

## I T T O

## INTERNATIONAL TROPICAL TIMBER ORGANIZATION

## DRAFT PROJECT DOCUMENT

Title:	INDUSTRIAL UTILIZATION AND IMPROVED MARKETING OF SOME GHANAIAN LESSER-USED TIMBER SPECIES FROM SUSTAINABLY MANAGED FORESTS
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- ITTO Contribution	US\$ 985,273
- Ghana Government Contribution	US\$ 148,907 (IN KIND)

Signed

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 On behalf of ITTO

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 Date

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 On behalf of Government of Ghana

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 Date

## SECTION 1: LEGAL CONTEXT

This project is submitted to the International Tropical Timber Organization (ITTO) in accordance with Articles 1 and 23 of ITTA. Specifically, the project aims to achieve objectives (c) and (e) as laid down in Article 1 of the agreement,

Viz.:-

- to promote and support research and development with a view to improving forest management and wood utilization, and
- to encourage increased and further processing of tropical timber in production member countries with the view of promoting their industrialization and thereby increase their export earnings.

In addition, this project conforms to priorities specified in the resolutions, and meets the requirements of article 23:

- paragraph 5: wood utilization, including the processing and utilization of lesser-known and lesser-used species.

- paragraph 6: which states that the project should:

- (a) be related to the production and utilization of industrial tropical timber;
- (b) yield benefits to the tropical timber economy and be relevant to producing as well as consuming members;
- (c) be related to the maintenance and expansion of the international tropical timber trade;
- (d) offer reasonable prospects for positive economic returns in relation to costs, and
- (e) make maximum use of existing research institution and, to the greatest extent possible avoid duplication of efforts.

## SECTION 2: GOAL, GENERAL OBJECTIVES AND OUTPUTS

The proposed project has as its ultimate goal the marketing of products from lesser known/lesser used species to meet the development needs of Ghanaian Society while also attaining the forest environmental needs embodied in I.T.T.O's target 2000. The project's general objectives are the successful promotion and marketing of higher value added timber-products; where the wood sources are Lesser Used Species (LUS)\*; and the harvest of the trees has a positive impact on forestry sustainable management practices. The project aims to improve the research and development technology in the manufacture of export items such as sawn timber, veneer, plywood, joinery, wood cement boards, wood-craft and furniture from the LUS under review it will link this technology with specific market segments within the principal importing countries of Europe and America and at some later date, other potential markets in the West African sub-region and the Arabic - middle east countries and Southeast Asia. It will aim to upgrade the existing manufacturing methods and export-promotion techniques in order to make the products more price-competitive on the world market. The project aims to improve product acceptance by ensuring its sustainable production by making available the research findings on the effects of harvesting LUS on elements of the ecosystem important for maintaining the habitat within which LUS and primary economic species regenerate and grow naturally. It will attempt to improve existing harvest and silvicultural practices to increase sustainable management practices in the production forest reserves as better information becomes available. A linkage will be achieved by engaging in studies aimed at analyzing the utilization and marketing of tropical hardwood products in Europe and America; and through the implementation of a product-development

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\* As is made clear in this project document, concentration is on species which are Lesser-Used but about which some properties are known. Therefore the use of LUS rather than LKS.

research and ecosystem studies in close association with the timber industries and export and marketing agencies, and others interested in forest management. The desire is to involve this range of non-governmental firms and organizations in finding solutions to forest management, product processing and marketing problems which will be identified during the ecological monitoring, industrial trial-production, and market activities.

For a substantial number of Ghanaian lesser-known species a certain amount of basic information regarding their technical properties and available volumes in the forest is already available, yet the dismal record of these species gaining acceptance in the marketplace indicates that knowledge of these alone is not sufficient to ensure market acceptance. To successfully market these new species, it is felt that:

1. the quality of the product must conform to internationally accepted standards;
2. production cost must be low enough to be able to make the product competitive on the world market; and
3. knowledge of the market channels of tropical hardwood products must be obtained for Europe and America and eventually Middle East countries as well as the West African sub-region where the market situation is still to be widely explored.

A well planned product-development research and market studies directed towards the utilization of tropical hardwoods in Europe, America and elsewhere would provide information making it possible for tropical hardwood producers to assess their market mix and focus their activities to the promotion of their lesser-known species on a sustainable basis and towards specific market segments. If Ghana is to succeed in maintaining a viable timber industry, it must be able to

persuade the industry to move into use of the abundant under-utilized species to sustain the forest and conserve the genetic resources of the presently dwindling primary species.

It is the linkage between product-development research; the market channel and consumer preference research data and the environmental research data that provides the basis for the unique aspect of this project. This co-operative research effort will provide the basis for the development of a methodology for linking the results of lesser-known species product research obtained through industrial trial production, with market information obtained through secondary and primary research and sustainable selection, harvest and management information obtained through the environmental impact assessments and regeneration monitoring. The resultant methodology will be of importance and applicable to West and other African forest managers and timber producers; and of interest to tropical hardwood producers and environmental interests everywhere.

Outputs:

At the end of the project, the following must have been accomplished:

1. An awareness must have been created in the industry about the need for increased and further processing of the selected LUS as a means of broadening forest resource use on a sustainable basis; ,
2. The basic working and technological properties of the selected species such as seasoning and preservation, machining and gluing properties, peeling and slicing characteristics etc., must have been evaluated and established;
3. Potential high value-added end-use products that could be manufactured from the selected species, must have been identified;
4. Prototype products in lumber, veneers, plywood, flooring panels,

- furniture etc. must have been developed;
5. The identification of appropriate silvicultural systems through the creation of canopy openings that will stimulate the regeneration of suitable seedlings;
  6. A description of the modification of nutrient cycling in tropical forests as a result of different intensities of logging;
  7. Enumeration of the level to destruction of residual trees at different intensities of logging;
  8. A description of the modification of climatic factors as a result of different sizes of canopy openings;
  9. Improved forest management practices consistent with sustainable production must be enumerated as a result of researching the effects of harvesting intensity on the forest ecosystem;
  10. A description of the structure of the market for tropical timber in Europe and North America and where Ghana fits in that market;
  11. A description of the dominant market channels through which existing wood products from LUS move; and those market channels with a high possibility of substitutability by products from LUS move;
  12. A seminar must have been held to disseminate technologies, ecological and other relevant research information to the industry, trade, forest and concession managers;
  13. Skilled labour and supervisory staff in industrial establishments must have received relevant training as part of technology transfer strategy;
  14. Manuals containing relevant research and commercial information must have been published to enhance promotional activities in production and

- marketing;
15. Selection of pilot wood products and target markets for a market pilot;  
and
  16. Design and implementation of pilot activities.

### SECTION 3: BACKGROUND AND JUSTIFICATION

#### Tropical Hardwood Resource in Ghana

Ghana has considerable wealth in tropical hardwood timber resources. In 1990, forest product exports were the third foreign exchange earner for Ghana, bringing in almost US \$135 million. Only exports of gold and cocoa exceeded timber exports in their ability to earn foreign exchange. It is clear that Ghana is dependent upon timber products to help meet some of the country's development goals.

The tropical hardwood resources of Ghana are contained within 253 forest reserves established across the country, but they are principally located in the southern third of the country. These forest reserves, which total 15,913 sq. km., are divided into three 'working circles' or reserves. The production reserves (11,590 sq. km.); the protection reserves (4,323 sq. km) and research reserves (which are currently insignificant). The production reserves or production working circles have been designated for sustainable harvesting by the timber industry; these reserves are managed for the sustainable yield of timber. Protection reserves are usually located in ecologically sensitive areas such as all steep slopes and all watershed areas including headwater catchment, and river and stream banks. No logging is permitted in protection reserves and they are managed solely for environmental protection. Research 'working circles' are managed for purposes of scientific research.

In addition to these reserves, there are 3,740 sq. km. of unreserved or open

forest. The open forest areas have been identified as areas that are to be converted to agricultural uses.

Past research has indicated that there are about 680 different species of trees in the forest reserves of Ghana (Hall and Swaine, 1981). In its current forest inventory services, the Forestry Department of Ghana identified approximately 420 tree species which attain timber size and therefore, are of potential economic value (Forestry Department, 1986). Further analysis of the inventory results indicated that 126 of these species occur in sufficient volume to be considered exploitable as a raw material base for the timber industry (Forest Inventory Project Report, 1989).

The Ghanaian Forestry Department has recently classified all Ghanaian timber species into one of the three Forest Inventory Project (FIP) classes developed during the forest inventory project (Forest Inventory Project Report, 1989). FIP class 1 contains those species that are recorded as having been exported at least once during the past 17 years. FIP class 2 species are those that, while never having been exported, grow to a harvestable size and occur with a density that exceeds one tree per sq.km. All other species are considered to be non-commercial and as such are grouped into FIP class 3. It is estimated that the 115 species included in classes 1 and 2 represent approximately 92.6% of the volume of trees found in the Ghanaian forest reserves (Ghanaian Forestry Department, 1991).

A review of the forest products' export permits covering the past twenty years indicated that 66 timber species have been exported from Ghana at least once (Forest Products Export Permit Reports). Currently there are about 30 timber species exported from Ghana. However, these figures do not indicate the dependence of the Ghanaian forest industry on a very few established species, the so-called "noble" species. In 1990, over 70% of log exports were from two species.



That same year over 70% of lumber exports consisted of three species and over 69% of veneer was three species. See Table 1.

The restriction of exports to a relatively limited number of established species may be attributed to several factors. Most importantly, foreign importers are reluctant to import lesser-known species of logs from West Africa. The ability of foreign importers to concentrate their demand upon the established species can be attributed to the availability of adequate supplies of the more established species from a variety of West African countries. Despite the fact that supplies of the established species are dwindling in many West African countries, other countries in the region are only just beginning to exploit their forest resources. Another important factor is the lack of readily available market strategies based on technical information regarding the properties and appropriate end-uses for most of the lesser-used species. Also, at times, the quality of industrial products do not match up to quality standards on the world market and thereby render them not competitive enough. Finally, West African producers have been unable to actively develop markets for the intermediate products of lesser-used species, due in part to an inability to implement aggressive marketing strategies.

Table 1: Principal export species from Ghana in 1990 in m<sup>3</sup>.

Species	Product	Export Volume	% of total produce exports
Wawa (Obeche)	Logs	123,441	62.4
Koto (Kyere)	Logs	18,662	9.4
Wawa	Lumber	86,284	43.0
Odum (Iroko)	Lumber	35,563	17.7
Mahogany (Khaya)	Lumber	20,348	10.1
Asanfona (Aningera)	Veneer	3,673	28.2
Makore (Baku)	Veneer	3,097	23.8
Sapele	Veneer	2,252	17.3
Mahogany	Veneer	1,168	9.0

Source: 1990 Forest Products Inspection Bureau Export Permit Report

### Environmental Considerations

It is clear from the export statistics that the forest resources of Ghana are being inefficiently utilized. The few species which represent the vast majority of timber exports are being seriously over-exploited, table 2. Considering the established species for which growth/extraction data is available, all exhibit extraction rates substantially in excess of their rate of annual growth. Each of these species, with the exception of Wawa, is projected to be depleted within 25 years. It is doubtful that the situation in other West African countries is much better.

Table 2: Estimated resource life for some established commercial species.

Species	Annual growth (m <sup>3</sup> /year)	Extraction rate (m <sup>3</sup> /year)	Resource life (years)
Odum	28,650	172,983	10
Hyedua	1,966	10,620	18
Utile	8,081	31,891	20
Mahogany	31,488	66,877	20
Sapele	31,496	41,135	25
Wawa	135,779	366,064	114

Source: Forest Inventory Project Report, 1989.

This dependence on the export of a few species, besides representing an inefficient utilization of the timber resource, has several other undesirable consequences. Probably the most disastrous occurs when loggers, searching for the ever scarcer established species, open up vast areas of the forest to reach these trees. The resultant network of logging infrastructure results in the destruction of a large volume of lesser-known and lesser-used timber species and allows for the intrusion of shifting cultivators into the forest. Not surprisingly, the cost of these logs increase as extraction costs and transportation costs rise. These

rising costs divert scarce operating capital towards raw material acquisition and away from vital functions such as sustainable management, equipment maintenance, facility expansion or marketing.

Currently, within tropical hardwood consuming countries there is substantial interest in the establishment of sustainable forest management regimes in tropical forests.

Environmentalists have begun urging consumers to boycott all products produced from tropical hardwoods not harvested in a sustainable manner. The potential for damage to the existing timber industries in West Africa caused by a successful boycott is considerable and cannot be ignored. However, the successful implementation of a system of sustainable forest management appears to require that a larger number of species be harvested. This would allow for the more intensive utilization of the timber resource located in a smaller area of forest. This is more important in the more heterogenous forests of Ghana and other African countries. It is clear that greater utilization of LUS will increase the output volume and value production per unit forest area and that in many situations this is necessary to allow effective, feasible and sustainable management. In some circumstances, the utilization of LUS will help achieve the level of disturbance required for the effective regeneration of more valuable species. Thus in these circumstances the utilization of LUS can transform harvesting from merely being an act of exploitation to a positive action for the silvicultural improvement of the forest. Equally, however, increased production per unit area of forest, to a level that may lead to biodiversity loss, reduction of site productivity due to soil erosion, nutrient loss and damage to the residual tree crop is possible. Studies source by Miler 1970, Chin 1979 and Sonit 1983 showed that greater canopy openings as a result of removal of LUS could result in management problems including

excessive weed and climber growth which would smother seedlings and saplings. Greater canopy openings may also result in increase in soil temperature which may affect mycorrhiza important in the growth of many tree species. There is, therefore, the urgent need of assessing the ecological impact of harvesting an increased number of LUS from the forest reserves of Ghana. The relative benefits and costs of specific harvest regimes of LUS should be carefully evaluated in relation to local circumstances. This will enable the prediction of threshold values for the selection and harvesting of LUS so as not to impair the productivity of the production reserves.

#### Constraint in the Industry

The timber industry in Ghana shows a wide divergence in size, structure and technology know-how. There are only a handful of capital intensive and vertically integrated companies e.g. Mim Timber Company, Scanstyle and the African Timber and Plywood Companies, which process their logs into sawn timber, veneer, plywood and furniture. On the other hand a lot of small companies also exist which often operate with obsolete equipment and often lack the adequate technical competence.

The industry in Ghana counts about:-

100 Sawmills

200 Furniture firms

250 Logging units

9 Plywood mills

13 Veneer slicing plants

7 Molding plants

6 Door manufacturers

1 Chipboard plant

For example, from the bulk of 200 furniture firms only a handful of them are

able to export a few items.

The reason for such constraints are:

- (i) weakness in design innovations;
- (ii) obsolete machines lacking regular maintenance and spare parts,
- (iii) complete lack of product development research; and
- (iv) lack of management skills and marketing strategies.

As a result of these, the mills are very often not utilized to full capacity. There is no proper quality control, no efficient waste utilization, lack of competitive pricing abilities. All of these shortcomings could be reduced considerably through direct co-operation of the research institutions and the industry in a product-research and management programme.

#### INADEQUATE MARKET INFORMATION ON LUS

The problem of the introduction of the lesser-known species into the European and American marketplaces are compounded by the shortage of trade and market structure analysis regarding LUS tropical hardwoods. In particular, the international trade statistics lack depth with respect to the LUS of timber imported by individual European countries as well as the channels through which products move to end-users for Ghanaian (and the Region's) LUS tropical timber products. This restricts the ability of Ghanaian (and the Region's) forests products manufacturers to acquire an understanding of the market and to develop long-term business strategies based upon the desirability of products from LUS. This deficiency reduces their competitiveness in these markets.

In 1986, European countries imported approximately 3.4 million cum of African tropical hardwood logs. These imports represented 48.6% of European hardwood log imports (ECE Timber Trade Statistics, 1987). Despite the importance of tropical logs in European trade, almost no data is available among producers to

describe conversion of these logs or end-uses for the value-added wood products manufactured.

While West Africa is the principal supplier of tropical logs and veneer to Europe, it is Southeast Asia which provides over 80% of the tropical sawnwood imported by Europe (FAO Forest Products Yearbook, 1990). This seems surprising given the European preference for African species and the distance of Southeast Asian producers from the European marketplace. The success of Southeast Asia in this area is due in large part to two factors. Important is the price differential offered with respect to high priced African species. Equally important, however, is the strong support provided to the Southeast Asian forest product's industry by market information from industry associations and government supported marketing boards.

Several Southeast Asian species which resemble some West African species in appearance are marketed in Europe as substitutes for these species. For example, Dark Red Meranti is promoted as a substitute for Utile, while Merbau and Mengkulang are similar to Doussie and Niangon, respectively. Additionally, these Asian species are available at a substantial price discount over their West African counterparts. FOB price data indicates that in 1990 prices for a cubic meter of lumber were: Utile; \$US760 vs Dark Red Meranti: \$US307, Niangon: \$US499 vs Mengkulang: \$US231 and Dossie: \$US565 vs Merbau: \$US333 (Ghana Forest Products Inspection Bureau Export Permit Report, Maskayu, 1990).

Most West African countries express a desire to reduce their dependence on tropical log exports. However, it is essential that they first develop the ability to compete effectively in the European markets for value-added wood products. In order to develop this ability, it will be necessary to obtain a thorough understanding of the structure of the market, for tropical LUS hardwoods in Europe

and America; and an in-depth analysis of product distribution channels; and consumer preferences (both intermediate and end-user) which influence the utility mix for which consumers pay. Only through developing a thorough understanding of the tropical LUS hardwood markets in Europe and the other importing countries can Ghanaian (and Regional) producers hope to compete effectively.

The Forestry Department of Ghana has expressed its intention of introducing a forest management regime based on sustainability for its forest reserves. It has been determined that the imposition of a harvest level of 1.1 million cum would achieve this objective, based upon a 40 year rotation schedule. The Forestry Department estimated that for the smallest size concession (52 sq.km.), this would allow for the harvesting of 1.3 sq.km. per year.

The success of this plan would necessitate a drastic reduction, or even elimination, in log exports. Already value-added wood processors, in Ghana are experiencing difficulty. Therefore, a shift towards the production of further processed wood products must be supported by a vigorous and effective marketing effort.

Finally it can not be underestimated, that the utilization of LUS will significantly increase revenue and foreign exchange earnings as well as generating employment for a large number of people; both of which are important development objectives of Ghana. The Ghanaian internal wood product's market also stands to benefit a lot by the utilization of the LUS.

SECTION 4: RESEARCH DESIGN: ACTIVITIES TO SECURE OUTPUTS:

The proposed research project will consist of 6 parts and two significant activities.

Part 1: will be aimed at investigating and evaluating the occurrence by volume of a number of lesser-known species about whom adequate information exist concerning their properties, workability and potential end-uses. A number of species will be selected for industrial research. This part has been completed and the results recorded below.

Part 2: will implement product development research of the species selected below. The research will be a broad-based product development research which will directly involve industry.

Part 3: will study ecological problems associated with the increased exploitation of the forest by bringing into mainstream industrial production the selected lesser-used species.

Part 4: will deal with primary research on market channels, consumer preferences and how to gain market acceptability for products from LUS.

Part 5: will deal with the transfer of information developed out of the above applied research. The information to be disseminated shall be from:

- the product development studies
- the ecology studies and
- the marketing studies

A seminar will be organized as part of the dissemination for this purpose.

Part 6: will deal with design and implementation of a pilot project on product development and marketing promotion of selected products of LUS.



## PART 1: SELECTION OF SPECIES FOR THE STUDIES

In the early 1960's the Forestry Department of Ghana produced a classification of the Ghanaian species into species groups. Group A containing species of classes IA, IB, IC, IIA and IIB. These consisted mainly of the most highly desirable species. Species group B was composed of class III and IV species which although considered to have some potential commercial value remained less-utilized; and species group C which could not immediately be classified as of much commercial value (Silviconsult - The Forest Department Review). A comparison of that classification with the latest FIP classification (Forest Inventory Project Report 1989) shows that out of the 57 species listed under FIP class 1, only 24 of them fall in the previous Forestry Department classes IA, IB, IC, IIA, IIB, i.e., under the group of the so-called traditional or primary species. The remaining 33 are considered in Ghana to be lesser-utilized. A further look at the FIP classification indicates that the FIP class 2 species comprising 58 species can be classed as lesser-known in Ghana.

This project will however not look at the FIP class 2 lesser-known species since most of their technical properties are not sufficiently established. The project will instead look at, and select from the 33 lesser-used species in FIP class 1 since their technical properties are fairly well known. From the 33 lesser-utilized species in FIP class 1 the following 14 species have been initially selected for the studies (this number may be reduced):

1. Albizia ferruginea (AWIEMFOSAMINA)
2. Antrocaryon incraster (APROKUMA)
3. Bombax brevicupse (ONYINAKOBEN)
4. Canarium schweinfurthii (BEDIWONUA)
5. Ceiba pentandra (ONYINA)

6. Celtis mildbraedii/zenkerei (ESA)
7. Chrysophyllum giganteum (AKASA)
8. Cylicodiscus gabonensis (DENYA)
9. Daniela ogea
10. Distemonanthus benthamianus (BONSAMDUA)
11. Petersianthus macrocarpus (ESIA)
12. Pycnanthus angolensis (OTIE)
13. Sterculia rhinopetala (WAWABIMA)
14. Strombosia glaucescens (AFENA)

The selection which was done under the guidance of the latest Ghana inventory report was based on the following considerations:-

- (a) that the distribution of the species to be extracted occurs only in the production working circle i.e from areas where one of the management objectives is sustainable timber production;
- (b) occurrence, measured in mean stem numbers per square km should be equal to or more than 30 trees, i.e the total number of standing trees/km<sup>2</sup> by cm diameter classes of all trees which can grow to achieve at least 70cm diameter (for Afena = 50cm) at the time of cut should be equal to or more than 30 trees; and
- (c) species whose mechanical properties indicate some specific end-use potentials which could make them substitutable for certain dwindling primary species and which are likely to compete successfully on the world market.

Table 3 shows the species and some specific end-use areas whose industrial processing and marketing possibilities will be researched during the project implementation.

Table 3: Species and some end-uses:

SPECIES	SAWN TIMB. DRIED PRESE.	FLOORING	PLYWOOD	VEN.	MOULD. FURNIT. + CABINET WORKS	JOIN.	STRUC- TURAL TIMB.	MARINE & MINE PROPS, POSTS	SLEEPER
Albizia ferru- ginea AWIEMFOSAMINA	x		x	x		x			
Antrocaryon incraster APROKUMA	x		x	x					
Bombax brevicupse ONYINAKOBEN	x		x	x	x	x			
Canarium schweinfurthii BEDIWONUA	x		x						
Ceiba pentandra ONYINA	x		x		x	x			
Celtis mildbrae- diid zenkeri ESA			x	x	x				x
Chrysophyllum giganteum/ subrundum albidum AKASA	x								
Cylicodiscus gabonensis DENYA	x	x					x	x	x
Daniella ogea HYEDUA	x		x	x	x				
Distemonanthus benthamianus BONSAMDUA	x	x					x	x	x
Petersianthus macrocarpus ESIA	x				x		x		x

SPECIES	SAWN TIMB. DRIED PRESE.	FLOORING	PLYWOOD	VEN.	MOULD. FURNIT. + CABINET WORKS	JOIN.	STRUC- TURAL TIMB.	MARINE & MINE PROPS, POSTS	SLEEPER
Pycnanthus angolensis OTIE	X			X	X		X		
Sterculia rhinopetala WAWABIMA	X	X		X			X		
Strombosia glaus]cescens AFENA	X	X					X	X	X

End-uses shown in the table constitute only the major potential end-use areas to be investigated. Other minor uses such as toys, tool handles, pallets etc. will also be looked at.

## PART II: PRODUCT DEVELOPMENT RESEARCH

The general framework for implementing the product development research shall be as follows:-

1. Selection of industrial processing units,
2. Concluding agreements with companies for using their facilities,
3. Definition of research methodology to be used and
4. Implementing product development programme in industrial establishments.

### 1. SELECTION OF INDUSTRIAL PROCESSING FIRMS

In order to make research results utilizable immediately in industry, it is proposed to carry out the applied research in industrial firms.

Selection of the companies shall be based on:-

- their interest and willingness to offer machine time,
- managerial and technological experience in particular product manufacture and
- existing experience with some LUS as a means of reducing the cost of project implementation.

Generally, since the development of products from the envisaged LKS/LUS should aid the development of the timber industry as a whole and significantly improve the utilization levels of the Ghanaian forest through improved forest management systems and cost reduction in harvesting and processing, this should minimize the problem of obtaining commitment and co-operation for the programme. It is however, intended as a first step to engage mainly public timber concerns and some private companies with the facilities, technical and managerial experience to add to their product diversity.

The following firms are proposed to participate in the programme:-

<u>FIRM</u>	<u>PRODUCTS</u>
1. Mim Timber Company	Kiln dried lumber, mouldings and sliced veneers.
2. Mim Scanstyle	Furniture, mouldings and flooring panels
3. Ehwia Sawmill	Air dried lumber
4. African Timber and Plywood	Rotary peeled veneers, plywood and flooring panels
5. Western Veneer and Lumber Company Limited	Rotary peeled veneers, lumber and flush doors, plywood.
6. Ghana Primewoods Products	Sliced veneers
7. Kumasi Furniture and Joinery	Furniture, mouldings and pallets
8. Specialized Timber Products	Lumber
9. Akuaba Toys	Toys and furniture
10. Dupaul Wood Treatment	Construction Lumber, electric and communication poles
11. Bondplex Ghana Limited	Sliced veneer and plywood.

2. CONCLUDING AGREEMENTS WITH COMPANIES FOR USING THEIR FACILITIES:

While cost centre shall be closely monitored to determine the future cost/benefit effects of introducing and processing the selected species, an agreement shall be reached with the companies concerned to use whatever sales that will result from the project to defray part of their costs in manpower, inputs, management expenses and other overheads. Remaining cost shall be government's contribution to the project.

3 DEFINITION OF RESEARCH METHODOLOGY:

From the information gathered from preliminary survey the selected species shall be divided according to their ease of conversion into the two primary products of lumber and veneers. Adequate samples of the species in each group shall be sent to the primary processing mills engaged in the project to process them into previously agreed specifications.

For the production of the primary product lumber, such factors as the effect of log size and grade, sawing method and blade treatment on lumber grade and yield shall be determined and analyzed in relation to technical and economic viability.

Similarly, for the production of the primary product veneers, such factors as affect the bolt before peeling or slicing and machine properties affecting surface quality and thickness shall be studied for their economic and technical feasibility.

From the lumber so produced further studies shall be conducted into:-

- seasoning (air and kiln) characteristics;
- preservative treatment and/or natural durability; and
- glueing and finishing characteristics.

Resulting from these will develop products such as profile boards, furniture and mouldings, construction timber, toys, various tool handles and parquet flooring panels and pallets.

From the veneers so produced, different types of plywood shall be produced after assessing their glueability with both exterior and interior type glues.

4 IMPLEMENTING PRODUCT DEVELOPMENT PROGRAMME IN INDUSTRIAL CONCERNS:

The applied research in industrial processing units shall be carried out under the following specific study titles and objectives:

- (a) Sawmilling Characteristics: the objective shall be to assess or investigate factors affecting the sawing properties of the selected species. In particular the study shall assess ease of cut with varying saw types; quantity and quality yields that are influenced by log factors, sawing methods and blade treatment;
- (b) Seasoning Characteristics: the objective shall be to determine seasoning properties of all selected species sawn into lumber. In particular the study shall formulate kiln drying schedules; determine the approximate length of time and period of year for optimum air drying and investigate the effect of drying on shrinkage and susceptibility to different drying defects;
- (c) Preservative Treatment: the objective shall be to study different treatment methods using oil-borne and water-borne preservatives;
- (d) Machining Characteristics: the study shall determine how the seasoned lumber of the selected species behave during planing, boring, turning, mortising and shaping;
- (e) Glueing Properties: the objectives shall be to ascertain bond quality for both interior and exterior type glue on each species and thereby classify species according to ease of glueing;
- (f) Finishing Properties: under this study title appropriate sanding schedules, lacquering and also painting shall be studied;
- (g) Manufacture of Furniture: the objective shall be to determine the suitability of the selected species for the manufacture of furniture, both ordinary and bentwood or arched. In particular the study shall observe



bending properties of the species; design and develop a prototype furniture, and assess the strength of joints in the prototype;

(h) Manufacture of Parquet Flooring Panels: the objective of this study shall be to determine the suitability of the selected species for the manufacture of parquet flooring panels, develop prototypes and test their service performance;

(i) Manufacture of Pallets: the objective of the study shall be to evaluate the suitability of the selected species for pallet manufacture and develop prototypes for laboratory and field tests;

(j) Rotary and Sliced Veneer Cutting: the general objectives shall be to produce quality veneers from some of the selected species suitable for veneers; and

(k) Production of Plywood: this study shall investigate drying, gluing and pressing properties of the veneers of the selected species in the production of plywood.

#### OUTPUT OF IMPLEMENTING PRODUCT DEVELOPMENT RESEARCH PROGRAMME;

Generally the study should:

1. determine and established appropriate processing technologies for the species in the programme, possibly improving on and establishing standards where some processing technologies are already known.
2. determine the economic feasibility of adapting the developed technologies. This will be done by monitoring of cost at all stages of processing.
3. help establish any comparative advantage that products, developed in the programme may have over similar products made from well known and used species.
4. help determine what training needs exist at the skilled manpower, supervisory and management levels for the different product development technologies.

### PART III: ENVIRONMENTAL IMPACT RESEARCH

In developing the research programme on the environmental impact of logging, the following topics will be considered:-

1. Effects on residual trees
2. Effects on regeneration
3. Effects on soil properties
4. Effects on nutrient cycling
5. Effects on hydrology
6. Effects on biodiversity.

Previous research has examined the effects of conventional (low intensity) logging on tree regeneration (Hawthorne 1990)<sup>1</sup>, and a current project is examining the influence of canopy opening on the growth rates of Ghanaian timber species (Swaine 1991)<sup>2</sup>. Furthermore an ongoing project in Ghana on the Better Utilization of Tropical Timber Resources being implemented by the Federal Research Centre of Forestry, University of Hamburg and FORIG aims to assess the logging damage in Ghanaian forests (ITTO Project No. PD74/90).

To avoid duplicating existing research items 1-3 above have therefore been selected as most in need of study. Items 4 and 5 although deemed to be very important cannot be fully considered by this project for the following reasons:

1. Studies on item 4 are very extensive and therefore it might be necessary to address this problem in a separate project to be conducted by FORIG. However, it will partly be addressed here in the study of logging on soil properties.

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<sup>1</sup>Hawthorne, W.D. 1990. Regeneration after logging in Bia South Forest Reserve. ODA draft report. Forestry Department, Kumasi.

<sup>2</sup>Swaine, M.D. 1991: Regeneration of timber tree species in Ghana. ODA/FORIG Research Project.

2. Research on hydrology is the responsibility of Water Resources Research Institute. It is however hoped that this project will draft a hydrologist from the Water Resources Research Institute to collect base line data which will be used to design a proposal to be submitted to ITTO on the effects of logging on hydrological properties.

For item 6, a further project has recently been completed, which surveyed the plant biodiversity in all the forest reserves in Ghana's forest zone, and the report (Hawthorne 1992)<sup>1</sup> considers in detail the effects of logging.

#### METHODS

The studies will be undertaken in each of the three forest ecological zones Wet Evergreen, Moist Semi-deciduous and Moist Evergreen from which the bulk of Ghana's timber is obtained.

In each zone 64 ha of forest land will be demarcated and divided into eight 8 ha plots (200 x 400m). Each treatment will be randomised and will have two replicate plots located on flat or gently sloping land and arranged to avoid run-on or run-off interference between plots. Sites on hill tops of middle or Upper slopes will be chosen on soil types of each zone. The four treatments will be: Control (on logging); Conventional logging (2 trees per ha); LUS logging (5 trees per ha). Trees to log will be selected from those enumerated above 60cm dbh.

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<sup>1</sup>Hawthorne, W.D. 1992: Protected forest areas in Ghana ODA draft report, Forestry Department, Kumasi.

### **Tree Enumerations:**

All trees 60cm dbh on all plots will be tagged, mapped, measured and identified to species before treatment, immediately after and then annually for two years. Each tree will be scored for bole damage (area of exposed wood) and crown damage (proportion of crown missing).

The initial enumeration will be used to determine the trees to be felled to achieve the treatments described above. The results will allow examination of the effects of different logging intensities on residual trees in terms of damage, tree mortality, and growth rates (including recruitment to harvestable size).

### **Seedlings and Regeneration:**

Assessment of smaller trees will be made by sub-sampling the 8 ha plots with five 200m transects laid across the width of each plot at random locations along the axis. All trees 10cm dbh of Class 1 timber species will be tagged, named and dbh measured within 5m on each side of the transect line. Seedlings and saplings 10cm dbh will be assessed within 2m of one side of the line. Seedlings less than 3m tall will be measured for height instead of dbh. Every tree will be scored for damage (leader broken, bent stem, bark damage and crown damage). The initial enumeration will be repeated after logging and annually for two years. New recruits will be recorded and mortality noted in second and subsequent enumerations.

The results will provide a quantitative assessment of the immediate damage to trees caused by logging of different intensities, including species-specific differences in mortality rates, responses of surviving trees to canopy opening and the effects of logging on the abundance and composition of natural regeneration.

Since these studies will be conducted in the same plots as will be used for the study of soil properties, it will be possible to study the interaction between

soil damage and seedling establishment. The experiment also provides for long-term assessment of the effects of logging on forest recovery, beyond the end of this project.

#### Soil damage assessment

Because soil damage and its effects will be heterogeneously distributed within each plot, the assessment of damage will be stratified into:-

1. no damage - undisturbed forest
2. felling gap-possible changes in nutrient status
3. skid trials - single use
4. skid trials - multiple use

Logged plots will be surveyed and the areas represented by each damage category mapped. Damage in each category (and the quality of the control) will then be

quantified by the following measurements: 5 small (ca. 0.5m deep) replicate pits will be dug for profile description and adjacent sampled for:

- i. Bulk density using a corer, at 0-4, 6-10 and 16-20cm (also stone content in these samples);
- ii. Total nutrient content in the upper profile horizons identified these may vary between damage categories, where soil has been scraped off, lost or modified), including pH, organic C, N and available P. In addition, one pit per plot will be sampled to depth for profile description and detailed measurements of soil nutrient status.
- iii. Infiltration with a double ring infiltrometer (5 replicates)
- iv. Simple erosion estimates at three monthly intervals from marker pegs.
- v. Penetration resistance (at least 30 measurements per plot per damage category) at 4, 8, 12 and 18cm depth using a Farnell cone penetrometer, towards the end of the rainy and at the end of the dry season.

PART IV: ANALYSIS MARKET STRUCTURE, PRODUCT MARKET CHANNELS AND CONSUMER PREFERENCES IN THE EUROPEAN AND AMERICAN MARKETS FOR GHANAIAN AND REGIONAL TROPICAL HARDWOODS, PARTICULARLY LUS.

Part IV of the proposed project will consist of a series of market surveys of the tropical hardwood industry in the principal importing countries of Europe and America. The international trade data indicates that the principal European importers of tropical hardwood are U.K., West Germany, France, Italy, Spain and Portugal.

A combination of secondary data and primary data will be used to achieve the objectives of the study. A review of the secondary data will entail an extensive review of the published literature found in U.N. publications, ITTO and member country publications and trade association publications. This information will be used to illustrate the structure of the market (who participates and to what extent). It will also be used to construct the channels (stage and intermediate consumers through which a product moves to the end-use consumer) of tropical wood products particularly LUS. The results of the literature review will provide the basis for developing the questionnaire to be used in the primary data collection phase. This market survey is intended to provide more information on the product channels and consumer preferences within each stage.

The target population for the market survey will include government agencies, industry associations, associations of intermediate users, such as architects, tropical hardwood importers and tropical hardwood manufactures as well as environmental and other groups interested in tropical hardwood in each of the targeted importing countries. Information will be obtained through a combination of personal interviews as well as mail questionnaires. Information of interest will include: importance of tropical sawnwood attributes, end-uses for tropical

hardwoods, distribution methods for tropical hardwoods and perceived risk posed by use of LUS and the perceived effect of sustainable produced tropical hardwood on consumers.

Data obtained through open-ended questions will be analyzed using qualitative methods of data analysis. The data pertaining to sawnwood attributes and risk perception will be measured using a Likert scale. The Likert scale facilitates the statistical analysis of quantitative data. The quantitative data analysis will involve using basic statistical methods as well as the multivariate data analysis techniques of factor analysis and multiple discriminant analysis. The statistical analysis of the data will be performed using the SPSS-Xk statistical package for the personal computer.

Illustrative of the survey's outputs are answers to the following examples:

- (a) What are the end-uses of the different LUS of tropical hardwoods in the various North American and European countries;
- (b) What are considered to be the most important sawnwood attributes by European and North American tropical hardwood importers? How does this affect LUS?;
- (c) What do European and other tropical hardwood importers consider to be the most important attributes for the successful introduction of a new timber LUS;
- (d) What are reason for the success of Southeast Asia in the tropical sawnwood market in Europe?;
- (e) What are the perception of European importers regarding both West African producers and Southeast Asian producers? and
- (f) What are the potential effects of supplying products from known sustainable sources on European and North American consumer's choice of

products;

- (g) Which species already established in the trade could be compared favourably or substituted with the LUS in the project in terms of working properties and aesthetic qualities.
- (h) The extent to which low prices of LUS could be disincentive for exploitation and utilization and incentive for marketing.

ENCLOSURE ONE (continued)

1. The following are the names of the species of LUS which are currently being marketed in the United States:

2. The following are the names of the species of LUS which are currently being marketed in the United States:

3. The following are the names of the species of LUS which are currently being marketed in the United States:



Part V      TRANSFER OF INFORMATION DEVELOPED OUT OF THE APPLIED RESEARCH.

The transfer of LUS product development technologies; the environmental impacts of different LUS harvest patterns and practices; and product market channels and consumer preferences of LUS will be transferred to those who comprise the various segments of the wood industry, forest management community and other interested parties in three ways: A seminar, training workshops and publications. Although the seminar is discussed in the next section of this document, it should be pointed out here that as a means of transferring lesson learned, it will attempt to integrate information and the audience. The training workshops will be directed at specific segments of the audience. Publications will be targeted in both directions.

TRAINING WORKSHOPS AND ACTIVITIES

A key element in ITTO's strategy to promote the expansion and diversification of the international trade in tropical timber based on sustainable production is the promotion of human resource development at all levels.

Product Development

It is envisaged that this promotional activity should help to improve industrial efficiency, strengthen management skills and ensure quality performance of products.

Having regard to ITTO project PD 4/87 Rev. 1 (1) currently being implemented by FTP of Finland to develop managerial skills of Ghanaian wood industry managers, it is envisaged by the project implementors that training in product development which will take place after the seminar, shall be targeted to line managers and supervisors, technicians and other relevant skilled labour.

The objectives of the training workshop shall be:

- to disseminate relevant information on the results of the applied research on the selected lesser used Ghanaian timber species;
- to improve skills and supervisor of capabilities generally;
- to introduce or improve technological skills in working with the selected species; and
- to raise participants level of appreciation to the need to look for and avoid or minimize waste as a means of reducing cost and increasing profitability of the companies.

At the end of the training workshops, participants would have:

- learnt about the products developed through the applied research on the lesser used species;
- learnt about the technology to enhance production based on the selected species;
- improved their various skills; and
- learnt about how their work and efforts contribute to output, efficiency and economic results of their various companies.

#### Sustainable Management and Harvest

It is hoped that these training activities should improve the management skills and efficiency of people involved in the management of tropical forests in Ghana, and also improve the harvesting techniques of loggers in favour of less environmental destruction.

Thus, this training shall be targeted to personnel from the Forestry Department and Forest Managers and their supervisors from the various forest industries in the country.

The objectives of the training workshop shall be:

1. to disseminate relevant information on the result of the research on the impact of logging of LKS on the environmental;
2. to improve the management skills of people involved in the management of forests for sustainable supply of forest product channels and consumer preferences;
3. to raise awareness and appreciation of loggers and people involved in the timber industry to maintain the forest in a state that can help it to provide sustainable supply of its products.

#### Marketing:

It is hoped that the training workshop for market channels and consumer preferences should improve the ability to match specific consumer desires with products and promote those products through the proper channels. Thus, this training shall be targeted to those responsible for product promotion and market development within firms, government and trade association.

The objectives of the training activities shall be:

1. To disseminate relevant information on the results of the research on market structure,
2. To improve the skills of those responsible for marketing Ghana's wood products in international markets; and
3. To understand the profile of the consumer interested in products produced from sustainable produced LUS.

#### PUBLICATIONS AND PROMOTIONAL ACTIVITIES

The various publications discussed below are aimed primarily at audiences with the wood industry and forest management sector. It must be mentioned, however, that participants in the research will also be developing information of

interest to the scientific community. This information will be presented in published form in scientific journals and presented in scientific forums.

**Forest products:**

The publications shall contain:

- names of species studied;
- their various characteristics and potential end-uses; and
- developed technologies for production of value-added goods; and

relevant extra information derived from seminar and training workshops.

Publications shall be produced in conjunction with TEDB as part of marketing strategy.

Promotional activities will take the form of:

strengthening linkages with government and non-governmental

organizations involved in wood processing and utilization; and

dialogues, press releases and showcasing prototypes through

exhibitions.

**Sustainable Management and Harvest**

The publications shall contain information on:

- the threshold values for harvesting LKS so as not to impair productivity of the forests;
- the modification of microclimatic factors and nutrient cycling of the forest by different intensities of logging; and
- the impact of different intensities of logging on biodiversity, regeneration and soil properties.

Promotional activities will take the form of:

- strengthening linkages with government and non-governmental organizations involved and interested in sustainable forestry management;
- environmental education activities with those interested in tropical forests.

Marketing:

The publications shall contain information on:

- marketing channels and the various routes by which Ghanaian wood products reach consumers;
- prospects for the future of products produced from LUS; and
- consumer preferences for Ghanaian wood products.

Promotional activities will take place within the pilot activities.

SEMINARS

Two of the projects significant activities are seminars. One will take place at the beginning of the project and the second will be at the end of year two, prior to the pilot marketing phase. The design of these seminars is intended to facilitate integrated research of several aspects of the tropical timber industry (this type of integrated, applied research has a short history in Ghana). The design will hopefully minimize several recognized risks. These risks include:-

Industry-Government Co-operation, it has not always been successful in the past:

- successful marketing strategy; this is dependent on more than product development and access to correct market channels. This information must be integrated with the results of PD 4/87 Rev. 1 currently being implemented with wood industry managers; and
- environment impact; it is often carried out in isolation of production

and its results are often not shared with the industry.

The first seminar will take place prior to activities in Parts 2, 3 and 4 (which are implemented simultaneously). It is intended to introduce all aspects of the project to all potential participants and interested parties. It will point out the inter-related nature of the activities and research outputs.

At the end of the activities implemented in Parts 2, 3 and 4 another seminar will take place (the specific objectives for Parts 2, 3 and 4 are listed above). A major objective of this seminar is to demonstrate how the results of the separate 'research tracks' can be combined to develop a market strategy. A selection of the parameters for the pilot should be one major result from the seminar.

The specific objectives for each part of the seminar are:

Product Development:

- encourage increased and further processing of the selected lesser-used Ghanaian timbers consistent with ITTA's focus on sustainable utilization and conservation of tropical forest resources; and
- promote this industrialization as a means of expanding and diversifying the timber trade economy of Ghana.

Environment:

- encourage improved selection and harvest of the selected lesser-used Ghanaian timbers; and
- promote these forestry management practices as a means of expanding and diversifying the sustainable timbers economy of Ghana.

Marketing:

- Encourage the aggressive marketing of products from LUS as a means of expanding and diversifying the timber economy of Ghana in a sustainable manner.

## Seminar Participants

The seminar shall have as its participants:

- industrialist/entrepreneurs (include furniture);
- wood industry managers (include furniture);
- representatives of TEDB, FPIB, and Universities in Ghana;
- overseas agents involved in marketing Ghana's wood products;
- end-users in both traditional and non-traditional export markets;
- local architects and engineers;
- local housing delivery and construction firms;
- production and marketing representatives from West African countries;
- forest managers and their supervisors from the forest industries in Ghana and other countries in the West African sub-region;
- representatives of forestry departments and allied institutions in Ghana and other countries in the sub-region;
- representatives of non-governmental organizations concerned with the environment; and
- representatives of wood product trade associations.

Supplementing the above forms of information dissemination, the two principal organizations implementing all aspects of the research (FORIG and TEDB) have a commitment to continually inform all segments of the wood industry and forest management communities of interesting information as it becomes available.

PART VI: PILOTING OF SELECTED TECHNOLOGIES AND PRODUCTS

Following from the seminar to be held as part of the project programme a pilot project shall be established:

- to evaluate further the technologies and products that hold most promise with regards to sustainable industrial production and forest conservation;
- further ascertain economic data that enhances viability for commercialization of the developed products;
- to develop specific marketing strategies to put the product on specific markets; and
- and finally to market several of the most promising products.

Not much detail can be given about the pilot strategy, it will result from the most promising products and highest potential market channels.



**TENTATIVE SCHEDULE OF ACTIVITIES**

Year	-1			1					2				3			
Product/Activity	6	9	12	0	3	6	9	12	15	18	21	24	27	30	33	36
Literature review, stockvolume evaluation, preselection of species, assessment of soil properties and seedling on forest floor before logging																
2-day Seminar																
Specific selection of species documentation Logging of LUS																
Assessment of impact of logging on forest environment																
Laboratory, Workshop, Factory (Sawing, drying, treatment etc.) Factory processing, product development																
Testing of finished products, quality control																
Nutrient cycling and climatic factor studies, preparation of																
Market Analysis																
Preparation of Annual Report																
Piloting of selected technologies (seminar)																
Promotion of appropriate technologies																
Preparation of final report																

## SECTION FIVE: OTHER IMPORTANT CONSIDERATIONS

### FRAMEWORK FOR EFFECTIVE STAFF PARTICIPATION

The nature of this project requires that it will be multidisciplinary in nature and will involve the participation of several sections of the Forestry Research Institute of Ghana (FORIG) in co-operation with private industry and other government bodies to successfully implement the activities necessary to produce the required outputs and achieve the projects' objectives. The expertise of the institute will be supplemented by internal and external consultants. The main departments of the institute that will participate in the project are the Utilization, Production and Processing, Silvicultural Departments, and the Ecology Section. In addition to the above, there is the Marketing and Statistics Section which together with the Timber Export Development Board (TEDB) will be the other principal participators.

The main international consultants will be experts in primary and further processing of timber marketing and forest ecology. They should preferably be holders of at least M.Sc. degrees with considerable practical experience in their field of specialization.

The local consultant should also hold an M.Sc. degree in Wood Science and Technology with at least 3 years experience in the relevant areas of research.

This is an institutional project which has the support of the director, as well as the support of the various sections which will be involved in the project implementation. Dr. A. Addae-Mensah, Head of the Timber Engineering and Mechanical processing division will be the Project Leader and will be responsible for coordinating the research activities and ensuring that the project meets the objectives of the proposed time schedule.

**(II) TERMS OF REFERENCE (TOR) OF INTERNAL (NATIONAL) AND EXTERNAL (EXPATRIATE)**

**CONSULTANTS:**

**1. Internal Consultant (Wood Technology)**

- (a) Be a member of the steering committee for the project
- (b) Design details of industrial processing with the help of external consultant.
- (c) Implement and supervise various stages of the project in industrial establishments.
- (d) Generally provide the linkages between industry and the research
- (e) Identify training needs for the industry and design with the help of the external consultant, programme for the training workshops.
- (f) Prepare Seminar papers
- (g) Contribute to final publication for market promotion.
- (h) Any other activities that may be assigned by the leader of the project or the steering committee.

**2. External Consultant (Wood Technology)**

TOR is as above except for (a) and (d). It will be preferable that this consultant splits his man/months, into two, 3 man/months at the beginning of the project, and 3 at the end.

**3. External Consultant (further processing);**

- (a) Design details of the further processing
- (b) Implement and supervise various stages of further processing in industrial establishments and the wood working shops of FORIG.
- (c) Identify training needs and design programmes for the training workshops.

- (d) Prepare Seminar papers.
- (e) Contribute to market promotional publications.
- (f) Any other duties that may be assigned by the steering committee for the achievement of project objectives.

4. External Consultant (Ecology):

- (a) Help to design details of the environmental aspects of the project.
- (b) Help with the initial implementation and final analysis of results.
- (c) Help to prepare seminar papers.
- (d) Publish useful forest environmental information in ITTO publication and other international journals.
- (e) Any other duties that may be assigned by steering committee.

5. External Consultant (Marketing):

- (a) Design details of the Market research programme.
- (b) Implement the Market research programme.
- (c) Prepare seminar papers on local and export market channels, consumer preference etc.
- (d) Publish market promotional literature.
- (e) Any other duties that may be assigned by the steering committee.

6. Internal Consultant (Hydrology):

- (a) Collect baseline data on hydrology.
- (b) Design details of a proposal on the effects of logging on hydrological properties for presentation to ITTO.
- (c) Eventually help to implement the project (b)
- (d) Prepare seminar papers.
- (e) Any other duties that may be assigned by the steering committee.

### REGIONAL INSTITUTIONAL CO-OPERATION

Many of the lesser-known species being investigated in this project occur in the forest regions of other West African countries. In this regard, the results of this project will be of interest to the research institutions, as well as the forest products industry, of those countries. Additionally, most of the West African countries share the markets of Europe as trading partners for tropical hardwood forest products. For this reason, the results of the improved production methods and market study will also be of direct interest to other West African countries. As a result of this similarity of interests, the results of this research project will be made available to peer institutions in the region. Our intention is to present the results of the project at regional seminars and workshops.

### PRIOR OBLIGATIONS AND PREREQUISITES

The Institute's primary function is to promote, through scientific and industrial research, the most efficient utilization of the nation's forest resources as an essential component of sustainable forest management. The proposed research project is strongly consistent with the Institute's primary function.

### SCHEDULES OF MONITORING EVALUATION AND REPORT

It is proposed that a four-person monitoring/evaluation team be assembled to evaluate the progress of the project. The members of this team would be comprised of the project leader (Dr. Augustus Addae-Mensah), the Managing Director of TEDB (Timber Export Development Board), Mr. S.K. Appiah, Prof. Dr. Jay A Johnson of College of Forest Resources, University of Washington, Seattle U.S.A. and a representative of the ITTO. The team would meet once a year to assess the status of the project, its progress and orientation. In the first year this team's meeting would coincide with the introduction seminar. A monitoring plan for the

first two year phase shall be determined. Monitoring reviews would be carried out by the project members every quarter. These reviews would provide an opportunity to identify problems and implement solutions to ensure that progress is maintained towards achieving the project goals.

#### MONITORING, EVALUATION AND REPORTS

The project will be subject to periodic technical monitoring and evaluation in accordance with the policies and procedures of ITTO as well as of the requirements of the project. The terms of reference and time of evaluation will be decided by consultation between the ITTO and the implementing agency.

Progress reports will be produced annually, an overall report on the projects activities, achievements and findings upon the conclusion of the project.

#### ACTIVITIES - INPUTS/BUDGET

For the achievement of the project objectives certain inputs in terms of personnel, laboratory and factory facilities, research supplies etc. will be needed. PART 1 of the project which consists mainly of literature surveys and interviews has been completed using FORIG resources.

PART 2: The product development research involving industry, will require the services of wood scientists from FORIG, FORIG laboratory and office personnel and equipment as well as facilities of processing factories as detailed below under Ghana Government contribution.

Additionally, the project requests the ITTO to provide some minimal allowances as incentives to the Ghanaian Staff at FORIG, who will be taking up extra responsibilities in the project apart from their normal schedules. These are detailed under BUDGET: ITTO contribution.

The request for equipment such as computer, working machines and vehicles are necessary to supplement what already exist at FORIG and so that the project can be

completed on schedule without having to wait in a queue for use of some of the already over burdened FORIG facilities. In this part of the project as well as in parts 3 and 4, the FORIG will require consultants to supplement the efforts of its staff. There will be two expatriate consultants, one each for primary and further processing respectively, and one internal consultant to work with them. The idea of expatriate consultants is envisaged to ensure that the project comes out with products that conform to quality standards on the foreign markets.

**PART 3: Ecological Problems:-** The research effort in this area will require the services of a Forest Ecologist based at FORIG, with the assistance of an expatriate consultant who will help in the details of the project design, implementation and monitoring. Requirements for laboratory facilities, material and other services have been budgeted for in detail.

**STEERING COMMITTEE:**

A steering committee, with the Director of FORIG as chairman, will be put in place to guide and evaluate the progress of the project. The committee members will represent the four basic interest areas of research, industry, marketing and ecology and will be nominated from the Ministry of Lands and Natural Resources (Government representative), Timber Export Development Board, Ghana Timber Association, Ghana Millers Association, Ghana Furniture Association, The Water Resource Research Institute and FORIG. The team will meet two times a year to assess the status of the project, its progress and orientation.

**IMPLEMENTATION CAPABILITY AT THE FORIG**

The overall implementation and co-ordination of the project will be handled by FORIG. This is a broad based Forestry and Forest Products Research Institute which has in the past handled or is still co-operating in a number of projects e.g ITTO IROKO Project PD 75/90 F, ITTO project PD 74/90 etc.

The institute has 7 divisions including Engineering and Mechanical Processing, Economics and Marketing and Natural Forest Management as well as a Production Unit with a well trained carpentry staff. The scientists of the various divisions include experienced and highly qualified Wood Technologists (Physics, Engineering, Processing), Forest Products Economists, Forest Ecologists, Silviculturists and Plant and Soil Nutritionists. The laboratories and workshops are not sophisticated but perhaps one of the best in Africa, and for local standards very good enough to implement such a project successfully.

There is a Director who is also the head of an efficient administration department with qualified accountants with experience in world bank and other international projects, to be able to handle the administrative and financial aspects of the project efficiently.



**INPUTS AND BUDGETS**

**BUDGET: CONTRIBUTION BY GHANA GOVERNMENT CEDIS**

	Man/months	Salary/month	Total
<b>A. Personnel</b>			
1. Wood Scientist (Engineering)	36	175,000	6,300,000
2. Forest Ecologist	36	165,000	5,940,000
3. Wood Scientist (Seasoning Preservation)	6	165,000	990,000
4. Supporting technical staff (10)	120	76,000	9,120,000
5. Supporting administrative staff (2)	72	54,000	3,888,000
6. Hired aides (10)	30	39,000	1,170,000
			<u>¢27,408,000</u>
<b>B. Facilities FORIG</b>			
1. Office and Laboratory space		¢1,200,000	
2. Work space		1,500,000	
3. Laboratory Equipment		6,000,000	
4. Workshop Equipment		5,000,000	
			<u>¢13,700,000</u>
<b>C. Operating Facilities/services</b>			
1. Factory facilities		8,000,000	
2. Concession titles		3,000,000	
3. Office supplies		540,000	
4. Other services		1,500,000	
			<u>¢13,040,000</u>
Total			54,148,000
Contingency 10%			5,414,800
Total Ghana Government contribution			<u>59,562,800</u>
@ US \$1 = ¢400.00 Ghana Government contribution			US\$ 148,907
			=====

**BUDGET: ITTO CONTRIBUTION**

Personnel	Man/months	salary/incentive per month US \$	Total
1. Wood Scientist Engineering (Project Leader)	36	800	28,800
2. Wood Scientist (Seasoning & Preservation)	6	650	3,900
3. Forest Ecologist	36	650	23,400
4. Internal Consultant (Wood Tech)	12	3,000	36,000
5. External Consultant (Wood Tech)	6	4,000	24,000
6. External Consultant (Marketing)	12	8,000	96,000
7. External Consultant (Further Processing)	12	8,000	96,000
8. External Consultant (Forest Ecology)	6	8,000	48,000
9. Supporting technical staff	120	250	30,000
10. Supporting Administrative Staff	72	100	7,200
11. Hired aides	30	50	1,500
12. Hydrologist	6	2,000	12,000
			<b>\$406,800</b>
			=====

**B. EQUIPMENT REQUIREMENTS**

<u>Equipment</u>	<u>Quantity</u>	<u>Amount US\$</u>
1. IBM P.C with accessories	1	8,000
2. Camping equipment	2	3,000
3. Furniture testing machine and accessories	1	40,000
4. Multi-purpose planner/thicknesses)		
Circular bench saw                     )	1	50,000
Copying lathe/duplicator             )		

5. Compass, Altimeter Relascope		7,000
6. Moisture meters (Veneer & lumber)	2	2,000
7. Drying oven	1	3,000
8. Analytical balance	2	2,000
9. Soil Sampling Equipment	1 set	2,500
10. Light meter		3,000
11. Ring infiltrometers		1,500
12. Rain Gauges	3	4,500
13. Thermohygrometer		1,500
14. pH Meter/soil thermometer		500
15. Bouyous moisture meter		1,500
16. Project vehicles (Double cab pick ups) 4 WD	2	38,000
17. Project vehicles (Motorcycles)	2	5,000
18. Knife and pressure setting devices for veneer cutting		2,000
19. Sander for curve press		6,000
20. Penetrometer		400
21. Turbidity meter (Nephelometer)		450
		<u>187,850</u>
		=====

**C. OPERATIONAL EXPENSES**

Including:

1. Research Supplies
2. Hauling/freight charges
3. Maintenance of vehicles
4. Fuels and Lubricants

50,000

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D. TRAVEL - PROJECT CONSULTANTS

1. Three round trips - Consultant (Further processing)	US\$	9,000
2. Four round trips - Consultant (Marketing)		12,000
3. Three round trips - Consultant (Forest ecology)		9,000
4. Two round trips - consultant		6,000
5. Expenses		29,000
	US\$	<u>65,000</u>
		=====

E. TRAVEL - PROJECT CONSULTANTS

1. 2 Seminars:		
(a) 60 participants for 2 days		
@ US \$100/diem to cover board and lodge		12,000
(b) 90 participants for 3 days @ US\$100/diem		
to cover board/lodging		27,000
		<u>39,000</u>
2. 4 training workshops:		
(a) 50 participants (sawmilling seasoning, preservation)		
@ US\$50 for 5 days		12,500
(b) 50 participants (Veneer/plywood) @ US\$50 for 5 days		12,500
(c) " " (further processing) " " " " "		12,500
(d) " " (ecology) " " " " "		12,500
		<u>50,000</u>
3. Expenses Resource personnel and other aides		
for seminar and training workshops		5,000
		<u>94,000</u>

F. MONITORING AND REVIEW

30,000

G. PILOTING AND PROMOTION

20,000

H. STEERING COMMITTEE MEETINGS: 2 one day meetings a year  
for 9 persons for 3 years = 54 man/days @ US\$100/diem to  
cover board and lodge

5,400

I. 5% ITTO Administrative Service charges

42,653

**SUMMARY - PROJECT BUDGET ITTO CONTRIBUTION**

1. Salaries of External Consultants	US\$ 264,000]	
2. Salaries Internal Consultant	48,000]	
3. Incentives local Scientist	56,100]A	
4. Incentives supporting technical, administrative and staff	38,700]	
5. Equipment requirements	181,850 B	
6. Operational Expenses	50,000 C	
7. Travel expenses - External Consultants	65,000 D	
8. Seminars/training workshops	94,000 E	
9. Monitoring and Review	30,000 F	
10. Piloting and Promotion	20,000 G	
11. Steering Committee meetings	5,400 H	
	<u>US\$853,050</u>	
12. 5% ITTO - Service Administrative charges	42,653 I	
	<u>895,703</u>	
Contingency 10%	89,570	
	<u>US\$985,273</u>	
Total Project Budget:		
Ghana Government contribution	US\$148,907	
ITTO Contribution	985,273	
	<u>US\$1,134,180</u>	