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RESTRICTED

19782

DP/ID/SER.B/705  
6 July 1992  
ORIGINAL: ENGLISH

1, 2 p

**JUTE RESEARCH AND DEVELOPMENT**

**Development and promotion of diversified end-uses of jute  
Ijira, Calcutta**

**DP/IND/86/037**

**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**

**Based on the work of R. R. Atkinson,  
chief technical adviser**

**Backstopping officer: J. P. Moll, Agro-based Industries Branch**

**United Nations Industrial Development Organization**

**Vienna**

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**\* This document has not been edited.**

**V.92 55596**

## GLOSSARY

IJIRA	Indian Jute Industries Research Association
NPD	National Project Director
PRO	Public Relations Officer
MLO	Mill Liaison Officer
CTA	Chief Technical Adviser
Procdoc	Project Document
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
JTRL	Jute Technological Research Laboratories
SSF	Solid state fermentation
JRP	Jute reinforced plastic
CFTRI	Central Food Technology Research Institute
GOI	Government of India
JMDC	Jute Manufacturers Development Council
IFC	Inter-firm comparison

CHAPTER ONE

AN OVERVIEW OF THE PROJECT

## INTRODUCTION

This terminal report discusses the Project from the viewpoint of its achievements relative to its objectives and it gives suggestions for action which might be followed to build upon the Activities which have been undertaken during the Project.

Chapter I gives a general assessment of the Project, (for a more detailed account of the Objectives reached under the various headings, see the NPD's Final Report on the Project); Chapter II deals generally with the quality of the Inputs to the Project; Chapter III discusses each Output in more detail along with suggestions for future work on each topic; finally, Chapter IV gives recommendations for a restructuring of IJIRA so that its R&D efforts may have greater impact on the industry and have a more product-oriented R&D framework.

It should be recorded that, throughout, the CTA received nothing but complete co-operation from all levels of the staff at IJIRA and any errors in his Reports have been his and are not due in any way to his friends among the staff. As well as thanking the technical staff for their many kindnesses, thanks are also due to the excellent work done by the administrative staff on the Project. As the end of the Project is reached, the CTA takes the opportunity to wish the Director and his staff every success in their most worthwhile work for the Indian jute industry.

R R Atkinson

CTA

29 May 1992

PROJECT OVERVIEW

The long term objectives of the Project were "to improve the competitiveness of conventional jute packaging products in terms of price and quality with a view to retaining their market share and to increase the current outputs of the industry." The immediate objectives were " to cut production costs by 10%, to increase the share of new, high-value products to 10-15% of the total output, to introduce improved and/or new technologies, to expand productivity information and consultancy services and to establish market research, planning and promotional capability." These objectives were to be reached by strengthening IJIRA's R&D capability through the provision of extra equipment, staff training and visits from overseas consultants.

There can be no doubt that UNDP, through their executing agency, UNIDO, has helped IJIRA to play a pivotable role in the GOI's long-term plans for the jute industry and that these international inputs have added to the already considerable facilities of the institute. The infrastructure at IJIRA has been enhanced and is now at a level from whence significant assistance can be given to the industry.

It is the CTA's view that now, with few exceptions any request for international funding at the institute over the next few years would have to be backed by extremely strong justification.

When one examines progress towards the immediate objectives, one make a broad assessment of the success rate as around 60-65% - a reasonable level when all is considered.

Not all of the Outputs were delivered; not due to any technical complexity but, in the CTA's view, due to a mixture of internal and external factors.

External factors:

Where new premises are to be built, planning permission can take much much longer than expected.

Lead times for machinery supply can be longer than anticipated and initial problems can be greater than expected.

Experts cannot always come at a time which seems suited to the project so some flexibility must be built into their participation in the work plan.



Planning and execution of Fellowships is often longer than expected and due allowance should be made for this.

Internal factors:

Selection of pilot plant was a very important feature of the project and more detailed preparatory work would have benefited the project.

Insufficient attention was given to the management and control of staff.

Regular progress meetings were lacking.

Targets became somewhat clouded by additions and alterations to the basic work plan.

Since it looks as though IJIRA will participate in the forthcoming Sectoral Programme, the institute should adopt a very professional approach to its work plans so as to avoid slippage happening again.

One may summarise the achievements of the project as:

1. Production costs can be reduced by 2% or so by the use of enzymes and/or chemicals to upgrade poor quality jute.
2. Process control instruments and productivity improvement can reduce costs by another 2%
3. Bio-modification of size can lead to a saving of 1-2%
4. In the last part of the project's life, progress was made towards using fine jute yarn as an alternative to cotton in weaving in the handloom and decentralised sectors.
5. Trials have shown that geo-jute has a worthwhile part to play in civil engineering in India.
6. Jute reinforced plastic composites offer environmental advantages over ply-wood products but the cost aspect has to be examined more closely.
7. New technologies which may have a role to play in diversification have been explored.
8. Cheese dyeing will be a saving once the problems of drying have been overcome.

9. Comprehensive shade cards have been made of dyed jute and any manufacturer wishing to dye jute can be assisted.
10. Advice can be given on the best type of machinery for blending jute with other fibres.

#### PROJECT CONCEPT AND DESIGN

The concept of the Project was relevant to the GOI's overall plan to improve the industry by (a) enhancing the competitiveness of jute goods (particularly against synthetics), reducing the weight of the jute content in some products without sacrificing their quality parameters, improving efficiency and productivity, standardisation and quality control and (b) broadening the product base by introducing new all-jute or multi-fibre yarns and fabrics with higher profitability.

It is the CTA's opinion that there is a danger that improvements relating to existing products and technology are sometimes put in the shade by the more glamorous development of new products and processes. Diversification plays a key part in the GOI's plans for the industry but it will only be successful in mills which have the technical and commercial staff to sustain their efforts and who are prepared to invest in new technologies. This might amount about 10 mills out of the 70 in India. Even at best, if the output of diversified products can be raised to 15% of the industry's production that still leaves well over 1 million tons of traditional jute goods being made annually.

Realistically, one cannot hope that all the mills will be amenable to IJIRA's R&D efforts (or capable of absorbing them) but if even if half of the mills used IJIRA to improve the manufacture of traditional products over 500,000 tons of jute goods would require R&D servicing each year.

A sobering thought.

As to the design of the Project, the CTA many times emphasised in his Reports that this was a very broad project which needed close management and control. The activities were so diverse it was rather like firing buck-shot and hoping to hit a bullseye at 20 m. This diversity of activity stretched control to its limits and the NPD and Heads of Division did well to keep the Activities moving along, albeit slowly at times.

When the project was being designed the senior scientists were asked what help they would look for from a UNDP project. What was lacking thereafter was objective managerial screening to ensure that the project would bring the maximum benefit to the industry at the lowest cost and yet be within IJIRA's capacity to deliver. This screening might have caused some disappointments among the staff but taking such decisions are part of a research manager's lot.

The lesson to be learned is that project planning is not easy and each step in building one should be critically scrutinised. Staff will need support during their work, so some preparation for this is essential. Project monitoring, too, cannot be left

to occasional ad hoc meetings. Regular, minuted inter-activity meetings are a must.

CHAPTER TWO

QUALITY OF THE INPUTS

PROJECT MANAGEMENT AND STAFFING

Since the Objective of the Project was to strengthen IJIRA's capacity for R&D work relevant to the industry's needs in the next few years, the best way of achieving this was by increasing the expertise of IJIRA staff members and improving their work habits. This was done for selected staff members by giving them overseas training and exposing them to the experience of working with foreign Experts in their particular field.

The NPD, supported by the Government's Project Committee, took the view that if the Project was executed within the current IJIRA staff structure, much of its effectiveness would be lost. To circumvent this he decided to create a new Project team, membership of which would be determined by the usual processes of application, interview and selection. Posts would be open to IJIRA staff members and outsiders. The CTA and the Back-stopping Officer pointed out the potential dangers of this scheme but it went ahead. Ultimately, about 30 staff were from outside and a similar number were seconded from the IJIRA staff. All the recruits were taken on a contract basis so that at the end of the Project the 'outsiders' would be let go and the IJIRA people would revert to the normal IJIRA hierarchy. From the beginning there was resentment and non-co-operation between the non-project IJIRA staff and those whom they saw as Project 'elite'. Moreover towards the end of the Project the recruits from outside became increasingly anxious to have an

assurance of continuity of employment by being absorbed into IJIRA or taken on to another project (even although they clearly understood that theirs' were contract jobs). In some, this anxiety affected their work while others left to take up other employment.

Time has proved that the decision to set up a separate project unit in IJIRA was wrong. To what extent this was detrimental to the project is impossible to quantify but it has certainly not improved the already delicate staff relations in IJIRA or eased the burden on the Divisional Heads.

Apparently it is not uncommon with UNDP projects to have contract staff who have to leave once their particular project is ended but, in a project of this type, it is counter-productive because one only strengthens an institution like IJIRA by improving the quality of its staff and it is a waste of money to send people on Fellowships if they are not to be retained by the institution.

In view of IJIRA's extensive experience of R&D in the Indian jute industry there was no need for a resident CTA for this Project and the decision to appoint a non-resident CTA was correct. Project management devolved upon IJIRA's Director of Research and in the first CTA's mission report it was recommended that a Deputy Director of Research should be appointed to take over much of the day-to-day running of the Project. For internal reasons this advice was not accepted. The management of the Project therefore fell to the part-time efforts of the Director and his Heads of Divisions.



Events have proved that this was insufficient for a project of this importance. To support this view one may cite the existence of lengthy delays in the building programme, a poor appreciation of the work being carried out by other Divisions, and a certain lack of a cross-fertilisation of ideas between divisions and slippage of work plans.

The lesson to be learned, therefore, is that in any similar project, the whole-time commitment of a local project manager is essential. It may be that, for various reasons, departmental heads who have other duties have to be used but this, more than ever, reinforces the need for a single co-ordinating manager who knows the local conditions and constraints and who can work with the non-resident CTA

On the matter of CTA's non-residential status, in these days of instant global communication by telex, telephone and fax there is no reason why a steady flow of information and dialogue between the CTA and the project should not be possible. Regretably, despite repeated pleas, this has not been the case in this Project. The lesson to be learned is that in any future project, there should be at the minimum a monthly progress report from the Project and from the non-resident CTA. Such a requirement needs to be included in the CTA's Job Description ( with an appropriate reflection in his contractual conditions).

Late in the Project the NPD resigned from IJIRA and the Head of the Applied Chemistry Division was appointed to the post of Director of Research and hence became the new NPD. Since this was his first experience of administration of a research organisation a Study Tour was arranged so that he could visit various research centres overseas to study their methods of research and project management.

In the view of the CTA there must be other cases where it would benefit the operation and effectiveness of UNDP/Governmental projects if the local project leader were to be given a appreciation course on project management methods. Somewhere in the UN family (ILO?) there could be a section committed to such training which could service the needs of the various agencies. Admittedly, the CTA can advise on methods of management but while he is present during the life of the project but once the project stands alone, the better its management, the more effective it will be.

#### EXPERTS

At the start of the Project an unrealistically high input of Experts was requested. In most cases the Divisional Heads were unclear about exactly what they wanted from an Expert in the

first place and who such an Expert might be in the second. Events proved that (a) the original number of Experts was too high and (b) the man-months requested were impossible to fulfil. The first lesson to be learned is that very, very few Experts can (or are prepared to) spend 3-6 months on a project. One month proved to be about as long as could be expected. The second lesson is that the choice of an Expert needs careful thought and, so that the maximum benefit may be gained, a closely-defined work programme should be available to him early in his mission. An Expert is a temporary employee of the Project who has been recruited at considerable expense and it is simple prudence to ensure that the maximum benefit is derived from his brief visit.

It is the writer's view that IJIRA in some ways under-values (or at least under-sells) itself. In the field of jute technology in the broadest sense, IJIRA has few rivals throughout the world. Divisional Heads did not always seem to appreciate that they are the experts in their field and that visiting UNDP-sponsored Experts should have been asked to give assistance with specific problems. It was ineffective to give them, as it were, carte blanche when deciding their duties.

The calibre of the Experts was generally good and most of them made a positive contribution to the Project. Their respective inputs are discussed in the later sections of this Report.

### STUDY TOURS

The NPD (and subsequently his successor) and each Head of Division made 3-4 week Study Tours in which they visited overseas centres of excellence in their respective disciplines. On these tours, the Project staff identified Experts and locations for Fellowship Training where they could.

In the writer's opinion, these tours were of value to the Project.

### FELLOWSHIP TRAINING

Fifteen members of the staff benefited from overseas training in Europe and America. For many this was their first exposure to a foreign environment and this, in itself, was valuable in broadening their view of their work. The technical relevance of their training is discussed in later sections of this Report, suffice to say here that the treatment the Fellows received was good and all returned to the Project with fresh ideas.

EQUIPMENT

Lead times were in some cases longer than anticipated, a contributory factor in slippage . In a project of this size and with such a diversity of outputs it was inevitable that some deletions from the original equipment list were necessary and other items had to be added in the light of the development work. This resulted in some items arriving late in the Project and so their full potential will not be exploited before the end of the Project ; this is not considered a serious drawback since IJIRA will need them in its normal R&D programme.

Some of the laboratory items are very hi-tech and one wonders if their capacities will be fully exploited - indeed some of the Experts expressed the view that their own laboratories could not afford such sophisticated equipment.

While one would not wish to see R&D restricted by a lack of essential equipment, the Director and his Heads of Division could have had a more pragmatic approach towards new purchases and worked to a list of priorities when funding equipment requisitions. Many of the original cost estimates for equipment were far too low and in future requisitioners should work with more up-to-date figures.

Mention must be made of apparent defects in the yarn dyeing equipment which was bought from Dalal (India) and Longclose (UK) - neither machine has been efficient in drying the yarn after it has been dyed. Although this has been taken up

with the suppliers it only came to light late in the Project and it is therefore unlikely that it will be resolved before the Project ends. In view of the fact that some \$ 300,000 has been spent on these plants an answer must be found and IJIRA must therefore absorb this problem into its R&D programme for 1992 as a matter of priority.

#### BUILDING PROGRAMME

The sites at the mills for the pilot plants were, with the exception of Kinnison, built quickly and carefully. Kinnison's programme dragged on and on until there was a grave danger of it being incomplete even at the extended end of the Project. Fortunately, this was avoided and work in the pilot plant was able to start in January 1992, 2 years behind schedule.

Sad to say, it was in IJIRA's own premises that the greatest delay was found. Extra laboratories were to be made above the Project office but progress was dogged by a litany of promises made and broken, target dates missed and months of inactivity. As a result one had a growing sense of doubt as to whether one would ever see the premises built. Problems with building warrants, planning applications, finance etc etc all played their part in this disappointing saga. It is to be hoped that the labs will be useable next year sometime. Meantime, some of the new laboratory equipment which was bought at considerable expense had to be used in cramped, unsuitable IJIRA labs.

PILOT PLANT LOCATIONS

So that the Project could be made as industry-oriented as possible the NPD decided that the pilot plant equipment should be located in selected jute mills. It was felt that this novel approach would give the mills a stake in the Project, increase the credibility of the development work and give the IJIRA staff greater exposure to the day-to-day problems of the industrial environment. This concept was good and worked well in the main although it did prove to have some practical lessons which should be remembered if this idea is to be repeated in any other projects.

1. The mills which are chosen must be strong, financially and technically. One of the mills (Anglo-India) was, the CTA later found, known at the outset to be financially unsound but, despite this, important dyeing equipment was installed there for "political" reasons. This mill was technically experienced and there was no doubting the enthusiasm of management but after some of the equipment had been installed and preliminary work begun, the mill was forced to close for commercial reasons and most of the machinery had to be transferred to New Central Jute Mill late in the Project's life but one item (jigger) could not be removed because of an embargo by the labour unions. Inevitably, this affected both the time-table and the quality of the output for this part of the Project.

2. Unless Project staff can be posted to the mills working time is lost in daily travel to and from the central institution. All trials and tests should be planned to reduce lost travelling time to a minimum and, if necessary, shift working should be adopted by the project staff.
  
- 3 Each mill provided premises and services for the pilot plants at considerable cost to themselves and although it is true that they have benefited from the development work, their co-operation should be rewarded in some way after the Project is finished - perhaps by the GOI allowing them to purchase the plant at a discounted price if they wish. Whatever mechanism the GOI ultimately adopts some, if not all, the money should come back to IJIRA and the institute should have access to the plant for trials for a period of five years.

Although it was agreed that each mill would provide services and material for the plants and staff to work alongside the Project personnel one mill (Kinnison) renegued on this and as a result the plant for producing enzymes will have to be operated by IJIRA alone. Strangely enough, this is one plant which need not have been sited at a mill in the first place since its product is to be sold to any mill who wishes it and its location was not dependent on a mill.



4. For successful execution of the work plan at the pilot plants the total responsibility for the plant must be clearly defined and regular (bi-monthly?) meetings between the mill staff and the NPD are recommended and a good communication system be set up. In the present project, this was somewhat lacking.

In sum, therefore, it may be said that the decision to site the pilot plants at the mills was quite sound and the Project benefited from it but, for the future, greater care is needed when selecting the mills and closer attention should be given to logistics.

CHAPTER THREE

DETAIL OF THE OUTPUTS AND RECOMMENDATIONS

OUTPUT 1 UPGRADING OF LOW-GRADE FIBRE

METHOD 1 BY ENZYMES

IJIRA began working on the use of enzymes to soften hard, low-grade jute some 15 or more years ago and in 1980 began to publish the results of their investigations in international journals. The process has been in regular use in some of the jute mills since around that time. Using the simple solid state fermentation (SSF) process developed by the IJIRA scientists some of the mills make their own enzymes while others have bought the enzyme which had been made in IJIRA's own SSF plant at Taratola Road.

The Activity for this Output was to set up a plant at Kinnison Jute Mill which would make about 100 kg per day of high grade enzyme.

Equipment.

Originally, a sophisticated French SSF plant was investigated but it was untried and extremely expensive and, fortunately, an indigenous system was found at the Central Food Technology Research Institute (CFTRI) in Mysore. CFTRI gave plans and machinery lists to IJIRA from which the Kinnison plant was built by an Indian engineering company (Murhopye Ltd)

After a number of problems the plant was installed and in January 1992 two lots of enzyme were made. Then the autoclave blew up and other parts of the plant were damaged. Whether this was due to faulty design, poor manufacture or improper use is still being argued but meanwhile the plant stood idle for 5 months. On the advice of the CTA steps were taken to repair the autoclave immediately (at a cost of about \$2500) and assign responsibility later.

IJIRA plans to sell the enzyme at Rs 15/kg but this may not be a realistic price in view of the high cost of the equipment. The plant cost around \$200,000 and CFTRI have given a 'theoretical' cost of manufacture of Rs 25/kg so it is essential that once the plant is functioning a true costing is carried out as quickly as possible. There is no reason why this plant should not make some contribution to IJIRA's funds each year by selling the product at a modest profit. Certainly there cannot be any justification for selling it at a loss.

IJIRA has now committed itself to the daily running of a plant 2-3 hours journey from its headquarters and arrangements need to be made for the effective control of the operation on an on-going basis.

### Experts

The chief Expert in SSF (Wood) gave sound, practical guidance for the operation of the plant based upon his own experience of running a similar plant in the UK. His three Reports should be

read and re-read because they contain much useful information. He advocated the purchase of an ultrafiltration plant. This advice has been followed.

The other Expert (Niyogi) made one brief visit and gave some academic advice on genetic engineering, cloning etc and he too advocated the use of ultra-filtration at the Kinnison plant.

### Fellowships

Two 6-month Fellowships were provided in America. These were of a very advanced scientific nature and the benefits deriving from them will be very long-term. In the CTA's view these Fellowships, scientifically rewarding though they may have been, had little bearing on the stated Output. For the future, the choice of location and topic for Fellowships should be more closely related to the immediate objectives of the project. This was the view of the Expert Wood also.

### Recommendations

The SSF plant at Kinnison will need careful supervision for at least 12 months and a senior micro-biologist should be made totally responsible for its operation, personnel, safety, procurement and sales. He should also be held responsible for introducing the enzyme to mills and providing technical back-up during trials. In about a year's

time day-to-day plant operation may be left to a more junior 'plant manager' monitored by the senior person.

The use of other, perhaps more effective, enzyme-producing media should be examined.

With the experience gained by operating the Kinnison plant, it may be possible to improve on the simple techniques currently being used in those mills which make their own enzyme. A fresh look at this might be fruitful.

A discrete, but close, watch should be kept on the health and safety aspects of this biological process both in the mills and at Kinnison.

So far, all the work with enzymes had been concerned with low-grade fibre. In the light of the work done in other parts of the Project on high quality, fine yarns and fabrics and the GOI's great interest in expanding the markets for high value-added goods it would seem prudent to see if these enzymes have any part to play in spinning top-quality, defect-free, fine count yarns. Despite using good fibre there are always some small accretions of bark and speck found in it; these are yarn faults in embryo. If these could be eliminated not only would better yarn result but finer yarns could be made too.

Still on the subject of fine yarns, the possibility of using the enzymes from this or some other fungal strain, for accelerated, controlled retting should be looked at.

A pre-requisite for making fine yarn is fine fibre and one way to obtain fine jute is to use fibre harvested earlier than usual. If this were to be combined with controlled retting using enzymes or some other bio-chemical process it might be possible to produce fibre of better grades than can be achieved with the present water-retting methods. The quantity of such 'super-fibre' would not be great (200-300 tonnes/year initially perhaps) so controlled tank-retting might become feasible.

OUTPUT 1 UPGRADING OF LOW GRADE FIBRE (cont'd)

METHOD 2: BY CHEMICALS

IJIRA has another method for softening hard, rooty jute in which chemicals are used. A surfactant, urea and soda ash are simply added to the usual oil-in-water emulsion used at the start of the process. Extensive trials proved that better processing and yarn quality resulted from the use of this mixture or, as a corollary, lower grades of jute could be used to make the standard grades of yarn.

For many years emulsifying agents containing urea have been commercially available, the idea being that the urea provided a source of nitrogen on which the naturally-occurring bacteria would thrive. Micro-biological action then destroys or loosens much of the dark, barky materials on the jute rendering their removal in carding easier. It might seem that the IJIRA 'chemical' method may have at least some elements of the 'enzyme' method in it.

By conducting these chemical trials and disseminating Reports on them throughout the industry, IJIRA has achieved this Output.

Equipment

The only equipment needed was a locally-made mixing tank.



### Expert

The Expert (Chatterjee) made two visits to the Project and suggested some alternative means of softening. His specific contribution to the stated Output was, in the CTA's opinion, not great.

### Fellowship

One 3-month visit was made to America.

### Recommendations

- . IJIRA is offering the mills two routes for fibre softening and up-grading - biological and chemical - and it seems logical to have a controlled comparison of the two methods. The chemical route is certainly much simpler than the biological one and the mills are entitled to the very best guidance on this matter. It is not, in the CTA's view, clearly established which is the better overall. It has been suggested that the biological route is better for the very poorest jute while the chemical is better for the slightly better types but there is no written evidence of a controlled scientific comparison between the methods. This should be a priority.

More mills should be offered free trials of the method.

OUTPUT 2: NEW HIGHER VALUE PRODUCTS

The GOI's Eighth Plan shows the following percentage split-up of various categories of production:

	<u>1992-3</u>	<u>1993-4</u>	<u>1994-5</u>
Hessian	11.0%	10.7%	10.2%
Sacking	69.7	66.1	64.3
Tarpaulin	14.3	14.8	15.1
Decoratives and others	2.6	3.8	5.2
Geo-jute	0.4	0.6	0.6
Yarn and twine	2.6	2.8	2.9
Canvas and others	1.4	1.4	1.7

If we take the 'higher-value' products of decoratives, geo-jute, yarn and twine their total rises from 5.6% of sales in 1992-3 to 8.7% in 1994-5 and in terms of tonnage from 75,000 to 136,000. It has been decided by the industry and the GOI that the main thrust of the increase will be in decoratives where a better profit per ton will be possible.

The respective activities under the umbrella title of 'new high-value products' will now be discussed.

### Blending

The methods for staple blending spinning have been known at IJIRA and elsewhere for many years and what was required in India was blending experience on the mill scale and for this purpose an intersecting gill-box was purchased. Extensive trials showed that this machine gave no better blending than the previously-used methods on conventional jute machines. In this sense the project failed but at least now it has been established that mills can use their existing machinery and can stop wondering if a more sophisticated machine would be better for the job.

Although the intersecting gill-box did not improve blending a most useful side-effect was found. It operates as a very effective, high-speed machine for good quality jute yarns. So much so that Birla Jute Mills where the machine is sited has ordered four machines. It is very doubtful if this would have happened, at least so quickly, if the project machine had not been placed in their mill.

Ironically, events proved that the greatest advances in blending were to be made in domestic union fabrics (cloth with yarns made from jute in the warp or weft and some other fibre in the weft or warp). This required no special techniques or equipment other than those normally taken when spinning fine jute yarns (4-6 lb, 125-200 tex).

Bleaching, dyeing and finishing

Thanks to the equipment bought under the Project, yarn package dyeing methods are being investigated but the drying problem gives cause for concern. This work will continue. Shade cards, dye recipes and fastness figures are all available to give designers a very wide range of colour.

Fabric dyeing and finishing has not proceeded so well because of the problems which arose at Anglo-India Jute Mills Ltd necessitating the removal of the pilot plant to New Central Jute Mills, but shade cards have been developed here too.

With the work done by the Project Staff and the considerable body of information deriving from IJIRA's previous R&D programme the mills are now well served with technical details for the coloration of jute.

It is recommended therefore that mill liaison and the application of existing knowledge should take precedence over basic bleaching and dyeing research for the immediate future. It is hard to see what coloration problem the mills might have over the next few years which cannot be solved with existing technology. The main field of improvement might be in the fastness properties but even there, by judicious choice of fabric construction and careful selection of dyes, figures of 4 or better are being achieved and for many commercial applications this is enough.

What is lacking is an understanding of the costs of dyeing and IJIJRA should undertake techno-economic studies of all its dyeing and finishing techniques.

To build upon the success of this part of the Project, the CTA recommends that an re-appraisal of IJIRA's R&D programme is needed. If more financially-rewarding markets are to be opened up for jute in the domestic/apparel fields then it is essential that fine yarns are produced at an acceptable cost. This should be the focus of a multi-discipline R&D attack.

It is suggested that this could possibly take the following shape:

Fibre. It is axiomatic that finer yarns call for finer fibre. Harvesting at 100 days should be examined. There is no time to explore genetic modification and other factors. Research should concentrate on known varieties and agricultural methods which give the finest (not strongest) fibre.

Retting. Is controlled retting, perhaps with enzymes, possible for the relatively small quantities of high-price fibre needed?

Processing. Do enzymes/chemicals have a role in separating fibres and removing impurities during maturing? Is triple carding beneficial to the cleanliness of the yarn? Should the drawing passages be increased to 4? What is the best spinning method?

Quality           What are the special quality parameters of such yarns? How can quality standards be certified?

These points, and no doubt others, are worthy of examination.

#### Jute composites

The history of organised R&D into the use of jute as a reinforcing agent in resin composites goes back over 30 years to research in the UK. Despite intensive efforts in the research labs there and in some European jute mills, costs could not be reduced sufficiently to interest laminators even when the physical and chemical properties of these jute reinforced plastics (JRP) were shown to be acceptable and interest waned.

Work at IJIRA has gone on since the 70's and finally, under the Project, reached the stage of large-scale field trials, the end-uses targeted being JRP tea and fruit boxes. Again, the quality of the laminate sheet and the boxes made from it is acceptable but the cost comparison against wood is dubious. Certainly, in these days of environmental consciousness the use of wood is to be discouraged wherever possible and jute, an annually renewable source of raw material for such boxes, is

better in this respect but this aspect of JRP is, in itself, unlikely to have a commercial impact in the near future.

The cost problems stem from two sources; (1) jute cloth has been selected for the reinforcing medium although cheaper jute non-woven fabrics are available and (2) the ratio of expensive resin to cheaper jute must be as low as possible.

Cloth was chosen because it was readily available and would help the mills most by requiring all the conventional processes of spinning and weaving. Non-woven felts, on the other hand, can only be made by a few mills. With hindsight greater progress might have been possible had felts been chosen at the start but at least felts are now recognised as the best base material. Advances have been made in reducing the quantity of resin in the JRP and a possible source of cheap, indigneous and biodegradable resin may have been found.

#### Equipment

Equipment has been usefully employed and the mill in which it was sited has now installed its own plant for laminating 8 x 4 sheets of JRP.



### Fellowships

One 6-month and two 3- month training Fellowships were provided. These were carried out in conjunction with a research contract on JRP at Harwell Laboratories, UK. They were useful for the Fellows in opening up new research possibilities.

### Subcontract

Under UK government funding in 1980-2, IJIRA had a research contract with Harwell on JRP and in this present Project it was decided to continue this co-operation by awarding a total of 12 months of contract time on the same subject at Harwell. This contract was specifically for JRP in its packaging context. The contract was expensive (\$ 175,000 ) and, on reflection, its cost-effectiveness was doubtful.

Summarising, the objective of the contract was firstly, to identify and characterise suitable materials for the construction of JRP boxes and secondly, to identify a suitable process for making them from which a pilot plant might be made. Extensive tests narrowed the best choice of material down to thermoplastic resins preferably reinforced with a non-woven felt.

It seems to the writer that this outcome could have been reached by IJIRA itself by using its own and indigenous expertise in the plastic laminating industry and the Indian

Institute of Packaging.

### Experts

Bowen, from Harwell, paid a brief visit to IJIRA to see progress on the ground and Gordon, a packaging and plastics consultant spent two months at IJIRA giving useful technical and costing advice.

### Recommendations

For this part of IJIRA's work it is recommended that a firm cost figure for JRP which would be acceptable to the rigid packaging market should be obtained and all the work be directed towards reaching it with a product of acceptable quality parameters. This should involve an objective re-appraisal of all the past technology and the preparation of a clear work-plan. If JRP cannot be made at a cost which will give a satisfactory return on capital employed, the work on JRP may have to be channelled in some other, more fruitful direction. This would be regrettable, since it seems that here at last is a new market which could have volume potential.

It is always better to make what you can sell rather than try to sell what you can make.

### Geo-jute

This is one product which should have further international funding in a 'stand-alone' project for technical developments and extensive field trials.

The use of jute as a geo-textile material has not been exploited to any great degree in India or abroad. The one firm which sells the product (Ludlow) have not promoted the use of geo-jute in India and have confined their efforts to servicing the minute sector of the huge American/international market held by jute.

Just as there is a multitude of synthetic geo-textile fabrics, there could be a range of jute and jute-based fabrics tailor-made for different applications in the civil engineering and construction industries. There should be no reason why jute and jute-based products cannot find a niche in the Indian and, at some later stage, in international markets. In these days of multi-fibre approaches, jute could quite comfortably sit alongside synthetics in this market by exploiting its special properties such as bio-degradability (modified if necessary by rot-proofing chemicals), ease of handle and laying, good soil retention, natural non-intrusive colour, strength and others.

The quality demands for jute geo-textile mats, be they woven fabrics, stitch-bonded or needle-punched felts or whatever, are unlikely to be high, their main use probably being erosion

control, slope stabilisation, field drains, ditch and canal lining and so forth. This means that low/medium fibre may be used on existing machinery which would need little or no modification.

In the Project a most useful start was made with field-trials which are showing encouraging results for a few different fabrics. Much praiseworthy promotional work was carried out when staff, accompanied by the Experts, made contact with civil engineers working on railway, harbour, forestry, waterway authorities. Interest has been aroused and it would be remiss if these efforts were not to be exploited. Given sufficient textile and engineering inputs geo-jute could be developed into a worthwhile product, firstly for India then overseas.

#### Equipment

None

#### Fellowship

None.

#### Experts

Two Experts visited the Project (Thomson and Ramaswamy) and gave productive inputs ( particularly the latter consultant). By their extensive field trips with IJIRA staff useful contacts

were made with engineers and now, as a result of their efforts, IJIRA has a much better understanding of the requirements for further development work with this product.

Recommendation

Funding for a project on geo-jute should be sought.

### OUTPUT 3: INSTRUMENTATION

During its R&D programme IJIRA had developed several on-line instruments for the mills which helped to produce more regular yarns; these were the sliver grist monitor and the card sliver autoleveller. The demand for these instruments in the industry was strong but it was not large enough to induce a manufacturer to take them up commercially. This was why the Physics Division's part of the Project was to set up a small workshop to make these instruments for the mills.

Premises and staff were arranged and it may be said that this Output was achieved but was not sustained as time went by. This was one section where 90% staff were 'outsiders' and some began to leave as the Project neared its end. The effectiveness of the unit has been reduced as a result. IJIRA has to decide how this unit will be operated in future and what staffing is needed for it. On the face of it, it looks very doubtful if such a unit can be run successfully by IJIRA unless the institute adopts a much more commercial attitude. The alternative is to search again for someone who can be relied upon to make these instruments. Some feelers have been put out to the Electronic Development Corporation to see if they would be interested in assuming responsibility for the manufacture of these instruments. These instruments have been shown to benefit the mills and there is a demand for them and although outside manufacture may be the best way ahead it would be a very good boost to IJIRA's image if this could be done internally.

### Equipment

Bench testing equipment was requisitioned for the workshop along with some scientific items for further instrumentation development work by the Division.

### Fellowship

The two 3-month Fellowships at N. Carolina State University were perhaps a little too short but nevertheless were of value to the Project.

### Expert

Campbell visited IJIRA twice and his Reports contain a host of useful practical suggestions for the improvement, not only in the machines themselves, but also in the manner in which they are being supplied to the mills and serviced thereafter.

This was certainly one case where, despite the Job Description, the Divisional Head did not know exactly what he wanted from the Expert and it was left to the Expert and the senior physicist to develop the programme when the Expert arrived.

### Recommendations

These instruments which IJIRA has developed are worthwhile and those mills which have installed them are satisfied with them. IJIRA has done a good job here and it could be made even better if a more planned, professional approach were to be adopted towards design, reliability, publicity, servicing and 'customer care'.

In view of the staffing problems which have rendered the workshop ineffective, a hard look is needed to decide whether such a unit can be operated in IJIRA. In Chapter IV of this Report a place is suggested for the workshop in a re-organised IJIRA but circumstances may block this. What is important is that either by outside manufacture or in-house capabilities, more of these instruments must be made quickly. The mills have shown that they want to use them and IJIRA has a back-log of orders for them.



#### OUTPUT 4. PRODUCTIVITY AND CONSULTANCY SERVICE

Since 1983 IJIRA has provided quarterly data to almost 20 mills on their productivity and labour inputs in yarn manufacture. By way of inter-firm comparisons (IFC) a computerised 'league table' of the mills is printed which shows each mill how it is performing, relative to the industry. Under the Project this comparison of mills has been extended to fabric production so now the participating mills have a comprehensive picture of their productivity from fibre to fabric. This information is of value to those mills which are determined to improve their performance. Further, IJIRA offers technical consultancies to such mills to assist them to improve their productivity.

Under the Project this IFC was to be extended to cover the weaving processes but unfortunately this was not achieved. The reasons given were (1) delay in constructing a suitable computer room and (2) the resignation of the programmer at a crucial stage when implementation was about to take place. Neither of these is really credible.

It is recommended that when the full IFC gets under way a fresh look at the presentation of the data be taken. Each quarter a mass of very useful statistics will be prepared but for a busy mill executive an edited version is more likely to be acted upon than a wad of indigestible computer data. It is recommended that the information in the IFC be condensed into a meaningful summary for each mill. Additionally, it is suggested that IJIRA should publish every year a critique of the mills performances in which problem areas are highlighted

and remedies suggested. This should be followed up by visits to the mills by experienced technical staff to try to help the mills to overcome their problems.

It is also recommended that the post of Mill Liaison Officer (MLO) be created. The MLO would strengthen the bridge between the mills and IJIRA by making regular mill visits in which he would bring the latest R&D results to the attention of the mill executives, arranging mill trials and provide back-up for IJIRA staff who are working in the mills. Of equal importance, by gaining an understanding of mill problems he could make a valuable contribution to the selection of projects for the annual R&D programme. By nature of its responsibility, this would be a senior post.

Also for this Output a machinery maintenance manual has been written. Now that the Project has video equipment it is strongly recommended that a series of short films on maintenance be made. Much of the machinery in the mills is old and over the years has gone out of specification and in some cases mill-floor engineers do not have the knowledge needed to put it to rights. This manual and proposed film will overcome at least part of this problem and they will have a good reception in the mills.

Jute processing is not technically complicated and time after time one can see improvements being brought about by simple, commonsense attention to details in the machinery and processing methods. Unfortunately, some of the day-to-day

checks and controls have been lost and this Division in IJIRA can help to correct this.

This part of IJIRA's work may seem somewhat elementary and hum-drum but it is very important and, in terms of cost-effectiveness, outstrips some of the more esoteric research which is being done in the institute.

### Equipment

The only UNDP input is video equipment. Extra computers for the IFC were provided by the GOI.

### Expert

The Expert (Haines) provided a good input by participating in productivity seminars and making sound practical suggestions. His knowledge was put to good use.

### Fellowship

No Fellowship was provided. Originally, one was planned but on the advice of the Expert this was rescinded since it was felt that daily contact with the Expert and mill personnel would be more fruitful than an off-the-job academic course.

OUTPUT 5: MARKETING

This Output was included in the Project Document because it was clear that no matter how good any new products deriving from IJIRA may seem unless they could be taken to the market and exploited commercially, they were useless. Until the Project really got under way, it was felt that the Activities associated with this Output should be delayed and, as time went by, problems of definition made a start more difficult and specifying the duties of an Expert became more complex. Between the NPD and the CTA, there developed a realisation that the concept was greater than could be encompassed in the Project. In the light of experience the doubt grew, certainly in the CTA's mind, that even if a marketing cell were to be established, IJIRA, without a fundamental change in its character, would not have the essential commercial drive to sustain the cell successfully after the Project finished.

In the light of these thoughts, the NPD and the CTA recommended to the GOI's Project Committee that this Output be deleted from the Project and this was done.

Since the Project was conceived, the GOI has concerned itself to a much greater extent in the market promotion of new jute and jute-based products and it is to be commended for the practical steps it has taken to disseminate information about decoratives and other jute textiles and to promote their use.

Where, however, does this put IJIRA's need for promoting its developments? It is suggested that marketing, as far as IJIRA is concerned, needs to be looked at more broadly. It is not only IJIRA's new products that have to be led to the market-place but its services to the industry as well.

Instrumentation, productivity measurement, technical service, information technology, new advances etc all need greater publicity.

It is therefore recommended that the creation of the post of Public Relations Officer (PRO) be considered. The PRO would have the tasks of collaborating with the GOI and the JMDC in market promotion of jute products, promoting IJIRA's other services to the industry, handling IJIRA's publications, organising seminars and exhibitions for the various Divisions, ensuring press and TV coverage for IJIRA's achievements, arranging visits by VIP's, and generally enhancing the institute's reputation in India and overseas.

CHAPTER FOUR

RECOMMENDATIONS FOR RESTRUCTURING IJIRA

## IJIRA AND THE FUTURE

The last Chapter of this report looks at the structure and management policy of IJIRA and the relevance of its R&D programme to the industry.

After many visits to IJIRA, a good understanding of its operation, its strengths and its weaknesses has been gained. The discussion which follows concentrates on these points and it is hoped that it will be seen as an attempt at a frank, constructive assessment of IJIRA's role in the next four to five years.

### I. THE STRUCTURE OF IJIRA

In common with many research institutes, IJIRA is organised in an 'academic' manner according to scientific and technological disciplines with Divisions of Biology, Applied Chemistry, Physics and so on.

For the staff, and especially new graduates, this type of organisation has advantages. Their daily work is in an area for which they have prepared themselves by many years of study; their professional expertise will be judged by a superior with a similar educational background; they have a feeling of loyalty to their chosen discipline.

This organisation is ideal for the conduct of specialist, basic research but it is not necessarily the best for a technological R&D institute where a pragmatic approach is required to turn basic knowledge, from whatever source, into commercial gain for the jute industry. Indeed it has some definite drawbacks. In this 'academic' system it is hard to persuade the staff that a quick, practical conclusion is preferable to the 'best' scientific conclusion; integration of several disciplines in problem-solving is not always possible; it tends to imply that progress can best be achieved by continuously pushing back scientific frontiers; it may have an inherent difficulty in distinguishing between those problems which are scientifically and intellectually interesting and those which are of greater practical use for the mills.

Many research institutes elsewhere have moved towards organisations based upon the functional needs of its 'customers' (in IJIRA's case these are the mills). One could envisage a Divisional structure based upon Fibres, Spinning, Weaving, Finishing, Testing and Technical Service. Each division would embrace several technological disciplines bring their own expertise to bear on a common goal. To an extent, IJIRA recognises this itself when it creates an inter-Divisional team to work upon a particular project. However, even then the team members are not relieved of their own Divisional work during the period when they are members of the mixed team and their basic loyalty probably still lies with their parent Division. One suspects that this may reduce the effectiveness of the team and may make its management difficult.



If a matrix organisation based upon Fibres, Spinning etc (or some other industry-related activities) were to be adopted the staff would then identify with a process or some commercial function and the Director of Research would have Divisional Heads having distinct executive responsibility in an industrially relevant area. This would make the overall management of the Institute simpler and more effective. At the moment, for example, the Biology and Chemistry Divisions both work on fibre upgrading and modification of tamarind kernel powder; the Mechanical Processing Division (MPD) and the Centre for Machine Design and Development (CMMD) both work on weaving development; the Physics Division (PD) works on machine refinement apparently independently of MPD and CMMD. Other examples of duplication and split responsibilities may be found in IJIRA also.

Understandably, each Division considers its approach to certain problems the best and would be reluctant to give their research up in favour of some other Division's methods for solving the same problem. This is a perfectly human reaction but it does not make the Director's task any easier for it is (or should be) he who advocates the best route forward.

Restructuring IJIRA would be far from simple. It would be a task requiring great tact and perseverance. Months of preparatory work, discussions and meetings would be needed to win the staff around to accepting a new philosophy of work. Some of the long-serving staff members may not be able to make the change so some kind of compensated early retiral scheme or 'guaranteed no job losses' might be required to clear the

decks as it were. On the other hand for many of the staff, particularly the younger ones, such a re-organisation would offer opportunities for greater responsibility, reward and job-satisfaction.

The decision on restructuring would have to be a joint one embracing the industry, the Ministry and IJIRA itself.

IJIRA costs around \$ 1,000,000 a year to run and the question which must be answered to justify this expenditure is, do the mills get value for money? If the answer to this question is positive, no action is needed at all but if it is negative, one either tries to improve the Institute's output or considers more drastic action.

In the present time of change in the industry with competition on all sides increasing, a good, practically-based development programme is essential. There is no doubt that IJIRA has contributed successfully to many innovations in the industry in the past but now as the rate of technological change increases, better and faster development output is needed. It is the writer's view (not necessarily endorsed by UNIDO) that a re-organisation of the Institute with the aim of producing a slimmer, more dynamic research force would be of great benefit.

The immediate requirements

So far, consideration has been given to the broader aspects of a possible re-organisation but there are, it is felt, two areas where immediate action should be taken.

The first of these concerns the Raw Jute Division. The inclusion of a division which deals with jute seeds, fibre yields, agricultural practices and so on, arose many years ago and there is no need to examine here the reasons why.

It is an anomaly that it is to be found in an institute where the primary function is clearly technical research and development. This Division's work properly belongs in one of the Ministry of Agriculture's research stations and it is more than likely that the members of that Division would have better job satisfaction among colleagues with a similar background in agriculture and botany. It is doubtful if many of the mill executives appreciate (or even understand) much of the useful work done by these scientists. In recent years the Division has conducted studies on the genetic and cytological parameters of jute, seed storage, seed drills and ribboning. These subjects, surely, are not germane in an industrial research institute. Moreover, they are being studied in more appropriate institutes elsewhere in West Bengal.

The Raw Jute Division has between 25 and 30 staff, making it about the same size as the Divisions of Chemistry, Mechanical Processing and indeed bigger than Biology and Jute Reinforced Plastics.

About 10% of staff salaries ( and presumably overheads) go to the Division. If it were to be wound up or divested to another institute the saving which would be made could go towards funding a new division specially for the development of new products; such a Division would seem to have more relevance than the Jute Division in today's commercial context.

### Product Development Division

For more years than most readers will care to remember, there has been a desire, in India elsewhere, to see the industry move into new markets. Attempts were made in the past to broaden the product base but they met with little success. However, times and technology change and one of the main planks of the UNIDO/IJIRA Project is the development of new uses for jute and jute-based products. Progress is being made in such fields as jute reinforced plastics, blends, geo-jute and the use of jute in domestic textiles. Several mills are succeeding in making an entry to completely new markets and it especially these which IJIRA can assist with technological expertise.

The setting up of a new Product Development Division would seem to offer the following advantages:

It would draw together under one Head the present work which is done by two or more Divisions, improving communication and co-operation between technical disciplines.

It would be very much at the sharp end of IJIRA, interacting with the most technologically and commercially advanced firms in the industry. By so doing, it could raise the status of the Institute.

It would reduce the chances of waste of resources due to duplication between Divisions.

#### The form of the Product Development Division

So as to reinforce the Division's role as a market-developer and to remind its staff of their commercial responsibilities, a new staff designation system is suggested. The Head of the Division would be its General Manager to emphasise his managerial role in guiding, controlling and motivating the Division. Under the G.M. would come Business Managers responsible for different market spheres such as new industrial uses,, domestic textiles, apparel uses and so on. The word 'business' is chosen to remind them that they are, in some sense, business men looking for new opportunities in their particular market. Each business sphere would then have Product Section Leaders who are responsible for the practical development work in each area.

These titles may seem a trifle grandiose but they are put forward in a serious attempt to introduce a modern, professional, commercial atmosphere into IJIRA.

Management policy

The on-going management policy for IJIRA is in the hands of the Council of Management (25 members)) supported by

Finance and Executive Committee (6 members)

Research Advisory Committee (17)

Senior Staff Committee (7)

Board of Trustees, Provident Fund (4)

Expert Panels

Raw Jute(12)

Biology (7)

Physics, mechanical processing, CHIND (18)

Applied Chemistry (12)

The members of these committees are drawn from the industry, Government, academic institutions and industries associated with the jute industry. IJIRA therefore has the benefit of the knowledge of many extremely experienced men to guide it and lay down policy.

Forming a strategy for development involves the consideration of what IJIRA might do, what it can do and what it should do. R&D in any sphere has, by its very nature, a built-in risk and the Research Committee has the unenviable task of trying, in many cases, to plan the unplannable.

If IJIRA were to be restructured along lines similar to those proposed earlier in this Paper some reallocation of governing committees will be required also. At that time the Council could take the opportunity to reconsider the whole ethos of IJIRA and its research programme.

#### The R&D programme and its relevance to the industry

Technical research on jute has been carried out at the British Jute Trade Research Association (1948 - 1970), IJIRA (1937 - present), Jute Technological Research Laboratories (1939-present) and the Bangladesh Jute Research Institute (1965 - present). It is a sobering thought that, despite a total of almost 150 years of effort in these research stations, no major, commercially-viable new product or process has emerged from them. Superficially, this seems hard to understand. However, when one looks into the situation one finds that there has been, and continues to be, a tremendous amount of duplication of effort. Each of these stations has looked into such things as the chemical composition of the fibre, the nature of lignin, the physical properties of jute, jute reinforced plastics, blending, light fastness and dyeing, micro-biological softening of fibre and many more subjects.

Over the years, IJIRA has built up a corpus of knowledge of the physical and chemical nature of jute second to none; it has given an excellent understanding of all stages of the processing of jute; it has provided various instruments and techniques which have helped production in terms of quality and quantity; it has stimulated greater interest in various non-

traditional products and technical back-up for their exploitation; it has given the industry an extremely useful pool of expertise in all aspects of jute manufacturing and it has engendered an awareness of the benefits of modern management methods.

Realistically, the jute industry in India is mature and indeed it is already showing signs of 'sickness' if not decline. Under the pressures of higher fibre and wage costs, fiscal policies and competition from Bangladesh it has lost many of its export markets. Fortunately a growing domestic market has compensated in some degree for this although it too is under threat from high density polyethylene products.

The bulk of the output is still in the form of sacks and bags and this situation is unlikely to alter in the near future. The industry, as a whole then, may be considered as one with long-established products and a small product range selling into declining markets.

IJIRA's R&D programme must take due account of the state of the industry and may be examined under several heads:

1. 'Basic' research

In the programme one still finds studies on such fundamental issues as the nature of lignin and the chemical nature of the fibre, the surface structure of jute fibres, the nature of jute bark, the fracture behaviour of fibres and other erudite matters. In the



present commercial climate one may ask, is this what IJIRA is for? These studies are extremely profound and more suited to university environments and one wonders if it would not be more cost-effective to fund these studies at Calcutta University or elsewhere. In IJIRA they consume staff time and resources which might be better employed in other more directly-involved Divisions.

One accepts that such deep studies are required and that they may eventually provide the basis for a real breakthrough in jute technology (nylon 66 took about 10 years to move from the laboratory bench to production; the first shuttleless loom patent dates from 1836; air-jet looms were patented in 1920; work on yarn texturing dates from 1920 and so on). The real question is not whether such basic work will or will not achieve a breakthrough but whether there will be a jute industry in India to exploit it when it arrives.

## 2. Short-term development of existing products

It may be assumed that sacks, bags and gunny cloth will form the backbone of the industry for some considerable time yet. Left in their present state it is reasonable to presume that their profitability will slowly decline under the impacts of rising costs and competition from other fibres. This threat can be met, in part at least, by R&D programmes aimed at improving existing technology leading to higher outputs, lower costs and product

modification. Such items are already being pursued at IJIRA and more emphasis should be put on them.

### 3. Medium-term development of existing products

It should be possible to extend the life of the product range by the introduction of better manufacturing methods or by modifying the products in it. These are a longer term developments since, not only do these methods have to worked out, they have to be introduced to the market and accepted by it. Work on circular weaving, union cloths, lighter products is part of the on-goint programme in IJIRA and this should be continued with greater inputs.

### 4. Development of new products

IJIRA's work on the development of new products is well-known and must continue vigourously. Much of the technolgy needed for such work is known and it is in the practical application of existing knowledge that the institute can assist the mills. Close co-operation with the mills and the promotional bodies coming into being now is the essence.

### Project selection

Since financial gain is what the mills hope for from IJIRA's work, the selection of projects which will reach that goal is

of paramount importance. Here, the Director of Research, acting within the guidelines given to him by Council, has a leading role in formulating a research programme compatible with the resources and capabilities of IJIRA.

Of almost equal importance to the choice of projects which have a good chance of success is the ability to decide when to terminate projects which are showing little chance of success. A project tends to develop its own momentum and there is often an assumption among those working on it that it will be allowed to continue and time will be given to explore all sorts of interesting by-ways.

An examination of IJIRA's portfolio of projects in recent years shows a very large number of projects, some of which, it seems to the writer, must be of very minor interest to the mills. Depending upon circumstances ruling in any given year, there are between 70 and 100 projects under way at IJIRA. For the size of the staff, this is a very large number. The practical implications of this means that the resources which can be allocated to each are extremely limited. By attempting to advance on a very broad front, progress is slow. Some comparatively minor projects take several years to complete, while other more complicated ones, can last a decade or more.

#### Project selection

The Research Committee, with the Director of Research and the Expert Panels, prepares the programme of work to be followed. This is then ratified or modified by Council. This is a

logical and satisfactory way of arriving at a research programme. It gives the Research Committee the opportunity to vet the ideas coming from the Panels of Experts and to modify them to fit the corporate strategy which the Council has, or should have, for IJIRA.

Choice of topics and, if necessary, their elimination is one of the hardest tasks facing IJIRA. Projects tend to gather their own momentum and the assumption is sometimes made that eventually some benefits will accrue so they are permitted to carry on.. Constant, searching reviews of all projects should be part of the management control system. IJIRA has a Research Evaluation Cell comprising four members ( 2 graduates and 2 assistants) which should be able to give an objective assessment of each project to the Director so as to enable him to manage the resources at his disposal more effectively.

It is thought-provoking to look at some of the projects upon which the jute research institutes in the UK, Bangladesh and India have all worked at one time or another:

The chemical and physical nature of jute and related fibres.

Lignin and its effects on jute's properties

Biological processes to improve fibre softening

Light fastness and dyeing

Fire retardency

Batching oil substitutes

Jute reinforced plastics

Non-wovens

Instrumentation

Blending jute and other fibres

These projects and many more have been duplicated several times over, indeed some of them were begun 30 or 40 years ago and are still being pursued.

This is perhaps also true of 'new' jute products. Jute/cotton unions were around in the '30s, jute reinforced bus wings were tried in the '60s, shellac/jute composites in the '40s, jute geo-textiles in the '50s. It looks as though a completely novel use of jute will be extremely hard to find.

By no means is the jute research picture all doom and gloom however. Looking objectively at IJIRA's work and the British experience too, it seems to the writer that that the function

at which IJIRA excels is in the field of technical service in its broadest sense. This was where the British were proficient as well.

The term 'technical service' is used in the context of helping the industry with its conventional products by improving productivity and lowering its costs through better quality control, enhanced processing methods, improved maintenance, instrumentation, redesign of products, testing, evaluation of new machinery, technical information and so on. With those mills already engaged in the manufacture of non-traditional products IJIRA offers textile expertise of a high order in a variety of disciplines, it can provide physical help in the early stages of diversification, it can liaise with new end-users and support the mill's field trials.

The IJIRA technologists have the duty also to keep a weather-eye open for new technologies which may be appropriate and which, after a certain amount of speculative project work, may be of commercial interest to the mills.

IJIRA has neither the funds or expertise to carry out the development of any new machinery. This may have to change in the future if the present machinery-makers withdraw from the market but currently, and in the near future, this is unlikely.

To try to sum up the question of the selection of projects, it is, it seems to the writer, a matter moving towards a smaller number of projects, each with greater inputs and only pursuing

those which have a clear commercial chance of success and which are within the capabilities of IJIRA to deliver. A rigorous evaluation of the present portfolio of projects is recommended

### The management and control of research

Many research associations have a Research Director and a Research Manager. The Research Director is responsible for formulating a programme compatible with the strategies laid down by his council or some other governing body and he interacts with top level management in his industry and high government officials; the Research Manager is responsible for the efficient implementation of the research programme within the resources which have been allocated to it. In IJIRA the two functions are combined in one person. It was stated quite early in the writer's visits to IJIRA that the administrative work-load on the Director was heavy. His visits to Delhi occurred almost weekly and during his absence decisions were not made. In the first mission report it was suggested that a Deputy Director should be appointed to ease this burden and to expedite research work. It appears that this concept had been considered in the past but because of resistance from the Divisional Heads the idea was dropped. Perhaps this is a good time to re-consider such post. If IJIRA were to be restructured, the post of Research Manager could be created. This person would be responsible to the Director for the day-to-day operation of IJIRA as a whole. Since the Divisional Heads themselves would have new, re-allocated responsibilities perhaps they would take more kindly to the

idea now. Such an appointment would leave the Director more time to be a positive link between the laboratory and the mills, interpreting the needs of the industry and IJIRA thus ensuring that he could make a positive contribution to the formulation of the forward strategy for IJIRA.

Management of each project falls on the shoulders of the Divisional Heads and the commitment they can engender in their staffs has a great bearing on the output of their Divisions. IJIRA is fortunate in having many able scientists and technologists who make useful contributions to the research programme and their contribution could be even greater if they could be made more aware of the commercial urgency facing the industry every day.

### Staffing

About 65% of the IJIRA budget goes on staff salaries - this is a very common figure for research laboratories of this type. There seems to be a large expenditure on overheads and ancillary labour and it might be fruitful to compare IJIRA's performance in this regard with that of some of the other Indian research institutes.