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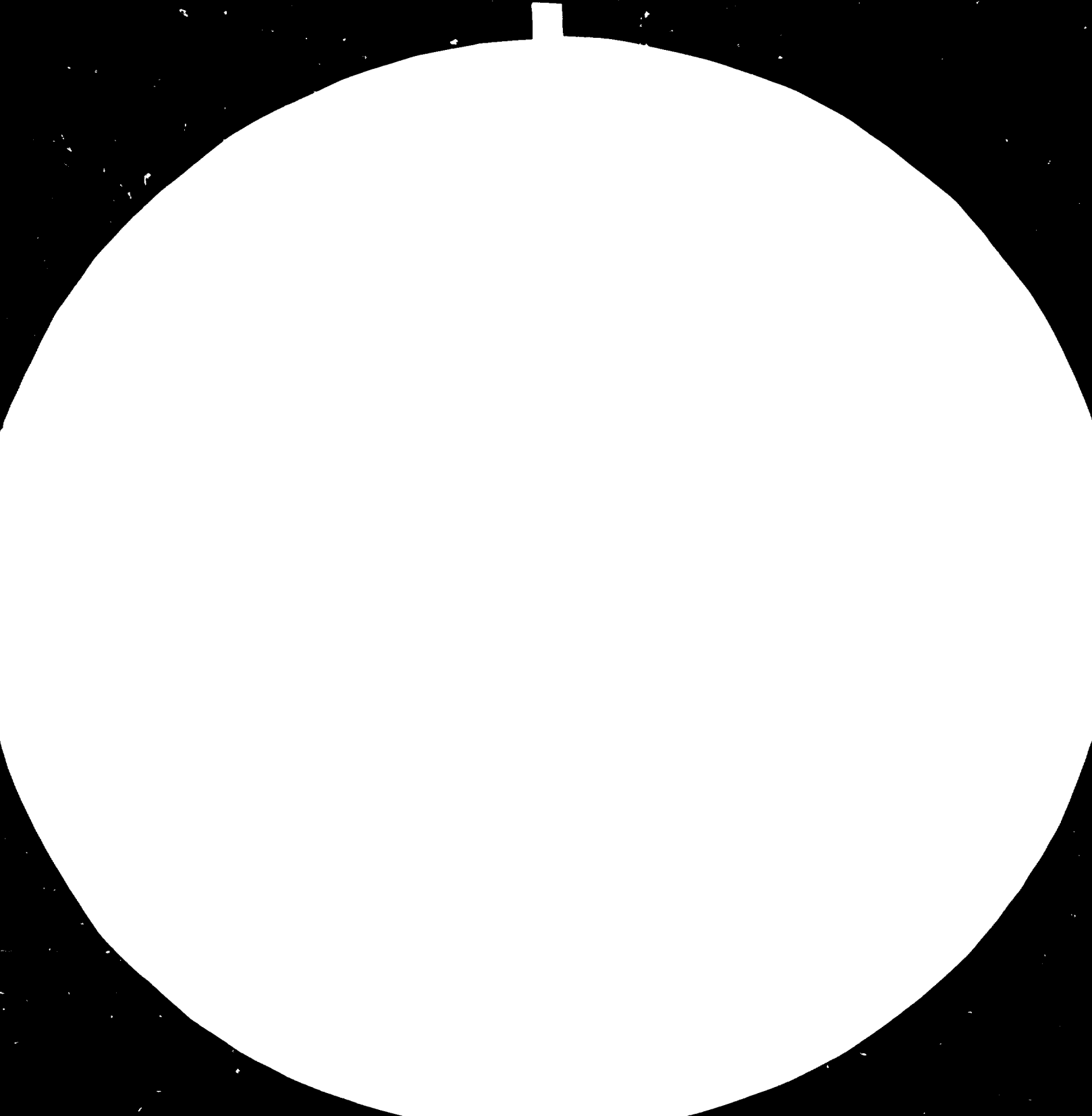
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MICROCOPY RESOLUTION TEST CHART

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U.S. GOVERNMENT PRINTING OFFICE: 1963 O 338

ANALYTICAL CHEMISTRY, VOL. 35, P. 1000 (1963)

RESTRICTED

13190

DP/ID/SER.B/429
16 November 1983
English

India.

DIVERSIFICATION AND DEVELOPMENT OF NEW FABRICS,
SITRA, COIMBATORE, PHASE II

DP/IND/76/023

INDIA

Terminal report*

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

M. Minke

United Nations Industrial Development Organization
Vienna

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V.83-63995

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Exchange rate

US\$ 1 = Rs 10.06

ABBREVIATIONS

CSIR	-	Council of Scientific and Industrial Research
GOI	-	Government of India
ISI	-	Indian Standard Institute
R + D	-	Research and Development
SITRA	-	South India Textile Research Association
TTRM	-	Terminal Tripartite Review Meeting
UNDP	-	United Nations Development Programme
UNIDO	-	United Nations Industrial Development Organization

1. Introduction

This report has been prepared by M. Minke, Industrial Development Officer, UNIDO, Vienna, based on his findings gathered during a visit to the project in relation with his participation in the Terminal Tripartite Project Review Meeting, which was held on 27 September 1983.

The National Project Director's Draft Terminal Report was used as a guideline for the discussions at the Terminal Tripartite Project Review Meeting as was the Self-Evaluation Report dated 19 September 1983.

For details on outputs, activities and the research and development programme the Draft Terminal Technical Report provides useful reference material.

The report on the Terminal Tripartite Project Review Meeting is also recommended as a source for further reference (see Annex IX).

2. Logic of the Project

In 1974 the Government of India requested assistance from the UNDP for the project "Diversification and Development of New Fabrics", South India Textile Research Association, Coimbatore (DP/IND/73/004) Phase I. The purpose of this project was to aid the cotton spinning industry of South India which, with 6 million installed spindles, will be vulnerable in any future expansion by its dependence upon the fabric production sector whose capacity to grow is limited by its lack of technical know-how and advanced technology. The industry is also vulnerable in times of recession. The intention was to create a modern knitting capacity, based on both large and small production units. The proposal also stated that the knitting industry seems to be one of the most labour-intensive industries and therefore a judicious and rapid expansion of the knitting industry would lead to the creation of employment potential at a comparatively low investment. The proposal recommended that to develop this industry the following activities should be taken into account:

- (a) Improvement of yarn quality;
- (b) Production of yarns suitable for knitting;

- (c) Formulation of part-time training courses;
- (d) Improvement in machine utilization;
- (e) Production of quality standards;
- (f) Standardization of garment sizes.

The proposal also stated that further development of the industry would depend to a large degree upon the introduction of advanced knitting technology including warp knitting and weft insertion processes that would require the introduction of a comprehensive and long-term programme of R+D to assist the entire knitting industry. The project was to be carried out in two phases. The request for Phase I was approved and the project commenced on 1 July 1975, for a duration of 18 months. UNIDO was the executing agency with CSIR, acting through SITRA as the co-operating agency. The UNDP contribution for Phase I totalled US\$ 64,350; the contribution of the Government of India totalled US\$ 99,710. The Phase I of the project came to a conclusion in January 1977.

In Phase I it was intended to concentrate on assistance for the benefit of the existing circular knitting industry through improvement in yarn quality, training in various knitting techniques, and technical advisory services to increase machine utilization. R+D activities were initiated and extension services were provided to individual units. Two of SITRA's staff members concerned with this project were sent abroad for training.

While the project did not fully achieve its objectives during the First Phase, important progress was made in several areas as outlined below:

- (a) A survey of the knitting industry was carried out which provides a useful basis for further studies of the operational efficiency of knitting mills and contains recommendations for follow-up action;

- (b) SITRA has been carrying out, for the past two decades, periodical surveys relating to norms, quality and productivity of the spinning as well as the weaving sectors of the textile industry. Additional studies which provide a useful beginning in a continuing programme of establishing norms for knitting, making-up, finishing and machine and worker efficiency were commenced;
- (c) Studies of fabric defects had also begun with a view to proposing remedial actions;
- (d) Studies of yarn quality in relation to knitting machine performance had also been carried to a certain extent;
- (e) Demonstration of knitting machinery and techniques within the scope of the limited equipment actually installed at SITRA, had been conducted;
- (f) Considerable attention had been devoted to the development of new products for manufacture on existing machines and to the methodology for the production of fabric trials, and
- (g) Experimental work had been initiated in improving machine efficiency by modification of existing machines; instruments developed included a course length tester, a yarn speed meter and a tachometer; in addition, a hand-to-cone winder had been developed.

It was, therefore, proposed that the Phase II of the project should built upon the achievements of the Phase I within the staff and other resources available to SITRA. It was also proposed that special emphasis should be given upon (a) the provision of practical training courses for the industry and the implementation of planned research and development programme along the lines proposed in Dr. Burnip's report "Project Findings and Recommendations (IND/73/004 - Phase I) and (b) the provision of advanced machinery and know-how in garment making and finishing suitable for this industry to SITRA and to build up sufficient expertise at SITRA in these fields to enable them to transfer this to the knitting industry. Accordingly, a project document was prepared and submitted to the UNDP in November 1979 (IND/76/023/A/01/37) for the Phase II of the project for a duration of 2 years.

The UNDP contribution envisaged was US\$ 259,300 and the GOI inputs envisaged was Rs. 1,093,520.

During the course of the Project, which was rephased to reflect the actual expenditure the budget was further increased to meet the recommendations of Dr. Burnip's report made during a technical evaluation mission in 1981 and once more in 1982 as a result of the decision taken during a tripartite meeting held in October 1981. The increases concerned additional equipment and fellowship training. The UNDP contribution of the project finally totalled US\$ 426,079.

3. Termination of the Project

During the TTRM, held on 29 September 1983 at the project site it was decided to:

- utilize the balance of the budget of approximately US\$ 11,000 for two additional fellowships;
- postpone the termination of the project upon return of the fellows, but not later than 31 December 1983;
- revise the budget accordingly.

4. Overall Assessment

As a result of the completed project, SITRA has obtained a fully operational section for providing consultancy services, conducting training programmes and technical seminars and carrying out R+D in knitting, dyeing/finishing and garment technologies. The acceptance of SITRA's services by the national cotton knitting industry is excellent and the present number of approximately 100 regular users of SITRA's facilities is steadily increasing.

In order to cope with increased demand for consultancy services SITRA plans to establish a sub-centre in the nearby knitting centre, TIRUPUR.

Although much has been accomplished during the course of the project, it will take quite some time and considerable efforts to bring the Indian cotton knitting and garment industry up to an international acceptable standard.

Therefore, it is recommended that SITRA's staff further defines a work plan for its knitting and garment section. Such a work plan could also serve as a parameter for the envisaged post project evaluation by UNDP/UNIDO.

It is further recommended that SITRA's staff in future is periodically be upgraded and informed about the rapid technological developments in the field of knitting and finishing of fabrics.

5. Results of the Project

While assessing the results of the terminated project DP/IND/76/023 it can be stated that the project has successfully achieved its objectives.

(A) Objectives

In general the objectives appeared to adequately cover the need of the South Indian industry. The objectives were:

- to increase the capacity of the South India Textile Research Association to provide training and specialised technical advisory services to the spinning mills and the knitting industry of South India in the production, dyeing and finishing of yarns, knitted fabrics and garments;
- to strengthen SITRA's capacity for applied research and development;
- to provide through SITRA, technical assistance to industry including the development of instruments and machine accessories and the provision of advice related to improved yarn, fabric, making-up and dyeing and finishing routines.

SITRA's knitting section has been equipped by UNDP/UNIDO with modern machinery and its laboratory with relevant equipment.

UNIDO also provided expertise to adequately utilize this input for applied research programmes, training and demonstration to local industry.

A competent staff of six technicians trained abroad under UNIDO fellowship programmes is now carrying out applied research, assist machine manufacturers in developing new machinery, advise on improvements of knitting machine elements and servicing of industry. Approximately 80-100 industrial enterprises seek regularly SITRA's advice in solving processing problems. Since industry became aware of the newly acquired know-how available at SITRA many enterprises show more confidence in accepting modern manufacturing methods and in utilizing modern equipment:

- a) As a result of provided technical consultancy service one of the dyeing plants has ordered a modern low liquid ratio dyeing machine; in most of the knitted garment factories pattern making, grading and lay planning in the cutting rooms were adopted, resulting in fabric saving so 40-50%, improvements in the production process of a sewing yarn mill resulted in improved quality and cost reduction. Demonstration of methods to improve the quality of knitted fabrics gradually leads to adopting of these methods. In at least one case, an enterprise was able to become a capable exporter of cotton outerwear;
- b) Furthermore, 17 long term research projects have been completed and 3 are under progress. About 100 consultancy assignments were carried out and 12 feasibility reports were prepared. Machinery and instruments for increasing the productivity of knitting have been developed;
- c) Syllabi for carrying out training programmes have also been prepared. At least 12 training programmes covering knitting, garment making and finishing were carried out. 237 technicians from 80 enterprises participated in the training courses. The technical staff of the knitting section is capable of carrying out the training programme. The training section of SITRA is the executing department.

Therefore, as a result of the project, SITRA complies with the objectives and now:

- a) has the capacity to provide training and specialised technical advisory services to the spinning mills and the knitting industry in the production, dyeing and finishing of yarns, knitted fabrics and garments;

- (b) has the capacity to independently carry out applied research and development;
- (c) is able to provide technical assistance to the industry in all areas related to knitting, finishing and garment making.

(B) Outputs

The outputs were well defined. In one case, however, outputs No. 5 overlapped part of the output No. 2. All outputs were completed.

Output No. 1

"A trained team of at least 6 qualified technical officers including the team leader to undertake research and development and to provide training and extension services to industry in knitting, garment making, dyeing and finishing".

At the end of the project the situation was as follows:

SITRA has recruited and trained a team of 7 technical officers including the project leader on a full time basis and 4 technical/statistical staff on a part time basis for this project (see Annex I).

Also in future, the project leader will be heading the group dealing with the knitting industry. SITRA intends to continue its R+D programmes in knitting and its immediate associated areas.

It will also continue to provide training and consultancy services to the knitting, finishing and garment industry. For the immediate future the activities are concentrated on servicing the industry in the nearby town of Tirupur where a service centre will soon be established. Consultancy services to the Bangalore apparel industry will also be taken up soon.

The organizational structure of SITRA's knitting section is relevant. The project leader reports directly to the Managing Director of SITRA and participates in all decision making meetings, including in the yearly meeting for establishing the Centre's work programme.

Output No. 2

"A suitably equipped research and development facility for product development and testing, and for development work on instruments and machine accessories for fabric, garment and finishing industries".

Adequate machinery and laboratory instruments and spare parts were installed at SITRA. Additional equipment as specified by UNIDO experts and essential spares for the rib jacquard machine and the steamer as specified by the respective erectors has also been provided. The equipment was found to be in excellent and working condition.

The Venor Table Top Tufting Machine, however, is in an unacceptable rusty state and advice from the supplier is awaited before the equipment is legally transferred to the Government of India.

Output No. 3

"A long-term research and development programme".

25 long-term research projects were undertaken during the Phase I as well as Phase II of this project. Out of these, 8 projects are under progress and are expected to be completed before the end of 1984 or in the beginning of 1985. The research projects are listed in Annex II.

Some of the earlier research reports are already outdated. It is recommended to include follow-up studies on these reports in the future R+D programme for the knitting industry where relevant and necessary. It is also recommended to give wide publicity to the results of the completed projects e.g. in SITRA seminars.

Output No. 4

"Syllabi and course material for practical training courses in modern knitting methods of setting, operation and maintenance of existing equipment, in management and quality control techniques, in garment making, and in improvement and control of fabric finishing using existing equipment".

Syllabi and course material for short-term training programmes were prepared for the following disciplines:

- i) circular knitting;
- ii) hand flat knitting;
- iii) pattern making and grading;
- iv) advanced finishing techniques;
- v) finishing for beginners.

Annex III provides the details of the training activities. Some 237 participants attended 12 courses. Many enterprises sent more than one staff member to the training courses and seem to have benefitted from the expertise given. In particular the courses conducted by UNIDO experts in dyeing, finishing and garment making were successful. It is recommended to invite foreign technicians from manufacturing companies for a series of additional courses. A continuous course programme should be encouraged.

Outout No. 5

"Development of new instruments and machine accessories to assist in the production of articles with improved characteristics, low fault rates and increased performance by a more efficient and reproducible use of manufacturing equipment".

The following machinery/equipment have been designed and developed:

- i) Course length tester;
- ii) Electronic yarn speed meter;
- iii) Fabric extension meter;
- iv) Positive feed for circular knitting machines.

The following machines/equipment are under development:

- i) Raising machine for knitted fabrics (evaluation under progress);
- ii) Fabric inspection machine (drawings completed, fabrication will start shortly);
- iii) Weft knitting machines with high speed.

The industry increasingly adopts the new developments. In particular the advantages of the positive feed device are gradually appreciated. Its price, however, (Rs 4,000) compared to a new knitting machine (Rs 23,000) causes a slow general acceptance.

Output No. 6

"Recommendations to industrial units relating to improved yarn, fabric, making-up and dyeing and finishing routines".

Recommendations have been made to the spinning industry in the manufacture of knitting yarns of superior quality. Norms have been fixed for fibre quality as well as yarn quality. Guidelines to the manufacture of sewing threads have been finalised. The knitting, garment making and the finishing industries are being continuously advised regarding improvements in productivity and quality. In all about 100 consultancy assignments have been undertaken and 12 feasibility reports have been prepared and distributed (see Annex IV).

The introduction of efficient fabric utilization in the cutting rooms of many factories resulting in 40-50% savings in waste was one of the most successful contributions of the UNIDO/UNDP programme.

Recommendations were given to dyeing and finishing factories, resulting in the adoption of modern processing techniques and in some cases in installations of modern low liquid ration dyeing machines.

Output No. 7

"Selected Applied Research Studies".

Research and development is being carried out on a continuous basis. Some details are given under Output No. 3. At least 20 research papers have been published based on work carried out in this regard (see Annex V).

Again it is recommended to give wide publicity to the work done for which seminars and conferences are possibly the most effective way. SITRA has an enormous goodwill and is known to be reliable and the best possible source of know-how in South India. Since so much know-how is available all efforts should be put into further dissemination.

6. Inputs

Equipment

All equipment initially planned was delivered and based on the recommendations of Dr. Burnip, made during his technical evaluation in 1981 additional equipment was supplied. During the Tripartite Review Meeting of October 1981, some modifications were made in the equipment list. At the end of the project all equipment has been delivered and installed.

On the Government side all the equipment planned was delivered during the first year of the project [see Annex VI (a) + (b)] 7.

Expertise

Four international experts were fielded and the UNIDO consultant, Dr. Burnip, reviewed Phase-I and the progress of Phase-II on short-term technical review missions.

A list of the experts and their main duties are given in Annex VII.

Fellowships

In Phase-I three national technicians were trained abroad. In Phase-II five fellows received training abroad. The programmes were well designed and coached by Dr. Burnip. Upon their return to the project the fellows proved to be capable to carry out their respective duties independently.

Two additional fellowships were created during the Terminal Tripartite Review Meeting in September 1983.

A list of the fellowship training is attached in Annex VIII.

7. Plans for Future Activities

According to the Draft Terminal Technical Report of the Project Director the following subjects call for further attention in the near future:

- (a) The quality of cotton knitting yarns spun in India has tremendous scope for improvement. Guidelines as to the selection of the right type of fibres and processing parameters have been established by SITRA and this know-how has been transferred on to the industry;

- (b) The cotton knitting industry in India, till a few years ago, was producing only low quality underwear fabrics is now diversifying its products into underwear and outerwear garments of quality;
- (c) The chemical finishing sector of the knitting industry is still backward and only in the last year on guidance from SITRA a few entrepreneurs have taken steps to incorporate sophisticated finishing machines and modern processing technology in their finishing plants;
- (d) The garment making sector lacked proper lay planning and production control methods. SITRA has successfully been providing expertise in areas like pattern making and grading, selection of sewing machines, sewing threads, etc. SITRA will advise the garment industry in other locations as well;
- (e) The quality of the knitted fabrics and garments exported are further to be improved. Quality standards established by the national ISI and other concerned organizations will have to be brought upto the level of international standards;
- (f) The trade associations determine whether knitting or garment making will have to be encouraged to show more initiative and interest in improving the technical levels of their member organizations.

8. Recommendations

In addition to SITRA's own list of subjects for further studies and activities to be carried out to support the cotton knitting industry as listed in the chapter recommendations in the Project Director's Draft Terminal Technical Report the following is recommended:

- In view of the rapid developments in knitting, garment and dyeing/finishing technologies SITRA regularly should assess the needs for updating its technological capabilities and take the necessary remedial actions, if necessary, through UNIDO/UNDP;

- It has been observed that the assistance to the industry is being rendered on an ad-hoc basis whenever it is requested by the industry. A proper mechanism should be developed for a more systematic way of providing services to the industry;
- It is also recommended to actively disseminate the results of research studies and technical developments through publicity, seminars and training programmes;
- The establishment of closer contacts with other similar organizations are recommended thus receiving impulses for further research activities, opening opportunities for co-ordinated national programmes and avoiding duplication of activities;
- Authorization by the Tamil Nadu Government of the envisaged "Diploma" courses in knitting at SITRA should be strongly encouraged;
- It is recommended that following the demand from the industry management oriented training courses should be included in the training programme;
- In view of the fact that the National Project Director, Dr. Sivakumar, is now acting as Assistant Director responsible for the Mechanical Processing Division at SITRA and as such is unable to devote all his time to the knitting section should be assisted by a research worker in knitting technology actir a section head. Only then the knitting section will ge attention it needs for carrying out the intended R + D programmes and the dissemination proposed;
- It is further recommended that as a follow-up activity of the now terminated project the knitting section of SITRA determines the objectives and related outputs for self-implementation. This will appear to be of great help during the envisaged UNIDO/UNDP post evaluation exercise after two years.

ANNEX I

NATIONAL STAFF

Post No.	Name of Incumbent	Post Description	Full/Part Time
<u>Phase I</u>			
1.	--	Project Leader (vacant)	Full
2.	K.T. Thomas	Technologist	"
3.	T.M. Krishna Varma	"	"
4.	R. Ramamurthy	"	"
5.	M.S. Balakrishnan	"	Part
6.	R. Rajendran	Technical Assistant	"
7.	S. Srinivasan	" "	"
8.	R. Mohan	" "	"
9.	A. Rajagopalan	Typist/Clerk	"
10.	D.S. Menon	Technical Service	Full
11.	K. Radhakrishnan	" "	"
12.	R. Govindarajulu	Staff Car Driver	Part
<u>Interregnum Phase</u>			
1.	Dr. V.R. Sivakumar	Project Leader	Full
<u>Phase II</u>			
1.	Dr. V.R. Sivakumar*	Project Leader (textile technologist)	Full
2.	T.M. Krishna Varma*	Technologist	"
3.	R. Ramamurthy*	"	"
4.	D. Venkatapathy*	"	"
5.	N. Lakshmi Narasimhan*	"	"
6.	S. Govindarajan*	Head of Engineering Dept.	"
7.	K. Krishnamoorthy*	Technical Assistant	"
8.	S. Kadirvel*	" "	"
9.	M.S. Balakrishnan**	Technologist	Part
10.	R. Rajendran**	Technical Assistant	"
11.	S. Srinivasan**	" "	"
12.	Vijayalakshmi (Mrs.)**	" "	Full
13.	D. Vadivel (parted)**	" "	"
14.	R. Mohan	Statistical Assistant	Part
15.	A. Rajagopalan	Clerk/Typist	"
16.	P. Nagarajan	Technical Service	Full
17.	J. Rajendran	" "	"
18.	K.R. Ramaswamy	" "	"
19.	R. Balakrishnan	" "	"
20.	H. John	Staff car driver	Part

* - Fellows trained abroad.

** - Fellows received in-house training.

ANNEX II

LONG TERM RESEARCH PROJECTS

A number of long term research programmes were carried out during the course of this project.

Three major long term research projects were completed during Phase I. These are:

1. Techno-economic feasibility of using spun yarns for warp knitting.
2. Chemical finishing of spun yarns for improved knitting performance and yarn friction in knitting.
3. The effect of moisture content and waxing of yarn and their performance in knitting single jersey fine gauge fabric.

The following major long term research projects were completed during Interregnum Phase.

1. Dimensional stability of knitted fabrics - Phase I.
2. Survey of the quality of knitting yarns.
3. Study on use of mercerised single yarns for knitting
4. Development of positive feed device for weft knitting.
5. Studies to improve bleaching in small process houses.

The following 17 research projects were either completed or in progress during Phase II of the project. They are:

1. Techno-economics of open-end yarns for knitting.
2. The influence of yarn faults on knitting performance and properties of knitted fabrics.
3. Dimensional stability of knitted fabrics - Phase II.
4. The effect of yarn twist parameters on properties of plain circular knitted fabrics.
5. The effect and cost of fabric faults in garment manufacture - cotton knitted underwear.
6. A survey of the quality of knitting yarns - II survey.
7. Fibre quality requirements for yarns and knitted fabrics.
8. A study of the properties of knitted fabrics made from polypropylene and its blends.

9. Development of raising machine for knitted fabrics.
10. Study of the properties of knitted fabrics made from acrylic and its blends.
11. Study of the quality of sewing threads.
12. An investigation of dimensional stability of rib fabrics.
13. Design and development of weft knitting machine with high speed cams to achieve a high production rate.
14. Study to improve the dimensional stability of knitted outerwear by different processes.
15. Development of thermal underwear.
16. Investigation of the behaviour of cotton sewing threads during sewing with particular reference with twist and twist direction.
17. Effect of ambient atmospheric conditions on the knitting of yarns and the properties of knitted fabrics.

The expertise gained by SITRA by way of the above mentioned research projects have been passed on to the spinning, knitting, chemical finishing and the garment making industries by publishing research papers and organising technical seminars. A list of papers were published and talks were given in this regard. SITRA is also represented in various committees connected with the knitting industry formed by Government of India.

ANNEX III

LIST OF TRAINING PROGRAMMES

<u>Title of Programme</u>	<u>Duration</u>	<u>No. of</u>	
		<u>Batches</u>	<u>Participants</u>
1978-79			
1. Executive development programme for the knitting industry	10 days	2	61
2. Training on hand flat knitting machines for a staff from Polytechnic	6 days	1	1
3. Training on hand flat knitting machines for Khadi and Village Industries	1 month	1	3
4. Training on hand flat knitting machine - Society for the aid of handicapped children	2 months	1	3
1980-81			
1. Knitting technology	8 days	1	25
2. Hand flat knitting	3 months	1	3
1981-82			
1. Knitting technology	8 days	2	50
2. Pattern making and grading	10 days	2	27
3. Garment assembly techniques	2 days	1	10
1982-83			
1. Garment assembly techniques	2 days	1	4
2. Training course in advanced finishing technology	5 days	1	22
3. Training course in finishing for beginners	5 days	1	23
Total	12	15	237
=====		==	===

Note: These training programmes cover 80-100 factories.

ANNEX IV
CONSULTANCY SERVICES

	<u>No. of cases</u>
<u>1976-77</u>	
1. Improving yarn appearance and reducing yarn faults in sewing threads	2
2. Improving yarn appearance of hosiery yarns	2
3. Manufacture of tubular fabric for artificial heart valves and blood vessel grafts	1
4. Experiments on different types of waxing on knitting performance	2
5. Possibilities of diversification of products for improving flat knitting garment industry's performance	1
6. Manufacture of stretch fabrics on knitting	1
7. Establishment of flat knitting unit	1
8. Causes for shrinkage and holes in banians	1
9. Chemical finishing to knit goods	1
10. Suggestion to remove oil stains on knitted garments	1
11. Waxing and Kerosene treatment for knitting yarns	2
12. Manufacture of knitted outerwear garments	1
13. Performance of waxed and unwaxed 40s combed hosiery yarn on circular knitting	2
<u>1977-78</u>	
1. Problems in waxing yarn during winding	1
2. Viscose-cotton blend yarns for underwear and outerwear garments	1
3. Bleaching procedure of knitted goods	1
4. Knittability of 2/80s mercerized yarn	1
5. Manufacture capability of various products on existing knitting machines and finishing facilities available	1

	<u>No. of cases</u>
6. Changing of desings for Raschel looms - suggestions for improving production and fabric quality	1
7. Effect of steam conditioning on hosiery yarns	1
8. Factors to be taken into account before going for manufacturing Terene blended knitted garments	1
9. Manufacture of raised weft knitted fabrics for making sweat shirts	1
10. Knittability of silk yarns on circular and flat knitting machines	2
11. Preparation of knitted cuffs for operating gowns and heat setting of warp knitted patch cloth	1
12. Possibilities of starting warp knitting and flat knitting units	3
13. Tubular mercerizing of single jersey fabrics, slit opening and gumming of knitted fabrics for printing, reducing shrinkage in knitted fabrics	1
14. Improvement in quality of hosiery yarn	1
15. Causes of waviness in knitted fabrics	1

1978-79

1. Analysis of given circular knitted fabrics for its defects and suggestions to avoid such defects	3
2. Manufacture of hosiery yarn-processing particulars, steam conditioning and waxing methods	1
3. Analysis of hosiery yarn samples	3
4. Analysis of hosiery yarn samples for defects and suggestions for improvement in quality	1
5. Analysis of circular knitted sample fabric for design and suggestion to reproduce the fabric	1
6. Knittability of polypropylene yarn	1
7. Knittability of Khadi yarn	1
8. Knittability of silk yarn	1
9. Use of synthetic yarn for manufacturing outer garments	1

	<u>No. of cases</u>
10. Testing equipment suitable for knitting	1
11. Details of circular knitting machinery and their selection	1
12. Suggestions to improve the performance of knitting machines	2
13. Suggestions to start a knitting complex	1
14. Application of fabric geometry of the manufacture of knitted fabric	1
15. Details of warp knitting machinery and their selection	1
 <u>1979-80</u>	
1. How to improve knitting performance of yarn	1
2. Effective structure of knitted fabric	1
3. Comparison of fabrics knitted with and without positive feed	1
4. Problems encountered in knitting yarns containing viscose and/or polynosic	1
5. Analysis and assessment of knitted fabrics	1
6. Knitting trials on polyester-Viloft dyed yarn	1
7. Assessment of hosiery yarn	5
8. Suggestion on selection of suitable machinery for knitting	1
9. Setting up of testing and quality control laboratory for knitting industry	1
10. Specification of machine and yarn to manufacture hand gloves	1

No. of cases1980-81

1. Manufacture of yarn suitable for hosiery	1
2. Assessment of hosiery yarn	1
3. Assessment of knitting performance of yarns and manufacture and improvement in quality.	18
4. Analysis of knitted fabric samples and guidelines for manufacture and improvement in quality.	7
5. Suggestions regarding the development of hosiery industry	1
6. Feasibility of setting up of a warp knitting unit for terry-fabrics	1
7. Improvements in the design of stop motions	1
8. Problems in knitting and finishing of fabrics containing blends and rayon	2
9. Planning and erection of a hand flat unit and training of personnel	1
10. Suggestions on the selection of machinery for knitting socks	1
11. Setting a raising machine for processing knitted fabrics	1

1981- 82

1. Quality of knitting yarns	2
2. Analysis of fabric defects	2
3. Testing of fabrics and methods of improving their dimensional stability	7
4. Assessment of knitting performance and suggestions to improve yarn quality	6
5. Production of new types of fabrics and selection of suitable machines	18
6. Manufacture of knitted garments	1
7. Suitable lubricants for knitting	2
8. Removal of oil stains from fabrics	

<u>1982-83</u>	<u>No. of cases</u>
1. Manufacturing of hosiery yarn	2
2. Hosiery yarn quality	2
3. Optimum twist levels in hosiery yarns	1
4. Black specks in hosiery yarn	1
5. Assessment of knitting yarns	5
6. Analysis of knitted fabrics	4
7. Analysis of knitted fabric defects	2
8. Assessment of knitting performance, problems in warp knitting	7
9. Testing of fabrics for their dimensional stability	3
10. Production of new type of knitted fabrics and selection of machines	10
11. Mercerisation of knitted goods	2
12. Evaluation of sewing thread	2
13. Design and production of garments	8

Note: These cases concerned work in 80-100 different factories.

ANNEX V

PAPERS PUBLISHED/TALKS GIVEN

PHASE I

1. Techno-economic feasibility of using spun yarns for warp knitting
Proceedings - 15th Jt. Tech. Confe. ATIRA 1975.
Pillay K.P.R. + Ranganathan K.

In January 1977 a technical seminar entitled "Get-together of Spinners and Knitters" was organised and the following papers were presented:

1. Knitting developments - its functions and aims
Moltu K.P. (UNIDO Knitting Technologist)
2. Effect of waxing and moisture on knitting performance
Shankaranarayana K.S. + Thomas K.T.
3. Bleaching of cotton knits
Padmanabha Prasad G.
4. Yarn quality requirements for knitting
Ramani N. + Sripathi R.

INTERREGNUM PHASE

1. Diversification of products of circular knitting industry by use of mercerised yarns
19th Jt. Tech. Confe. ATIRA, 1978.
Shankaranarayana K.S., Sivakumar V.R., Varma T.M.K.
2. SITRA's work in the field of knitting
Joint Meeting - Executive Committee of Hosiery Association, West Bengal
Shankaranarayana K.S.
3. Problems in using yarns from cotton blends with regenerated cellulosic fibres in knitting
Conference organised by Textile Association (India) at Coimbatore, 1979
Sivakumar V.R., Shankaranarayana K.S., Varma T.M.K.
4. A survey of the quality of knitting yarns - I Survey
20th Jt. Tech. Confe., SITRA, 1979
Sivakumar V.R. and Varma T.M.K.

5. Shrinkage control of cotton and cotton blended knit goods
Hosiery Workshop-cum-Seminar conducted by the Bengal Hosiery
Manufacturers' Association, Calcutta, 1979
(Also published by Textile Asia, Vol. XI, No. 1, 1980)
Varma T.M.K., Pillay K.P.R., Sivakumar V.R.
6. Positive feed for weft knits
Hosiery Workshop-cum-Seminar conducted by the Bengal Hosiery
Manufacturers' Association, Calcutta, 1979
(Also published by Textile Asia, Vol. XI, No. 1, 1980)
Ramamurthy R., Pillay K.P.R., Govindarajan S., Sivakumar V.R.
7. Studies to develop bleachline operations of knit goods
in small process houses
SITRA Report, 1979
Padmanabha Prasad G.
3. Secrets of good knitting
Textile Institute (South India Branch), Coimbatore, 1979
Sivakumar V.R.

PHASE II

1. Wear trials on knitted fabrics from blends of cotton
and viscose staple fibre
17th Tech. Confe., SITRA, 1981
Badami P.K., Sivakumar V.R.
2. Focus on knitters quality control
Seminar on Textile Industry organised by Malaysian Textile
Manufacturers' Association at Kuala Lumpur, Malaysia,
18 and 19 September 1981
Sivakumar V.R.
3. Influence of yarn faults on knitting performance and properties
of knitted fabrics
23rd Jt. Tech. Confe., SITRA, 1982
Pillay K.P.R.
4. Fibre quality requirements for knitting yarns and knitted fabrics
SITRA Research Report, 1982
V.R. Sivakumar
5. Diversification of knitted fabrics
Seminar organised by District Sma-1 Industries Centre
of Government of Tamil Nadu at Tirupur, 1982
Varma T.M.K.

6. A study on fibre and yarn quality requirements for knitting
24th Jt. Tech. Confe., SITRA 1983
Sivakumar V.R., Varma T.M.K.

7. A survey of the quality of knitting yarns - II Survey
SITRA Research Report, Vol. 28, No. 2, 1983
Varma T.M.K., Sivakumar V.R.

ANNEX VI (a)

UNDP NON-EXPENDABLE EQUIPMENT

All the UNDP non-expendable equipment were acquired under Phase II

<u>S. No.</u>	<u>Description</u>	<u>Quantity</u>
1.	Yarn length counter	1 no.
2.	Yarn speed meter	1 no.
3.	Intermediate rib jacquard machine	1 no.
4.	Table top tufting machine	1 no.
5.	Cubex washing machine	1 no.
6.	2-needle safety stitch 5 thread machine	1 no.
7.	Flat lock machine - 3 needles	1 no.
8.	Chain stitch machine	1 no.
9.	Socks knitting machine	1 no.
10.	Hand held rotary fabric cutter	1 no.
11.	Reciprocating hand held fabric cutter	1 no.
12.	Hatra sewability tester	1 no.
13.	Flat lock machine - 2 needles with collarette attachment	1 no.
14.	Overlock machine - 2 needle 4 thread	1 no.
15.	Linking machine - 4 gauge	1 no.
16.	Fibre analysis knitter	1 no.
17.	Single jersey machine - 4 track	1 no.
18.	Laboratory type fabric jet dyeing machine	1 no.
19.	Laboratory steamer	1 no.
20.	Laboratory package dyeing machine	1 no.
21.	Transfer printing press	1 no.
22.	Polymat dyeing apparatus	1 no.

ANNEX VI (b)

NON-EXPENDABLE EQUIPMENT ACQUIRED BY SITPA
(Government of India Input)

<u>S. No.</u>	<u>Description</u>	<u>Quantity</u>
<u>PHASE I</u>		
1.	Hand flat knitting machine 12 gg, 40" width	1 no.
2.	Hand flat knitting machine 8 gg, 40" width	1 no.
3.	Hand flat knitting machine 5 gg, 40" width	1 no.
4.	Single jersey machine 24 gg, 17" dia.	1 no.
5.	Single jersey machine 24 gg, 1" dia.	1 no.
6.	Interlock machine 24 gg, 17" dia.	1 no.
7.	Wheel jacquard machine 14 gg, 24" dia.	1 no.
8.	Yarn speed meter	1 no.
9.	3 bar Tricot knitting machine 24 gg, 32" width compound needle with warper (obtained under Colombo Plan before commencement of the UNDP project)	1 no.
<u>INTERREGNUM PHASE</u>		
1.	Hand operated half hose machine (Griswold type)	1 no.
2.	Single jersey machine 24 gg, 16" dia. with positive feed device	1 no.
3.	Positive tape yarn feed unit - fitted to 24 gg, 17" dia. machine acquired under Phase I.	1 no.
4.	Tumble dryer	1 no.
5.	Industrial washing machine	1 no.
6.	Hydro extractor	1 no.
7.	High temperature high pressure steam boiler with automatic controls	1 no.

<u>S. No.</u>	<u>Description</u>	<u>Quantity</u>
8.	Overlock machine - 3 thread	1 no.
9.	Rib machine - 14 gg, 16" dia.	1 no.
10.	Lock stitch machine - domestic type	1 no.
11.	Electronic yarn tension meter	1 no.
12.	Course length tester	1 no.
13.	Fabric extension meter	1 no.
<u>PHASE II</u>		
1.	Air conditioning plant for the knitting area	
2.	Hand flat knitting machine 8 gg, 40" width	1 no.
3.	Single jersey machine 20 gg, 10" dia. with SITRA-Knitmac positive feed	1 no.
4.	SITRA-Knitmac positive feed units	2 nos.
5.	Course length tester	1 no.
6.	Electric iron	1 no.
7.	Rib machine 16 gg, 2 tracks, 10" dia. with SITRA-Knitmac positive feed	1 no.
8.	Industrial sewing machine	6 nos.
9.	Fabric cutting table	1 no.
10.	Air compressor	1 no.
11.	Fabric inspection machine	1 no.
12.	Flat lock machine - 2 needle with folder	1 no.
13.	Designers' dummy	5 nos.
14.	Simac hand flat machine	1 no.
15.	Balance 2 kg capacity	1 no.
Building:	Knitting division - Phase I	Area 100' x 60'
	Additions (for chemical processing)- Phase II	Area 60' x 55'

ANNEX VII

LIST OF EXPERTS AND THEIR MAIN DUTIES

S. No.	Name, Discipline and period	Duration months	Contribution
<u>PHASE I</u>			
1.	K.P. Meltu Knitting (Oct. 1975 to March 1977)	18	Help in setting up a knitting section at SITRA, assistance in the selection of indigenously manufactured knitting machines and the basic training of SITRA staff in knitting.
2.	Dr. M.S. Burnip Consultant (January - February 1977)	1	Review of the Phase I of the project. Recommendations for future work.
<u>INTERREGNUM PHASE</u>			
1.	Dr. M.S. Burnip Consultant (July - August 1980)	1	Review of the progress made and preparation for Phase II, finalisation of the UNDP input machineries.
<u>PHASE II</u>			
1.	Hans L. Sterenberg Training in knitting (January - April 1981)	1	Help in the identification of training areas and in the formation of syllabus for short term training programmes. Conducted training programmes.
2.	Ms. Verka P. Boeva Chemical finishing to knitted fabrics (i) (May - June 1981)	2	Orientation to the existing conditions prevailing in the industry in India. Identification of the areas and places for the training of UN fellow in dyeing and finishing. Selection of finishing equipment.

S. No.	Name, Discipline and period	Duration months	Contribution
(ii)	Ms. Verka P. Boeva (January - May 1983)	4	Identification of research projects in chemical finishing. Identification of training areas. Formation of the syllabus for training programmes. Post fellowship training of the UN fellow.
3.	Ms. Beverley D. Dickson Garment technology (November 1981 - April 1983)	6	Post fellowship training of UN fellow in garment making and other associated SITRA staff. Selection of garment making machines. Consultancy. Short term training programmes in pattern making and grading and garment assembly techniques.

ANNEX VIII

FELLOWSHIPS TRAINING AND STUDY TOURS

S. No.	Name and Period	Duration months	Area of training and countries
<u>PHASE I</u>			
1.	T.M. Krishna Varma (Oct. 1975 - Oct. 1976)	12	Industrial training in warp and weft knitting (U.K., Switzerland)
2.	R. Ramamurthy (April 1976 to Sept. 1977)	16	Training in warp and weft knitting. Post graduate diploma course in knitwear technology at Leicerter Polytechnic, U.K. (West Germany, Switzerland, U.K.)
<u>INTERREGNUM PHASE</u>			
1.	Dr. V.R. Sivakumar (Sept. 1978 - March 1983)	6	Visits to manufacturers and R+D organizations specialising in warp knitting, weft knitting and garment making. Visit to ITMA 79 in Hannover, West Germany (West Germany, U.K., Switzerland)
<u>PHASE II</u>			
1.	D. Venkatapathy (i) (Sept. 1980 - Aug. 1981)	11	Post graduate diploma in clothing technology at Manchester Polytechnic, U.K. Industrial training in garment making factories in U.K. Visit to clothing machinery and garment exhibitions (U.K., France)
	D. Venkatapathy (ii) (Oct. - Nov. 1982)	1	Erection and maintenance of sewing machines at Rockwell-Rimoldi S.p.A., Italy. Visit to clothing machine and knitting machinery accessories and spares' exhibition at Milan, Italy.

S. No.	Name and Period	Duration months	Area of training and countries
2.	N. Lakshmi Narasimhan (Feb. - Aug. 1982)	6	Dyeing and finishing of knitted fabrics at Shirley Institute, Manchester. Visits to dyeing and finishing factories and manufacturers of finishing machines (U.K., France)
3.	S. Govindarajan (April - Oct. 1982)	6	Visits to manufacturers of warp and weft knitting and garment making and finishing machines. Visit to "Clothing Machinery Accessories and Spares" exhibition at Milan. (West Germany, Switzerland, U.K., Italy)
4.	K. Moorthy (November 1983)	1	Visit to knitting machine manufacturers in U.K. for additional training on hosiery machines and stripe fabric machines.
5.	S. Kadirvel (November 1983)	1	Visit to Italian machine manufacturers to study tubular mercerizing of knitwear and crochet knitting technology.

ANNEX IX

UNITED NATIONS DEVELOPMENT PROGRAMME

INDIA

TERMINAL TRIPARTITE REVIEW REPORT

IND/76/023 - Diversification and Development of New Fabrics
(SITRA, PHASE II)

(July 1980 - September 1983)

INTRODUCTION

The terminal tripartite review of the above project was held at SITRA (South India Textile Research Association) at Coimbatore on 26 and 27 September 1983. The meeting was attended by the following:

Department of Economic Affairs

1. Mr. C.K. Ramachandran, Under Secretary.

South India Textile Research Association

1. Mr. T.V. Ratnam, Director
2. Dr. V.R. Sivakumar, Assistant Director/Project Leader
3. Mr. R. Ranga Rajan, Secretary-cum-Administrative Officer

UNIDO

1. Mr. Martin Minke, Industrial Development Officer, UNIDO, Vienna.

UNDP

1. Mr. Tilak R. Maakan, Programme Officer
2. Mr. S. Ramamurthy, Assistant Programme Officer.

The terminal tripartite review meeting on 27 September 1983 was preceded by field visits on 26 September by the participants to the following industrial units at Coimbatore and Tirupur (about 50 KM from Coimbatore), receiving technical assistance through SITRA under the above project. These are:

1. Knitting and Machinery Works,
Ganapathy, Coimbatore.
Manufacturers of knitting machines and accessories.
(Licensee of the SITRA-Knitmac Positive feed device).
2. Arun Sewing Threads,
Tirupur.
Manufacturers of sewing threads.
3. Jay Jav Mills,
Tirupur.
Commission knitters and manufacturers of knitted
underwear garments.
4. Okay Textiles,
Tirupur.
Manufacturers of knitted garments.
5. Spy Knitters,
Tirupur.
Manufacturers of knitted underwear and outerwear
garments.
6. Gentex,
Tirupur.
Manufacturers of knitted outerwear garments.
7. Reliance Textiles,
Tirupur.
Commission dyeing and finishing of knitted fabrics.

The visits were organized by SITRA and the concerned officials accompanied the participants. The purpose of these visits was to have inter-action with the industrial units receiving technical assistance from SITRA with a view to assess the impact of the project activities and to obtain any feedback relevant to project operations and suggestions for utilization of project results.

The participants were highly impressed by the unanimous response of all the industrial units with regard to the facilities created with the assistance of UNDP/UNIDO and being provided by SITRA for development of cotton and blended hosiery and knitwear industry in the region. The industrial units visited greatly benefitted from the assistance provided by the project in the areas of dyeing, finishing, garment making, pattern making and grading, and trouble shooting. The training facilities provided by SITRA and utilized by the personnel of these industrial units were highly appreciated by the industrialists. In one case the participants were informed that, as a result of the project's efforts the unit was able to diversify its products from underwears to outerwears and also was able to enter the export market. The assistance from SITRA also helped the industries in the reduction of waste and improvement of the quality of yarns. One of the units visited informed the participants that as a result of the assistance received from SITRA they were able to increase their production of quality yarns, the demand for which had considerably increased beyond their production capacity.

However, some of the industrialists pointed out that there was a great need for upgrading their know how in knitting technology. One of the industrial units suggested that the training courses organized by SITRA should lay more emphasis on the management aspect in order to equip the small scale entrepreneurs to be able to run the industry on scientific lines. More than one industrial units expressed the necessity for establishment of a service centre at Tirupur where 35-40% of the cotton knitwear industry is concentrated. The participants were informed that out of the remaining 60%, 50% was in the eastern region (West Bengal) and approximately 10% in other regions of India.

On the morning of 27 September 1983, the participants had an opportunity to visit the laboratories, workshop and the training division at SITRA. All items of equipment costing approximately US \$ 270,000 (except one item) have been received at the project site, installed and are being extensively used. The government provided equipment is also in position and is operational.

SITRA has established excellent infrastructural facilities and organizational structure to provide training and consultancy at all levels which will be further expanded. The new building for carrying out training activities has been added to the existing facilities where trainees from various parts of the country attend training courses organized by SITRA. One of the training programmes for trainees from Andhra Pradesh was in progress when the participants visited the training branch.

The formal terminal tripartite review meeting was held at 11 a.m. on 27 September 1983. The approved project document, the report on the last tripartite review held in October 1981, the draft terminal report prepared by the project authorities and the project evaluation report were used as source of reference.

Mr. T.V. Ratnam was requested by the participants to chair the meeting and conduct the proceedings.

Mr. Ratnam extended a hearty welcome to the participants and highly appreciated the keen interest taken by the Government of India and UNDP/UNIDO in the implementation of this project of great significance to the cotton textile industry in the Southern region in particular and to India in general. He requested Dr. Sivakumar to briefly outline the achievements of the project.

Dr. Sivakumar informed the meeting that SITRA started with a membership of approximately 40 mills which has now grown up to more than 200 mills. These mills are located at different places in the country. The meeting was informed that 50% of the total revenue expenditure of SITRA is contributed by the members and the remaining 50% comes from the Government of India as grant. This clearly demonstrates the industry's active participation and interest in the activities of SITRA. In return, SITRA provides consultancy services to the textile mills and has gained the confidence of the industry in meeting their requirements. The geographical situation of SITRA limits its scope of activities to mostly the Southern region whereas there is demand for such facilities particularly from the eastern region where more than 50% of the cotton hosiery industry is concentrated. As mentioned above the West Bengal Hosiery Manufacturers' Association is in touch with SITRA for establishing a similar centre in that region.

In response to a query from one of the participants, the meeting was informed that the total consumption of spun yarn in the country had gone up from 32 million kgs. in 1977-78 to 60 million kgs. in 1981-82. This indicates the enlargement in the scope of the cotton knitting industry and the resultant increased demand on the services of SITRA particularly in the Southern region.

A detailed discussion took place with regard to the achievement of the stated immediate objectives of the project. As a result of co-ordinated efforts during the implementation of this project, the training division has been strengthened by establishing training courses in areas such as circular knitting, hand flat knitting, pattern making and grading, advanced finishing techniques, etc. Detailed syllabi has been prepared for such courses. Eight training programmes were conducted during this period in which approximately 170 trainees from about 60 to 70 industrial units were trained by SITRA staff who had undergone specialized training abroad under fellowships sponsored by UNDP/UNIDO under this project. These trainees included not only the technicians from the industrial units but also entrepreneurs themselves. An excellent capability has been established at SITRA for providing training courses in the areas mentioned above. The technical capabilities of the SITRA scientists trained abroad are of high quality and the assistance rendered by them is being highly appreciated by the industry.

Approximately 25 R&D projects were initiated during this period out of which 17 have already been completed and 8 projects are at various stages of implementation. The latter are expected to be completed towards the end of 1984 or early 1985. SITRA has conducted several feasibility studies and prepared technical/survey reports for the knitting industry.

The scope and nature of these reports are varied and the quality is of high standard (some of these reports have already been circulated to UNDP/UNIDO Headquarters and the Government of India). The meeting was informed that 20 research papers were published by the scientists of SITRA.

With regard to the technical assistance to the industry, a cell with competent staff has been established which has rendered assistance to the cotton textile industry not only in Southern region but also in other regions including some consultancy assignments in Malaysia and Sri Lanka.

Based on the activities of the project it can be said with confidence that the project has achieved its objectives. These efforts in the achievement of the immediate objectives has created a capability in SITRA to assist the industry in the diversification of products and produce goods of high quality acceptable in international markets which will result in the increased exports in the years to come and is expected to contribute towards the achievement of the development objective.

In the process of implementation of this project and the achievement of project objectives the project has produced the required outputs listed in the approved project document. A team of 6 scientists has been trained abroad which have assumed the role of trainers and are providing training to the personnel from the textile industry and on the job training to SITRA staff. These staff members are also rendering consultancy services to the industry in the areas of knitting, garment making, dyeing and finishing. The R&D facility with imported and indigenous equipment and qualified staff has been established. The programme of work for development of new products/instruments is in progress. SITRA has now the capacity for development of new products,

providing testing facilities and consultancy services. The details on this output have been mentioned in the preceding paragraphs. As a result of SITRA staff's training abroad and the services of experts engaged under UNDP programme, a long term research and development programme has been prepared. SITRA has the capacity to expand its activities and assurances were given that these activities will be continued after the conclusion of the UNDP-assisted project. As will be noticed from the draft terminal report and the UNIDO project evaluation report (Terminal Assessment), syllabi and course material for practical training in modern knitting methods, operation and maintenance of existing equipment, maintenance and quality control techniques, garment making and in the improvement of fabric finishing with existing equipment have been developed. The statistics with regard to the number of training courses, participants and the number of units who received assistance have been mentioned in the preceding paragraphs.

Vigorous efforts have been made in the development of new instruments and machine accessories to assist in the production of articles with improved characteristics. 5 new or improved machinery and instruments 1) Fabric extensio meter 2) Positive feed for circular knitting machines 3) Raising machines for knitted fabrics 4) Fabric inspection machine and 5) Weft knitting machine with high speed cams. Four more products i.e. Positive feed device has been licenced for commercial manufacture and a local factory has already undertaken production. During the course of field visits the participants were informed that this production unit has on hand orders not only from India but from one of the developing countries, a number of consultancy assignments to industrial units in the areas of improved yarn and fabric, making up and dyeing and finishing have been rendered during the implementation of the project. A strong consultancy cell has been

been established at SITRA which will continue to render these services to the industry. In conclusion, it can be said with confidence that the project has achieved its stated objectives and produced the required outputs.

IMPLEMENTATION

The project with UNDP input of \$ 259,300 was approved in December 1979 with the estimated starting date of April 1980. The actual field operations commenced in July 1980. Based on the recommendations of the last tripartite review meeting held in October 1981, the duration of the project was extended upto 31 December 1982. The present approved UNDP allocations to this project is \$ 426,079. The increase of \$ 166,779 (approximately 65%) is due to procurement of items of equipment as recommended by the consultants and strengthening of training component well justified to achieve the stated objectives. As will be observed from the subsequent paragraphs, the project will be further extended through December 1983 for implementation of the additional fellowships recommended by this meeting.

All inputs, both Government and UNDP have been delivered. Fellowships have been completed. (6 fellowships were originally envisaged but only four could be accommodated within the available man-months). Experts assigned to this project have completed their assignments. As regards equipment, there are a couple of items already ordered, but not yet received. Two items of equipment were received in damaged/rusted condition and the representative of UNIDO was requested to follow-up on the settlement of insurance claim on one item and if possible, the replacement of the rusted equipment. It was observed that the services of experts assigned to the project were gainfully utilized. However, the

meeting expressed its concern that the quality of expertise provided was partly not up to expectations; but it was gratifying to note that the transfer of know-how in dyeing and finishing and in pattern making and grading was successful and accepted by the industry. The training of fellows abroad was very successful and the experience gained during this period is being effectively utilized by SITRA for the benefit of the industry. However, it was brought to the notice at the meeting that due to rapid change in the technology, some of the staff members needed updating of their know-how in modern methods of technology particularly in socks knitting, tubular Mercerisation of knitted fabrics and crochet knitting/ripper mechanism for circular knitting machines. Since these areas have considerable importance to the textile industry and there is an increasing demand for assistance from the industry it was suggested that two scientists of SITRA should be sent on fellowship programme by utilizing the balance funds available in the approved budget. The quantum of actual unutilized funds would be confirmed by UNIDO. The representative of DFA said that his Department agrees to provide any marginal increase in UNDP inputs i.e. upto US \$ 5,000, if this was required for the training component. It was agreed that the actual duration of these fellowships should not exceed 8 weeks. The representative of the Ministry of Finance appreciated the need of SITRA and agreed to the sponsorship of these fellowships.

The Government inputs have been provided as scheduled in the project document. Some delays have occurred in the procurement of UNDP/UNIDO supplied equipment due to inadequate specifications resulting in delays in the assignment of experts and training of fellows abroad. This consequently necessitated extension of the project duration.

Based on field visits and subsequent discussions with SITRA, it has been observed that very good linkages between ~~SITRA and the industry have been established.~~ However, there is further scope of improvement and SITRA should endeavour to reach maximum number of units for providing services so that the facilities established could be effectively utilized. It was pointed out that there is need for closer association between SITRA and other organizations like ATIRA, BTRA, SASMIRA, and Hosiery and Knitwear Development Corporation, Punjab, some of which are being assisted by UNDP/UNIDO. It was recommended that the project technical staff should be afforded opportunities to visit these organizations for closer association.

Findings and Recommendations

1. The nature and scope of assistance required by the cotton/knitting textile industry in the country is varied and large. The demand for SITRA' services is constantly on the increase.
2. Based on the assessment of the needs of the industry as outlined in the previous paragraphs, there is a need for establishment of extension service centre at Tirupur and follow up on the proposal to assist the hosiery manufacture in the West Bengal Region.
3. The meeting observed that though there have been some delays, the immediate objectives of the project have been achieved and the stated outputs produced.
4. There is scope for expansion within the existing facilities created at SITRA. It has been observed that the assistance to the industry is being rendered on an ad hoc basis as and when requested by the industry. A proper mechanism should be developed for systematic dissemination of information and providing services to the industry. Regular contacts by SITRA with the knitting industry should be further strengthened with a view to consolidate its activities and strengthen its linkages.

5. Closer contacts should be established with other similar organizations with a view to avoid duplication of activities and co-ordination/implementation of programmes at national level.
6. A brochure outlining the facilities available at SITRA has been published and has been widely circulated.
7. There is a proposal pending with the Tamil Nadu Government to initiate diploma courses in knitting at SITRA for students in textile technology from all over the country. This should be vigorously followed up with a view to implement this course to make available to the industry, train technicians in knitting which are in short supply and in great demand.
8. The duration of the project needs to be extended up to December 1983 for the purpose of implementation of the proposed additional fellowships even if it involves marginal increase in UNDP inputs i.e. up to US \$ 5,000 and without any increase in Government inputs. To ensure speedy implementation of this input the project authorities will officially submit completed fellowship nomination forms at the earliest.
9. It was felt that there is a need for strengthening the training programmes in the area of management for which there is demand from the industry. SITRA should give serious attention to this area.

