seen to be equipped with :-

- 1 set miniature dyeing apparatus.
- 1 projection microscope (Polish) used to measure fibre lengths.
- Wrap reel and balances, 3 x quadrant type grad in Nm & Tex.
- 1 x chemical balance (Italian)
- 1 moisture oven for testing moisture regain & content.
- 2 twist testers.
- 1 single yarn strength tester.
- 1 rubbing fastness (cracking) tester for dyes.

Routine. Twice a day during each shift 5 samples are selected at random and tested for :- Count, twist, strength using the same sample so that a count/strength product can be calculated.

The results are recorded on a special form and sent to the production management. Unfortunately the procedure gives the impression of being more academic than of practical quality control. A more effective system requires process control as well as laboratory testing.

The quality control laboratory in the blanket factory is also equipped for the testing of yarns, but at present all yarn testing is done by the woollen spinning mill. The blanket factory does pH tests and tests for metallic salts in the water supply.

The Blanket Factory. Al Marj

Raw Materials. Wool/polyamide yarn spun at the Spinning Mill, Al Marj.
Wool/Waste/Polyamide yarn " " " " "
Acrylic fibre for non-woven.
Cotton warps on beam.

The raw material store is a four height palletisation system operated by fork lift trucks, about 75 cones per pallet.

Cotton warps are stored on beam racks.

Acrylic fibre scrim for the non-woven blankets are stored on eight tier racks.

Preparation equipment.

1 x Schlarfhorst section warper with creel.

1 x cone winder for winding up small lots left on cones after making warps.

Weaving. Total looms 48 "Somet" including 8 with Jacquard harness.

All have rapier method for weft insertion from large cones of weft, with selvage maker & cutter.

40 looms have dobby operated shafts operated by, punch card dobby with capacity for 24 shafts.

All looms have weft colour change operated by punch card.

Full warp and weft protection motions.

"Inching" motion and open shed finder.

Loom speed 168 mm. Width 220-240 cms.

Four looms per weaver.

Eight full beams ready to tie in.

Factory., Completely new well laid out plant very well lit and first class working conditions.

Blanket qualities.

A	B	C	D	E	F
Tone/tone	Tartan	Jacquard	Various	Large	Cot.
with stripe	all	cotton warp	sizes	size	size
all wool	wool	& wool weft.	ditto.		

Woven blanket finishing.

3 machines of rope type combines scouring & milling.

4 pairs of pieces running each machine

1 "Krantz" pin control tenter, speed 10 metres/min.

Inspection table with lighted panel for examination
and inspection of pieces and repairing of faults.

8 single action card wire raising machines, arranged in pairs.

Non-woven line.

Four hopper blending line for the 100% acrylic fibre blending.

Colour blending for mixture effects.

Fan ducted to :-

2 carding lines with volumetric feeds and all enclosed swifts.

Bottom layer batt former.

Four layers batt.

Scrim inserted.

Top layer batt former.

Four layers batt.

First needling (passing over bed with reciprocating needles).

Second needling.

Squeeze rollers.

Inspection, cuttling and edge trimming and packing.

Blanket finishing and packing.

2 machines for blanket ribbon edging and folding.

1 cutting machine.

10 sewing machines for blanket edging.

1 auto packing machine for packing blankets in
polythene bags and affixing labels.

(28 blankets per carton).

Production.

Target production is 500,000 woven blankets,

400,000 non-woven blankets, per annum.

The first impression of the woven blankets is that the character of the indigenous Libyan wool contributes to a hard wearing but hard handling blanket, better results might be obtained by a blend which includes early clip lambs wool and good quality soft waste. Tests at the I.R.C. have confirmed the finer quality of the early clip Libyan lambswool. Large amounts of soft waste were observed occupying the storage areas during the last visit of the I.R.C. to the Wool Washing & Spinning Mill at Al Marg.

Ready Made Garment Factory. Derna.

For the making up of garments. Established 1974.

Products:-	Two piece military uniforms	165,000 pieces per annum (target)
	or	
	One piece school uniforms	250,000 " " " "
	plus one piece kitchen overall	5,000 " " " "

Raw material. All fabrics for the garments are manufactured by the National Establishment for Spinning and Weaving. Zanzour. Tripoli.

100% Cotton.

65/35 Polyester and cotton.

100% Cotton hank dyed fabrics for hand towels.

Cotton sheetings.

Cotton "Bunting" cloth.

Lining cloths.

Imported worsted serge for police uniforms.

Denim fabric.

Imported Khaki drill.

At the time of this report only piece dye cotton & polyester cotton fabrics were being made up.

Equipment includes :

A design department to construct the templates for cutting out garment shapes.

Spreading tables for layering as many as 350 peices ready for cutting out with mobile band saws.

Nine production lines operating a semi--bundle system.

2 lines for jackets.

2 lines for trousers.

2 lines for making good repairs.

3 lines not in use (at time of reporting)

Hoffman press room with 22 presses, not in use.

Training.

A training school well equipped with all types machines to teach all the different processes. Students now spend one month in the training school and two months working on production, but under supervision, then proceed on full production basis.

Process flow sheet.

Design dept.

Fabric, button & thread warehouse.

Spreading dept.

Cutting & storing.

Nine lines for making up.

One inspection point per line.

Storage & Hoffman pressing.

Employees	Libyan	Other Arab Nat.	Expat.	Total	Training
Exec. & Admn	3			3	
Commercial	74	7		81	
Production	240	90		330	6
Total				<u>411</u>	<u>6</u>
Working days/year		300			
" hours/day		6½ (7-30 to 2 pm)			These hours include one hour military training and 20 mins breakfast
Number of shifts		One			

Quality Control.

Inspection on each line check the garments for defined faults before buttons are sewn on in case repairs are needed. About 30-40% are rejected for repairs which requires two lines to be continuously occupied. Most faults are missing stitches.

Many faults were seen in the fabrics being used for the uniforms. All the fabrics are woven by the Establishment for Spinning and Weaving, Zanzour. The faults seen include :-

Synthetic fibre undyed.

Drag-ins from weft lacking tension control.

Double picks.

Missing warp ends.

Wrongly drawn warp ends.

Dye variations within same peice.

Weft bars, wrong weft.

Variation within width of same piece.

To fulfill their production quotes the Ready Made Garment Factory is obliged to use fabrics containing too many faults. These faults should have been corrected or discarded at the weaving factory which supplied the cloth. The efforts to control the quality of the finished fabrics at Zanzour are obviously not effective.

The Control of Quality

A problem common to all departments of the textile industry within the Jamahiriya is the control of quality and the identification of the acceptable standards. Nearly all the textile factories surveyed in the 1980 and the 1981 visits to the industry have been found to have problems with excessive faults and damages to the fabrics. Faults which can be attributed to substandards:—

Warp preparation (pre-beaming, sizing).

Weft preparation (pirn winding, pirn changing).

Weaving (Weavers faults, mechanical faults, loom maintenance).

No quality or progress control for any of above processes.

No yarn testing, loom inspection or grey cloth inspection.

No warehouse inspection.

No fault repairing (Mending).

This report has shown that the larger and more up to date establishments have testing facilities, but in many cases the routines are not effective. The smaller establishments make little or no attempt at testing or quality control of the product.

The fact that a manufacturer controls the product quality by regular testing does not absolve all other staff from responsibility for the quality standards unhappily this attitude is too often the case. For effective quality control the responsibility belongs to everybody who works in a

factory, each person should have his/her quality control responsibility written into their job description.

Quality control check points clearly identified.

The action to be taken when products tested are below standards.

When production can continue.

Effective quality control has been described as a "state of mind" in which all employees should be encouraged.

Process control assists quality control to achieve the desired level of quality, but process control is practised on the actual production line whilst laboratory testing is a routine which examines the product specifications in greater detail and maintains records of the test results. Long term testing helps to establish the acceptable limits for results through the construction of control charts. Both process control and laboratory testing contribute to good and effective quality control, these are practises which should be used by the textile industry of the Jamahiriyah.

In order to obtain an unbiased opinion samples of fabrics, yarn and fibres should be submitted to the textile testing laboratories of the Industrial Research Centre for testing at regular intervals. The centre will test the samples in the capacity of an independent authority and issue an unbiased report or certificate confirming the standard achieved.

The individual factory reports in the Appendices of this Industrial survey describe the number and type of faults seen in the different fabrics, many of which were wrapped and awaiting despatch in the factory warehouse. The consumer should be protected and therefore standards should be at all times maintained. See Appendix H.

8. PARTICIPATION IN FEASIBILITY STUDIES

- 1.0. From time to time the expert has been invited to become a member of a committee for the appraisal of a feasibility study submitted by an international consulting company at the request of the I.R.C.
- 1.1. The first study was prepared by Messrs Sodetag (France), for a factory to manufacture polypropylene bags from extruded tapes using circular weaving machinery.
- 1.2. The study for regional development prepared by the National Industrial Development Corporation of India concerned the two regions of Misurata-Sirte and the Fezzan. The expert attended committee meetings for textile and related industrial development plans.
- 1.3. A world textile study which included a development plan for the Jamahiriya, prepared by the University of Grenoble ADR, on behalf of the National Oil Corporation was submitted to the expert for comments and a written report was submitted to the N.O.C.
- 1.4. In collaboration with the UNIDO Senior Economist, Mr V. Vardjan, the expert prepared a scope of work for a detailed feasibility study for the present and future development of the textile industry of the Jamahiriya.
- 1.5. The expert assisted in the study of proposals received from consultants relative to a decision on this question (1.4) and is currently participating in a study of the reports submitted by Messrs Battelle. S.A. for the future development of the National Textile Industry of the Jamahiriya.

- 2.0. During the period of his assignment the expert has collaborated with the Secretariat of Light Industry, with the I.R.C. and Mr. V. Vardjan, UNIDO Senior Economist for the UNIDO Project. in the development of economic plans such as the current Transformation Plan to 1985 and for the period 1981 to year 2000.
- 3.0. Other assistance, technical and economic, has been given by the expert to the National Company for Fabric and Clothing Manufacture (Eng Kh. M. El Dabbar, Secretary).

C. RECOMMENDATIONS

- A. The future role of the Industrial Research Centre.
- 1.0. The impending transition of the I.R.C. from its present site to the new centre at Tajura near Tripoli could coincide with an expanded role as the leader and co-ordinator of the industrial society of the Jamahiriyah, by so doing it would fulfill an important requirements for the industrial scene.
- 1.1. The textile industry is s one small section of the industry, but it is planned for rapid and extensive expansion on account of the policy for self reliance whereby most consumer goods will be manufactured domestically and no longer imported.
- 1.2. Many factories serving many industries are being developed in the Jamahiriyah, the I.R.C. is involved in many of them such as for food packing and processing, building materials, textiles, footwear, etc. One of the most important mediums that all these factories have in common is for the control of the quality and development of standards for consumer protection. It is this role for which the I.R.C. should be primarily designated and for which it is ideally equipped by virtue of laboratory accomodation and instruments at the new centre.

B. Training for national staff.

2.0. The major problem confronting the I.R.C. is the lack of well trained and experienced staff, particularly for the textile laboratories. A staff of one person is totally unrealistic and at the time of writing there is no prospect of increasing this number. In this respect the I.R.C. policy has been short sighted and every effort should be made to recruit suitable national staff for training and offer them the opportunity to obtain professional qualifications and in depth practical experience. The UNIDO expert has previously brought this situation to the notice of the Directors I.R.C. during his assignment.

C. Quality Control and the Textile Industry

3.0. So far the operation of the textile quality control laboratories of the I.R.C. have maintained a low key function relative to the textile industry of the Jamahiriya, being content to provide testing services on application, to carry out programmes of investigations and to provide technical advice to I.R.C. committees engaged on feasibility studies for the textile industry.

3.1. The textile testing laboratories of the I.R.C. should advance in step with the industry and be prepared to offer appropriate services, as listed in Appendix E, recruit staff, train them and to assist the textile industry itself to become more quality minded so that the quality levels are maintained and upgraded in the interests of the consumer.

3.2. The knowledge gained and the part played by the I.R.O. textile laboratory in the last 1981 survey of the industry has helped towards greater understanding of the industry and its problems and the important significance for quality control. The aim of any textile enterprise is to make profits, now and in the future, to do this the company should satisfy its customers for price, quality, types of product and good service.

This can be accomplished by :-

1. Creating the right attitude of mind for all personnel in the factory.
2. Having the proper theoretical and practical skills to judge the quality variations.
3. Being alert to take action to rectify variations and obtain good results.

3.3. Every employee of a textile company from top to bottom should be involved in the aims of the company, a keen, interested and competent attitude has to be promoted by the example of the senior management of the company. To achieve this a quality control department should be set up in each factory headed by a quality control manager responsible to the chief executive. It has to be pointed out that the quality control department is the only one

in the factory involved in the operation of every other department or section of the factory. The I.R.C. textile testing laboratories should be in a position to offer advice on these procedures to any textile manufacturing enterprise.

Definition .

"Quality control is the science and art of controlling the level of quality of production and its cost".

Its objectives are :-

1. To see that the product is made so that it meets the specification in terms of acceptable quality, without fault and suitable for the intended and use.
2. To maximise profits.
3. To continually develop the products in terms of quality , price and service.

DRAFT PRELIMINARY REPORT AND WORK PROGRAMME

By

J.L. ISLES

EXPERT IN QUALITY CONTROL FOR
TEXTILE MATERIALS.

UNIDO PROJECT TO THE INDUSTRIAL RESEARCH CENTRE

DP/LIB/77/001/11-09.

SECRETARIAT OF INDUSTRY

SOCIALIST PEOPLE'S LIBYAN ARAB JAMAHIRIYA

TRIPOLI

26 October 1978

This report and the work programme is submitted to the Director General of the Industrial Research Centre of the Secretariat of Industry following a preliminary survey of the Textile Quality Control testing laboratories and a meeting with the Head of the Laboratory Section, Mr. A. Hawisa & Mr. George Hillesley, Project Co-ordinator.

The work programme is intended to fulfill the terms of reference outlined in the UNIDO experts job description and to meet the requirements of the Textile Laboratory counterpart national staff in respect of training and practical experience and to broaden the scope and effectiveness of the laboratory in maintaining quality standards for all types of textile products and for consultancy services to the textile industry in Libya.

Abbreviations used in this report :

B.S.I.	British Standards Institute
A.S.T.M.	American Society for Testing and Materials
I.S.O.	International Organisation for Standardisation
I.R.C.	Industrial Research Centre, Secretariat of Industry

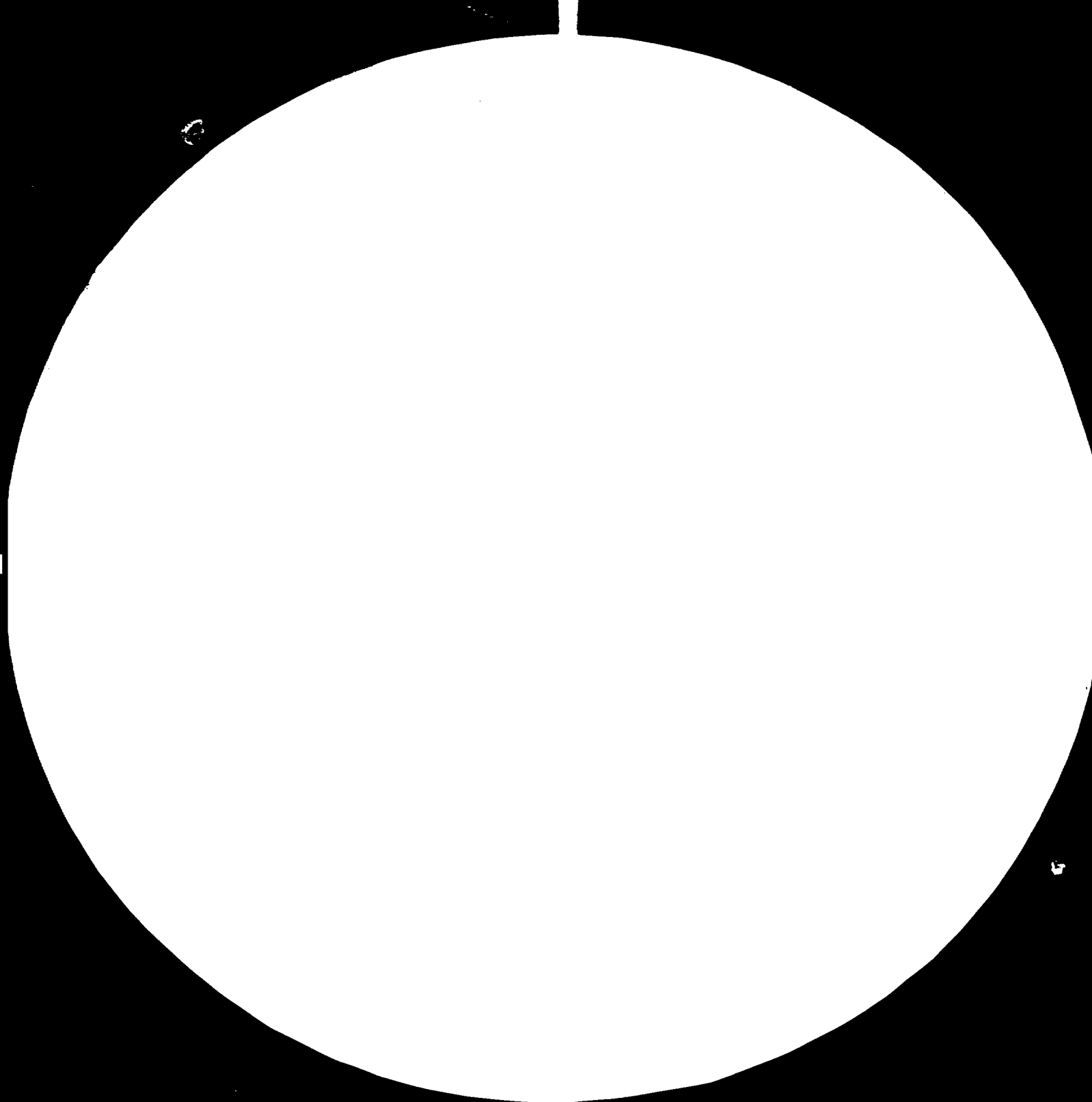
Programme of work

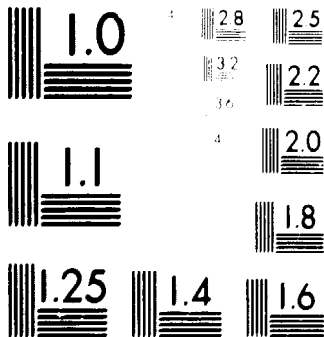
1. Help in the organisation and working of the textile testing laboratory.
- 1.1. To assist the head of the textile quality control laboratory in carrying out the regular routine testing programme, result interpretation and reporting.



83.08.08

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MICROCOPY RESOLUTION TEST CHART

NBS 1963-A (ANSI #1) U.S. GOVERNMENT PRINTING OFFICE: 1963-O

- 1.2. Advise on laboratory layout and instrument care and maintenance.
- 1.3. Give advice on allocation of work responsibilities for the more junior laboratory staff and for laboratory safety and conduct.
2. Train local staff in all aspects of physical and chemical methods of testing textile materials.
 - 2.1. Through a series of lectures in textile technology provide the textile quality control counterpart staff with basic instruction in textile fibres and identification, yarn manufacture, weaving, knitting, and non-woven manufacturing methods, also for fabric finishing, cloth structure and analysis.
 - 2.2. To train the counterpart laboratory staff in methods of physical and chemical tests and use of instruments also to train the staff in the use and operation of such new instruments as are installed to supplement the range of textile testing services.
3. Help in selection and adaptation of proper test procedures as well as in the evaluation of quality control standards.
 - 3.1. With the object of carrying out quality control testing to acceptable international standards the counterpart national staff to be trained and practised in the testing procedures set out by the Standards and Specifications Section, Department of Industrial Organisation, Secretariat of Industry, Government of Libya. The B.S.I., A.S.T.M. and the I.S.O.
 - 3.2. From the experience gained in para 3.1. the range of standards to be developed and expanded in such a way as to be appropriate to the requirements of the I.R.C. textile quality control laboratory.

4. Assist in carrying out quality control related measurements.
 - 4.1. Train and give experience to the senior local staff of the Textile quality control laboratory in statistical quality control, use of control charts and result interpretation.
 - 4.2. To give the senior local staff of the textile quality control laboratory guidance and experience in scientific report writing.

5. Give assistance in completion and selection of equipment and instruments in the field.
 - 5.1. Recommend the selection of quality control testing instruments appropriate to the full range of testing routines and research programme regularly undertaken by the quality control laboratory.
 - 5.2. Recommend suitable measures for the control of the testing environment in terms of temperature, humidity and a dust free atmosphere.

6. Assist and advise the library on information sources for appropriate subjects.
 - 6.1. Submit lists for technical books and journals on textile and related subjects for quality control, standards, etc. Also suitable reference books and charts for reference use in the testing laboratory.

- 7.1. To participate in programme of research in the textile field and through a series of factory visits to give practise to the senior counterpart staff in in-plant quality control and consultancy services to the textile industry in Libya.

ORGANISATION CHART OF INDUSTRIAL RESEARCH CENTRE

DIRECTOR GENERAL.

Mr. Mohammed Abour Rhakes

Director of Admn.

Mr. Basher Fenaish

Director of Techno-Economic Dept.

Mr. Taher El Bishti

Director of Geology

Mr. I. Maghrabi

Head of Lab. Sec.

A. Hawisa

Head of Tech. Studies

A. El Habishi

Head of Economics

Mr. M.A. Huwej

A/Head El Hadi

Head of Build Mats.

E. Zindah

Textile testing.

Miss Aisha El Braiky

Head of Testing Lab.

The Textile Quality Control Testing Laboratories,
Industrial Research Centre, Tripoli.

List of Testing Instruments at 12 December 1978

Projection Microscopes (1 Carl Zeiss, Jena) (1 Spencer, broken)	Total 2
Pilling Machine (J.Heal)	1
Bottle Stirrer. Moving platform. (Kottermann FRG)	1
Furnace. (Thermolyne, U.S.A.)	1
F.T.G. Felting Test Set (Paulsen, FRG)	1
Martindale Wear & Abrasion Tester. (J.Heal)	1
Air Permeability (Paulsen FRG)	1
Water Proofing. Shirley Hydrostatic Head Tester. (J.Heal)	1
A.W.P.M.A. Fibre Strength Tester. (Paulsen)	1
Linitest Washing Resistance Tester. ()	1
Xenotest 150 Light Fastness & Weathering Tester. (Hanan)	1
A.A.T.C.C. Crocking Tester. (Atlas U.S.A.)	1
Cloth Tensile Strength Tester. (German)	1
Cloth Bursting Strength Tester. (J.Heal). Requires parts,	1
Mettler Chemical Balance	1
Mobile Lamp	1
Elmendorf Tearing Tester. (Light weight)	1
Thelco Laboratory Oven. G.C.A. Corp.	1
Waring Blender	1
Mobile Quadrant Balance for Cloth (J.Heal)	1
Twist Tester (J.Heal)	1
Water Bath, six position. (Kottermann FRG)	1
Hot Plate (Rieckermann. FRG)	1
Water Distillation Unit	1
Sewing Machine	1
Soxhlet Apparatus	1
Laboratory Glassware	1
Chemicals	1

APPENDIX D

Textile Testing and Quality Control Laboratory, I.R.C. Tripoli.
Instrument list with dimensions and power supply. As at 21 March 1982.

1. Projection Microscope, Carl Zeiss, Jena. (Bench top).
300 x 1100 x 500 mm high. 220 V. 50 Hz.
2. Pilling Tester. J. Heal. (Bench top).
430 x 850 x 560 mm high. 220 V. 50 Hz.
3. Platform stirrer. Kotterman. (bench top).
400 x 400 x 500 mm high. 220 V. 50 Hz.
4. F.T.G. Wool Felting Machine. Paulsen (Bench top)
600 x 700 x 300 mm high. 220 V. 50 Hz.
5. Martindale Wear & Abrasion Tester. J. Heal. (Bench top)
1000 x 500 x 350 mm high. 220/240 V. 50 Hz.
6. Air Permeability Tester. Paulsen. (Bench top)
500 x 300 x 600 mm high. 220/240 V. 50 Hz.
7. Shirley Hydrostatic Head Tester. J.Heal. (Bench top)
500 x 500 x 700 mm high. 220 V. 50 Hz.
8. "Linitest", washing tester. Hanau. (Bench top)
450 x 550 x 450 mm high. 220 V. 50 Hz.
9. "Xenotest", light fastness, Hanau. Free standing.
130 Kg. 1300 x 800 x 2000 mm high. 220/380 V. 3 phase.
10. A.A.T.C.C. Crocking Tester. (Bench top)
600 x 80 mm. No power.
11. Elmendorfer tearing tester. (Bench top)
250 x 120 x 330 mm high. No power

12. Thelco laboratory oven. G.C.A. (Bench top)
500 x 500 x 550 mm high. 110 V.
13. Wareing Blender. (Bench top)
200 mm dia x 360 mm high. 110 V.
14. Mobile Quadrant Cloth Balance. J.Heal. (Bench top)
100 x 100 mm. No power.
15. Twist Tester for yarn, H.Heal. (Bench top)
700 x 100 mm. 127 V.
16. Water Bath, six position . (Bench top)
1000 x 500 x 660 mm high. 220 V. 50 Hz.
17. Hot plate with thermostat. Rieckermann. (Bench top)
400 x 200 x 160 mm high. 220 V. 50 Hz.
18. Mettler Analytical Balance. (Bench top)
410 x 250 x 560 mm high. 110 V.
19. Air compressor. AEG. CB = 20uf/360 V. (Bench top)
450 x 150 mm.
20. Flammability and Flame Resistance Tester. No.280. J.Heal (Bench top)
700 x 700 x 1100 mm high. Module 700 x 300 mm. 5 amp single phase.
21. Cusick Drape Tester No.165, J.Heal. (Bench top)
500 x 500 x 460 mm high. 6 volt lamp transformer. Mains 220 V.
22. Thickness gauge for carpets, Shirley Dev, Ltd. (Bench top)
200 x 210 x 510 mm high. No power.
23. Static Loading Tester. W.I.R.A. Leeds (Bench top)
700 x 150 mm. No power.

24. Tuft Withdrawal Tensometer. Shirley Dev, Ltd. (Bench top)
420 x 320 x 560 mm high. No power.
25. Recording Thermohygrograph with chart. (Bench top)
100 x 300 mm. No power.
26. Portable Moisture Meter with long & short probes. J.Heal. (Portable)
150 x 190 mm. Battery operated with 220V charger.
27. Fibre identification "Shirlastain Kit", Shirley Dev, Ltd. (Bench top)
Reagents in containers, No power.
28. Drying Oven with balance. No.82. (Free standing)
700 x 500 x 600 mm high. 210/220 V. single phase. Wt 106 Kg.
29. Shirley Analyser. Platt Saco-Lowell. (Free standing)
1000 x 2500 x 1400 mm high. 220 V single phase. 50 Hz 7.1. amps.
30. Comb Sorter, for fibre diagram. Shirley Dev Ltd. (Bench top)
250 x 120 x 150 mm high. No power.
31. Fibre diameter measurement for cotton, micronaire, W.I.R.A.(Bench top)
150 x 280 x 570 mm high. 220 V. 1.5/1.7 amp compressor.
32. Fibre diameter measurement for wool. W.I.R.A. (Bench top)
150 x 280 x 570 mm high. 220 V. 1.5/1.7 amp compressor.
33. Fibre Bundle tensile tester. Pressley type with micro-balance.
300 x 300 x 350 mm high. No power.
34. Cotton/rayon fluidity testing kit, with agitator. Shirley Dev. Ltd.
(Bench top). 600 x 600 x 600 mm high. Agit motor 230/250 V. 60 Hz.

35. Yarn wrapping reel and Quadrant Balance. J.Heal. (Bench top)
1000 x 560 x 660 mm high. No power.
36. Serioplane Yarn Inspection instrument. J.Heal. (Bench top)
1070 x 500 mm high. 220 V. 50 Hz.
37. Uster electronic Evenness Tester, yarns and roving. Imperfection
Indicator. Spectrograph. Type Uster 1. (Bench top).
2000 x 500 x 650 mm high. 220 V. 50 Hz.
38. Self Indicating Weighing Scale. Capacity 20 Kg x 10 grams.
400 x 300 x 900 mm high. No power.

APPENDIX E

Draft Proposals for the re-organisation of the Textile Testing and Quality Control Laboratory.

This short terms draft proposal is intended to be a temporary measure to assist in the improved efficiency and viability of the existing laboratory and to provide space for the instalation of the new instruments.

The proposed new layout includes :

- (a) An extra table in the centre of the room, to replace the two desks.
- (b) Plug sockets mounted as 3 x fused 13 amp on wooden blocks in such a way as to be more accessible.
- (c) Extra lighting, particularly for the centre tables, plus one or two table top lights which can be plugged into the sockets.
- (d) For the accurate testing of hygroscopic materials such as textiles the atmospheric conditions within the laboratory must be maintained at internationally acceptable standards :-

Standard atmosphere.	Temperature (C)	Relative humidity (%)
Temperate	20 \pm 2.	65 \pm 2.
Tropical	27 \pm 2.	65 \pm 2.

The reorganisation includes a system of ducting for a small air conditioning unit to feed temperature controlled air (and if possible humidified) into the laboratory. The air intake could be sited at the existing window, it is also hoped that by utilising this window it will help to reduce the amount of dust at present entering the laboratory. It is suggested that quotations and specifications should be obtained for a small air conditioning unit.

- (e) Each of the entrances, the main door from the passage and the door to the "wet" laboratory have been changed to double doors with air locks to help maintain the Standard Atmosphere within the physical testing lab. The unused door to the duplicator room could be sealed off.
- (f) Preferably the fume cupboard should be sited in the "wet" laboratory adjacent to a sink or alternatively a new fume cupboard installed in the chemical testing laboratory and the existing fume cupboard retained for flammability testing.
- (g) The "wet" laboratory and chemical store have not been included in the reorganisation plan as the siting of the proposed new instruments has been the first consideration. The prospect of a new water distillation plant to replace the existing unit in the "wet" lab precludes the possibility of short term reorganisation.

Draft Organisation Chart for the Textile Testing and Quality Control
Laboratory.

The present staff of the textile laboratory of the I.R.C. consists of the Head of the Laboratory and the one Technical Officer, under normal circumstances of a fully equipped laboratory capable of handling a daily programme of tests this level of staffing would be inadequate.

In consideration of the proposed expansion for testing services an alternative organisation chart is shown herewith. This chart shows a total staff of eight personnel including four graduates and four assistants. The instrument mechanic could be employed on a wider basis for the benefit of other laboratories, if necessary.

The Job description for the proposed staff of the textile testing laboratory are shown on page 107. These job descriptions are the "Ideal" and it is recognised that experienced graduates in textile technology may not be readily available so that in the short term plan less experienced, but potentially suitable, people may have to be appointed and given the opportunity to improve their level of knowledge through graduation from an overseas textile university and practical "on the job" training in Libya.

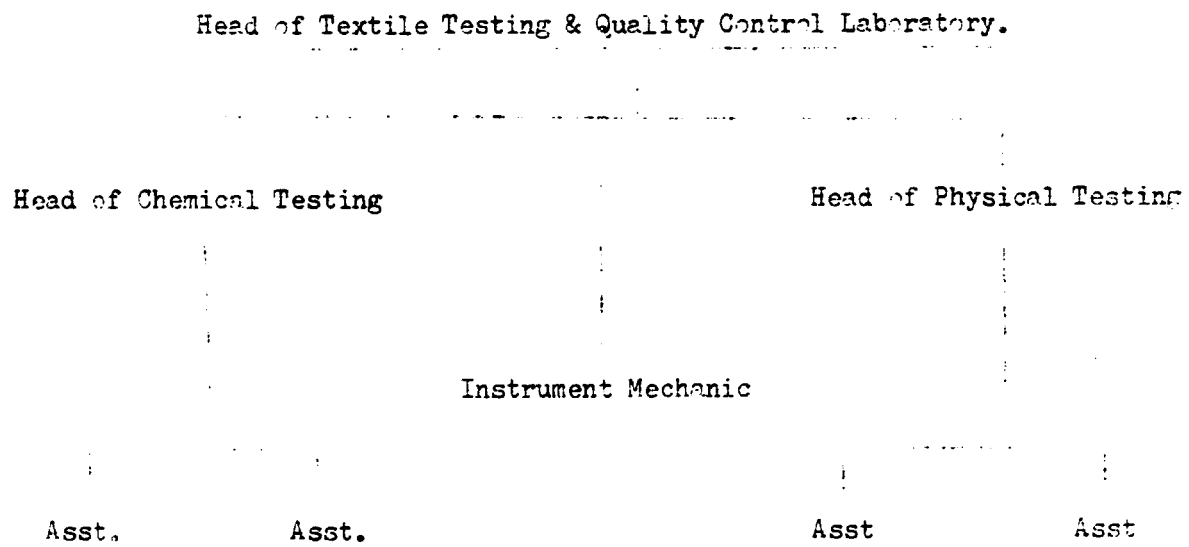
It is anticipated that the Heads of Physical and Chemical Testing will have practical knowledge and experience of the whole range of textile quality control testing procedures and will be able to train their assistants to carry out designated tests competently, the assistants duties include maintenance of the proper laboratory standard atmosphere and daily recording, calibration and cleanliness of the instruments and proper observation of the safety regulations.

The Head of the Textile Quality Control Laboratories in addition to the overall management of the testing programme should be responsible for result analysis, statistical reporting, and extension services to the industry for quality and process control operations within the plant. He should also be able to initiate and administrate programme for research designed to improve the quality and efficiency of the textile industry. Regular meetings with industrial management would help guide the Textile Quality Control Laboratory towards maintaining continuous and practical work programmes of direct benefit to the industry and other departments.

Draft Programme of Work, Regular Routine Tests for All Textiles

1. Acceptance testing for finished fabric samples from imported garments for physical properties, fibre identification and proportions, cloth construction.
2. Comparative testing between textile factories and the I.R.C. quality control laboratories for confirmation of test result viability.
3. Testing fibres and yarns for appropriate levels of residuals in consideration of dyeing and subsequent treatments. I.R.C. report and certification of approval.
4. Testing for quality standards for imported fibres, yarns, woven and knitted fabrics and carpets. (I.R.C. Certificate of Approval).
5. Testing for quality standards for exported fibres (wool), yarns woven and knitted fabrics and carpets. (I.R.C. Certificate of Approval).
6. Technical consultancy services for problem solving extension work to the textile industry.
7. Special request testing from textile factories in connection with process control in-plant tests.
8. Special request testing in connection with arbitration for quality standard disputes.
9. Dissemination of textile technical information distributed to textile industry by the Industrial Research Centre.

Textile Testing and Quality Control Laboratory Organisation Chart



Job Descriptions for Industrial Research Centre.

Textile Testing & Quality Control Laboratory Staff.

1. Head of Textile Quality Control & Research Laboratories.
2. Head of Quality Control.

Textile Technologist. Associate of the Textile Institute or B.Sc. Hons. degree from a British, American or Australian textile university. post graduate studies should include quality and process control for textiles and statistical analysis.

A minimum of four years experience of running a textile laboratory in a position of responsibility for staff management and should include experience in the programming of quality and process control operations, research projects, cost accounting and work study. Should be able to communicate well.

A precise and analytical attitude of mind if necessary with ability to speak and write fluently in Arabic and English languages.

3. Head of Chemical Testing.

Textile Technologist. Associate of the Textile Institute, or a degree from a British or American or Australian textile university following three years of full time study in textile technology plus other studies in the chemical testing of textiles and statistical analysis.

A minimum of three years experience in running chemical testing laboratory and supervising laboratory staff, work programming, test result interpretation, report writing and liaison with other departments.

A precise and analytical attitude of mind if necessary with ability to speak and write fluently in Arabic and English languages.

4. Head of Physical Testing.

Textile Technologist. Associate of the Textile Institute, or a degree from a British, American or Australian textile university following three years of full time study in textile technology plus other studies in the physical testing of textiles and statistical analysis.

A minimum of three years experience in running a physical testing laboratory and supervising laboratory work, programming of work, result interpretation, report writing and liaison with other departments.

A precise and analytical attitude of mind is necessary and to be able to speak and write fluently in Arabic and English languages.

5. Textile Laboratory Assistant.

Degree/Diploma in Textile Technology from national university.

Prepared to study further in own time.

A precise and responsible attitude to work.

Fluent in Arabic and English languages.

6. Instrument Mechanic.

Degree/Diploma in Electronics from national university or polytechnic.

Minimum two years experience in maintenance and repair of laboratory testing instruments.

A precise and responsible attitude to work.

Ability to speak and read fluently in Arabic and English languages.

APPENDIX F

Testing for comparison of quality and suitability between two samples military winter weight trouser fabric, A/282 - (1) and A/283 - (2), submitted for test by the armed forces to the Textile Quality Control and Testing Laboratories of the I.R.C. Tripoli on 29 April 1982.

Programme of tests following 24 hour conditioning period for samples :-

- (i) Inspection of each sample garment.
- (ii) Test for tensile strength and % extension in warp and weft directions. (Insufficient sample material for tensile test in weft direction).
- (iii) Weight per square metre in grams.
- (iv) Analysis of fabric weave.
- (v) Analysis of fabric construction - Picks and ends.
- (vi) Analysis of yarn count.
- (vii) Test fabric for % loss by abrasion.
- (viii) Test for air permeability.
- (ix) Flammability.
- (x) Test for identification of fibres and blend composition by physical and chemical methods.

Test results according to sequence of programme :-

Test (i). A/282 - (1). Trouser construction good standard with ample "turn up" material (7.0 cms), whipped edges and adequately strong sewing thread.

A/283 - (2). Trouser construction good standard with ample "turn up" material (6.5 cms), whipped edges and adequately strong sewing thread.

A/282 - (1)

A/283 - (2)

Test (ii). Mean, 87.87 Kp, 34.25%	90.5 Kp, 37%. Diff = 3%
Test (iii). Weight. 426 gms/m ²	428 gms/m ² . Diff = 0.5%
Test (iv). Weave. Baratheia.	Baratheia.
Test (v). Constr. Ends in 2 cms = 72 Picks in 2 cms = 45.	Ends in 2 cms = 68. Picks in 2 cms = 45.
Test (vi). Count. Warp, 2 ply 90 Tex RC Weft " " 82 Tex RC.	Warp, 2 ply 94 Tex RC Weft, " " 100 Tex RC.
Test (vii). Abrasion Loss. (8.3 hrs). 5.25%.	7.24 %. Diff. = 2.0%
Test (viii) Air Permeability 47.6 ml.	49.6 ml.
Test (ix). Flameproof.	Flameproof.
Test (x) By microscopic & chemical test. 100% wool.	100% wool.

Conclusion

Due to the very similar results obtained for both fabric samples during the programme of tests to which they have been submitted it is difficult to categorically declare which sample has the best quality and suitability standard.

By examination of the test results :-

- Test (i) Garment construction is equally good.
- Test (ii) Sample 2 is 3% stronger in tensile strength of warp than sample 1.
- Text (iii) Sample 2 is 0.5% heavier than sample 1.
- Test (iv) The fabric weaves are the same but warp density of sample 1 is finer than the warp count of sample 2.
- Test (v) The yarn count of warp in sample 1 is finer than the warp count of sample 2.
- Test (vi) The abraision test is significant and for sample 1 the loss in weight is only 5.5% compared with a loss of 7.25% for sample 2.
- Test (vii) The air permeability for sample 1 is less than 2, possibly owing to the greater warp density of 1.
- Test (viii) Being wool both samples resist burning, both are 100% wool.

Although sample 2 is slightly stronger than sample 1 the results of the abraision test show sample 1 to be significantly more resistant to the abraision, the finer and more dense warp probably contributes to this characteristic. Accordingly sample 1 may be a more suitable uniform trouser fabric than sample 2, but both are equally good quality fabrics. The khaki colour is slightly different between the samples, rating 4 on the Grey Scales.

APPENDIX G

Memorandum.

1 August 1979.

To : Mr. Taher El Bishti. Director Techno-Economics
Industrial Research Centre, Tripoli.

From : Mr. J.L.Isles. UNIDO Expert in Quality Control for
Textile Materials.

Further to my memorandum of 15 July 1979 I beg to enclose a draft proposal for a survey of the existing textile and allied industries with the object of obtaining detailed information on raw material resources, distribution, quality, and to appraise the production performance of the processing plants and factories.

It is suggested that the information obtained would be of considerable value to the Industrial Research Centre and the methodology employed for the survey could be extended to many other industries.

A. INTRODUCTION

The importance of wool as a textile fibre indigenous to Libya and the prospect for expanding its use for carpets, etc. for the domestic market are beginning^{to} take shape, it is therefore suggested that the time is opportune for an in depth survey and analysis of the existing textile and allied industries.

It is suggested that the survey could be undertaken on a project basis working as a team for management, economics and technology to study by observation and check list systems the function of management, manufacturing processes and economic performance. The reports being brought back to the I.R.C. for analysis.

The value obtained from a broader and deeper survey would enable the strengths and weaknesses of the existing industry to be more completely understood and the knowledge obtained would make it possible for the new factories to be brought into economic production more quickly and efficiently.

It is anticipated that problems may be identified during the course of the factory visits that would justify further assistance from the experts and their national counterparts.

B. Survey objectives and work plan.

1. Motivation

The rapidly expanding industrialisation of the Libyan Jamahiriya and the role of the I.R.C. in supplying technological, management development and consultancy services.

2. Objectives.

- 2.1. Methodology. By visiting industrial enterprises and factories to survey the production and quality levels being achieved and to assist in resolving problems identified.
- 2.2. To obtain a more complete understanding of the current situation in the manufacturing industries of the Libyan Jamahiriya in order to provide appropriate services to the industry and for the new enterprises being planned.
- 2.3. To provide a "model" of methodology for other industrial surveys by the Industrial Research Centre.
- 2.4. Draft formulation for long term objectives. Within the agreed terms of reference for the I.R.C. project to gain information from the study of existing industries which can be used for the benefit of expanding and developing new industries. To better understand how indigenous raw materials can be produced and economically utilised.

- 2.5. Immediate objectives. To provide effective assistance to the Libyan industries through in-plant problem solving consultancy for improved quality and productivity and to provide advice on training for Libyan supervisors and management to enable them to assume responsible positions within the organisation structure of the companies where they are employed.
- 2.6. To use the resources of the I.R.C. laboratories for programmed testing of the products of the industry to enable the manufacturers achieve a quality level compatible with those determined by the Libyan Standards Institute and so be acceptable for the domestic and overseas markets.
- 2.7. To develop new process technology for improved production, quality and profitability through the up to date facilities of the I.R.C. laboratories.

C. Examples

1. The sources and availability of indigenous raw materials.
 - 1.1. Many of the existing textile and allied industries use Libyan wool, hides and skins. In the future synthetic fibres may be produced by the new Libyan enterprises as petro-chemical by-products.
 - 1.2. The survey should describe the consistency of quality and classification of raw materials and their method for distribution, the current production weight of raw materials per classification category and a forecaste of future production levels.

- 1.3. A list with details of the processing centres for raw materials such as tanners, picklers, fellmongers, etc. production efficiency and quality.
- 2.0. To survey the manufacturing enterprises.
- 2.1. Under the headings of management functions, technology and economic analysis.
- 2.2. Management organisation.
- 2.3. Management training.
- 2.4. Production control and efficiency.
- 2.5. Labour recruitment, training and turnover.
- 2.6. Marketing and distribution.
- 3.0. Technology.
- 3.1. Plant layout, balancing, age and general condition.
- 3.2. Raw material sources and availability for subject plant.
- 3.3. To study in-plant process and quality control.
- 3.4. Product specifications, variety and quality standards.
- 3.5. Buildings, power supply and services.
- 3.6. System for in-plant maintenance, spare part availability & stores.
- 3.7. Workshop facilities.

APPENDIX H

The Tripoli Traditional Garment Establishment

Jezirah Factory

Tuesday 8th Dec 1981.

The factory was visited by :-

Miss Aisha El-Braiky, Chief of the I.R.C. Textile Laboratories.

Miss Karima Nasser, Chief of the Instrumental Analysis Laboratories, I.R.C.

Mr. J.L. Isles UNIDI Expert for Quality Control of Textile Materials

Persons seen :-

Mr. Guma El Hadad, Secretary of the Peoples Committee of the Tripoli
Traditional Garment Establishment.

Previous visits to this factory have been made by the I.R.C. on = 13 and 19
April 1981 when reports were made and included in the final survey report
for the Textile Industry of the S.P.L.A.J. published on 10 Aug 1981.

In the course of this visit to the Jezirah Factory, which is the headquarter
factory of the Establishment, the I.R.C. requested a representative collection
of samples of yarns commonly used for weaving their products and also samples
of the traditional garments in current production. Samples of garments were/^{also}
taken from the knitting dept.

Mr. Guma described the programme for expansion of the Establishment which
includes equipping with sixty new Japanese shuttleless looms in the Jezirah
factory, he also described the current product range, as described in this
report. Mr. El Hadad said that recruitment of good weavers remained a problem.

The Tripoli Traditional Garment Weaving Establishment

Ref. No.	Name	Wght in. Grams.	Size in cms.	Wght/So in gms.	M Ends per cm.	Picks per cm.	Weave.	Warp.	Woft
1.	RIDA	680	140x450	108	20.5	14.2	1/3	Rayon filament.	Silver metal.
2.	FARASHIA	1,055	186x306	185	18.1	12.6	Plain	Rayon filament.	2 Ply Acrylic.
3.	FARASHIA	805	193x292	143	19.6	22.0	Plain	Rayon Filament.	Rayon Filament.
4.	JARED	1400	144x512	190	19.6	11.8	Plain	Rayon Filament.	2ply Acrylic.
5.	RIDA	552	150x472	80	20.5	18.8 (2 as 1)	Plain & 1/2 tw.	Pure sil: Fil.	P.Silk Fil.
6.	RIDA	552	150x476	77	20.5	16.0 (2 as 1)	Plain & 1/2 tw.	Pure silk Fil	P.Silk Fil.
7.	RIDA	1858	150x458	125	19.7	14.2	Plain & 1/3 tw.	Rayon Filament	Rayon Filament
8.	RIDA	1161	148x512	153	21.2	10.2	1/3 tw.	Rayon Filament	2ply Acrylic.
9.	RIDA	786	146x451	119	18.9	14.2	Plain & 1/3 tw.	Rayon Filament	Rayon Fil. & Metal.
10.	RIDA	1318	145x506	180	19.7	15.8	1/3 tw.	Rayon Filmnt	2 ply Acrylic
11.	RIDA	982	152x480	134	19.7	13.4	1/3 tw.	Pure silk Filmnt	2 ply Acrylic
12.	Knitted sweater	380	Abt 34" (83 cms)		Wales	12/cm	Course	7.5/cm.	Woft knit.
13.	Scarf	60	98x43	142	19.7	16.0 (3 as 1)	2/2 tw	Pure silk Filmnt.	P.Silk Filmnt.
14.	RIDA	740	147x464	108	20.9	15.7	Plain	Rayon Filmnt.	Metallic & Rayon
15.	RIDA	770	144x452	118	20.9	15.7	Plain & 1/3 tw.	Rayon Filmnt.	Rayon & Metal.
16.	RIDA	1490	145x490	210	23.6	13.4	1/3 tw	Rayon Filmnt.	2 ply Acrylic & metal

The Tripoli Traditional Garment Weaving Establishment

Ref. No.	Traditional Garments	Fault Analysis	
1.	Rida. Temple marks.	weft loops. Loose ends.	14 faults.
2.	Farashia. Many drag ins one side.	Slack weft. Chafe Dirty marks. Yarn.	47 faults.
3.	Farashia. 10 sets double ends length of garment.	Double weft tight weft. Chafe Oil marks. stains.	25 faults.
4.	Jared. Many drag ins.	Slack weft. Bad oil stains on yarn.	36 faults.
5.	Rida Temple marks. craks.	Drag ins. Oil marks Slack weft. Shuttle damage.	26 faults.
6.	Silk Rida. Temple marks. Drag-ins.	Slack weft. Oil stains. Missing weft. Oil on weft.	55 faults.
7.	Rida. Temple marks.	Drag-ins. Slack weft. Loose wrong drawn warp. Slubs in weft. Yarn	20 faults.
8.	Rida. Man drag-ins.	Slack weft. Loose yarn on Weft loops Surface.	19 faults.
9.	Rida. Temple marks..	Wrong drawn warp ends. Slack weft. Crease Double weft. marks.	16 faults.
10.	Rida. Many drag-ins oil stains	Shading attributed to tension changes in weaving.	28 faults.
11.	Rida. Temple marks.	Drag ins Weaving bars. (white across colour)	10 faults.
12.	Knitted sweater	No obvious faults. Over-firm fabric construction.	
13.	Silk scarf. Temple marks. Drag-ins.	Varying weft. Tight warp. tension. threads.	9 faults
14.	Rida. Tight warp threads. Warp floats.	Double weft. Crease marks. Weft loops.	8 faults + 17 thin places
15.	Rida. Drag-ins. Loose threads.	Thin places. Weft loops.	13 faults
16.	Rida. Many drag-ins.	Slack weft Oil marks. Weft loops	29 faults.

Quality Control & Inspection for Traditional Garments.

From the appearance of the garments being offered for sale it is clear that there is no effective inspection between weaving and folding up for packing and despatch. The impression gained from the inspection and fault analysis carried out by the I.R.C. Textile Laboratories is that the standard of weaving and tuning is careless and indifferent to the quality of the product.

Temple marks appear on most of the garments, these could be diminished by finishing processes or by using less heavy temples.

Drag-ins are very frequent (also known as "lashed-in weft") caused by pulling into the fabric of lengths of thread from weft between the selvedge and the auto weft change mechanism. This mechanism should have scissors which automatically cut the weft thread off, but on many looms seen during the factory surveys the scissors did not work, or were missing. (See factory visit reports).

Weft loops, slack weft and double weft in the garments is attributed to a lack of properly regulated drag on the weft supply from the shuttle.

There are many oil stains and marks on the garments attributed to oil dripping from the overhead harness onto the fabric during weaving, and oil picked up by the yarn during pirn filling. In all cases this is probably due to over-zealous use of the oil can and lack of regular cleaning of the machinery.

In all cases the garments require loose threads to be removed also headings and to have a much improved fringe made at each end of the garment.

There is an urgent need for a more conscientious and quality oriented attitude for this section of the textile industry. Most of the garments examined qualify for only a second class rating, and there are others which may be unsaleable, especially some of the silk quality.

To improve the quality requires improved weaving, more efficient loom tuning and maintenance with fabric inspection during weaving and inspection of all the pieces immediately after weaving. All faults requiring to be repaired should be identified, but a good standard of weaving will reduce the amount and the cost of mending.

All faults should be repaired and stains removed by trained staff in the ware house. Badly creased garments should be relaxed by steaming, probably by pressing with a "Hoffman" type press. All garments should have a final examination and passed by the warehouse supervisor before packing for despatch.

As a first step it is recommended that standards should be developed for the acceptable number of faults for 1st and 2nd categories with the garments priced accordingly. Samples should be submitted to the I.R.C. Textile Testing Labs. for certificates of acceptability at regular intervals.

To : - Chief Librarian. The Technical Library
Industrial Research Centre

From : J.L. Isles. UNIDO Expert for Textile Quality Control.

Subject : Textile Technical Journals

The attached list of journals are suggested as appropriate reference and information mediums for the textile and quality control and research laboratories.

The list has been so arranged to represent the whole spectrum of the textile and clothing industry and is mainly technical and research orientated.

1. Carpet Review. London. Monthly.
2. Fibre Science and Technology. London. Quarterly.
3. International Dyer. Manchester. Bi Monthly.
4. Journal of the Textile Institute. Manchester. Monthly.
5. Knitting International. Leicester. Monthly.
6. Manufacturing Clothier. London. Monthly.
7. Technical Manual and Year Book of the American Association of Textile Chemists and Colourists. New York. Annually.
8. Textile Manufacturer. Manchester. Monthly.
9. Wool Science Review. London. Quarterly.

TRIPOLI.

28/11/78.

APPENDIX J

Textile Quality Control Department Laboratory.

Suggested Book list for period 1979/80.

Principles of Textile Testing. By J.E.Booth. Publ. 1976
Newnes-Butterworths.
Borough Green,
Sevenoaks. Kent.
TN15 8PH. U.K.

The WIRA Textile Data Book. Publ. by WIRA. 1973.
Headingley Lane,
LEEDS. LS6 1BW. U.K.

A Handbook of Textiles. by Ann M. Collier. Publ. 1974
Pergamon Press Ltd.
Headington Hill Hall
Oxford. U.K.

Wool. by H.S.Bell. Publ. by : 1970
Sir Issac Pitman and Sons, Ltd.
Pitman House, Parker Street
Kingsway, Lond. WC2B 5PB. U.K.

An Outline of Statistical Methods for use in the Textile Industry.
by A. Brearley and D.R. Cox.

Publ by : 7th Edn.
WIRA, Headingley Lane
Leeds. LS6 1BW. U.K.

Chemical Testing of Textiles. A laboratory Manual. by D.M.Hall. 3rd Edn.

Publ by :

Dept. of Textile Engineering. Auburn University

Auburn. Alabama. U.S.A.

Applied Fibre Science. by F.Happey. Vol 1 and vol. 2 1978/79.

Publ by Academic Press.

24-28 Oval Road

London. N.W.1 U.K.

Textile Terms and Definitions. by Carolyn A. Farnfield & P.J.Alvey.

Publ by :

The Textile Institute

10 Blackfraire Street

Manchester. M3 5DR. U.K.

The Condensed Chemical Dictionary. Rev by G.G.Hawley. 1977. 9th Edn.

Publ by :

Van Nostrand Reinhold Co. New York. U.S.A.

(Textile Inst & Industry. Nov. 1978 p.369).

Principles of Weaving. 1976

R.Marks and A.T.C. Robinson

Textile Institute Manchester

Textile Finishing, 1978

P.W. Harrison

Textile Institute, Manchester

APPENDIX K

A List of Draft Reports Submitted to the Directors of the Industrial Research Centre. Tripoli. S.P.L.A.J. by J.L. Isles UNIDO Expert for Quality Control of Textile Materials, during period October 1978 to October 1982.

- I. Period 10/78 - 6/79.
 1. Investigation into the "Brambach" fibre (Calotropis Procera), Published June 1979.
 2. List of instruments recommended for I.R.C. textile laboratory purchased during 1979/80.
 3. List of books and periodicals in Textile technology recommended for the I.R.C. library.
 4. Laboratory reorganisation plan, published June 1979.
 5. Textile Laboratory national staff job description as part of "Draft interim Textile Quality Control Laboratory Layout and Organisation Plan", Published 1979.

- II. Period 7/79- 12/79.
 1. Lecture programme subject "Statistical Reporting", given under five headings to national counterpart staff. 1979.
 2. Lecture programme subject "Atmospheric Control for Hygroscopic Materials". Given to national counterpart staff. 1979.
 3. Draft report on a programme of investigation into the properties of indigenous Libyan wool. 19/8/79.
 4. Contemporary notes on synthetic fibre development.

5. Special report on Quality Control and Standards in S.P.L.A.J.
Addressed to Techno-Economic Director. I.R.C.
- III. Period 12/79 - 31/5/80.
1. Compiled and implemented training programme for ten students from the Industrial Bank of Libya, in textile technology.
 2. Published a draft report on a survey of twelve textile factories in the Benghazi area after completing tour of this area in April 1980.
 3. Recommended instrument and equipment for the textile laboratories of the new I.R.C. Tajura, as part of budget for economic period to 1985.
 4. In association with Mr. V. Vardjan WNIDO, Senior Industrial Economist co-operated in publishing "A Blueprint for the Textile Industry of the S.P.L.A.J. to year 2000".
- IV. Period 6/80 - 11/80.
1. Draft report with comments on ADR University of Grenoble publication addressed to National Oil Corp of Jamahiriyah, "Libyan Textile Industry and World Textile Trade".
 2. Technical report for manufacture of velvet fabrics and feasibility of handkerchief manufacture.
 3. Compiled draft training manual in textile testing for national counterpart staff.
- V. Period 12/80 - 5/81.
1. Draft report on dye fastness of domestic manufactured textiles, using Xenon test for light fastness and the Linitest for wet fastness.
 2. Previous reports rewritten and brought up to date.
 3. Draft report on a programme of visits to nine traditional garment weaving factories in the Tripoli and Misurata areas.

4. Report of tests carried out on samples obtained from visits to factories in para (3).

VI. Period 6/81 - 31/12/81.

1. Co-operated with Mr. L. Haweisa, I.R.C. and Dr. Zoltan Halmos, UNIDO for a paper on the thermoanalytical examination of Libyan wool samples.
2. Part II of a draft report for a study of source related samples of the indigenous breeds of Libyan wool, co-operation with FAO Gezara Plain project.
3. Submitted a paper requested by I.R.C. for historical background to development of the world textile industry.
4. Collaborated with Mr. S. Conquy UNIDO expert for marketing in a draft report on the marketing of textiles in S.P.L.A.J.!
5. Submitted a draft report to the I.R.C. for the present status and future plans for the development of the synthetic fibre industry.
6. Report on testing of samples of yarn from the wool washing and spinning mill. El Merj.

VII. Period 1/1/82 30/6/82.

1. Comprehensive draft report with test results for sixteen typical samples of traditional garments from Benghazi and Tripoli factories. The report recommends necessity for reduction in excessive number of faults per garment.
2. An account for the procedure for testing fluidity of cotton and other cellulosic fibres, for translation into Arabic.
3. New edited report on characteristics of the fibres from Libyan wool.

4. Revised draft for a report on productivity from National Establishment for Spinning and Weaving, Zanzour. As part of national survey of whole textile industry of S.P.L.A.J. by I.R.C. team during 1981.
5. Forecasts to the year 2000 for potential consumption of polyacrylonitrile fibres in the S.P.L.A.J.
6. Submitted draft report on the results of the surveys made for the whole national textile industry of the S.P.L.A.J. Now translated into Arabic.

Testing.

Applications for tests have exceeded three hundred since Oct 1978 and involved about 4000 tests, physical and chemical, all results fully reported with appropriate comments and recommendations.

Reporting

Reports made following factory visits, surveys and other extension work include summaries of findings, recommendations and any measurable benefits achieved.



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