

ITTO PROJECT PD. 179/91

INDUSTRIAL UTILIZATION AND IMPROVED MARKETING OF SOME GHANAIAN
LESSER-USED TIMBER SPECIES FROM SUSTAINABLY MANAGED FORESTS

REPORT ON :

INDUSTRIAL SURVEY

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INTRODUCTION

The ITTO Project PD 179/91, "Industrial Utilization and Improved Marketing of some Ghanaian Lesser-Used Species from sustainably Managed Forests", has as its ultimate goal, the marketing of products from 14 selected lesser-used species to meet the development needs of Ghanaian society while also attaining the forest environmental needs embodied in ITTO's target 2000. The project's general objectives are the successful promotion and marketing of higher value-added timber products, where the wood source are lesser-used species (LUS).

In order to achieve the above objectives, eleven public and private timber companies with relevant facilities, managerial and technological experience in particular product manufacture and existing experience with some LUS, were selected to participate in the project. This industrial survey, the first stage of the product development research aspect of the project, was planned not only to assess the extent to which the selected species are currently being processed into various value-added products in the companies or the existing experience with the selected LUS, but also the present interest and willingness of the selected companies to offer machine time for the project.

Information collected during the survey ranged from species which is currently being processed and the types of value-added products manufactured from them, processing characteristics and quality control measures being practised to the unit values of products from some of the species and the reported comparative advantage and disadvantage of the LUS to the primary species.

These results are expected to serve as guide for the product development research aspects of the project.

1. NAMES OF MILLS

The survey was expected to cover eleven companies as selected in the project document. However, only ten companies/ mills permitted the survey team to visit them. Dupaul Wood Treatment, Tarkoradi, turned down our request to visit her. Companies which showed interest were:

1. Ghana Primewood Products Limited, Takoradi.
2. Western Veneer and Lumber Company Limited, Takoradi.
3. Akuaba Limited, Accra.
4. African Timber and Plywood Limited, Samreboi.
5. Scanstyle Mim Limited, Mim.
6. Mim Timber Company Limited, Mim.
7. Specialized Timber Products Limited, Kumasi.
8. Bondplex and Naja David Group of Companies, Kumasi.
9. Kumasi Furniture Company Limited, Kumasi.
10. Ehwia Wood Products Limited, Kumasi.

2. LESSER-USED SPECIES BEING PROCESSED.

Out of the 14 selected lesser-used species for the project, 13 species are currently being processed, in at least one mill or company. Only Afina (*Strombosia glauscescens*) is not being processed. The lesser-used species currently being processed are listed below:

- | | |
|--|---|
| 1. Awiemfosamina
(<u>Albizia ferrugenia</u>) | 8. Hyedua
(<u>Daniella Oyea</u>) |
| 2. Aprojuma
(<u>Antocaryon micraster</u>) | 9. Bonsamdua/Ayan
(<u>Distemonanthus benthamianus</u>) |
| 3. Bombax
(<u>Bombax brevicuspe</u>) | 10. Otie/Ilomba
(<u>Pycnanthus angolensis</u>) |
| 4. Onyina
(<u>Ceiba pentandra</u>) | 11. Wawabima
(<u>Sterculia rhinopetala</u>) |
| 5. Bediwonua
(<u>Canarium schweinfurthii</u>) | 12. Akasaa
(<u>Chrysophyllum albidum</u>) |
| 6. Esa
(<u>Celtis mildbraedi/zenkeri</u>) | 13. Essia
(<u>Petersianthus macrocarpus</u>) |

7. Denya/Okan
(Cylicodiscus gabunensis)

3. PROPHYLACTIC TREATMENTS EMPLOYED

Basically, three chemicals are mainly employed by the companies for treatment of products from species with very low durability, before drying. These chemicals as well as concentrations usually used are as follows:-

<u>Chemical</u>	<u>Concentrations</u>
Hickson Antiblu 3737	2.5%, 1.0%
Antiborer 3767	0.25%
PCP	2.0%

These concentrations were said to be efficient. Other prophylactic treatments such as quick debarking of perishable species like Celtis, Ceiba etc. and exposing them to the sun for about two weeks before peeling, are also employed to reduce the excessive moisture content usually reported to be present in fresh logs of such species.

4. TYPES OF VALUE-ADDED PRODUCTS MANUFACTURED FROM LUS

The products listed in the table on the next page have at least once been manufactured from the lesser-used species either for export, local sales or for trial/experimental purposes by at least one of the companies:

Types of Value-added Products Manufactured from the Lesser-used Species

Species	Products
Awiemfosamina (<u>Albizia ferruginea</u>)	Kiln/Air-dried lumber; mouldings, profile boards (T & G).
Aprokuma (<u>Antrocaryon micraster</u>)	lumber, mouldings, face and core plywood, profile boards (T & G); rotary veneer.
Bombax (<u>Bombax brevicuspe</u>)	Mouldings, plywood(face and core) profile boards (T & G); rotary veneer.
Onyina (<u>Ceiba pentandra</u>)	Lumber: plywood (core and face) picture frames; mouldings, profile boards (T & G).
Bediwonua (<u>Canarium schweinfurthii</u>)	Core and face plywood; sitting room furniture.
Esa (<u>Celtis mildbraedii/zenkeri</u>)	Flooring (Lamperquet); rotary veneer; lumber; plywood; furniture parts.
Denya/Okan (<u>Cylicodiscus gabunensis</u>)	Structural lumber (Air/kiln dried); railway sleepers; marine/pit props and flooring.
Hyedua (<u>Daniella ogea</u>)	Lumber; door frames; rotary veneer; plywood; mouldings; joinery (furniture); profile boards (T & G).
Bonsandua/Ayan (<u>Distemonanthus benthamianus</u>)	Lumber; decorative plywood; mouldings; profile boards (T & G); door and window frames.
Otie/Ilomba (<u>Pycnanthus angolensis</u>)	Lumber (formwork); plywood; peeled veneer; sitting room furniture.
Wawabima (<u>Sterculia rhinopetala</u>)	Lumber; plywood; rotary veneer.
Akasaa (<u>Chrysophyllum albidum</u>)	Sitting room furniture; sliced veneer; mouldings; profile boards (T & G).
Essia (<u>Petersianthus macrocarpus</u>)	Mouldings; profile boards (T & G)

Some of the products indicated as being manufactured from the LUS are in the trial stage in some mills. Even though most of them have been certified as suitable for the products, they have not yet been exported or sold out locally. Some of the LUS being tried are as follows:

Species	Trial Products
Esa (<u>Celtis mildbraedii</u>)	Lumber and flooring (lamperquet)
Onyina (<u>Ceiba pentandra</u>)	Picture frames and lumber
Essia (<u>Petersianthus macrocarpus</u>)	Mouldings and profile boards (T & G)
Aprokuma (<u>Antrocaryon micraster</u>)	Profile boards (T & G)
Bombax (<u>Bombax brevicuspe</u>)	Profile boards (T & G)
Bonsandua/Ayan	decorative plywood

5. UNIT VALUE OF FINISHED PRODUCTS FROM LUS
(Based on FPIB Export Permit Report, 1992)

In order to compare the unit values of various value-added products manufactured from the selected LUS, the FPIB Export Permit Report was consulted. The calculated results are as shown below:

(a) Unit Value of Lumber

Species	Value (DM/m ³)
Akasaa	741.83
Bonsandua	543.75
Albizia	452.90
Otie	600.02
Denya	454.62

(b) Unit Value of Sliced Veneer

Species	Value cost (DM/m ²)
Akasaa	1.05
Ceiba	1.57

(c) Unit Value of Furniture Parts

Species	Value (DM/m ³)
Otie	180.03

(d) Unit Value of Rotary Veneer

Species	Value (DM/m ³)
Ceiba	480.78
Otie	602.11
Daniella	595.59
Bombax	640.00

(e) Unit value of Flooring

Species	Value (DM/m ³)
Daniella	2,417.31

(f) Unit value of Mouldings

Species	Value (DM/m ³)
Bonsamdua	900.55

(g) Unit value of plywood

Species	Value (DM/m ³)
Ceiba	814.38

It is observed from the cost data that unit value of high value-added products such as flooring, mouldings, plywood etc. are comparatively higher than that of lumber. For example, the unit value of Bonsamdua lumber is about DM 543/m³, but mouldings cost about DM 900.55/m³. Similarly, unit value of Ceiba plywood of DM 814.38/m³ is comparatively higher than that of rotary veneer of DM 480.78/m³.

It is also observed from the data that some species have higher value as lumber than in high value-added forms. For example, Otie lumber has a unit value of DM 600/m³ whereas that of furniture parts is about DM 180/m³ for the same year.

The unit value of flooring is observed to be very high. Daniella flooring has a unit value of DM 2,417.31/m³, whereas rotary veneer of the same species has DM 595.59/m³.

It is also observed from the value data that on the external market, prices of timber products seem not to be strictly tied to the durability or strength of the species (i.e not species oriented), but rather, the emphasis is more on the workmanship than on the quality of the timber species. For example whereas Otie lumber has unit value of DM 600/m³, Bonsamdua cost DM544, Danya DM 455 and Albizia DM453. Otie, however, is known to be perishable and has very little recognition on the local market compared with the other species. This price trend is also observed in other value added products such as sliced veneer.

6. QUALITY CONTROL MEASURES IN PRACTICE

Quality control measures being applied at various processing stages of logs vary from company to company and range from:

- (a) Logging: Quick debarking of perishable species to avoid attack. Application of Antiblu and Antiborer chemicals of various concentrations.
- (b) Milling: Ensuring that dimensions of products are accurate to specification. Adequate bond strength must be achieved by following correct pressing procedures and using well mixed glues. To avoid staining, some species are milled as soon as delivered.
- (c) Treatment: It is ensured that correct concentrations of chemicals are used for effectiveness. Proper methods of applying chemicals are also ensured. It is ensured also that glue application is satisfactory in terms of proper glue mixing and pressure application. Some products are dipped for complete soaking of the chemicals.
- (d) Drying: Some species are quickly dried to avoid fungal stains. Kiln-drying is the method usually used for products from such species. Some products come out for sales on local markets only when air-dried to 18-20% moisture content. Products are properly stacked to ensure dimensional stability. Tolerances are often provided in dimensions to accommodate shrinkages. Regular monitoring of moisture levels are carried out during seasoning.
- (e) Finishing: For those species said to have poor finishing characteristics eg. Canarium, Otie etc., to avoid spongy and wooly surfaces, planing and sandpapering are done in the direction of the grains. Both faces of plywood are sometimes sanded to smooth finish especially in the case of decorative plywood. For some products (e.g furniture), rigidity checks are done by vigorously shaking products before sales. Overall final inspections are sometimes done to ensure that products going out have been manufactured to required specifications.

7. PRICING OF PRODUCTS

Prices of products are generally arrived at by the companies through two main criteria:

- (a) Actual costing of products: Cost of production is usually built up involving:
 - cost of raw materials
 - wastage from out-turn
 - cost of kilning
 - wastage incurred as a result of kilning
 - overhead costs
 - company's profit
 - about 13 1/2% sales tax.

- (b) Market Forces: Prices of some products, especially those that are exported, are determined by what the market is prepared to offer. Such prices are said to be provided by the Ghana Timber Export Development Board (TEDEB) for guidance.

8. STANDARD TESTS APPLIED TO PRODUCTS

The survey showed that at the moment, not much is done with respect to testing of products to ensure that products conform to specific quality standards before sales. The following are said to be conducted by some companies to ensure product quality:

- (a) Knife cuts through glue lines of samples taken from batches of plywood are carried out to ensure that plywood bond quality conforms to BS 1455. Sub-standard products are said to be rejected and production quality control measures are subsequently applied.
- (b) Samples of products are randomly selected for inspection and certification by agents of customers or trained personnel of companies to ensure that products conform to customer's specification.
- (c) For furniture, no machines are available for testing. However, methods like vigorous shaking to expose weak joints are adopted. Products are graded to one of three grade (Grade 1, Grade 2 and Grade 3). Grade 1 products are said to be of the best quality, whilst Grade 3 products are generally of the inferior quality. Grade 2 products are of intermediate quality. In the case of plywood, Grade 3 products generally go to the local markets.
- (e) Occasionally, the Forest Products Inspection Bureau (FFIB) and Ghana Standards Board personnel visit companies and certify products quality before sales.

9. COMPARATIVE ADVANTAGES OF LUS OVER SIMILAR PRODUCTS FROM PRIMARY SPECIES

The following are some of the reported advantages of LUS over similar products manufactured from the primary species.

- (a) Lumber from some LUS have superior strength properties to those from primary species.
- (b) Some of the LUS have easy processing characteristic and therefore cheaper overall product cost. Bombax for example, is said to have extraordinary processing characteristics and is substitutable for some primary species. Ceiba plywood is said to be cheaper in overall cost than the redwoods.
- (c) The LUS are readily available and production is not affected by shortage of raw material. A company imports Afrormosia (Kokrodua) from the Ivory Coast, since the species is said to be almost extinct from the Ghanaian forest.

Some companies however, mentioned the following as disadvantages of processing the LUS:

- (a) Some of the LUS are generally of smaller log sizes compared with primary species (example Otie). Recovery is therefore low due to the problems encountered in conversion of small diameter logs. Overall product cost is therefore higher than that of primary species.
- (b) Processing costs of some of the LUS are higher than the primary species due to excessive moisture in the wood, excessive split etc. These often slow down production and/or reduce conversion and hence increase production cost.
- (c) Some LUS are easily susceptible to attack especially by fungi. They need immediate and serious attention such as quick conversion and kiln-drying. Any little oversight may result in substantial losses.

10. SAWMILLING CHARACTERISTICS OF LUS.

The following were recorded as observed sawmilling characteristics of the selected LUS:

(a) ALBIZIA

It is said to be heavy and hard and varies from easy to moderate in sawing characteristics. The tree often has a hole around the pith and this makes sawmilling difficult. It is also said to have a high sapwood proportion and cross grains are sometime present.

(b) APROKUMA.

The wood is said to saw easily.

(c) CANARIUM.

It is said to be difficult to saw and blunts saws frequently. The logs can be very big and sometimes require bigger dogs for holding them. The log is said to have punky middle and therefore has poor conversion.

(d) CELTIS.

Celtis is said to be very dense and hard and therefore difficult to saw. It often blunts saws. The middle portion is sometimes said to be black. It is also said to have excessive moisture content which makes sawing difficult.

(e) DENYA/OKAN.

The wood is said to be very hard and difficult to saw. It is often referred to as the "Iron wood". It often requires very sharp and special saw treatments eg. TCH tip knives.

(f) DANIELLA.

Daniella wood is said to saw easily but tends to be difficult when fresh due to the presence of some gum substances. It is also said to have fibrous sapwood and sometimes have wavy grains and therefore tends to

distort. The sawing properties of the wood are said to be area-dependent. Cross cutting of the wood is said to cause easy splitting.

(g) BONSAMDUA/AYAN.

The wood's sawing characteristics are said to vary from moderate to difficult. It is said to contain gummy materials and stellite tip saws are therefore recommended. The wood is also said to be a little fibrous but quite stable.

(h) OTTE/ILOMBA

The wood is said to saw easily but splits at ends and is therefore recommended to be processed quickly to avoid excessive splitting.

(i) STERCULIA

Sterculia is said to be hard but it saws fairly easily. The wood is said to be stable.

(j) AKASAA.

The wood is said to be hard and contains mineral substances. It is also said to blunt saws. Stellite tip saws are therefore recommended.

11. SEASONING CHARACTERISTICS.

(a) ALBIZIA.

The wood is said to dry easily without degrade. It is also said to dry fast even by air-drying. The wood is stable and said to have similar drying characteristics to Odum/Iroko.

(b) APROKUMA

The wood of Aprozuma seasons easily and well without degrade. It is said to have medium seasoning characteristics and moderate drying schedule with high initial temperature is recommended. It is recommended that it should always be kiln-dried.

(c) BOMBAY.

The wood is said to dry fairly easily but sometimes tends to become wavy. The wood does not split significantly after seasoning.

(d) CEIBA.

Ceiba is said to dry slowly and without degrade. It is recommended for drying immediately after conversion to prevent staining. The wood is said to have excessive moisture and should be dried with extra care.

(e) CANARIUM.

The wood is said to have moderate drying characteristics.

(f) CELTIS.

Esa is said to have excessive moisture and drying can therefore be difficult. It is liable to sapstain (like koto) and is recommended to be kiln-dried immediately after conversion. Air-drying is not recommended.

(g) DENYA/OKAN.

The wood is said to be stable and have moderate seasoning characteristics. Its characteristic unpleasant smell when fresh ceases after drying.

(h) DANIELLA.

Ogea is said to possess excessive moisture and dries slowly. The moisture content is said to be uneven in the wood. The wood's characteristic wavy grains usually cause distortion during drying. The colour of the wood is said to turn whiter after drying.

(i) BONSAMDUA/AYAN.

Ayan is said to dry fairly fast and easy without degrade. The wood is also stable. The wood, for export, is however, recommend to be air-dried two or three weeks before shipment to reduce the characteristic gummy material in the wood.

(j) OTIE/TLOMBA.

Whereas in some companies, wood is said to dry easily and well without much degrade, one company said it has variable drying characteristic and therefore difficult to dry, a problem which makes it difficult to meet its high demand. The wood is generally said to dry slowly and liable to quick fungal stains. It is therefore recommended for kiln-drying immediately after conversion. Air-drying is not recommended

(k) STERCULIA.

The wood is said to dry easily without much degrade. It is also to be stable.

(l) AKASAA.

The wood is said to dry slowly with possibility of splitting and checking. It is also said to stain and has gummy substances. It is therefore recommended to be dried well and with care

(m) ESSIA.

The wood is said to have poor stability, high drying defects and also said to stain fast. It is therefore recommended to be kiln-dried in good time. Its characteristic unpleasant smell is said to cease after drying.

12. GLUING CHARACTERISTICS.

(a) ALBIZIA

The wood is said to glue satisfactorily.

(b) APROKUMA

It is said to glue very well

(c) BOMBAX

Gluing is satisfactory

- (d) CEIBA
The wood is said to be easy to glue
- (e) CANARIUM
Canarium glues satisfactorily well
- (f) CELTIS
Takes glue fairly satisfactorily but sometimes needs high pressure application to obtain adequate glue bond.
- (g) DENYA/OKAN
Denya is said to glue satisfactorily.
- (h) DANIELLA
The wood is said to glue well but requires more glue due to its woolly surface finish.
- (i) BONSAMDUA/AYAN
The wood takes glue satisfactorily well.
- (j) OTIE/ILOMBA
The wood is said to have easy gluing characteristics.
- (k) STERCULIA
Sterculia glues well and easily.
- (l) AKASAA
Gluing of the wood is said to be satisfactory.
- (m) ESSIA
No information obtained.

13. MACHINING AND WOOD WORKING CHARACTERISTICS

- (a) ALBIZIA

The wood is said to have poor peeling characteristics; cross grains usually hinder satisfactorily machining. Finish is said to be good and smooth and takes nails well.
- (b) APROKUMA
The wood is said to be easy to peel and has good peeling characteristics; planed surfaces are not smooth but slightly woolly. Finishing however is said to be good.
- (c) BOMBAX
Bombax is said to be easy to peel, soft and flexible; it also has high conversion. The wood is said to machine to good and smooth finish.

(d) CEIBA

Ceiba is said to be soft but is difficult to machine since the wood fibres get stuck to knives. The surfaces are woolly not smooth. Ceiba from Ashanti Region is said to peel better than that from the Western Region (with highest amount of rainfall throughout the year). The excessive moisture in the wood is said to affect rate of conversion. Sharp knives are recommended for use. After sanding, the wood is said to have good surface finish.

(e) CANARIUM

It is machined with much difficulty. The punky middle sometimes affect rate of machining. The bigger size logs usually require bigger dogs to hold them. The log is said to have poor conversion. Machined surfaces are said to be spongy and should be sanded in direction of grain for smooth finish. The wood takes nails well.

(f) CELTIS

The wood is said to be dense, hard and therefore difficult to machine: it is however is said to peel well. Steaming is said to be difficult. Machined surfaces are smooth and finish is good.

(g) DENYA/OKAN

The wood is very hard and difficult to plane, bore or shape. It is said to be as hard as iron". Shape blades etc. are recommended. When air-dried are left for sometime, the wood is said to be very difficult to nail and pre-boring is required. The wood's properties are said to be nearer to those of kaku/bongossi. The wood is said to have an oily finish.

(h) DANIELLA

Ojea is said to peel easily but does not peel smoothly, especially the sapwood, which is said to be fibrous. The presence of some gum substances in the wood is said to affect machining. Surface finish is said to be unattractive due to its colour.

(i) BONSAMBUA/AYAN

The wood is said to peel with difficult which might be due to the gummy material in the wood. The wood, although said to be a little fibrous, is said to machine smoothly and finishes nicely. It also takes nails well.

(j) OTIE/TLOMBA

The log is said to split at ends and the wood tears easily. Peeling is therefore recommended to be done alone over 2mm thicknesses and done slowly to prevent excessive tearing. The wood however is machined easily. It is also said to be spongy and should be sanded in the direction of the grains for good finish. The wood is said to polish well and takes nails easily and well.

(k) STERCULIA

Sterculia is said to peel well but requires steaming. The wood is however said to peel best when peeled over 2mm thicknesses. Peeled surfaces are coarse not smooth. Machined surface is said to be dull and not attractive. The wood also splits easily.

(l) AKASAA

The wood is said to have mineral deposits and machining is made difficult. Strong and sharp teeth are recommended.

(m) ESSIA

The wood is said to machine to good and smooth finish.

14. DURABILITY AND TREATMENT CHARACTERISTICS

(a) ALBIZIA

The wood is durable and treatable.

(b) APROKUMA

The wood is said to vary from durable to non-durable but it is treatable

(c) BOMBAX

It is non-durable and liable to sapstain. The durability of Bombax is likened to Mahogany. It is however treatable.

(d) CEIBA

Ceiba is non-durable. It is however treatable.

(e) CANARIUM

The wood is said to vary from durable to non-durable but it is treatable.

(f) CELTIS

It is said to be non-durable. It stains as fast as koto/kyere (Pterygota macrocarpa). It is however easy to treat.

(g) DENYA/OKAN

The wood is said to vary from durable to very durable.

(h) DANIELLA

Ogea is said to be non-durable but treatable.

(i) CONSAMDUA/AYAN

The wood is said to vary from moderately durable to durable.

(j) OTIE/ILOMBA

The wood is said to be perishable and requires treatment before use in conditions prone to attack. It is said to be treatable.

(k) STERCULIA

It is said to be durable and likened to the redwoods.

(l) AKASAA

The wood is said to be durable but liable to sapstain. Dip treatment is recommended.

(m) ESSIA

The wood is said to be susceptible to fungal stains and treatment by dipping is recommended.

15. DRYING SCHEDULES

A. KILN DRYING

The following were given as the average kiln drying times of some LUS from green to about 12% moisture content.

ALBIZIA

150mm thick lumber dries in about 3 weeks.

AYAN/EONGAMDU

50mm thick lumber dries in about 3 weeks.

DANIELLA

50mm thick lumber takes about 3 weeks to dry.

APROKUMA

Lumber of 40mm to 42mm thicknesses are said to dry in about 17 to 18 days.

DENYA/OKAN

Wood of 40mm to 42mm thicknesses dry in about 21 days (3 weeks).

ESSIA

Wood of thickness from 40mm to 42mm dry in about 12 to 13 days.

B. AIR-DRYING

CELTIS

Wood samples of Celtis of 38mm thickness is reported to air-dry in about 5 months to about 20% moisture content.

AKASAA

Akasaa samples of thicknesses from 50mm to 75mm are reported to take from 3 to 6 weeks to dry to about 20% moisture content.