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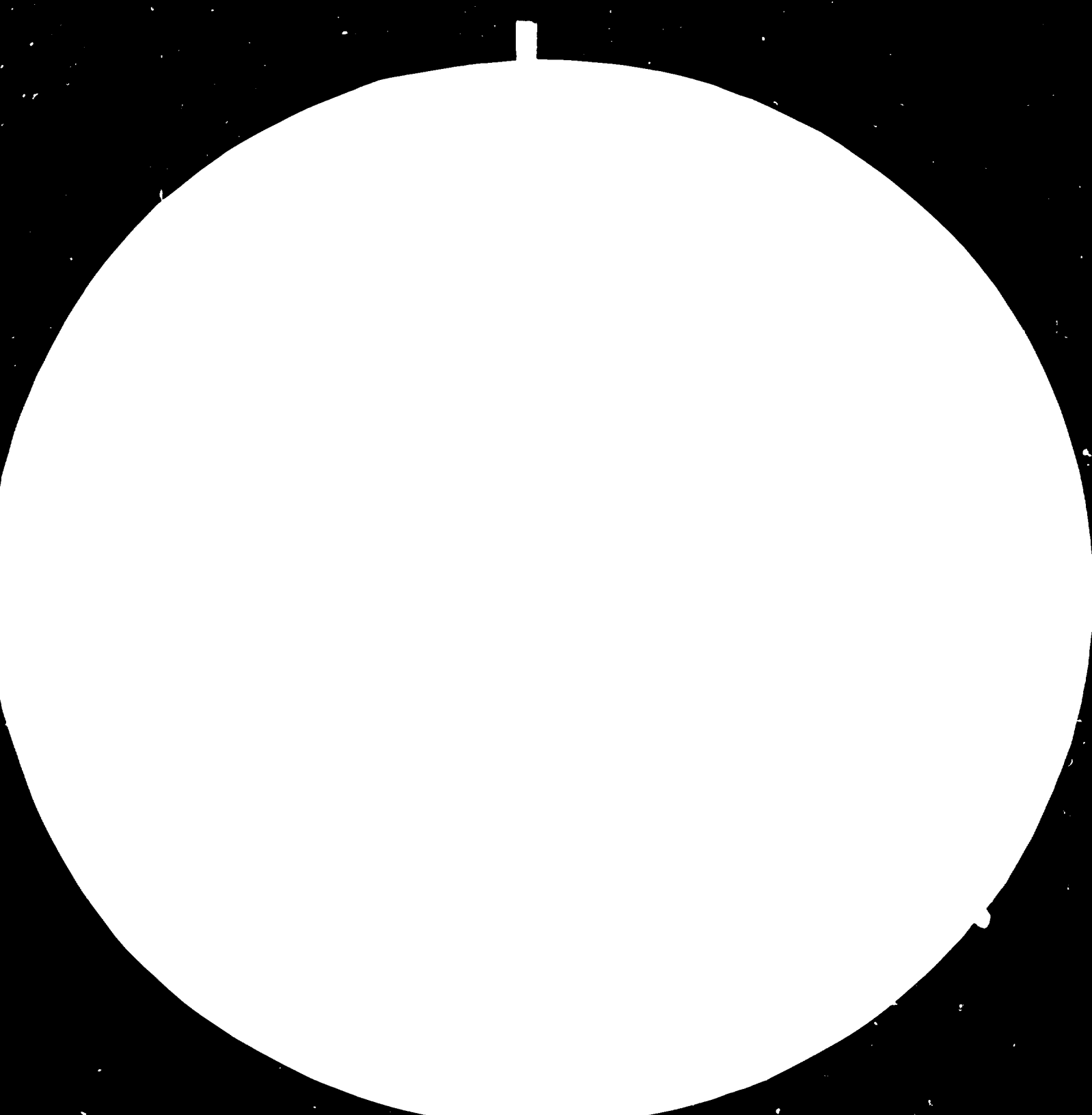

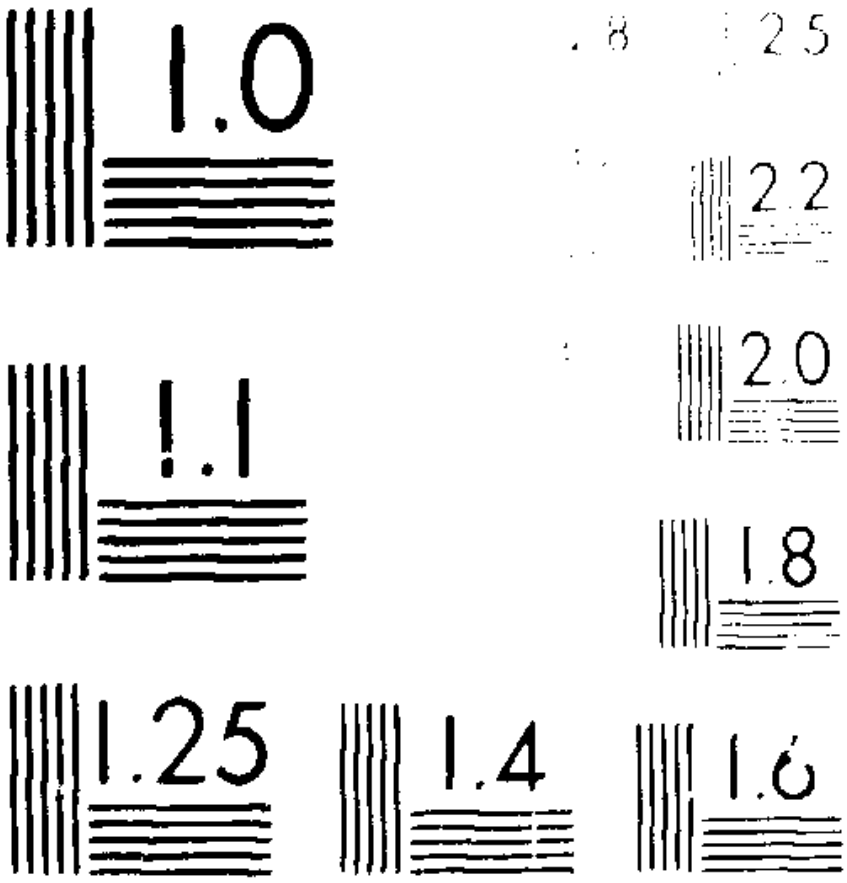
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DP/ID/SER.A/260
20 November 1980
English

PROPOSED ASSISTANCE TO THE SIERRA LEONE FOREST INDUSTRIES CORPORATION *

DP/SIL/78/002

SIERRA LEONE

Technical report

Prepared for the Government of Sierra Leone
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Desmond P. Cody,
wood industry consultant

United Nations Industrial Development Organization
Vienna

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Annexes

Introduction

The Government of Sierra Leone requested UNDP/UNIDO assistance to undertake an exploratory technical assistance mission in the following sectors: secondary wood processing, building materials and industrial training. A consultant attached to the UNIDO Industrial Development Programming and Research Elaboration Project attached to the Ministry of Trade and Industry in Freetown identified the following priority fields for possible assistance, in particular, to the Sierra Leone Forest Industries Corporation which were subsequently confirmed by that organization:

(a) Timber utilization research;
(b) Design and production of solid wood and panel based furniture;
(c) Design and production of timber framed housing;
(d) Design and production of modular wooden bridges;
(e) Marketing study for furniture and joinery;
(f) Industrial training in production management, wood technology and industrial engineering;
(g) Feasibility of charcoal production.

As a result of this request a UNIDO wood industry consultant undertook a two week mission to Sierra Leone, from 23 October to 5 November 1980.

During his stay he had discussions with officials of the Ministry of Trade and Industry, Ministry of Transport and Communications, Officers of the Forest Industries Corporation as well as with UNDP officials.

The list of persons with whom he had discussions is given in Annex I.

Discussions with the Officials of the Ministry of Trade and Industry

A meeting was arranged on the first day of the mission with members of the UNIDO Industrial Development Programming and Project Elaboration Team attached to the Ministry of Trade and Industry.

The team leader, Mr. D. Ali, outlined the background to the present mission and the events leading up to it. In particular he emphasized the low level of productivity currently pertaining in the Forest Industries Corporation's plant at Kenema and the need to provide comprehensive

assistance in all aspects of management and production.

He also referred to a current consultancy programme being carried out by a firm of German consultants on behalf of the Federal Republic of Germany and the provision by that Government of DM 16.8 million to finance the envisaged expansion. While the consultants report on this subject was not available it is understood that it refers in particular to the Corporation's primary and secondary wood processing activities including logging and saw milling and the re-equipping of its furniture and joinery plants.

It was agreed that as far as possible the proposed UNIDO project would complement these activities and concentrate on aspects and areas not covered by the German consultants. These would be clarified in subsequent discussions with the management of the Corporation.

Discussions with the General Manager of the Sierra Leone Forest Industries Corporation

These were held at the Corporation's showrooms and offices in Freetown on the afternoon of the first day. Present were Mr. Ivan T. Contreras, Senior Industrial Development Field Adviser UNDP/UNIDO, Mr. I.T.D. Lewally, General Manager, F.I.C., Mr. D. Ali and the expert.

Mr. Lewally, at the outset emphasized the importance of the F.I.C. to the Sierra Leone economy and the urgent need to update and improve its manufacturing base in the light of Government policy to exploit the country's natural resources especially in the fields of timber and timber utilization. He therefore fully endorsed Mr. Ali's findings and recommendations and, subject to confirmation by the expert, these would form the basis for the proposed UNIDO input.

It was decided, therefore, that the expert would proceed immediately to Kenema where he would make an on-the-spot assessment of the Corporation's plant and, on the basis of his findings and further discussions with the management, would prepare a mutually acceptable programme for implementation by UNIDO.

Mr. Lewally described the activities of the German consultants already referred to and gave an assurance that those would not in any way clash with the proposed UNIDO programme. On the contrary it would be a natural

corollary to them since the former mainly envisaged initially the provision of manufacturing facilities, i.e. buildings, machinery and equipment, and ultimately personnel for the longer term implementation of their proposals. Mr. Lewally also emphasized the need for a market survey of current demand and future potential for wood products not only in Sierra Leone but also in neighbouring countries such as Guinea, Liberia and ultimately overseas markets.

Assessment of Forest Industries Corporation Plant at Kenema

The main attention of the expert was focused on the moulding, furniture and joinery sections of the plant since these were the areas for which assistance had been requested. During the course of the assessment he had the opportunity to speak to production management and supervisory personnel and to discuss with them and clarify with them his views and observations.

The following is a summary of his findings:

Buildings

1. In the main, these are adequate for timber storage after kilning and moulding operations. However, in the case of joinery and furniture they are neither large enough nor sufficiently well laid out.

2. Lighting is insufficient.

3. Internal transport and storage facilities are inadequate.

4. Supply of compressed air is limited and there is no dust exhaust system.

5. Production arrangements are generally not conducive to good productivity. This is largely as a result of a fire which destroyed the main production area.

Machinery and Equipment

6. In general it is inadequate for modern production requirements and would need to be considerably augmented especially in wood shaping, jointing, turning and sanding.

7. What machinery there is, appears to be reasonably well maintained, but there is a shortage of spares and accessories.

8. Not sufficient use is made of jigs fixtures and formers to assist in the production of uniform parts in series.

9. As a consequence there is a build-up of work-in-progress at certain machines causing severe bottle-necks in production.

10. A further consequence is the inordinate amount of time required at the assembly and finishing stages adding considerably to costs.

11. Not sufficient attention is given to sanding and the quality of the lacquering suffers as a result.

12. Lacquering arrangements are generally unsatisfactory, The area is congested, poorly laid out and there is no provision for manual handling.

13. Nitro -cellulose is the basis for the lacquering system currently in use. It would need to be replaced by acid-catalysed lacquers especially if exports to Western Europe are contemplated.

14. Upholstery equipment currently in use is inadequate and production procedures require to be improved.

Products

15. The Corporation produces a wide and diverse range of furniture and joinery in which there appears to be little integration, rationalization, or standardization.

16. Designs are generally poor and with few exceptions have little aesthetic appeal.

17. Ergonomic and functional aspects of design require considerable additional attention.

18. Considerable savings can be achieved in raw material usuage if many existing models are professionally re-designed.

Raw materials

19. Supplies of raw timber are adequate but more careful kiln drying will be necessary especially for export models.

20. The supply situation of sheet materials (e.g. plywood, hardboard and blockboard) plastic laminates, fittings and accessories, glues, lacquers, hardware, upholstery materials and other similar components is unsatisfactory and costly since all must be imported through local dealers.

Production of timber-framed housing and low-cost modular pre-fabricated wooden bridges

21. Neither product was in production during the course of the assessment.

Management and Labour

22. Production and supervisory management is generally inexperienced in modern production techniques. It is also hampered by inadequate production facilities. However, the expert is confident that with appropriate direction and training these shortcomings can be quickly overcome.

23. The expert formed a good impression of the labour force which with the proper direction and supervision could quickly reach an acceptable level of productivity.

Management systems and procedures

24. These, in general, are lacking and would need to be introduced as quickly as possible. The most important are: prototyping and product development including the design of production aids for series production; production planning and control documentation; estimating and costing; materials and stock control; quality control and inspection; control of wastes; low-cost production mechanization; machine and tool maintenance and setting-up procedures; machine loading; materials handling and works study.

25. Of particular importance would be the development of a range of products, particularly chairs and seating, incorporating suitable techniques for shipping as machined components or as sub and final assemblies incorporating appropriate knock-down (K.D) techniques.

Marketing

This aspect of management is virtually non-existent in the Corporation. It is necessary not only to assess local potential but also the prospects for selling abroad.

German Consultants Proposals

The expert had an opportunity to study the proposals for the re-organization and re-equipping of the Kenema plant prepared by a group of German consultants who had been commissioned by the Government of the Federal Republic of Germany to carry out this work. While their work is not yet complete it is evident that its main emphasis is on the provision of logging equipment and the improvement of the manufacturing facilities for joinery (including timber-framed housing and wooden bridges) and furniture production. There are also long term plans for the provision of appropriate personnel.

The assistance to be provided may be summarized as follows:

(1) Provision of logging equipment.
(2) Provision of log yard adjacent to sawmills.
(3) Provision of additional kiln-drying facilities.
(4) Extension and re-equipping of furniture and joinery shops having common machining facilities.
(5) Extension and re-equipping of saw doctoring and machine maintenance workshops.
(6) Provision of new moulding shops.
(7) Provision of additional timbers sheds.
(8) Provision of access roads to all production and storage departments.

Further discussions with the General Manager of the Forest Industries Corporation

The expert presented his findings to Mr. Lewally, the General Manager, who was in agreement with his views and the need to co-ordinate the proposed technical assistance to be provided by UNIDO with the aforementioned German input.

Consequently an integrated approach was discussed and the following major fields of technical assistance were identified:

A. Assistance in respect of furniture and joinery production

The Corporation is already firmly established as the main producer of furniture and joinery in Sierra Leone and has experience in this field dating back to 1946. Its production and supervisory skills are well developed and given further experience and training in modern production methods, especially industrial engineering, could have considerable potential in producing for export as well as catering for increasing domestic demand.

This would, however, require particular attention to product design and development including consideration of Knock Down techniques and the production of machined components in accordance with established technological criteria and standard specifications. It would therefore envisage the establishment of a new or revised product policy for the Corporation which would take into account not only the needs of specific markets but also the requirements for large series production consistent with the level of investment envisaged and acceptable norms of productivity for this type of plant.

The proposed assistance to the furniture and joinery departments is included in the draft project document given in Annex II.

B. Study on the grouping of Sierra Leone timbers used in furniture and construction

The rational use of timber in furniture and construction in countries in the tropics calls for the utilization of as wide a range as possible of the species growing in the forest. In spite of the fact that considerable work has already been done on the

properties of these species, no attempt seems to have been made in Sierra Leone to group them according to major parameters (strength, durability and shrinkage) with a view to their use, in mixed assortments, in construction.

The expert therefore recommends that a study be commissioned to develop this grouping. Once such a study has been prepared it will serve for all applications of timber in construction in the country, thus not only reducing costs, and promoting additional, hitherto unutilized species in construction, but also liberating timber of some of the better known species currently used in local construction for possible export. Such a scientifically based study would also ensure that timber is used correctly thus preventing consumer resistance to this material on the one hand and costly remedial action to timber construction the other.

Subsequently a small quality control laboratory would be established at Kenema to carry out ad hoc tests on specific species and to establish quality control procedures in their commercial application.

C. Study on the comparative cost of timber construction

In order to determine the role that timber can play in construction, the expert proposes that a comparative study be carried out to determine the costs, suitability, ease and speed of construction, availability of raw materials and of production capacity and skills, transport costs, of timber and the building materials it could replace for various end-uses.

This study should compare various types of wooden components used in construction (e.g. roof trusses, internal and external walls, doors, windows, flooring, joists, agricultural buildings such as barns, pigsties, silos, roof systems for industrial buildings and timber bridges). The methodology used should be such that the study could be easily updated to take into account changes in costs of raw materials, transport, labour or production costs.

Based on the findings of this study it would be possible to determine for which possible uses in construction timber should be seriously considered and special efforts be devoted to design appropriate structures and components using the system of grouped species referred to above.

D. Development of designs for the rational use of timber in construction

The expert recommends that, once the above-mentioned studies have been completed, the Forest Industries Corporation should determine its priorities for developing the use of wood in construction and once this has been determined, have designs (for prefabricated modular systems of wooden constructions or wooden elements used in construction and not just designs for specific items) developed by a consulting engineering firm specialized in design of timber engineered products. This assistance should not only comprise the designs but also the erection of prototypes of each design system developed and preparation of design, production and erection manuals.

E. Development of modular prefabricated wooden bridges

The Forest Industries Corporation is aware of the advantages of the system developed by UNIDO in Kenya.

Such bridges are eminently suited for non-metallized rural roads, since they can have spans of up to 30 meters, carry loads of upto 40 tons and also be produced in series and erected quickly using unskilled labour and no mechanical devices (such as cranes). Furthermore, once a manual has been prepared, bridges can be "composed" from the basic elements by referring to the various tables in the manual.

The proposal for providing assistance was discussed with all concerned, and is included in the overall proposal for assistance to the Corporation given in Annex II.

F. Marketing study for furniture and joinery

An essential demand in the overall strategy for the development of the Forest Industries Corporation is an analysis of market trends which will provide a broad indication of the demand of major markets for various categories of furniture and joinery products. This will help to identify the best marketing prospects on home and international markets for those products which can best be produced by the Corporation.

The expert therefore recommends that this study be carried out at an early stage so that such aspects as product design and adaptation costing and pricing and export procedures are adjusted accordingly.

G. Feasibility of charcoal production

The expert was requested to include in his proposed assistance an investigation into the feasibility or otherwise of establishing a charcoal plant on the basis of the initial plant; the investment required and a study of the commercial possibilities as indicated by source and cost of raw materials, cost of labour, and the market for the charcoal produced. Wood and labour costs, operational efficiency and sound marketing practices are the chief economic factors governing success in charcoal production.

H. Further industrial training for Forest Industries Corporation Personnel

A key factor in the upgrading and further development of production supervisory personnel at the Kenema plant is the industrial training input. This will consist in their direct participation in the project as carried out by the various specialized consultant services and the putting into practice of production management techniques concerned with technology, quality control, productivity and appropriate documentation for management systems and procedures.

In addition, the expert recommends that collected managers and supervisors should participate in a UNIDO sponsored study tour of well organized plants possibly in Europe, which approximate in size and

scope to that at Kenema. The objectove of this study tour would be to see and study at first hand now these plants are managed and to discuss with the managements concerned their implication and adaptation in respect of Kenema.

Detailed proposals for all the above suggested topics of technical assistance have been incorporated in one project document, reproduced as Annex II of this report.

ANNEX I

LIST OF PERSONS ENCOUNTERED

Forest Industries Corporation

Mr. I.T.D. Lewally	General Manager
Mr. A.G. Caulker	Manager, Freetown
Mr. D.C.R. Cudjoe	Production Manager, Furniture and Joinery
Mr. R. Young	Production Manager, Logging and Saw Milling

United Nations Development Programme

Mr. Berude Halbert	Resident Representative
Mr. Ivan Contreras	Senior Industrial Development Field Adviser
Mr. S. Ali	Team Leader UNIDO Project with Ministry of Trade and Industry

ANNEX I

UNITED NATIONS DEVELOPMENT PROGRAMME

Project of the Government of Sierra Leone

DRAFT PROJECT DOCUMENT

Title: Assistance in secondary wood processing

Number:

Primary Function:

Secondary Function:

Sector: (Govt.class.) Industrial Development (UNDP class. and code) Industrial Development

Sub-sector: (Govt. class.) Manufacturing Industry (UNDP class and code) Manufacturing Industry

Government Implementing Agency: Forest Industries Corporation

Executing Agency: United Nations Industrial Development Organization

Estimated starting date: June 1981

Government inputs: (in kind) UNPD inuts: 585,450 (US dollars)

Signed: _____ Date: _____
on behalf of the Government

_____ Date: _____
on behalf of the Executing Agency

_____ Date: _____
on behalf of the United Nations Development Programme

PART 1. Legal Contex:

This project document shall be the instrument referred to as such in Article I, paragraph 1, of the Assistance Agreement between the Government of the Republic of Sierra Leone and the United Nations Development Programme signed by the Parties on 21 December 1977.

Part II. A. Development objective

The long-term objective of the project is to assist the Forest Industries Corporation in re-organizing and developing its furniture, joinery and general woodworking activities, increase its productivity and eventually enable it to enter export markets.

Part II. B. Immediate objectives

The immediate objectives of the project are:

1. To survey the production activities of the Forest Industries Corporation so as to compile data on:

- the existing physical facilities (buildings, etc.);
- the production and auxiliary equipment installed (including an assessment of its state and its suitability for industrial production);
- the manpower available (including an assessment of skills and suitability for industrial production);
- the utilization of installed and planned capacity for the range of products that the equipment could be used for;
- the quality of the products produced.

2. Based on the above survey, prepare, in collaboration with Management, a development plan for its development for the next five years.

This plan will make proposals for:

- the consolidation of the existing enterprise into larger specialized departments each specializing in a smaller range of specific products initially for the national market, but eventually also for exports;
- the additional physical facilities required including the rehabilitation of existing equipment and selection of new equipment;
- the programme of re-location of the existing equipment to the consolidated specialized departments and the installation and commissioning of new equipment;
- the training needs for the existing manpower, including schedules and programme for in-plant training;
- the need for expatriate personnel (field or specialization, number, duration, etc.);
- the range of products to be manufactured by the various specialized plants and an indication of the expected quality and sizes of series (or batches);

- the assumptions made in drawing up the development plan;
- the requirements for the implementation of the above development plan both with respect to availability of raw materials, power, and financial requirements (including foreign exchange requirements);
- the possibility of reducing imports of auxiliary materials (abrasive belts, adhesives, surface finishing and upholstery materials, hardware fittings, etc.) through the production locally of such produce and/or additions to the existing industrial infrastructure and marketing channels.

3. To improve the productivity, product quality and the level of skills (both at middle management and operator levels) at the Forest Industries Corporation woodworking plant at Kenema.

4. To develop new furniture designs and/or to modify existing designs to suit the requirements of serial production and shipment in knock-down form. These designs will not be limited to high cost products (eventually for export) but also for low cost household and institutional furniture suitable for the country's new development areas.

5. To introduce sound tool and machine maintenance in the plant through the creation of a department for woodworking machine and tool maintenance which will cater for its needs.

6. To familiarize three production management and supervisory personnel with modern conditions through study tours to countries whose woodworking industry is developed, during which they will be accompanied by the respective experts.

7. To provide market information and marketing assistance required to help the plant to cater more effectively for local requirements and to penetrate selected export markets.

8. To create an understanding of modern export marketing techniques especially the possibilities offered by:

- Long-term sales contracts, and
- international sub-contracting.

9. To carry out a study on the grouping of Sierra Leone timber species which could be used in construction.

10. To prepare a study on the comparative costs of timber construction, comparing the relative merits of various building materials (such as, but not limited to: clay bricks, cement blocks, timber poles, sawn wood, various wood based panels, asbestos cement sheets, metal sheeting, metal construction, reinforced concrete, etc.) their availability, costs, storage and transport costs, ease of utilization (including skills required), and costs of constructions using them.

11. Based on the above study, to develop designs for the rational use of wood in construction through the use of prefabricated modular systems for series production, and not ad hoc designs for on site construction, suitable for the local climatic and social conditions and prepare design, production and erection manuals.

12. Erect prototypes of each design system developed under 11 above.

13. Adapt the system developed by a UNIDO project in Kenya for low cost modular prefabricated wooden bridges to suit the timber species and loading conditions of Sierra Leone and prepare design, production and erection manuals.

14. Erect prototype bridge(s) using the system developed under 11 above.

Part II. C. Background and justification:

Although Sierra Leone is endowed with good forest resources and has a sawmilling industry, timber has so far not been used in construction to anywhere near its potential.

The Government is interested in developing rural areas as quickly as possible and, in doing so, wishes to introduce timber constructions whenever appropriate to assure the rational utilization of its renewable natural resources, the rapid development of its rural areas, and the creation of employment in rural areas (since timber construction is labour intensive and does not call for high skills).

To this effect it wishes to have carried out a study on the grouping of timber species native to Sierra Leone to assure on the one hand their correct utilization, and a rational and intensive use of the forest resources on the other.

To achieve this the Government also wishes to obtain designs for industrial production of modular prefabricated timber structures and their components specially suited to the local climatic and social conditions. These could then be produced either in the existing factories at Kenema or, using simpler production methods, on site.

Another field in which timber is called upon to play an important role in Sierra Leone is in its use in the construction of bridges. UNIDO has developed a system of low cost modular prefabricated timber bridges, which the Government wishes to adapt for use in Sierra Leone.

Since 1965 the Forest Industries Corporation (F.I.C.) has operated a woodworking complex as well as its own logging concessions and a retail store and warehouse in Freetown.

The rapid development of demand on the local market has led to an expansion in the Corporation's manufacturing activities which has not been thoroughly planned. Shortcomings in production planning and management in the logging and sawmilling operations have been identified and bilateral assistance in this field is now being sought. Technical assistance comprising specific advisory posts is required to help improve the various production elements of the Corporation.

Much can be done to develop the secondary wood processing industries. The increased capacity of the sawmill will make available larger quantities of sawmill wastes, shorts and commercially marketable sawnwood for conversion into manufactured wood products.

The Forest Industries Corporation has been utilizing durable species to produce prefabricated wooden houses of quite pleasing designs.

The time has come for Sierra Leone to make a concerted effort to use its lesser known species. The felling of secondary species for sawing and pressure treating with preservatives for use in wooden elements for low cost housing could liberate the equivalent volume of better known species for further processing and for export as finished products.

This project is designed to respond to both specific and general objectives of the National Development Plan (1974/75 - 1978/79). Specifically the Plan states that an investment of about Le 500,000 is envisaged in order to establish in Freetown a furniture assembly plant for knock-down furniture produced in Kenema.

The project will also relate closely to objectives for increasing national sawmilling capacity as delineated in the Plan.

More generally, the project will help to increase opportunities for rural employment. It will encourage the use of local products, thus helping to improve the balance of payments situation.

It has good export possibilities, particularly to Liberia under the Manor River Union customs union, and to the neighbouring countries.

Part II. E. Outputs

The principal outputs of the project will be:

1. The preparation of a detailed survey of the existing plant at Kenema.

2. The elaboration of a plan for its development.

3. The introduction of industrial production methods.

4. The development of designs for furniture and joinery suitable for industrial production.

5. The designs of new products - or modification of existing furniture designs - for shipment in knock-down form, or as fully machined components.

6. Establishment of maintenance procedures for woodworking tools and machines and training of personnel in these skills.

7. The exposure of three Sierra Leone managers to modern conditions in woodworking plants in more developed countries through study tours.

8. A study on the grouping of Sierra Leone timber species which would be used in furniture joinery and construction according to their main characteristics (e.g. strength, durability, shrinkage). For details see Appendix III.

9. A study on the comparative costs of timber construction comparing the relative merits and costs of timber with various other building materials as well as the cost of various timber based building components (e.g. joists, trusses, doors, windows, load bearing walls, non load bearing partitions, etc.) with alternative non-wood-based components. This study will take into account also the comparative costs of the building materials proper, the cost of transport, the cost of labour (both at a factory fabricating the component and on site) and the effect of the use of the building material in question on other costs (e.g. additional costs of foundations due to increased dead weight, etc.). For details see Appendix IV.

10. Designs for low cost timber constructions (and timber components for non timber constructions) for dwellings, institutional and agricultural buildings in rural areas, as well for these and industrial buildings in urban areas, according to specifications to be drafted by F.I.C. (including designs, production and erection manuals). For details see Appendix V.

11. Prototypes of the above designs.

12. Designs for low cost modular prefabricated timber bridges, to suit local species and road loading regulations. (Including design, production and erection manuals).

13. Prototypes of the above designs.

14. The training of teams of Sierra Leone technicians in the production and erection of all these timber structures.

15. The introduction of industrial production methods in the Kenema plant and the training of personnel in these skills.

16. The carrying out of a feasibility study into the production of charcoal for commercial exploitation.

Part II. E. Activities (all located in Kenema unless specified)

	Description	Starting Time	Duration
	Purchase of project vehicles	June 1981	
1[1/]	Survey of the plant	June 1981	1/2 month
2	Elaboration of a development plan	Sept. 1981	1/2 month
3.	Introduction of the plan	Sept. 1981	12 months
3	Improvement of plant layout	July 1981	12 months (on an ad hoc basis)
3	Introduction of production planning	July 1981	12 months (on an ad hoc basis)
3	Introduction of process and quality control	July 1981	12 months (on an ad hoc basis)
3	Introduction of machine maintenance	July 1981	12 months
3	Introduction of industrial costing	July 1981	12 months (on an ad hoc basis)
3	Training of personnel in the above fields	July 1981	12 months (on an ad hoc basis)
3	Preparation of manuals and reports	Sept. 1981	12 months (on an ad hoc basis)
4	Development of designs (and adaptation of existing designs) for knock-down furniture	July 1981	Total 6 months over 12 month period
5	Production of prototypes of above furniture	Sept. 1981	2 months
5	Preparation of manuals and reports	June 1982	2 months
7	Study tour by three production managers and expert to countries whose woodworking industry is developed	May 1982	3 weeks

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1/ Numbers refer to the corresponding numbering of the immediate objectives (see II. B. above).

	Description	Starting Time	Duration
	Mid-term technical review with a staff member of UNIDO (from Vienna)	Dec. 1981	one week
	Tripartite review with a staff member of UNIDO (From Vienna)	Sept. 1981	one week
1 [1/]	Study on the grouping of Sierra Leone timber species	June 1981 (HQ of consulting engineering firm or institute)	4 months
2	Study on the comparative costs of construction (field work) - (Headquarters work)	Sept. 1981 (HQ of consulting engineering firm or institute)	2 months
5	Adapt the designs for the low cost modular prefabricated bridges to loading conditions and timber species of Sierra Leone	November 1981	2 months
6	Preparation of manuals fellowships for two Sierra Leone personnel to train in bridge production and erection	Sept. 1981 (Kenya ?)	one month
6	Selection of site for prototype bridge and construction of abutments	Sept. 1981 (Sierre Leone)	2 months
6	Purchase of equipment for the production of the bridges - including one four-wheel drive vehicle and mobile pressure impregnation cylinder	Sept. 1981 (Vienna)	2 months
12	Order spare parts and equipment	March 1982	one month
3	Design of timber constructions preparation of manuals	Sept. 1981 (HQ of consulting engineering firm or institute)	6 months

1/ Numbers refer to the corresponding numbering of the immediate objectives

	Description	Starting Time	Duration
6	Arrival of equipment production of elements	December 1981	one month
6	Erection of prototype bridge(s)	March 1982	4 months
-	Mid-term technical review with a staff member of UNIDO (from Vienna)	December 1981	one week
12	Receipt of equipment and spare parts and its installation	May 1982	3 months
4	Erection of prototype wooden constructions	October 1982	4 months
12	Design of timber-framed housing systems. Preparation of manuals	September 1981	3 months

Part II. F. Inputs

Government Inputs:

The Government of the Republic of Sierra Leone will contribute to the project in the following way:

- Counterpart technical personnel for the international experts and consultants, at all levels;
- Counterpart administrative personnel (secretaries and drivers) for the international experts and consultants;
- premises, furniture and office supply and equipment;
- transport vehicle(s) for transporting sawn timber and wooden elements;
- information, as necessary, for the execution of the project (specially with respect to objectives Nos. 1, 2, 5, 7, 8,and 12);
- fuel costs for the projects vehicles;
- raw materials available locally as required, for prototypes, jigs, modifications to equipment, etc.

UNDP/UNIDO Inputs:

Experts and consultants

The internationally recruited team will comprise the following experts and consultants (the numbers in bracket refer to their involvement in the various immediate objectives). Total durations are indicated in man/months (m/m) some missions being split.

11-01	Expert in furniture production - Industrial Engineering - team leader (1 to 8)	12 m/m
11-02	Expert in maintenance of wood working tools and machines (3, 6 and 8)	6 m/m
11-03	Associate expert - furniture technician	12 m/m
11-04	Expert(s) in furniture design (4, 5, 7 and 8)	6 m/m
11-05	Consultant in charcoal production	1 m/m
11-06	Timber engineer (wooden bridges)	6 m/m
11-50	Consultant(s) in fields to be determined later	6 m/m

Component total: 49 m/m

Sub-Contracts

The following sub-contracts will be awarded:

1. A study on the grouping of some 50 timber species native to Sierra Leone which could be used in construction based on a list of species provided by the Ministry of Agriculture and Forestry. This study will group the species according to their characteristics important in construction, namely strength, natural durability and shrinkage (draft terms of reference are attached in Appendix III).

2. A study on the comparative costs of timber construction, comparing the relative merits and costs of timber with various other building materials as well as the cost of various timber based building components (joists, trusses, doors, windows, load bearing walls, partitions, etc.) with alternative, non wood-based components. This study will take into account also the comparative costs of the building material proper, the cost of transport, the cost of labour (both at the factory fabricating the component and on site) and the effect of the use of the building materials in question on other costs, (e.g. additional costs of foundations due to increased dead weight, etc.). (Draft terms of reference are attached in Appendix IV).

3. Development of designs for low cost timber constructions (and timber components for non timber constructions) for dwellings, institutional and agricultural buildings in rural areas as well as for these and industrial buildings in urban areas, according to specifications to be drafted by the Forest Industries Corporation taking into account the findings of sub-contracts (1) and (2) above.

This sub-contract will comprise not only the design work, but also the preparation of design, production and erection manuals for the products envisaged, and supervise the production and erection of the prototypes. (Draft terms of reference are attached in Appendix V).

Study Tours:

One study tour of three weeks, to countries whose woodworking industries are developed for three participants plus an accompanying expert.

Training:

Two one-month fellowships for Sierra Leone technicians who will be responsible for the production of the modular bridges elements and their erection on site respectively.

Equipment:

- 2 vehicles: one four-wheel drive car, one station wagon (US$ 14,000).
- Equipment for production and launching of modular bridges (approximately US$ 10,000).
- Equipment for quality control of furniture, samples of special tools, fillings, etc. to be used in conjunction with the industrial production of furniture and the new knock-down designs. (US$ 16,000)
- Pressure impregnation cylinder (US$ 75,000)
- Chemicals for pressure impregnation cylinder (US$ 5,000).

Part II. G. Work Plan

A tentative work plan is shown under section E (activities) of this document. A detailed work plan for the implementation of the project will be prepared by the team leader, in consultation with his national counterpart within three months of the start of the project. This detailed work plan will be annexed to this project document, after its approval by all the three parties concerned, and will be considered as an integral part of this project document.

Part II. H. Preparation of the framework for effective participation of national and international staff in the project

The activities necessary to achieve the project's immediate objectives will be carried out jointly by the national and international staff assigned to it. The Forest Industries Corporation will provide all the requisite facilities for the implementation of the project. The respective roles of the national and international staff shall be in accordance with the established concept and specific purpose of technical co-operation.

Part II. I. Development Support Communication:

Not applicable.

Part II. J. Institutional Framework

The project will be integrated through the Sierra Leone Forest Industries Corporation.

Other government authorities will, as and when appropriate, collaborate in drafting the development plan.

Part II. K. Prior Obligations and Prerequisites

1. Prior obligations

None.

2. Prerequisites

(a) Assignment of adequate technical administrative and support personnel.

(b) Provision of suitable office premises and equipment.

(c) Provision of adequate financial resources to cover costs of locally available materials for prototypes, etc. and for fuel for the project vehicles.

(For details of (a), (b) and (c) see attach[illegible] Government's budget.)

UNDP/UNIDO assistance to the project will be provided subject to UNDP receiving satisfaction that the pre-requisites listed above have been fulfilled or will be fulfilled. When anticipated fulfillment of one or more pre-requisites fails to materialize, the problem will be discussed between the three parties in order to resolve the situation. If no solution appears possible UNDP may, at its discretion, either suspend or terminate its assistance.

Future UNDP assistance

Future UNDP assistance, if any, will be determined by a review of the project three months before its scheduled completion.

Part III. Schedules of monitoring, evaluation and reports

A. Tripartite Review Meeting

The project will be subject to a midterm technical review some six months after its starting date. A special review to consider the necessity for further assistance should take place three months before project completion.

B. Evaluation

The project will be subject to evaluation, in accordance with the policies and procedures established for this purpose by UNDP. The organization, terms of reference and timing of the evaluation will be decided upon by consultation between the national authorities, UNDP and UNIDO.

C. Reports

Progress reports

These will be submitted at six months intervals according to the format prescribed by UNDP.

Technical reports

These will be prepared by the project staff on an ad hoc basis. Their titles and schedules will be indicated in the work programme.

Terminal report

The terminal report will be prepared by the team leader for UNIDO's review one month prior to the completion of the project. It will be submitted formally by UNIDO upon completion of the project.

(to be completed by the Government authorities in collaboration with the local UNDP Office)

Project Budget Covering the Government's Contribution in Kind

(1000 Leones)

Country: Sierra Leone

Project Number: DP/SIL/80/XXX/A/01/37

Title: Assistance in Secondary Wood Processing

	Total		1981		1982	
	M/M	Leones	M/M	Leones	M/M	Leones
Personnel						
(List function, qualification and number)						
Equipment and Supplies						
Raw materials for prototypes etc.						
Tools, jigs, etc.						
Maintenance of equipment						
Fuel for vehicles						
Office equipment						
Office supplies						
Office expenses						
Land and buildings for the tool maintenance centre.						
Operating expenses for tool maintenance centre.						
TOTAL						

UNIDO

PROJECT BUDGET/REVISION

3. COUNTRY	4. PROJECT NUMBER AND AMEND.	5. SPECIFIC ACTIVITY
SIERRA LEONE	DP/SIL/80/XXX/	31.7.A

10. PROJECT TITLE

Assistance in Secondary Wood Processing

15. 10. PROJECT PERSONNEL	16. TOTAL		17. 1981		18. 1982		19.		20.	
11 EXPERTS / Post title	m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
11-01 Expert in furniture production and industrial engineering (team leader)	12	75,600	6	37,800	6	37,800				
02 Expert in maintenance of woodworking tools and machines	6	37,800	2	12,600	4	25,200				
03 Associate expert - furniture technician	12	p.m.	6	p.m.	6	p.m.				
04 Expert(s) in furniture design	6	37,800	4	25,200	2	12,600				
05 Consultant in charcoal production	1	6,300	-	-	1	6,300				
06 Timber engineer (wooden bridges)	6	37,800	2	12,600	4	25,200				
50 Consultant(s) in fields to be determined later	6	37,800	-	-	6	37,800				
08										
09										
10										
11										
12										
13										
14										
11-99 SUBTOTAL:	49	233,100	20	88,200	29	144,900				

21. REMARKS

UNIDO

PROJECT BUDGET/REVISION

2. PAD NUMBER

4. PROJECT NUMBER DP/SIL/80/XXX/01/37A		16. TOTAL		17. 1981		18. 1982		19.		20.	
		m/m	$	m/m	$	m/m	$	m/m	$	m/m	$
12.01	OPAS Experts										
13.00	Support Personnel										
14.00	Volunteers										
15.00	Experts Travel		7,350		3,000		4,350				
16.00	Other Personnel Costs		5,000				5,000				
17.01	Locally hired Experts										
17.02	Locally hired Experts										
19.00	Total Personnel Component		245,450		91,200		154,250				
20.	SUBCONTRACTS										
29.00	Total Subcontracts Component		200,000		75,000		125,000				
30.	TRAINING										
31.00	Fellowships	2	4,000	2	4,000	-	-				
32.00	Study Tours, UNDP G. Training/Meetings	2	12,000	-	-	2	12,000				
33.00	In-service Training										
34.00	Group Training (non-UNDP)										
35.00	Meetings/Consultations (non-UNDP)										
39.00	Total Training Component	4	16,000	2	4,000	2	12,000				
40.	EQUIPMENT										
49.00	Total Equipment Component		120,000		80,000		40,000				
50.	MISCELLANEOUS										
51.00	Operations — Maintenance		3,000		1,500		1,500				
52.00	Reports		5,000		2,000		3,000				
53.00	Sundries		4,000		2,000		2,000				
55.00	Hospitality (non-UNDP)										
59.00	Total Miscellaneous Component		12,000		5,500		6,500				
99.	GRAND TOTAL:	53	585,450	22	255,700	31	337,750				

Form/FS.83/Rev.3/Add.1/Rev.1 (2.79)

APPENDIX III

Draft Terms of Reference in Grouping of Timber Species Native to Sierra Leone for use in Construction

1. Introduction

The United Nations Industrial Development Organization is to provide the Government of the Republic of Sierra Leone with technical assistance in the form of a technical study on the grouping of some 60 timber species, native to Sierra Leone or growing there on man-made plantations, which could be used in construction of buildings and other timber engineered products both as load bearing and non load bearing elements.

The project is to be implemented using the services of a firm of consulting engineers or an institution specialized in such work, referred to hereafter as the "Contractor".

II. Duties of the Contractor

The Contractor shall:

1. Obtain data on the natural occurrence of these species in the various regions of Sierra Leone.

2. Review the results of tests done in Sierra Leone and abroad on the properties (strength, durability and treatability, machining characteristics, drying characteristics, etc.) of the timber species more commonly found in Sierra Leone and compile these for inclusion in comparative tables of the report;

3. Group the species selected according to common properties;

4. Compile data on the relative prices of these species and on cost of pressure impregnation;

5. Based on the above group those species best suited for use in buildings in Sierra Leone into categories having common properties and give reasons for the choice.

III. Implementation

The Ministry of Agriculture and Forestry and the Forest Industries Corporation will make available to the Contractor (through UNIDO) a list of some 80 species they wish the Contractor to consider. This list will be made available to the Contractor at the time of the signature of the contract with UNIDO.

He shall, based on already published material, both in Sierra Leone and abroad, carry out a study, within a period not exceeding ten weeks from the signature of the contract, and submit a draft report, in 5 copies in English, to UNIDO for review. The methodology used in classifying the species should be explained in detail in an annex to the report.

IV. Background Information

Sierra Leone is endowed with good forest reserves, currently not fully utilized. The Government has embarked on the development of rural areas, including the creation of agricultural communities and the necessary infrastructure (roads, bridges, schools, hospitals, etc.).

Timber is one of the country's major resources, and, furthermore, it is a renewable resource. A certain number of sawmills exist, and there are plans for the development of this sector to cater both for the local as well as regional and overseas markets. Plans also exist for the creation and subsequent exploitation of man-made forests and the development of a modern integrated timber processing complex.

The Government's wish to increase the use of timber in construction, (both in rural and urban areas) for such products as bridges, trusses, joists, load bearing and non load bearing wall elements, floors, joinery, shuttering, etc.

In order to assure a rational use of its timber resources and to avoid consumer resistance due to incorrect applications, it is felt necessary to undertake a study on the grouping of species.

(Tentative cost estimate US$ 20,000.)

APPENDIX IV

Draft Terms of Reference

for a Study on the Comparative Costs of Construction using Timber and other Building Material in Sierra Leone

1. Introduction

The United Nations Industrial Development Organization is to provide the Republic of Sierra Leone with technical assistance in the form of a study on the comparative costs of timber products [1/] and timber building elements [2/] used in construction, and those of other products it could compete with and replace.

The project is to be implemented using the services of a firm of consulting engineers or an institution specialized in such work, referred to hereafter as the "Contractor".

II. Duties of the Contractor

The contractor shall delegate qualified personnel to Sierra Leone to:

1. Compile information on the availability of timber products [1/] (both produced locally and those currently imported but which it is envisaged will be produced in Sierra Leone in the near future), their specifications and costs.

2. Compile information on the building materials being produced in the country with which timber and timber products could compete. [3/]

3. Compile information on the availability, specifications and costs of timber building elements [2/] being produced in Sierra Leone.

1/ Poles; sawnwood; plywood; wood-wool cement slabs, particle board and fibreboard; shingles; bamboo.

2/ Such as but not limited to: modular bridges: roof trusses for dwellings, agricultural and industrial buildings and warehouses; joists, wall (both load bearing and non load bearing) floor and ceiling systems, staircases, doors, windows, agricultural buildings (barns, silos, etc.) shuttering for concrete, their specifications and costs.

3/ Such as: sand, aggregate, cement, mortar, lime, steel (reinforcing rods and sections used in trusses and metal joinery) metal sheet material (galvanized and arrodized, corrugated or flat), cement blocks, soil stabilized blocks, baked and unbaked bricks, gypsum board, roofing material (asbestos sheets and clay tiles).

4. Visit a representative sample of joinery plants to assess production methods used and hence be able to estimate costs of timber building products if productivity and designs were improved.

5. Compile information on the availability, specifications and costs of non-wood building elements (metal trusses, metal joinery, metal partitions and external walls for silos and industrial buildings, pre cast concrete elements, etc.).

6. Compile information on the major consumption centres where timber construction could play a large role and the location of the plants producing the various building materials and building elements mentioned above.

7. Compile information on the availability and costs of transport, and limitations - if any - on the transport of large elements.

8. Compile information on the availability, skills, cost and productivity of labour and for on-site construction and for assembly on site of prefabricated elements.

9. Visit some building sites to assess the methods used and hence be able to estimate costs if productivity were improved.

10. Study the statutory limitations - if any - on the use of timber and timber products in construction.

Based on the above data, the consultant shall prepare a comparative study on the costs of timber products 1/ and timber building elements 2/ compared with other building materials or building elements which compete with timber and which it could eventually replace.

This study shall basically take into account the present situation; it shall also identify the changes which would occur if productivity of the plants were to increase and/or if the designs of the products were to be modified.

The methodology of the study and its presentation should be such that the figures could be easily updated by the authorities in Sierra Leone if and when the situation with respect to costs of the various inputs changes.

1/ and 2/ on page 33

The study should compare not only the costs of the building materials and the building elements themselves, but also the effect they have on the costs of the complete structure due to the use of a given building material (e.g. prefabricated timber constructions call for lighter foundations and hence lower costs than prefabricated concrete construction).

III. Implementation

The contractor is to delegate a team of qualified specialists to Sierra Leone within two weeks of the submission of the contract to him for signature, to obtain the necessary information on the availability and costs of the various building materials and services related to the study. These specialists (or the team leader) shall visit UNIDO, Vienna, on their way to and from Sierra Leone for briefing and exchange of views. The tentative total duration of the specialists stay in Sierra Leone is about 3 to 4 man months.

The team should tentatively be composed of a quantity surveyor and an architect or engineer with experience in the production of a wide range of building components.

Five copies in English of the draft report should be submitted to UNIDO, Vienna, within two months of the return of the team from Sierra Leone. It will be received by UNIDO, and the comments should be incorporated by the contractor in the final report, of which 30 copies in English should be submitted to UNIDO within one month of the receipt of the comments.

IV. Background Information

Sierra Leone is endowed with good forest reserves, currently not fully utilized. The Government has embarked on the development of rural areas, including the creation of agricultural communities and the necessary infrastructure (roads, bridges, schools, hospitals, etc.).

Timber is one of the country's major resources, and, furthermore, it is a renewable resource. A certain number of sawmills exist, and there are plans for the development of this sector to cater both for

the local as well as regional and overseas markets. Plans also exist for the creation and subsequent exploitation of man-made forests and the development of a modern integrated timber processing complex.

The Governments's wish to increase the use of timber in construction, (both in rural and urban areas) for such products as bridges, trusses, joists, load bearing and non load bearing wall elements, floors, joinery, shuttering, etc.

In order to assure a rational use of its timber resources and to avoid consumer resistance due to incorrect applications, a study on the grouping of species has been undertaken.

Before embarking on the design of timber structures and their industrial production, it is felt that a study on the comparative costs of timber and timber building components and those materials it could replace should be undertaken.

(Tenative cost estimate US$ 50,000).

APPENDIX V

Draft Terms of Reference
for the Design of Wooden Buildings and Trusses from Species Native to Sierra Leone

I. Introduction

The United Nations Industrial Development Organization is to provide the Government of the Republic of Sierra Leone with technical assistance in the form of designs (drawings and specifications for buildings (low-cost dwellings, agricultural buildings, schools, hospitals, offices, etc.) and wooden trusses for the more common spans and using species native to Sierra Leone.

The project is to be implemented using the services of a firm of consulting engineers or an institution specialized in such work, referred to hereafter as the "Contractor".

II. Duties of the Contractor

The contractor shall:

- Survey the present and potential future demand for pre-cut and prefabricated low-cost dwellings, agricultural and institutional buildings made from wood, as well as that for pre-cut and prefabricated wooden trusses for use by industry or as warehouses.
- Based on the above considerations design and draft complete specifications incorporated in production and erection manuals for the institutional buildings best suited for the local conditions and living habits, taking into account the studies on the grouping of species growing in Sierra Leone and the comparative study on costs of timber products and timber building elements and those of materials timber competes with and could replace, already prepared by UNIDO for the Government of Sierra Leone under the same project of technical assistance.

In particular he will:

A. Compilation of data

1. Review the above mentioned two studies, and, if he deems it necessary update and/or complement them;

2. Review the medium and long-range programmes for construction of low-cost dwellings, agricultural and institutional buildings as well as for industrial buildings and warehouses which the various governmental bodies have drawn up;

3. Obtain the present specifications for the above constructions and information on cost estimates for such buildings (and their components) for various rural (and eventually also urban) sites;

4. Compile basic information on climate, rainfall, etc.

B. Design requirements

1. The contractor will present two standardized types of designs for the buildings enumerated above:

(a) full timber construction except for concrete foundations;

(b) mixed-type construction of timber and other materials, namely: floors and certain walls of non timber construction.

2. The designs will be based on the modular system in order to reduce to a minimum the number of standard components as well as to facilitate the subsequent addition of new building units.

3. If economically feasible, both external walls and internal partitions should present recesses easily convertable into built-in cabinets when required, thus reducing expenditures in free-standing furniture.

C. Design of pre-cut (and eventually prefabiracted) low-cost wooden housing and institutional buildings

Based on the above information, the contractor is to design a modular building component system for the buildings listed above which should conform to the required specifications (with respect to area, height of ceilings, size of rooms, etc.) and to suit local climatic

conditions, living habits, buildings codes, and/or traditional building habits. This design is to make full use of the inherent properties of the local species - preferably using the lesser utilized ones - and take into account the skills available locally for both production and erection.

The contractor will present his designs in the following way:

1. Propose narrative descriptions of the buildings with the necessary plans, perspective views, etc., highlighting the building's characteristics, features, methods of erection, etc.

2. Complete production and erection manuals, written for the understanding of the persons with the limited education and skills available in the areas where the buildings are to be erected.

Each set of manuals will comprise - but not be limited to - the following items:

(a) Narrative specifications of the building with a perspective drawing;

(b) Overall drawing of the type of building designed;

(c) Detailed, dimensional drawings for each element;

(d) Wherever needed, detailed sections and/or explosions and/or detailed drawing showing methods of fastening of element;

(e) Detailed cutting list of the wood to be used for each unit, including detailed instructions on its marketing and crating;

(f) Detailed lists of species that could be used for the various elements of this building, indicating the preservation treatment needed whenever applicable;

(g) Detailed qualitative specifications of masonry and related work;

(h) Detailed qualitative specifications of the non wood inputs (hardware, etc.) needed for the erection of the building;

(i) Detailed step-by-step instructions for the erection of the building designed, including inter alia:

(i) marking of site;
(ii) preparation of foundations;
(iii) concrete work;
(iv) erection of structure;
(v) erection of roofing;
(vi) erection of cladding;
(vii) erection of partitions - if any;
(viii) installation of doors, windows, etc.;
(ix) surface finishing alternatives and electrical and sanitary installations - if any.

3. Cost calculation of the building designed for:

(a) the wood raw material and other inputs used;
(b) cost of machining and bundling and/or crating;
(c) estimated cost of transport of the components both pre-cut and prefabricated for each complete building for distances of, say, 25 and 100 kilometers;
(d) cost of erection - including size and qualifications of the team of erectors.

4. Qualitative specifications of the inputs needed for each building - including if convenient, grouping of species that could be used for the structural and non-structural elements; indicating for these species needing preservation the best suited preservative treatment.

D. Design of pre-cut and prefabricated wooden trusses

Based on the information compiled under A. above the contractor will design a total of nine trusses, to be constructed using timbers with three different strength groupings; for each strenth group, three trusses will be designed with spans of 9, 12 and 15 meters. He will select the pitch best suited to the climate conditions in Sierra Leone. These trusses should be for general industrial, or agricultural use, or for use for warehouses. They should be usable in conjuction with wooden concrete or masonry wall or posts, and with various types

of roofing materials (corrugated metal sheets, corrugated asbestos sheets, tiles, shingles, etc.).

The contractor will present his design in the following way:

1. Specifications of the trusses, indicating:

   (a) Loading characteristics (assumed wind load, load of roofing material, etc.);

   (b) selection of type of gusset plate used (plywood, solid timber, metal plate - "Gangnail" type - other metal connectors, etc.) bearing in mind local conditions and skills, and justifying this choice;

   (c) species to be used - listing three groups according to strength and indicating the preservative treatment for these species that are subject to fungal and/or termite attack.

2. Design of the trusses, indicating:

   (a) Overall drawing of the type of truss designed;

   (b) detailed, dimensional drawings for each truss;

   (c) wherever needed, detailed sections and/or explosions and/or detailed drawing showing method of fastening of element (e.g. nailing patterns).

3. Qualitative specifications of the wood to be used and all other inputs (metal connectors, etc.).

4. Cost calculation of the trusses, for:

   (a) the wood raw material and other inputs used;

   (b) cost of machining;

   (c) cost of assembling - in factory and on site;

   (d) cost of transport for each truss for a distance of, say: 100 kilometers, both for on-site and in-plant assembly.

D. Equipment and labour requirements for industrial production

Bearing in mind the local conditions and the size of batches envisaged, the contractor shall briefly enumerate the minimum equipment needed for the industrial production of the items he has designed giving technical specifications, tentative plant layout, and describing, in greater detail, any jigs which may be needed to produce these components in Sierra Leone. He shall also enumerate the size and skills of the labour force needed for the above plant.

III. Implementation

1. Phase one - compilation of data

The contractor is to delegate a qualified specialist to Sierra Leone within two weeks of the submission of the contract to him for signature, to obtain all the necessary information. This specialist and/or team leader shall visit UNIDO, Vienna, on his way to and from Sierra Leone for briefing and exchange of views. The tentative duration of the specialist's stay in Sierra Leone is about 4 weeks.

2. Phase two - Preparation of designs and specifications

The designs and specifications will be prepared by the contractor's specialist team and are to be submitted to UNIDO as a draft report in five copies in English within three months of the return of the specialist from Sierra Leone. Thirty copies of the final report in English must be submitted to reach UNIDO within four weeks of the date of UNIDO's comments on the draft report.

3. Phase three

Within one month of the delivery of the report to UNIDO, the contractor will delegate a qualified specialist to Sierra Leone to follow-up and assist in the erection of at least one prototype of each design system. The consultant will carry out revisions of the original designs as required. Duration of the mission is 6 man months.

IV. Background information

Sierra Leone is endowed with good forest reserves, currently not fully utilized. The Government has embarked on a large scale development of rural areas, including the creation of agricultural communities and the necessary infrastructure (roads, bridges, schools, hospitals, etc.).

Timber is one of the country's major resources, and, furthermore, it is a renewable resource. A certain number of sawmills exist, and there exists plans for the development of this sector to cater both to the local as well as regional and overseas markets. Plans also exist for the creation and subsequent exploitation of man-made forests.

The Government's wish is to increase the use of timber in construction, (both in rural and urban areas) for such products as: bridges, trusses, joists, load bearing and non load bearing wall elements, joinery, shuttering, etc.

In order to assure a rational use of its timber resources, and to avoid consumer resistance due to incorrect applications, studies on the grouping of species and comparative costs of construction using various building materials have been undertaken. These are to be complemented by a set of designs for building systems for prefabricated or pre-cut low-cost wooden dwellings, institutional and agricultural and industrial buildings and warehouses, based on general specifications prepared by the Forest Industries Corporation.