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DEVELOPMENT OF BHUTHAN'S SECONDARY WOOD-PROCESSING INDUSTRIES

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BHUTHAN

Technical report: Assessment of the secondary wood-processing industries*

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

Based on the work of a UNIDO staff member

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United Nations Industrial Development Organization
Vienna

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INTRODUCTION

At the request of the Royal Government of Bhutan, the United Nations Industrial Development Organization (UNIDO) sent one of its Senior Industrial Development Officers, Antoine V. Bassili, of the Agro-based Industries Branch, Industrial Operations Technology Division, on a mission to Bhutan from 20 February to 10 March 1987.

He was to assess the present situation of the Kingdom's wood processing industries and identify measures to be taken to ensure the development of the sector. His detailed terms of reference are given in Annex I.

During his two week stay in Bhutan he visited the Gedu Wood Manufacturing Corporation in Gedu; three sawmills and two furniture shops, a broom stick manufacturer and three teachest batten plants, as well as a blockboard plant in Phuntsholing and three sawmills and three furniture manufacturers in Thimphu. He also visited the site of the new particle board complex in Tala and a logging camp at Changkaphu. Details of the plants visited, and in some cases of the persons met, are given in Annex II. Technical assistance was provided on an ad hoc basis to all the plants visited. This covered mainly machine utilization and selection, production, technology, etc. except in Gedu where more in-depth assistance was provided on the potential of the existing equipment in the joinery mill. All the field visits to Gedu and Phuntsholling were in the company of Mr. C. R. Francis, UNIDO's bridge expert/timber engineer serving on a one year assignment under post SM/BHU/84/010/11-01. Mr. Tensing Chodah, Assistant Industrial Officer at the Department of Industry, accompanied him on all visits.

A. RAW MATERIALS

Present situation

1. Overmature (climaxed) forests: Bhutan's forests are overmature (climaxed), be they softwoods or hardwoods.

2. They comprise good, well known, easily marketed conifers, and less good, and less well known hardwoods.

3. The staff seem to suffer from a lack of information on species' properties.

4. Most of the exports go out as logs, while some go out as squared logs and only the minority as sawnwood.

5. Logs are bucked to short lengths, in spite of the availability of equipment (cable systems and lorries) that could cope with longer lengths.

6. Bark beetle infestation is a problem in coniferous forests.

7. The blockboard plant in Phuntsholing was importing sawnwood and veneer from India.

8. The logs supplied to the Gedu complex were of a poor quality and resulted in extremely low yields.

Suggestions

1. The Forest service should consider the country's forest resources as a renewable national asset that should be developed and managed to ensure maximum yield, and not only market those logs that have to be felled to improve the growing stand.

2. Once this has been done, consideration should be given to invest in sawmills with log inputs of 5-10,000 m^3/year (in the conifer area initially). A system must also be developed to assure sawmills a preferential treatment in log supply because they provide more value added to the country's exports.

3. The Logging Corporation should attempt at selling mixed hardwoods after they have been grouped.

4. Publications on the properties of the most common species should be prepared and diffused.

5. The contractors should be awarded a price differential for longer logs (that will be more than made up in their sales price in India and in the lowering of transport costs) to encourage them to buck longer lengths.

6. The logging should be better planned to ensure as short a stay in the forest after felling as possible. Better 'hygiene' and prophylactic treatment is necessary and steps should be taken in this respect.

7. An investigation should be carried out to find out how and why sawnwood from India is more competitive than that produced in Bhutan for the production of blockboard, and remedies found.

B. PRIMARY PROCESSING

Present Situation

1. Some 25 small local sawmills using Indian equipment exist in Bhutan.

2. There are also two small mills, supplied by HELVETAS, the Swiss bilateral aid organization, and two more shall be provided in the foreseeable future.

3. A fully mechanized sawmill has recently been erected at the Gedu Wood Manufacturing Corporation in Gedu. It is equipped with a modern bandsaw, has a resaw, kiln drying and pressure impregnation facilities, as well as a fully equipped saw doctoring shop. It lacks however a sorting line.

4. Two blockboard mills exist: the one in Phuntsholing is a very labour intensive operation, while the one at Gedu is fully mechanized. Both produce panels of good quality.

5. Wood preservation is currently not commonly used. A 10 meter pressure cylinder is being installed in Gedu, and a mobile unit, of 4.5 m each, have been provided to the Public Works Department (PWD) in Gaylegphug under project SM/BHU/84/010. Demand for treated sawnwood and poles appears to be non-existant, all utility poles being of metal.

6. Wood drying facilities exist only at Gedu (4 modern kilns of 70 cu.m. capacity each). A small kiln exists in a mill in Thimphu, but was not being used at the time of the mission. The kiln

operators at the Gedu complex are not sufficiently trained to ensure adequate drying of the numerous species being sawn. Degrade - mainly warping - lowers considerably the yield of the planing mill.

7. Sawnwood produced is not graded. In fact it is often loaded onto lorries directly from the saw, without even scraping the sawdust off, and exported. No attempt seems to have been made at introducing any grading rules, not at training of graders once this has been done.

8. In spite of the country's large forest resources, all the sawmillers interviewed by the mission listed the regular supply of logs as being their major problem - more important than that of obtaining trained manpower.

9. Except for the Gedu Complex, all the sawyers were not trained to saw so as to get a high yield from low quality logs.

10. Good saw doctoring facilities and skills exist at Gedu, however saw doctoring skills and facilities elsewhere are rated poor to very poor.

11. The equipment in the existing sawmills is very poor: of old designs, resulting in low productivity, not accurate and not properly maintained. Layout is poor, and internal transport (transfer lines) non-existant.

Suggestions

1. Once the Forest Department's policy concerning forest management has changed, the creation of new sawmills for sawing coniferous logs should be encouraged. These should have bigger capacities (5,000 - 10,000 m^3 log input). Equipment should be more

sophisticated and mechanized, and all the mills should have good tool maintenance facilities[1/].

2. A sorting line should be installed at Gedu. It will facilitate kilning operations, but space available is the major constraint.

3. Mobile wood preservation plants could be the solution for the smaller mills. The authorities should specify, whenever necessary, pressure treated timber. The existance of such pressure cylinders would facilitate the marketing of wooden shingles and thus result in a reduction of imports of corrugated galvanized iron roofing sheets.

4. Wood drying - even if only air drying - should be encouraged. It will result in better products on the local and export markets and lower transport costs for export.

5. Some sort of grading rules must be introduced. This will enhance the image of Bhutanese exports of sawnwood and eventually permit exports to overseas markets where quality is at a premium. Their adoption will necessitate the training of graders.

6. The development of industry is impossible without an assured raw material supply. Steps must be taken to ensure this happens. Sawmillers in Bhutan should get preferential treatment over exporters of logs in having their specific demands met, otherwise the private sector will not invest in sawmilling, and the non availability of sawnwood of acceptable quality will stifle all future development of the sector be it wood based panels (using sawmills waste) or further manufacturing (furniture, joinery, prefabricated housing, etc.).

1/ Technical assistance for a full techno-economic feasibility study for such a plant could be provided, if requested through the official channels. This study should be detailed enough to give a detailed specification of the equipment, a manning table and a training programme for its personnel. Such a modern plant could serve as a 'model' for future investments and allow a more rational use of the Gedu complex (Gedu processing hardwoods and this new plant softwoods).

7. Investments in hardware (i.e. equipment) must go hand-in-hand with corresponding investments in software (i.e. training and manpower development). Gedu can serve as a training centre for hardwood sawmills. Good sawyers increase both the qualitative and quantitative yield hence the mill's profitability.

8. The same applies to tool maintenance, which is a skill that takes a long time to acquire and that affects enormously the quality of the sawnwood produced. The use of the Gedu facilities - which are excellent - to train saw doctors from all mills, specially all new ones has to be given serious consideration.

9. Serious consideration should also be given to establish, at a later date, a wood-wool (or wood-chip) cement plant to use the sawmill waste from the larger coniferous sawmill which it is proposed to establish. Prior to undertaking the feasibility study for such a mill, the suitability of the species and that of the local cement should be tested, since tannins, sugars and other extracts, if found in large enough quantities, affect the setting of the cement and thus the quality of the product and profitability of the plant. The panels produced could be tested and used to construct prototypes of housing elements that would be specifically designed for using them.

10. Advice should be given in selection of sawmilling equipment and an effort made to provide would-be investors with the necessary hard currency to enable the country's sawmilling industry to introduce technologies more advanced than those used in India. Because the sawmilling industry is using the rudimentary equipment it currently has, it impedes on the development of further processing (production of furniture and joinery) on an industrial - as against craft - scale.

C. SECONDARY PROCESSING

Present situation

1. There are no facilities producing furniture, joinery or prefabricated housing on an industrial scale (i.e. in series and with interchangeable parts) except that at the Gedu Wood Manufacturing Corporation which has the facilities, but no trained manpower, no product range, no tooling, no designs and no information whatsoever on marketing of the products that it could manufacture on the equipment installed.

2. The existing craft operations produce on a 'one-off' ad hoc basis. Quality is poor, wood is not dried, labour migrant (all work on a contractual basis) and productivity extremely low. The few machines that do exist are in a state of total disrepair and 'plant house keeping' is non existant. The market being a seller's market, the small entrepreneurs are not interested to make any improvements in equipment.

   Furthermore, these small entrepreneurs do not have the background and entrepreneurship to ensure a possible move from craft to industrial production methods.

   No information exists on modern production methods, equipment, auxilliary materials (adhesives, surface finishes, hardware fittings, etc.). Particle board is not being used by the local craftsmen or industry, (except for one operation in Phuntsholing).

   The only serial production seen was broomsticks made in the 'Pencil Factory' in Phuntsholing. This is a product with very little value added.

3. Production of teachest battens is really a marginal operation; it is very labour intensive and more an offshoot of a sawmill than real secondary wood processing.

4. Although timber plays a major structural role in traditional Bhutanese construction of housing, there is no serial production and no prefabrication. Timber components used in housing for structural purposes are usually pre-cut and assembled to ensure precision. They are subsequently dismantled, if need be, shipped to the site and re-assembled in situ.

Suggestions

1. The time does not yet seem ripe for entering serial production of furniture because of the smallness of the Bhutanese market and the traditional approach to hand made furniture in the Indian market. Production of furniture components for export calls for an assured supply of dried sawnwood in the required dimensions, quantities and qualities. This is unlikely to be assured at the present moment, because of the rudimentary sawmills (except for the Gedu Complex)..

2. Gedu's joinery plant should receive UNDP/UNIDO assistance in the following fields: machining using modern tools, wood drying, furniture design, joinery design, design of a complete prefabricated wooden house system, surface finishing, use of a wider range of species, training of manpower in plant management, machine maintenance, production planning and control, industrial costing, etc.

3. It is difficult to motivate the small entrepreneurs. Extension officers could be made available on an ad hoc basis, but this calls for an established body to cater for their needs. If such a body were to exist it could also be responsible for the operation of a common service facility centre that would cater for them in providing wood drying, wood preservation, tool maintenance. It could also provide some machining facility to carry out the more specialized operations. The current situation however, does not warrant such a facility because of the relatively small number of units and their dispersion.

One exception would however be the introduction of solar drying of timber. It is recommended to install a simple solar drying kiln in the PWD workshop in Gaylegphug, (and eventually also one in Thimphu) train people in its installation and operation, keep records of the results achieved and encourage small entrepreneurs to establish their own facilities through a demonstration cum promotion seminar in Gaylegphug after it has been operating for some time (minimum six months).

Similarly, the excellent tool maintenance facilities at Gedu and the less complete ones at the PWD workshop in Gaylegphug as well as the wood preservation facilities at Gedu and Gaylegphug should be made available to small entrepreneurs. They should be encouraged to make use of them. To widen the possible clientele for such a service the collection and delivery of the tools to a central point in Thimphu, Phuntsholing, Gaylegphug and Paro should be arranged. Fees charged should initially be nominal - i.e. actual operating costs with no overheads - to encourage use. When a solar drying kiln would have been established in the Thimphu area, it might be justifiable to also provide saw doctoring services at the same site.

4. UNDP/UNIDO could organize a study tour of about two weeks to small yet efficiently run plants in Singapore and Malaysia. This tour should be accompanied by a furniture or joinery production expert familiar with conditions in Bhutan and followed-up by a short summing up session in Bhutan. (A six week assignment of an expert would be needed.)

5. There are many other simple products other than teachest battens and broomsticks which could be produced in series. It is hoped that the market survey of the sector in North East India, proposed in the technical assistance project, will identify these and that this will lead to further processing facilities being established. These, however, will necessitate an assured supply of sawnwood of the appropriate species, grades and dimensions.

6. The production of teachest battens should only be seen as a way of improving sawmills' yields and should not be considered as an industry per se.

7. The development of new designs will probably rationalize the current traditional methods of house construction. It may even eventually be possible for the Gedu Joinery Plant to produce pre-cut 'kits' to local craftsmen for on-site assembly. To achieve this it would have to liaise closely with the National Urban Development Corporation (NUDC).

8. A data bank on modern production methods, equipment, auxilliary materials etc. should be compiled, samples kept, and information diffused to all interested parties. In the proposed technical assistance package, a small sum for documentation and quality control equipment is foreseen. Gedu would currently be the most logical place to house this data bank.

9. Local craftsmen should be trained in, and informed about, the correct use of particle board for use in furniture and joinery, and the appropriate specialized hardware should be imported and made available at cost. Unless this is done, the particle board that will be produced at Tala will be used incorrectly, since although it can replace solid wood, it is not solid wood, and has other properties which must be taken into account. This will result in consumer resistance leading to the non acceptance of the product on the local market. (The same applies to the export market in the North East of India.)

10. A simple machine to produce wooden shingles should be developed. The production of shingles by hand calls for considerable skill and is slow. The object is to make the machine available to contractors on hire (and eventual purchase) basis. They would thus be using it on site, together with a concrete mixer and cement block compactor. This would render possible the increased use of wooden shingles, a traditional and highly suitable material, and reduce the country's increasing reliance on imported

galvanized corrugated iron sheets. (The development work for this machine should be carried out on a subcontract basis in a developed country.) This should be preceded by information, to be supplied by NUDC, on the species commonly used, the envisaged capacity and the range of dimensions of the shingles to be produced. (The shingles, once produced, could, if necessary, be treated in mobile pressure impregnation plants such as the one supplied to the PWD workshop in Gaylegphug).

D. EXPORT MARKETING

Present situation

1. The market for wood products is, and will continue to be, a seller's market. A considerable volume of logs, and a lesser volume of sawnwood, is exported to India, sales are purely on a cash and carry basis. Sales are solely on a price basis. Although a premium exists in India for longer lengths, there is no attempt to produce and market longer lengths. The goods sold are neither graded nor are they dried. At present no planning of production is necessary, everything that is produced is sold. Processing is minimal, exports are either in the form of logs or squares. These are further processed in India, and sawn into the final required dimensions. No surveys of the market in North East India seemed to have ever been carried out. No information seems to be available on final end uses of the logs and sawnwood sold.

7. The only 'manufactured' product that has been exported so far by Bhutan is some plywood and blockboard, tea chest battens and broomsticks. Only the latter has been shipped overseas, all the rest being sold to India.

Suggestions

1. The Bhutanese authorities should give incentives to ensure that exports have as much value added as possible. Introducing a wider range of products would lead to specialization and possibly sales could be on a quality as against price basis. (This calls for an assured supply of sawnwood of the appropriate species in the desired grades and dimensions.)

2. An in-depth market survey for a wide range of semi-manufactured and manufactured wooden products (electric transmission poles and cross arms, sawnwood, wooden crates, mouldings, parquet, doors, windows, other joinery products, trusses, furniture and its components, turned items, etc.). This will cover also marketing channels, custom of the trade, grades and standards, etc. This will guide both the authorities and entrepreneurs on what sectors are worth developing further.

3. As a result of the above market survey, it is hoped that new products will be introduced and these will be manufactured on an industrial scale. Additional value added will result in a need for more precise production planning and control to conform to the specification sold. (This is a production not a marketing problem, but it will affect marketing adversely.)

4. The result of the market survey will also result in sales of those products that fetch a higher price on the Indian market. This will result in the need to sell specific grades of products to meet the buyers' special requirements. (Buyers are willing to pay more if they get what they specifically want and do not have to pay for the transport of what subsequently ends as waste).

5. Once the sawmilling industry of Bhutan has developed, it will be necessary to establish grading rules. (The historical importance of grading rules becomes apparent on comparing the development of exports to Europe of sawnwood from Malaysia - which had good grading rules and a serious inspection system - and Indonesia - which did not. Malaysia added value to its logs while Indonesia continued the export of large volumes of logs for many years.)

6. The sale of sawnwood that is not air-dried results in the unnecessary transport of water over large distances. The limiting factor in transport of air-dried sawnwood is often volume and not weight. If undried coniferous sawnwood is transported the limiting factor is always weight. The cost of air drying - increased financial costs of keeping the inventory - is usually more than compensated by the savings in transport costs.

7. It is felt that initially the product that stands the best chance for export overseas is graded and kiln dried sawn coniferous softwoods. There is a good market for these speciality products in Singapore who imports these from as far as New Zealand.

Joinery products, once designed and produced on an industrial scale at the Gedu Wood Manufacturing Corporation can probably find a good market in India if quality is assured.

E. MANPOWER DEVELOPMENT

Present situation

1. The vast majority of the staff of woodworking industries and craft operations in Bhutan are aliens who are highly mobile. Especially in secondary processing, these are contract labour, paid a lumpsum or on a piece basis, the employer providing only the use of the existing facilities. Training these casual labourers is therefore of no importance to the entrepreneur.

2. Plants have been established - or are being erected - in which the aspects of machine maintenance have not been given the importance this topic deserves. Relatively sophisticated technologies have been introduced without realizing that skills to maintain this type of equipment not only do not exist in Bhutan but are also not common even in India.

3. The local population, like in all developing countries at an early stage of development, is not used to the work discipline that industrial production calls for.

4. Whatever training in carpentry and woodworking is given locally, it is grossly insufficient to cover the country's needs in what is to become, by virtue of the resources available, one of the country's major industrial sectors.

5. There is a total lack of middle management and technicians who understand the operation of the process they are involved with.

6. Technical documentation of all types is not available in the country; although it should be no problem obtaining it, since it is readily available in English, which is the language of education in Bhutan.

Suggestions

1. The fact that the labour force in the sawmilling and furniture plants are aliens makes it difficult for the Bhutanese authorities to organize some form of training - the more so as they are highly mobile. As the rural population increasingly enters the money economy, the authorities should impress upon the skilled craftsmen, who are employed in woodworking only on a part-time basis, to specialize and make a full-time career of it. Training facilities, at all levels, must be expanded and more emphasis placed on manpower development.

2. With the increased development of the wood processing industries in Bhutan, and with their increased mechanization (especially because of the increased sophistication of the equipment used), the current practice of subcontracting work on a piece work basis will become increasingly inappropriate and hence less common. In order to provide a competent labour force to these industries, the Government should provide training for machine operators - as against craftsmen carpenters and joiners at the skilled worker level. The success of the development of this sector of the Bhutanese economy will depend to a very large extent on the success of this programme.

3. The training of skilled technicians, at all levels, specialized in the maintenance of the relaitvely sophisticated equipment being installed in Gedu and Tala should be given top priority. The current practice of deciding on the investment and proceeding with the purchase of the equipment and its installation does not bode well for the financial success of the enterprises being established. The Bhutanese authorities should accord to the development of manpower the importance it rightly deserves.

Since the equipment being installed in Gedu and Tala is, by and large, more sophisticated than any existing in plants producing similar products in India, the industry will not be able to rely on Indian know-how to repair the equipment post facto.

The authorities should therefore appoint young Bhutanese to positions of responsibility in the field of maintenance of equipment as soon as an investment decision is taken, involve them (passively) in the process of equipment selection, and train them fully for the duties they are supposed to assume immediately upon the order of the equipment. This calls for a considerable investment, but it will be money well spent. Fields of electro-mechanics, electronic controls, management of maintenance etc. are specifically important.

4. The wood processing industries sector, if fully developed (i.e. if as much value is added locally as possible), could make a large contribution to Bhutan's economy and foreign exchange earnings. In order to do so, not only will investments have to be made in plant and equipment, but also - and this is just as important - in manpower development.

The authorities should plan this hand in hand with their plans for industrialization, and ensure, as soon as possible, that the local technical school covers the country's needs in skilled manpower at all levels. Emphasis should be given in this school to training in technical rather than craft skills.

5. The availability of a competent and motivated middle management is a sine qua non condition to the efficient operation of any industrial undertaking of any size larger than 'small'. Steps should be taken to train young persons in these skills both in Bhutan and abroad. Study tours should be organized to Malaysia and Singapore to familiarize them with operations in well run factories.

6. Technical documentation aimed at the needs of developing countries, giving basic information in an easily readable and understandable form, is hard to get. UNIDO has attempted, through its manuals, to cater for these needs. The authorities should create documentation units in the main centres of the country, staffed by a documentation specialist cum extension officer that could provide ad hoc advice to the small scale entrepreneurs and make copies of relevant documents available. Providing this type of assistance will help create small entrepreneurs who will be able to share the government's financial cost of industrialization. These entrepreneurs could also benefit from study tours to industries and specialized woodworking machinery fairs abroad.

ANNEX I

TERMS OF REFERENCE

Introduction

The Government is presently in the process of identifying many timber based industries in the country, based on the immense forest resources. Presently, there are many furniture and sawmilling units, some T-chest battens, cable-drums, veneer, plywood and blockboard manufacturing units. A particle board manufacturing unit is in the pipeline to be commissioned in the middle of 1987.

A draft strategy for the development of a timber based industry has been prepared as part of the overall industrial strategy of Bhutan. But the purpose of the consultancy is to provide a more detailed policy, for an area which has been identified as having major growth potential for the country.

Scope of work

The expert will carry out the following:

1. Visit most of the existing timber based industries in Thimphu, Gedu and Phuntsholing. Also make suggestions wherever possible to the units, on equipment, machine layout, production, etc.
2. Visit the source of raw material, analysis on quality and supply, i.e. one of the logging centres (Changkaphu) under Bhutan Logging Corporation.

The expert after field visits and reviewing the strategy for development of a timber based industry will advise the government on the following:

1. Make suggestions on the type of timber based industries that could be established in the country, looking into the present stage of industrial development and the future plans.

2. On the product mix at the Gedu WMC, Gedu, and give views on the practicability of the proposed plans for the development of pre-fabricated housing industry and the fielding of a short term expert to implement the programme.

3. On the possibility of developing in the longer term an export oriented industry producing specialized knock-down furniture and other similar market oriented product, the potential for attracting a foreign partner for a joint venture exercise, the inducements which such an investor would need and the possibility of prior research into the technical and market qualities of selected hard woods in the Kingdom.

As part of its priority plan to upgrade the smaller private sector of the economy, the Government is envisaging an integrated programme of support for private sector finished wood products. With the appointment of a field expert to work closely with a number of selected private entrepreneurs to assist them in work and management practices and methods of market penetration. The expert will be asked to prepare the terms of reference for such a consultant.

ANNEX II

List of persons met

Royal Government of Bhutan

Planning commission

Dasho C. Dorji, Secretary, Planning Commission

Mr. Ugen Tsering, Director, Planning Commission

Ministry of Industry

Dasho Oum Pradhan, Deputy Minister

Department of Industry

Mr. Yishey Zimba, Director of Industry

Mr. Tshenghok Telle, Project Officer

Mr. Tensing Chodah, Assistant Industrial Officer 1/

Department of Education

Mr. Jigmy Thinley, Director of Education

Mr. Zangley Dukpa, Deputy Director, in charge of school planning and building cell.

Mr. Robert Fielding, B. V. O. Architect

Mr. John Blaney, B. V. O. Engineer

Department of Public Works

Mr. A. L. Sharma, Principal Architect

Mr. Kunzang Wangdi, Engineer in charge of bridges

Department of Forests

Mr. Sangay Wangchuck, Assistant Director, Planning office

1/ Accompanied the mission on all plant visits.

National Urban Development Corporation, Thimphu
Mr. Megh Raj Adhikari, Urban Planner
Mr. Ian Mackey. CTA UNDP/HABITAT project

Royal Insurance Corporation, Phuntsholing
Mr. Kipchu Tshering

Gedu Wood Manufacturing Corporation, Gedu
Mr. Nawang Gyetse, General Manager
Mr. William Chalmers, FAO Production Expert

Bhutan Board Products Ltd., Tala
Mr. Chhimi Thendup

Chhoden Engineering Works (sawmill), Phuntsholing
Mr. Mamendra Lakhotia, Manager

Evergreen Sawmill, Phuntsholing,
Mr. Narbu Tshering, General Manager

Bhutan Wood Panel Industries, Phuntsholing.
Manager

Phuntsho Pencil Slat Factory, Phuntsholing
Manager

Hing and Kong Co. Furniture Factory, Phuntsholing
Mr. Thendup, Manager

Bhutan Logging Corporation, Changkaphu
Officer in charge

Jattu Furniture Works, Thimphu
Mr. Jattu Dukpa, Proprietor

Kuenga Zokhang Modern Furniture Co., Thimphu
Manager

Army Welfare Organization's Sawmill, Thimphu
Manager

Kaydee Timber Industries, Thimphu
Mr. K. Dorji, Manager

Helvetas (Swiss Corporation for Development)
Mr. Ernst Reinhardt, Resident Coordinator

The World Bank
Ms. Ai Chin Wee, Economist, South Asia Projects
Mr. Jack Urner, Consultant
Mr. Jean de Spiegeleer, School Construction architect.

Asian Development Bank
Mr. Peter C. Brankmann, Project Economist
Mr. Michael Burisch, Consultant in industrial estates

FAO
Mr. Rainer K. Stolz, Sylviculturist

UNDP
Mr. Paul Matthews, Resident Representative
Mr. David Lockwood, Deputy Resident Representative
Ms. Sonam Yangchen, Programme Officer

UNIDO
Mr. M. Kamal Hussein, Senior Industrial Development Field Adviser (stationed in New Delhi, India)
Mr. C. R. Francis, UNIDO Bridge expert/Timber engineer.

ANNEX III

PROPOSED REVISION FOR SM/BHU/84/010 (BRIDGE PROJECT)
(ADDITIONS TO THE EXISTING PROJECT DOCUMENT)

Part II A - Development Objectives:

1. To improve the quality (and hence durability and quality of end products) of the sawnwood used in Bhutan through drying.
2. To introduce a simple solar timber drying kiln, suitable for local conditions.

Part II-B Immediate objectives:

1. To construct a simple solar timber drying kiln, suitable for use by the small craftsmen in Bhutan.
2. To operate this solar kiln so as to obtain data on its performance and recommend drying schedules suited for the local species and climatic conditions.
3. To promote this design among potential end users.
4. To train potential end users in its operation.

Part II-C Special considerations:

Solar drying of timber is a simple technology suited for use by the primitive craft furniture and joinery plants in Bhutan. It calls for small investments of simple products (plastic foil, fans and electric motors), readily available, and is eminently suited for the conditions in Bhutan, a least developed country.

Part II-D Background and justification:

Apart from the facilities existing at the Gedu Wood Manufacturing Corporation's Joinery Plant, there exist in Bhutan no industrial facilities for the production of furniture and joinery on an industrial

scale. All production is still at the craft level. The existing small units produce low quality products, either on a one-off basis or in very small series using no or only some of the very basic woodworking machines (small diameter bandsaws, planer-jointers and thicknessers). None of these craft operations kiln dry the timber they use and, if air dried, it is done for very short periods because they cannot afford to immobilize their scarce working capital. The result is poor quality products that crack and have weak joints due to the subsequent shrinkage of timber.

Simple, low cost and small scale (approximately 200 cu.ft.) solar timber drying kilns have been designed, developed and tested under conditions prevailing in other developing countries under UNIDO executed projects. The results have indicated that moisture contents of as low as 8 percent have been obtained, inside temperatures can be up to 20°C (36°F) higher than the ambient air temperature and drying times can be reduced by 30 percent compared with air drying with no degrade.

It is proposed to introduce this technology to Bhutan using the facilities of the PWD Workshop at Gaylegphug used by the ongoing low cost modular bridge project (SM/BHU/84/010)

Part II-E Outputs:

1. A prototype small scale and simple solar timber drying kiln suited to local conditions.
2. A manual on its construction and operation.
3. Proposed drying schedules for the species most commonly used in Bhutan, suited to local climatic conditions.
4. Operators at the PWD trained in the construction and operation of the kiln.

Part II-F Activities

The major Benchmarks foreseen are as follows:

Activity	Time	Responsibility of:	Location
1. Fielding of wood drying consultant to adapt existing designs and draw up specifications of equipment	May 1987	UNIDO	Gaylegphug
2.Construction of solar kilns prototype using local equipment	June/ August 1987	PWD	Gaylegphug
3. Purchase of imported components	June/ August 87	UNIDO	Vienna& Thimphu
4. Commissioning of prototype kiln	Sept.87	UNIDO&PWD	Gaylegphut
5. Drafting of construction manual	Sept. 87	UNIDO&PWD	Gaylegphug
6. Testing of drying characteristics of kiln and training of operators	March 88	UNIDO & PWD	Gaylegphug
7. Wood drying consultant's analysis of results and drafting of operation manual	April 1988	UNIDO	Gaylegphug
8. two-day seminar for potential operators	April 1988	PWD	Gaylegphug

Part II-F Inputs

Government Inputs*

Counterpart	Duration
'In charge' (from Gaylegphug PWD)	From April 1988 to end of project
Labour to erect prototype kiln	As and when needed
Labour to operation and stack kiln	As and when needed
Services and material	
Locally available building materials (cement wood, etc.)	June to August 1987
Sawn timber to operate the kiln	September 87 to end of project

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* Over and above those already provided by the project.

UNDP Inputs*

International Experts

11-50 Consultant in solar drying of timber (split mission 3m/m

Wood technologist specialized in drying of timber Experience in design and operation of solar kilns essential

Equipment

Imported equipment for prototype kiln (motors, fans, starters, plastic film testing equipment, etc.)

Part II-H Preparation of a work plan

(see activities)

Part II-I No additional inputs needed

Part II-J Ditto

Part II-K Ditto

Part II-L Ditto

Part II-M Future UNDP assistance: None foreseen at this stage

Part III: No additional inputs needed

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* Over and above those already provided by the project.

Project Budget ADDITIONAL INPUTS

	Total		1987		1988	
10 Project personnel	m/m	US$	m/m	US$	m/m	US$
11-50 Wood drying consultant	3	21.750	1.5	10.500	1.5	11.250
15-00 Local travel		450		225		225
19-00 Component total	3	22.200	1.5	10.725	1.5	11.475
Equipment						
41-00 Expendable equipment		8.500		8.500		
49-00 Total Component		8.500		8.500		
50-Miscellaneous						
53-00 Reporting costs & sundry		2.000		500		1.500
Component total		2.000		500		1.500
99-00 Grand total	3	32.700	1.5	19.725	1.5	12.975

ANNEX IV

PROPOSAL FOR A TECHNICAL ASSISTANCE PROJECT TO DEVELOP TIMBER-BASED INDUSTRIES IN BHUTAN

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Royal Government of Bhutan

Project Document

Title: Development of Timber Based Industries
Number: BHU/87/ /A/01/37 **Duration:** 36 months

Primary Function: Direct Support
Secondary Function: Institution Building

Sector: (Government class) Trade, Industries and Forests
(UNDP class and code) Industry (05)
Sub-sector: (Government class) Industry
(UNDP class and code) Direct support (0510)

Government Implementing Agency: Ministry of Industries and Trade
Executing Agency: United Nations Industrial Development Organization (UNIDO)

Estimated Starting date: August 1987

Government inputs: In kind

UNDP Inputs: US$ 953.325

Signed:_____ Date:
On behalf of the Royal Government
of Bhutan

_____ Date:
On behalf of the Executing Agency

_____ Date:
On behalf of UNDP

PART I. Legal Context

This Project Document shall be the instrument referred to as such in Article 1, paragraph 1, of the Assistance Agreement between the Royal Government of Bhutan and the United Nations Development Programme, signed by the Parties on 21 February 1973.

The Government Implementing Agency shall, for the purposes of the Standard Agreement, refer to the Government Cooperating Agency described in that Agreement.

PART II A. Development Objectives

The overall development objective towards whose achievement the project is expected to contribute is the fuller utilization and further processing of the country's rich, but only partially tapped, forest resources and to the increase in the value added of its exports of timber products. More particularly the project is expected to contribute to the Royal Government's development of appropriate wood processing industries, bearing in mind the limited manpower available, its lack of skills and entrepreneurial experience as well as cultural considerations. It will also result in a fuller and more efficient use of the forest resources thus helping conserve them, and in improving the quality of housing in remote areas.

PART II B. Immediate Objectives

The project will complement the assistance provided by UNDP/FAO through project BHU/80/014 and UNDP/UNIDO through project BHU/84/010. The immediate objectives of the development package foreseen in this project are to:

1. Design, fabricate and erect three prototype modular prefabricated buildings for institutional buildings for use in accessible yet remote areas of the country; and demonstrate that such constructions are both feasible, suitable and economic and can be produced with facilities and using materials already existing in the country. (The final, if necessary modified, designs will be introduced for serial production under objectives 11 and 12 below.)

2. Commission fully the existing kiln drying facilities at the Gedu Wood Manufacturing Corporation (GWMC), train three operators in their use and in the rudiments of wood drying technology. Propose a methodology for the identification of the most appropriate kiln schedules and suitable species groups for kiln loads.

3. Prepare a manual of the physical, mechanical, machining, durability, treatment and kiln drying properties of the species supplied to the GWMC; recommending appropriate end uses for each. (This work will be based solely on a bibliographic search and will be complemented under objectives 7 and 10 below.)

4. Advise on the selection of complementary equipment for the joinery plant (tooling, surface finishing, quality control and reference library) and provide this equipment.

5. Undertake a detailed market survey for semi-manufactured and manufactured wood products in North East India. The range of products shall include: utility poles and crossarms, sawnwood, mouldings, plywood, blockboard, tea-chests and their components, doors, windows, other joinery items, furniture components, school and office furniture, parquet flooring and miscellaneous turnery items. Obtain information on 'custom of the trade', prices, volumes and marketing channels.

6. Provide three six month training fellowships in appropriate plants to the GWMC Maintenance Manager, the Manager of the GWMC joinery plant, and its foreman[1/]. (It is assumed that these posts will be filled by persons yet to be appointed. Prior to their assuming their duties, it is recommended that they should benefit from the proposed fellowships.) Upon the return of the fellows, UNDP/UNIDO will appoint three experts for two years each to introduce sound management in the complex.

7. Test a maximum of five of those species, not included in the bibliographic search which occur frequently enough to justify their selection and obtain the corresponding values as for those included in objective 3. Among these five species may be included species whose local properties appear to vary significantly from the data published.

8. Provide designs for a range of joinery products suitable for serial production that take into account the Bhutanese cultural heritage and its aesthetic values, and produce prototypes.

9. Provide designs for a range of office furniture suitable for serial production that would replace those that the Government currently has to import, and produce prototypes of the major items.

10. Group the species covered by the work produced as a result of objectives 3 and 7 into the following major categories: decorative, structural, heavy utility and light utility. For each category further in-depth grouping will be carried out (eg. machining properties for heavy utility species; strength grouping for structural uses; peeling/slicing properties for decorative species, etc.).

11. Publish three detailed manuals describing the revised building system specifically aimed at (a) the specifiers, (b) the production manager of the plant producing the elements and, (c) the chief of the team erecting the buildings on site. These manuals will incorporate the information obtained from the work produced as a result of objectives 3, 7, 8 and 10 above into the preliminary designs prepared under objective 1.

12. Construct one or more structures incorporating the revisions made to the system developed under objective 1 through objective 11 above.

1/ This objective may have to be complemented by the subsequent provision of expert services which will advise on the adaptation of the skills acquired to local conditions.

PART I: C. Special Considerations

The Royal Government has invested considerable sums in the development of its wood processing industries sector. It has created the Gedu Wood Manufacturing Corp. (GWMC), which comprises a veneer, plywood and blockboard line, a sawmill with drying and preservation facilities, and a new joinery plant. Part of the wood based panel line has received UNDP assistance (under project BHU/80/014) while the rest and the other lines were financed from Kuwait Fund for Arab Economic Development (KFAED) funds, and did not comprise a technical assistance component other than a site engineer to supervise erection.

Acute shortage of manpower, in absolute terms as well as in respect of trained and experienced personnel at all levels, are the major constraint (together with lack of investment resources) facing the development of the sector.

Investments were made for a joinery plant without prior market surveys and without a range of designs for the products. This project attempts at correcting these shortcomings and to improve the operation of the GWMC's joinery plant.

PART II D. Background and Justification

Forests are one of Bhutan's major natural resources. Furthermore, it is a renewable resource. They cover approximately two thirds of the country's total surface. Wood can and should therefore make an important contribution to the country's development, contributing not only to the Government's revenues but also to the country's foreign exchange earnings.

So far, the majority of the country's exports of wood have been in log form with only a small proportion of squares and battens. Sawmill waste is often converted to tea chest battens and exported. Until quite recently wood processing has been limited to some 25 very small sawmills, the majority of which are using small, hand-fed horizontal bandmills and table band re-saws. The very few furniture-cum-joinery plants that exist in the major urban centres are purely craft operations having a maximum of some three to four basic woodworking machines (table bandsaws, jointers, and thicknessers). Some tea-chest battens are also produced for export using as raw material edgings from the sawmills. One small outfit produces broomsticks for export.

The only wood processing plant operating on an industrial scale and using modern equipment is an integrated complex established in Gedu as a public sector company. Originally, it comprised a sliced veneer, a blockboard and plywood plant, and a sawmill. A kiln drying and wood preservation facility and a joinery plant have been added recently. The wood based panels plants have been provided under UNDP/FAO project BHU/80/014 (Forest Industries), that provided both the equipment as well as the technical aasistance. The more recent additions were financed through a loan from the Kuwait Fund for Arab Economic Development. Although this loan included the services of a site engineer to supervise erection, it did not foresee a technical assistance component. At the time of drafting this project document, the plywood plant had benefitted from UNDP/FAO experts and was operating satisfactorily. The operation of the more recent additions was erratic due to the poor quality of the log input, the relative inexperience of

the workforce in operating the equipment - which is unique in the country and sophisticated by local and even Indian standards - and the non-availability of any detailed market survey, marketing channels and product information.

In fact the only training that the operators have been provided with so far is that given by the equipment manufacturers' fitters. Middle management in the joinery plant is non-existant. The project will aim at overcoming these difficulties by providing training on an ad hoc basis in selected fields (eg. wood drying, surface finishing).

The joinery plant has also been purchased without the normal range of tools. It is therefore proposed to provide assistance in selecting the necessary tools and demonstrating their correct use.

Gedu is located in an area where broad-leaved forests predominate. The plant has so far received a multitude (over 60) different hardwood species. Since there does not seem to exist in Bhutan any information on the properties and potential end uses of native species, it has been obliged to use these haphazardly, resulting in possibly unnecessary (such as unnecessary steaming of logs) or inappropriate treatments. The project aims at overcoming this through a bibliographic search of the properties of the species native to Bhutan and the testing (or complementing the testing) of a selected few that predominate and for whom published data is not available, not complete or incorrect (due to changes in climatic and soil conditions).

The use of timber in construction calls primarily for a strength grading, while its use in furniture calls for appearance grading. Consequently, it is possible, for construction end-uses, in low lying areas where broad-leaved forests predominate to use mixed species - thus ensuring a more rational use of the forest and intensive as against extensive harvesting methods - provided these have been grouped according to their properties and only species from the same group are used. This approach also permits the marketing of 'lesser known' (more correctly called 'commercially less desirable') species and those whose natural occurrence is too small to permit their rational exploitation if marketed individually. Thus a more rational use of the mixed hardwood forest can be assured.

With this in view, the project proposes to undertake a study on the grouping of species, whose results will be of use to all timber users, present and future, in Bhutan and those areas to which Bhutanese forest products will be exported.

Currently, Bhutan exports the majority of its forest products in log form, with the balance as squared baulks. Considerably more profits could be generated if the exporters attempted to produce what the Indian market seeks and not merely wood to be used as shuttering for concrete or battens for cable reels. Consequently, the project will undertake an in-depth market survey of semi-manufactured and manufactured wood products in North East India. The results of this study will indentify a range of products which could be manufactured in Bhutan and measures (such as the supply of longer length logs from the forests) to be taken. It would also lead to the establishment of new wood processing industries in Bhutan.

Currently Bhutan imports a sizeable portion of its needs of office and institutional furniture. Metal furniture is also used. This is because the quality obtained from local manufacturers is poor and they are not in a position to ensure quick supplies. This could be assured if the GWMC plant

were to produce such furniture. The introduction of such products could lead to eventual exports of furniture components overseas. With respect to joinery, it is felt that a good potential exists for exports to India. These would however only materialize if well designed products were available and the plant had the necessary expertise to produce on a serial basis. With this in view the project will provide the services of furniture and joinery designers who will design a range of office furniture and joinery for serial production at GWMC.

Timber is traditionally being used in Bhutan for building purposes. It is used structurally as well as for cladding, in both rural and urban constructions. Traditional housing is constructed on site using craft methods. It is customary to prepare the components, pre-assemble them for testing, dismantle them again and then assemble them finally in situ. This method is time and labour consuming. Nevertheless, the system used can be adopted for prefabrication and production in small series.

The Royal Government of Bhutan is interested in developing and producing prefabricated wooden elements for use in their school and other institutional building programmes in remote rural areas.

PART II E. Outputs

1. A better knowledge of the properties and potential uses of species occurring in Bhutan, resulting in a more rational and intensive use of the country's forest resources, more economic production, better quality products and a facilitation for their eventual marketing abroad for a wider range of end products and/or uses. (Objectives 3, 5 and 10)
2. A fuller utilization of the facilities existing at the GWMC resulting in a wider range of items manufactured, higher quality products, better trained personnel, bringing about improved overall financial results (Objectives 1, 2, 4, 5, 6, 8, 9, 11 and 12).
3. A more rational use of timber in construction in Bhutan and an improvement in the standard of building construction in remote rural areas hopefully resulting in a reduction of urban migration, an overall improvement of social conditions, and at the same time a reduction in construction costs (objectives 1, 8, 11 and 12).
4. An improvement in the level of knowledge of professional, managerial, technical and trades staff in Bhutan's wood using sector (all the objectives).
5. Improvement of the country's balance of payments through an increase in the range of wood-based products exported, more value added to these exports and a reduction of imports through increased local manufacturing (objectives 2, 5, 8 and 9).

PART II F Activities

The major benchmarks foreseen are as follows:

Activity	Time	Responsibility of:	Location
0. Project identification and formulation, mission by a UNIDO staff member	February/ March 87	UNIDO	Bhutan
1. Construction of 3 prototype prefabricated buildings	March-December 87	UNIDO	Gedu, Gaylegphug & countryside
2. Approval of terms of reference of firms for bibliographic search	October 87	Government & GWMC	Thimphu & Gedu
3. Nomination of 3 fellows	November 87	Govt. & GWMC	
4. Market survey for wood products in N.E. India	November 87-January 88	UNIDO	N.E.India
5. Commission kilns	December 87	UNIDO	Gedu
6. Compile bibliographic search	December 87 - March 88	UNIDO	HQ of consulting firm selected
7. Selection of supplementary equipment for joinery plant	December 87	UNIDO	Gedu
8. Placement of 3 fellows and training	February 88-August 88	UNIDO	Abroad (to be arranged)
9. Provision of assistance in	September 88	UNIDO	Gedu
(a) Plant maintenance	August 90		
(b) Management of the Joinery Plant	September 88 August 90	UNIDO	Gedu
(c) Production planning and control of joinery	September 88 August 90	UNIDO	Gedu
10. Purchase and delivery of joinery equipment	January 88 May 88	UNIDO	Vienna and Gedu
11. Design of joinery products	February 88 - April 88	UNIDO	Gedu and Thimphu
12. Identification of max. 5 species to be tested and approval of terms of reference and firms.	May 88	Government & GWMC	Thimphu and Gedu
Activity	Time	Responsibility of:	Location
13. Testing of max. 5 species	August - November 88	UNIDO	HQ of consulting firm selected
14. Design of office furniture	August - November 88	UNIDO	Gedu & Thimphu
15. Approval of terms of reference and firms for grouping of species		Government & GWMC	Thimphu & Gedu

16. Grouping of species	January - April 89	UNIDO	HQ of consulting firm selected
17. Approval of terms of reference and firms for 3 manuals on construction systems	January 89	Government & GNMC	Thimphu & Gedu
18. Preparation of 3 manuals on construction systems	June - September 89	UNIDO	HQ of consulting firm
19. Construction of structures using revised system	October - December 89	UNIDO	Gedu, Gaylegphug & countryside
20. Consultants in fields to be determined later	2 months	UNIDO	Bhutan

NOTE: The construction of prefabricated wooden buildings, developed under objective 1 and activity 1 could proceed throughout the life of the project, until such time as the designs are revised to incorporate the work produced under the relevant objectives under activities 17 and 18 when the latter will supercede the original designs.

PART II G. Inputs

Government inputs: Counterparts	Duration	
National Project Director (to monitor overall performance of the project)	35	m/m
Architect (for objectives 1, 11 and 12)	2	m/m
Factory foreman and staff at Gaylegphug (over a period of 4 months)(for objectives 1, 11 and 12)	25	m/m
Joinery factory foreman and staff at Gedu (over a period of 4 months)(for objectives 1, 11 and 12)	35	m/m
Site foreman and crew (for objectives 1 and 12)	35	m/m
Chief kiln operator and kiln staff (for objective 2)	10	m/m
Manager and foreman of joinery plant at Gedu (for objectives 4, 8 and 9)	30	m/m
Head of marketing Department at Gedu (for objective 5)	0.5	m/m
Draughtsman at Gedu (for objectives 8 and 9)	4	m/m
Manager of maintenance Department at Gedu (for objective 6)	30	m/m

Services

1. Plans and specifications of prototype buildings to be erected (from Department of Education) as well as provision of transport (for objectives 1, 11 and 12).
2. All available information on the properties of species native to Bhutan (from Forest Department)(for objective 3).
3. Statistics on intake of hardwoods at Gedu (from GWMC) (for objective 3).
4. Plan and layout of joinery department at Gedu and all technical specifications on the equipment installed. The layout and plan should indicate services (compressed air, power, water and waste extraction lines) (from GWMC) (for objective 4).
5. Existing information on Indian market for Bhutanese Wood products (from GWMC and the Expert Development Corporation).
6. Names of up to five species to be tested, detailed list of tests to be carried out for each (from Forest Department and GWMC) (for objective 7).
7. Freight of samples to the testing establishment selected (from Forest Department and GWMC) (for objective 7).
8. Specifications of joinery in Government financed construction that could be produced in series (from Departments of Education, Public Works, National Urban Development Corp. (NUDC), etc.)(for objective 8).
9. Information on quantities purchased over five years and range of office furniture for government use (from various government departments) (for objective 9).
10. Cost data and design briefs on construction that are to be replaced by wooden prefabricated buildings (from Departments of Education, Public Works and NUDC)(for objective 11).
11. Design brief, and provision of transport of the prototype of the revised design (from Department of Education) (for objective 12).
12; Offices, furniture and office supplies for internationally recruited staff and administrative personnel (secretary and draughtsman).

Salary of fellowship holders

Salary of the three fellowship holders for six months each (18 m/m)

Materials

1. All building materials for three prototype buildings, including site preparation (from GWMC and Department of Education) (for objective 1)
2. Freshly sawn timber for kilns - volume commensurate with one month's operation of four kilns (from GWMC) (for objective 2).
3. Appropriate quantity of a maximum of five species, each taken from five different trees, sawn to the required specification. (form Forest Department and GWMC) (for objective 7)
4. Materials for prototypes of joinery products designed (from GWMC) (for objective 8)
5. Materials for prototypes of major items of furniture designed (from GWMC) (for objective 9)

6. All building materials and site preparation for the building to be erected using the revised designs (from GNMC and the Department of Education) (for objective 12).

UNDP inputs

International experts

11-01 Timber engineer 6 m/m[1/]

Timber engineer with considerable experience in the design and construction of simple structures and prefabrication techniques. Experience in developing countries highly desirable (objectives 1 and 12).

11-02 Foreman carpenter 12 m/m[2/]

Skilled carpenter with experience of construction in developing countries and in the supervision and training of local workmen (objectives 1 and 12).

11-03 Timber drying expert 1.5 m/m[3/]

Wood technologist specialized in kiln drying of timber. Experience in training desirable (objective 2)

11-04 Wood machining expert 1 m/m

Engineer or wood technologist with experience in the day to day operation of furniture or joinery plants (objective 4)

11-05 Joinery designer 3 m/m

Technician with long experience in the design and production of a wide range of joinery products (objective 8)

11-06 Furniture designer 3 m/m

Furniture designer with considerable experience in the design of office furniture using panels and solid wood. Experience in developing countries desirable (objective 9).

11-07 Expert in Plant maintenance 24 m/m[4/]

Mechanical or electrical engineer with long experience in the maintenance of large integrated wood processing complexes. Experience in management of maintenance and in developing ocuntries highly desirable (objective 6).

11-08 Expert in Production of Joinery 24 m/m[4/]

Wood technologist or engineer with long experience in the technical management of furniture or joinery plants. Experience in developing countries desirable (objective 6).

11-09 Technician in production of joinery 24 m/m[4/]

Wood technician with long experience at the shop floor (foreman) level in operation of furniture and joinery plants. Experience in developing countries desirable (objective 6).

11-50 Consultants in fields to be determined later 2 m/m

1/ For job description see appendix III.
2/ For job description see appendix IV.
3/ For job description see appendix V.
4/ Implementation of this post conditional to completion of corresponding fellowships.

Administrative support

13-00 A secretary, a driver and a draughtsman for the entire duration of the project.

Sub-contracts

21-01 Manual on properties of Bhutanese wood species.

Undertake a bibliographic search of the publication describing the physical, mechanical, machining, durability, treatment and kiln drying properties of the species supplied to GWMC, and recommend appropriate end uses for each (objective 3). The tentative list of species is given in Appendix I.

21-02 Market survey for semi-manufactured and manufactured wood products in North East India.

The range of products shall include: utility poles and cross arms, sawnwood, mouldings, plywood, blockboard, teachests, and their components, doors, windows, other joinery items, furniture components, school and office furniture, parquet flooring and miscellaneous turnery items (objective 6).

21-03 Testing of five Bhutanese wood species

Full testing of five species not included in the bibliographic search occurring frequently in GWMC's supply of logs (objective 7).

21-04 Grouping of Bhutanese species.

Group the species covered by the work produced as a result of objectives 3 and 7 into categories detailed in objective 3 (objective 10). Consideration will be given to using the grouping approach developed by TRADA and in the United Kingdom.

21-05 Manuals on the prefabricated building system.

Prepare three detailed manuals describing the revised building system specifically aimed at (a) the specifiers, (b) the production managers of the plants producing the elements, and, (c) the chiefs of the teams erecting the building on the site. These manuals will incorporate the information obtained from the work produced as a result of objectives 3, 7, 8 and 10 into the preliminary designs prepared under objective 1.

Fellowships

31-01	Manager of the GWMC joinery plant	6 m/m
31-02	Maintenance manager of GWMC	6 m/m
31-03	Foreman of GWMC joinery plant	6 m/m

Equipment

41-00 Tooling for the GWMC joinery plant.
(Representative range of tooling normally used for the production of furniture and joinery in plants having similar equipment to the GWMC). It will be used for demonstration and training purposes.
Testing and quality control equipment.
(To test surface finishes, precision of jigs, etc.)
Documentation
(Small reference library on properties of species wood technology, wood drying and preservation, production of furniture and joinery, industrial engineering, etc.)
Surface finishing material
(Small quantities of various products for demonstration and training purposes)

42-00 Surface finishing equipment: Two spray guns and simple locally made cabin for surface finishing of furniture and joinery.
One Toyota pick-up with double cabin and 4-wheel drive including spares and four extra tires.

50-00 Miscellaneous
Reporting costs
Sundry: Operating costs, etc.

PART II H. Preparation of a work plan

A tentative work plan, in bar chart form, is attached in Appendix II. A detailed work plan will be prepared after the approval of the project.

PART II I. Preparation of the framework for effective participation of national and international staff in the project.

No special preparations are foreseen since basically only short-term assistance will be provided to entities that are already functioning.

PART II J. Development Support Communication

Not applicable.

PART II K. Institutional Framework

The official counterpart body will be the Department of Industry. Actual working level contacts will be with the Gedu Wood Manufacturing Corporation, the School Planning and Building cell of the Department of Education, the Department of Forestry, the National Urban Development Corporation, the Export Development Corporation, as well as privately owned woodworking plants and other government bodies as appropriate.

PART II L. Prior obligations and prerequisites

Prior obligations: there are no special prior obligations on the part of either the government or the executing agency.

Prerequisites: It will be the responsibility of the Department of Industry to coordinate the inputs of the various entities with the project and liaise with them. These bodies will be called upon to provide data, services, materials and counterparts to the short-term experts as and when needed.

This project document will be signed by the Resident Representative on behalf of UNDP and UNDP assistance to the project will be provided only if UNDP has received satisfaction that the prerequisites listed above have been fulfilled or are likely to be fulfilled. If anticipated fulfillment fails to materialize, UNDP may, at its discretion, either suspend or terminate the assistance, or part thereof.

PART II M. Future UNDP assistance

None foreseen at this stage.

PART III. Scheduling of monitoring, evaluation and reports.

PART III A. Tripartite monitoring reviews and technical reviews

The project will be subject to periodic review in accordance with the policies and procedures established by UNDP for monitoring project and programme implementation.

A special technical review is foreseen six months before the end of the project. Technical personnel from the executing agency will also participate at the project's expense. If need be, a consultant will be recruited and charged to the project.

PART III B. Evaluation

The project will be subject to evaluation in accordance with the policies and procedures of UNDP.

Any costs related to the participation of UNDP and Executing Agency personnel or outside consultants specially recruited for such evaluation will be covered under the personnel component of the project.

PART III C. Progress and terminal reports.

Because no long term CTA is foreseen for this project, the National Project Director will be responsible for the preparation of Project Progress Reports, of the prescribed format, at regular six-monthly intervals.

He will also be responsible for the preparation of the terminal report, in accordance with UNDP's policies and procedures.

COUNTRY	PROJECT NUMBER AND AMENDMENT	SPECIFIC ACTIVITY CODE
Bhutan	BHU/87/ /A/01/37	

PROJECT TITLE
Development of timber based industries

INT.EXPERTS (func.titles req. except for line 11-50)		TOTAL		1987		1988		1989		1990	
		m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
11-01	Timber Engineer	6	40500	3	19200	0	0	3	21300	0	0
11-02	Foreman carpenter	12	81000	3	19200	6	40500	3	21300	0	0
11-03	Wood drying expert	1.5	11250	1.5	11250	0	0	0	0	0	0
11-04	Wood machining expert	1	7500	1	7500	0	0	0	0	0	0
11-05	Joinery designer	3	19200	3	19200	0	0	0	0	0	0
11-06	Furniture designer	3	20250	0	0	3	20250	0	0	0	0
11-07	Plant Maintenance expert	24	169000	0	0	4	27000	12	85200	8	56800
11-08	Joinery production expert	24	169000	0	0	4	27000	12	85200	8	56800
11-09	Joinery production technician	24	169000	0	0	4	27000	12	85200	8	56800
11-10		0	0	0	0	0	0	0	0	0	0
11-11		0	0	0	0	0	0	0	0	0	0
11-12		0	0	0	0	0	0	0	0	0	0
11-13		0	0	0	0	0	0	0	0	0	0
11-14		0	0	0	0	0	0	0	0	0	0
11-15		0	0	0	0	0	0	0	0	0	0
11-16		0	0	0	0	0	0	0	0	0	0
11-50	Short term cons.	6	25500	0	0	2	8000	2	8500	2	9000
11-99	Sub-total int.experts	104.5	712200	11.5	76350	23	149750	44	306700	26	179400

REMARKS:

PROJECT NUMBER: SHU/87/ /A/01/37		TOTAL		1987		1988		1989		1990	
		m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
OPAS Experts (func.titles req.)											
12-01		0	0		0		0		0		0
12-02		0	0		0		0		0		0
12-99	Sub-total OPAS experts	0	0	0	0	0	0	0	0	0	0
ADMIN.SUPPORT PERSONNEL											
13-00	Clerks, secr.,drivers	0	24900		4150		8300		8300		4150
13-50	Freel.interpret.(non-UNDP)	0	0								
13-99	Sub-total Admin.Supp.Personnel	0	24900	0	4150	0	8300	0	8300	0	4150
UN Volunteers (func.titles req.)											
14-01		0	0		0		0		0		0
14-02		0	0		0		0		0		0
14-03		0	0		0		0		0		0
14-04		0	0		0		0		0		0
14-99	Sub-total UNV	0	0	0	0	0	0	0	0	0	0
15-00	Project travel		14325		1875		2550		6300		3600
16-00	Other personnel costs (incl.UNIDO s/m mission costs)		9000		4500				4500		
NATIONAL EXPERTS (func.titles req.)											
17-01		0			0		0		0		0
17-02		0			0		0		0		0
17-03		0			0		0		0		0
17-04		0			0		0		0		0
17-05		0			0		0		0		0
17-99	Sub-total nat. experts	0	0	0	0	0	0	0	0	0	0
18-00	Surr.prior years' obl.		0								
19-99	TOTAL PERSONNEL COMPONENT	104.5	760425	11.5	86875	23	160600	44	325800	26	187150

PROJECT NUMBER:		TOTAL		1987		1988		1989		1990	
BHU/87/	/A/01/37	m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
SUBCONTRACTS											
21-00	Subcontracts		110000		30000		40000		40000		
28-00	Surr.prior years' obl.		0								
29-00	Total Subcontracts		110000		30000		40000		40000		0
TRAINING											
31-00	Individual fellowships	18	41400	12	27600	6	13800		0		0
32-00	Study tours,UNDP group trng		0								
33-00	In-service trng		0								
34-00	Non-UNDP group trng		0								
35-00	Non-UNDP meetings		0								
38-00	Surr.prior years' obl.		0								
39-99	Total trng component	18	41400	12	27600	6	13800	0	0	0	0
EQUIPMENT											
41-00	Expendable equip.		18000		18000						
42-00	Non-expendable equip.		14000		14000						
43-00	Premises		0								
48-00	Surr.prior years' obl.		0								
49-99	Total equip. component		32000	0	32000	0	0	0	0	0	0
MISCELLANEOUS											
51-00	Sundries		9500		1500		2000		3000		3000
55-00	Hospitality (non-UNDP proj.)		0								
56-00	Supp.costs(CC&DC proj.only)		0								
58-00	Surr.prior years' obl.		0								
59-99	Total misc. component		9500	0	1500	0	2000	0	3000	0	3000
99-99	PROJECT TOTAL	122.5	953325	23.5	177975	29	216400	44	368800	26	190150

APPENDIX I

PLYWOOD SPECIES OF TIMBER AVAILABLE

Sl.No.	Botanical Name	Trade Name
1	Acer spp.	Maple
2	Acrocarpus fraxinifolius Wight et Arn.	Mundani
3	Adina cordifolia (Roxb.) HK.F.	Haldu
4	Ailanthus grandis Prain	Gokul
5	Albizia Lebbeck Benth	Kokko
6	Alcimandra cathcartii	Tite champ
7	Alnus spp.	Alder
8	Alstonia scholaris R. Br.	Chatian
9	Altingia excelsa Noronha	Jutili
10	Amoora sp.	Amoora (Lali)
11	Anthocephelus cadamba Miq.	Kadam
12	Artocarpus chaplash Roxb.	Chaplash
13	Artocarpus hirsuta Lamk	Aini
14	Artocarpus heterophyllus Lamk	Kathal
15	Beilschmeidia sp.	Tarsing
16	Betula spp.	Birch
17	Bischofia javanica Blume	Uriam
18	Bucklandia populnea	Pipli
19	Castanopsis sp.	Chestnut
20	Canarium spp.	Dhup
21	Cedrela toona	Toon
22	Chukrasia tabularis A. Juss	Chikrassy
23	Cinnamomum cecidodaphne	Gondsoroi
24	Dalbergia sissoo Roxb.	Sissoo
25	Daphniphyllum sp.	Lalchandan
26	Dillenia spp.	Dillenia

27	Dipterocarpus marcocarpus vesque	Hollong
28	Dunbanga grandiflora Buch-Ham	Lampati
29	Garuga pinnata Roxb.	Garuga
30	Gmelina arborea Linn	Gamari
31	Holoptelia integrifolia Planch	Kanju
32	Juglans spp.	Walnut
33	Kydia calycina Roxb.	Pula
34	Lagerstroemia hypoleuca Kurz	Pyinma
35	Lannea grandis Eng.	Jhingan
36	Litsaea polyantha	Litsaea
37	Machilus spp.	Machilus
38	Mangifera indica Linn	Mango
39	Michelia champaca Linn	Champ
40	Neolitsaea sp.	Bhale Sissi
41	Nyssa javanica	Tumbrung (Lekh chilauni)
42	Phoebe spp.	Bonsum
43	Pterospermum acerifolium Willd.	Hathipaila
44	Quercus spp.	Oak
45	Salmalia malabarica Schoot and Endl.	Semul
46	Sapium baccatum Roxb.	Seleng
47	Shorea assamica Dyer	Makai
48	Schima wallichii Choisy	Chilauni
49	Spondias spp.	Amra
59	Sterculia villosa Roxb.	Udal
51	Symplocos sp.	Kharane
52	Syzygium spp.	Jaman
53	Terminalia myriocarpa Heurck et Muell. Arg.	Hollock
54	Terminalia tomentosa Wight et Arn.	Laurel
55	Terminalia bellirica Roxb.	Bahera
56	Terminalia arjuna Bedd.	Arjun
57	Terminalia paniculata Roth	Kindal
58	Tetrameles nudiflora Linn.	Maina
59	Trewia nudiflora Linn.	Gutel

APPENDIX II

TENTATIVE WORK PLAN
DEVELOPMENT OF TIMBER BASED INDUSTRIES

Item	Activity	1987	1988	1989
1	Construction of three prototype buildings		———	
2	Approval of firms for bibliographic search & market survey		-	
3	Nomination of three fellows		-	
4	Market survey for wood products in NE India		—	
5	Commission kilns		-	
6	Compile bibliographic search		—	
7	Selection of supplementary equipment for joinery plant		-	
8	Placement of three fellows and training		———	
	Technical assistance to plant		———————	———————
9	Purchase and delivery of joinery equipment		———	
10	Design joinery products		——	
11	Identification of maximum five species to be tested		-	
12	Testing of maximum five species			——
13	Design of office furniture			——
14	App. of terms of reference & firms for grouping of species			-
15	Grouping of species			——
16	Approval of terms of reference & firms for three manuals const. systems			-
17	Preparation of three manuals on construction systems			
18	Construction of structure using revised system			
19	Consultants in field to be determined later			- -

APPENDIX III

JOB DESCRIPTION

Post title	**Timber engineer (team leader)**
Duration	**6 Months, split missions**
Duty station	**Gaylegphug with extensive travel in the country.**
Date required	**As soon as possible**
Purpose of the project	**Prefabricated buildings for a variety of institutional purposes are urgently required in both accessible and remote parts of Bhutan. The project will design, fabricate and erect three prototype modular timber prefabricated buildings using the manufacturing facilities already established at Gaylegphug under project SM/BHU/84/010 and at Gedu, and train counterparts in these techniques.**
Duties:	**The timber engineer will supervise the work of the other member of the team (a foreman carpenter) in the development and erection of the prototype timber prefabricated buildings. In particular he is expected to:** **1. Prepare detailed designs of major components for a system of modular prefabricated buildings suitable for Bhutan, bearing in mind limitation of skills, transport and timber dimensions available.** **2. Prepare detailed materials schedules of quantities.** **3. Arrange and supervise the manufacture of these components.** **4. Arrange and control erection of three prototype buildings.** **5. Maintain a register for the compilation of cost data for subsequent analysis and estimating purposes.** **6. Prepare drawings and a draft manual on manufacture and erection, which may subsequently be expanded.**
Qualifications:	**Professional engineer with extensive experience of timber design, factory fabrication and construction in developing countries.**
Language requirements	**English**

Background information

Bhutan has extensive forest resources of high quality timbers. A complete sawmill and joinery plant are being commissioned at and existing plywood complex at Gedu and a modular prefabricated timber bridge workshop has been established at Gaylegphug. These include the necessary kiln drying and pressure treatment facilities. Between them, these plants have ample facilities to produce prefabricated building components.

Much of Bhutan is steep with only Jeep or foot track access and skill levels in these areas are unsophisticated. A successful system must therefore be portable and easily erected.

Timber is a readily available natural resource widely used in traditional construction for roofs, windows, floors and structural members in the Bhutanese tradition of post and beam with wattle and dub infill construction. Modern construction techniques can maintain many of these features while speeding construction time and conserving forest resources through economical engineered building components.

The demand for buildings of this type is foreseen as being particularly for schools lodgings, and offices.

Architectural traditions in Bhutan are strong and, to the extent possible, public buildings must conform with these traditions. Architectural advice is available from the Public Works Department, the Education Department and the National Urban Development Corporation.

APPENDIX IV

JOB DESCRIPTION

Post title	**Foreman carpenter**
Duration	**9 Months, split missions**
Duty station	**Gaylegphug with extensive travel in the country.**
Date required	**As soon as possible**
Purpose of the project	**Prefabricated buildings for a variety of institutional purposes are urgently required in both accessible and remote parts of Bhutan. The project will design , fabricate and erect three prototype modular timber prefabricated buildings using the manufacturing facilities already established at Gaylegphug under project SM/BHU/84/010 and at Gedu, and train counterparts in these techniques.**
Duties:	**Under the direction of the Timber Engineer (post 11-01) construct jigs and other equipment and train Bhutanese workmen in the safe and efficient fabrication of components.** **Construct foundations for the prototype buildings and train two counterparts in the setting out and precision required.** **Supervise the transport and erection of the three prototype buildings and train two counterparts in these duties.**
Qualifications	**Skilled carpenter with experience of construction in developing countries and in the supervision and training of local workmen.**
Language requirements	**English**
Background information	**Bhutan has extensive forest resources of high quality timbers. A complete sawmill and joinery plant are being commissioned at and existing plywood complex at Gedu and a modular prefabricated timber bridge workshop has been established at Gaylegphug. These include the necessary kiln drying and pressure treatment facilities. Between them, these plants have ample facilities to produce prefabricated building components.**

Much of Bhutan is steep with only Jeep or foot track access and skill levels in these areas are unsophisticated. A successful system must therefore be portable and easily erected.

Timber is a readily available natural resource widely used in traditional construction for roofs, windows, floors and structural members in the Bhutanese tradition of post and beam with wattle and dub infill construction. Modern construction techniques can maintain many of these features while speeding construction time and conserving forest resources through economical engineered building components.

The demand for buildings of this type is foreseen as being particularly for schools lodgings, and offices.

Architectural traditions in Bhutan are strong and, to the extent possible, public buildings must conform with these traditions. Architectural advice is available from the Public Works Department, the Education Department and the National Urban Development Corporation.

APPENDIX V

JOB DESCRIPTION

Post title	**Consultant in timber drying**
Duration	**6 weeks**
Duty station	**Gedu (Bhutan**
Date required	**As soon as possible**
Purpose of the project	**To train personnel of the Gedu Wood Manufacturing Corporation in the Operation of the existing kilns.**
Duties:	**The expert will be attached to the Gedu Wood Manufacturing Corporation in Gedu. He will be expected to:** **1. Assess the state of the four 70 m^3 kilns and all auxilliary equipment, and, if necessary, make the required adjustments and calibrations.** **2. Obtain information on the species likely to be dried and recommend drying schedules.** **3. Train labourers and kiln operators on the correct staking and operation of the kilns.** **4. Conduct a short course for the operators and for the technicians in the Gedu Complex to cover:** **- basic wood anatomy;** **- air humidity/moisture content relations** **- how wood dried (air drying);** **- defects of drying (case hardening, honeycombing, checks, warping, etc.);** **- kiln drying (what happens in the kiln);** **- kiln design;** **- kiln operation;** **- kiln maintenance;** **- quality control of kiln dried wood;** **- parameters for the selection of kiln schedules.** **5. Compile the teaching aids, materials and handouts used in the courses into a 'Manual on Kiln Drying of Timber' for future use as a textbook and by the staff at Gedu and in Technical Schools (and future wood processing plants) in Bhutan.**
Qualifications	**Wood technologist or engineer specialized in the kiln drying of timber. Experience in conducting short courses and in developing countries desirable.**
Language requirements	**English**

Background information

Bhutan has extensive forest resources of high quality timbers. A complete sawmill and joinery plant are being commissioned at and existing plywood complex at Gedu and a modular prefabricated timber bridge workshop has been established at Gaylegphug. These include the necessary kiln drying and pressure treatment facilities. Between them, these plants have ample facilities to produce prefabricated building components.

Much of Bhutan is steep with only Jeep or foot track access and skill levels in these areas are unsophisticated. A successful system must therefore be portable and easily erected.

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Architectural traditions in Bhutan are strong and, to the extent possible, public buildings must conform with these traditions. Architectural advice is available from the Public Works Department, the Education Department and the National Urban Development Corporation.