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COCONUT WOOD AND BUILDING

in the

ASIA AND PACIFIC REGION \*

Prepared by

Agro-Industries Branch  
Division of Industrial Operations

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## PREFACE

The United Nations Industrial Development Organization (UNIDO) was established in 1967 to assist developing countries in their efforts towards industrialization. Wood is a virtually universal material which is familiar to people world-wide, whether grown in their country or not. Wood is used for a great variety of purposes but principally for construction, furniture, packaging and other specialized uses such as transmission poles, railway sleepers, matches and household woodenware. UNIDO has the responsibility within the United Nations' system for assisting in the development of secondary woodworking industries, and has done so since its inception, at national, regional and interregional levels through projects both large and small. UNIDO also assists through the preparation of a range of manuals dealing with specific topics of widespread interest which are common to most countries' woodworking sectors. 1/

The chapters of this document were contributed by participants at the 9-day Training Course on Coconut Wood building, held in the Philippines in February 1985. It is hoped that their reproduction will help focus attention on the potential for the abundant coconut wood resources in the region and on the means and assistance available for their use - especially to meet domestic needs related to building.

Since the durability of building materials is of paramount importance, UNIDO has reproduced the lecture on Preservative Treatment of Coconut Wood presented at the national seminar on the use of coconut wood as a building material, held in Lucena City, 20-22 February 1985. (UNIDO/IO.626). Other relevant documentation is available, particularly (in limited numbers) four reports on grading and mechanical properties of coconut wood and on its use in building which were based on work done in cooperation with FAO at the Zamboanga Research Centre, Philippines, between 1982 and 1984.

Also, UNIDO has published, in 5 parts, the lectures from the 3-week training course on timber engineering, held in Australia in May 1983 which are available on request.

Part 1. Introduction to Wood and Timber Engineering	UNIDO/IO.606
Part 2. Structural Timber and Products	UNIDO/IO.607
Part 3. Durability and Fire Resistance of Timber	UNIDO/IO.608
Part 4. Strength Characteristics and Timber Design	UNIDO/IO.609
Part 5. Applications and Construction	UNIDO/IO.610

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1/ A fuller summary of these activities is available in a brochure entitled "UNIDO for Industrialization, Wood Processing and Wood Products", PI/78.

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## WESTERN SAMOA: SOME IDEAS ON LOW COST HOUSES

### 1. GENERAL

Every family in every country should have a home. A low cost house is one that the average family in any country can afford to build, but the design should be flexible enough to fit any income group and allow for future extensions and improvements. One simple formula for cost is that a basic shelter should cost 5 years of gross pay at the minimum legal wage level. In many developing countries this is \$US 1-2 per day, suggesting a basic 40 - 50 m<sup>2</sup> house should cost between \$US 1,800 and 3,600. The following is a summary of what to look for when designing low cost houses considering especially the use of coconut poles and sawn wood.

### 2. What is a low cost house?

If coconut wood is adequately treated it can provide an excellent source of building materials for low cost houses. The important considerations (which can be added to/amended) are as follows:

#### A) Size

To provide maximum building space with available funds and land area.

#### B) Design

To be simple and functional and easy to build. Also to utilize available local materials.

#### C) Orientation

Siting of the house is very important depending on local factors (sun, winds, etc.). It is also important to ensure adequate ventilation and/or insulation.

#### D) Permanence

To satisfy minimum earthquake and wind resistance requirements for the area and all building code requirements (e.g. fire, plumbing, electric installations, etc.).

#### E) Extensions

To allow for future extensions and improvements in all building elements (e.g. new rooms, walls, ceiling, roof lining, internal walls, etc.).

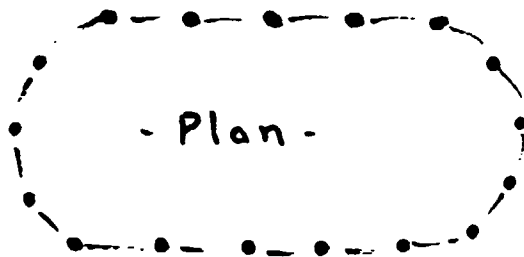
F) Acceptance

To educate the public that low cost houses can be beautifully built, comfortable to live in and within everyone's budget.

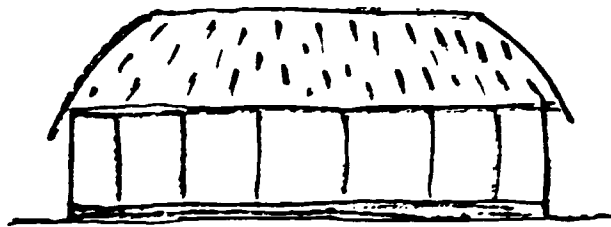
3. Example - low cost housing in Western Samoa using coconut wood

A. Size

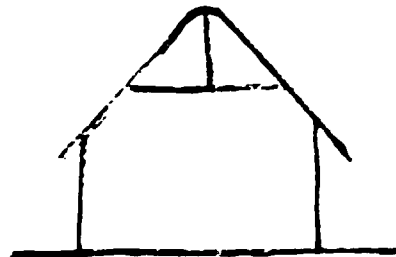
The traditional samoan house is very simple and open. Typical arrangement is:



Coconut stems embedded in concrete or just soil.



Side view



Typical section

- land consideration is not a problem
- size will be determined according to the size of the family and the purpose the house will be used for (e.g. living, living and meetings, etc.)
- the average house size is 60 to 70 m<sup>2</sup>.

B. Design

- typical arrangement proven over 2000 years with no layout problem as building is open
- use of coconut stems for poles (save on other timbers that are now being exported)
- use coconut timber for all roof framing
- use thatches for roof or coconut shingles.

C. Orientation

- not a problem as building is open on all sides
- when using traditional thatching or shingles no roof insulation is needed but it will need some sissation for roof if aluminum or iron sheets are used.
- coconut blinds or shutters to keep out rain, sun.

D. Performance

- ensure that poles are properly treated and fixed to ground
- proper fixing of all roof framing
- if traditional material is used for roof lining (thatches) they should be treated and should last for 15 years; also netting should be put on top to hold it down from the winds.

E. Extensions

- start with thatches and then replace with coconut shingles
- start with open plan house and later put in coconut timber walls and screen wire to keep out flies and mosquitoes
- may also include low partitions inside for privacy.

F. Acceptance

There is no need to educate the public on building this type of house as most of the people presently live in traditional faies.

NOTE

If anyone prefers to have a european style house, then the design can be modified and coconut timber and poles can still be used quite successfully.

YUANATU: COCONUT TIMBER PROJECT PROPOSAL

Coconut timber is as yet not utilized in Vanuatu, however research and development of the technical and mechanical methods of coconut tree conversion have already been undertaken by various organizations, ministries and parties who are interested in the establishment of such a project. Through this research it has been established that such an industry had potential for success due to the following factors:

1. A vast area of senescent coconut has been located in the following islands: Santo, Efate, Epi and Ambae. On Santo and Efate the senescent resource is located around a 30 km radius of Luganville and Port Vila (2 main towns in Vanuatu).
2. The Vanuatu Government has a positive attitude towards rehabilitation programmes for genetically improved hybrid plants, and has made available the services of the IRHO organization to provide improved stock.
3. On Santo and Efate infrastructure development, including roads and communications, ports, airport service and plantations/small holder plantations are well established.
4. Santo and Vila are capable of providing a sound back-up service for agricultural equipment, repair and maintenance of spare parts and trade. A rural labour force is available at village and plantation level.
5. Santo and Vila have a sound commercial base which offers personal services and emergence of Ni-Vanuatu entrepreneurs.
6. The Development Bank of Vanuatu and Barclays Bank have a positive attitude towards financing such a project, subject to commercial viability.
7. A Ni-Vanuatu legally registered land owning organization has shown interest and other groups on the outer islands can also participate in the venture.

Availability of the Vanuatu coconut resource is outlined below:

Age	AGE and Sector (area by hectares)		
	Large Estates	Small holders	Total
Less than 50	2,000	26,000	40,000
50 to 70	12,000		
Over 70	8,000	21,000	29,000
T O T A L	22,000	47,000	69,000

Coconut Resource by age sector and location (hectares)

Location	Total Area	Distribution by Ownership		Distribution by age			
		Large estates	Small holders	-50	50-70	+70	+50
Santo	13,000	10,000	3,000	2,000	8,500	2,500	11,000
Malekula	11,000	4,000	7,000	5,000	5,500	500	6,000
Efate	7,000	4,000	3,000	2,000	3,000	2,000	5,000
Ambae	8,000	-	8,000	3,000	4,000	1,000	5,000
Other	30,000	4,000	26,000	3,000	4,000	23,000	27,000
T o t a l:	69,000	22,000	47,000	15,000	25,000	29,000	54,000

This table indicates that:



1. There is an estimated 29,000 ha of senescent coconut trees in Vanuatu.
2. Most of the plantations can be found in small holdings.

NOTE: Three hurricanes in January of this year have pulled down most of the trees on Ambae and some on the outer islands as well as in Santo which are now currently rotting.

Initially the timber that is produced in such a venture can be exported, however local furniture and building organizations in the country can use the timber for such things as:

1. Wall panels
2. Block flooring
3. Furniture
4. Roof tiles
5. Roof shingles
6. Tool handles
7. Ornaments (some used now by the local people)
8. Framing timber
9. Fencing material
10. Decorative log walls (both inside and outside the house)

There are also the many uses of the other parts of the tree once the tree has been felled.

Due to the trees being scattered all over the country, land ownership problems and an inexperienced labour force, simple technology should be used. Relocatable sawmills which can be moved around such as the ones talked about in the Seminar in Lucena City, Philippines can be used in such a project.

Possible help from UNIDO in finding a potential foreign partner and also in the form of technical assistance would be greatly appreciated.

The idea of using coconut timber in low cost housing will have to be promoted and accepted before it can be used in Vanuatu.

We are now looking into a low cost housing (prefabricated houses) scheme joint venture with an Australian firm. Possible technical assistance from UNIDO might have to be sought as soon as financial plans are finalized with the Australians.

#### THAILAND: COCONUT WOOD TECHNOLOGY

##### Present situation

Thailand has a great deal of coconut palms all over the country, especially in the southern region with 50.5% of the total coconut plantation area.

Coconut plantation area in 1981

Northern region	8.5%
North eastern region	8.6%
Middle region	3.0%
Eastern region	13.8%
Western region	15.6%
Southern region	50.5%
T o t a l :	100.0% = 356,000 hectares

The number of coconut palms in Thailand totals approximately 50 million. No survey of old coconut palms (age over 60 years old) has been done.

The cost of one old coconut palm stem in Surattani province (which is in the southern region) is about \$US 4 - 5.

Sawmills saw cocowood on special request only. The rural people mostly use chain saws for cutting the coconut palms into lumber.

Coconut wood utilization for construction and furniture is as follows:

For construction:

- whole trunks without preservative treatment are used for columns , fences and landscape furniture.
- half trunks with bark are used for interior partitions
- coconut timber is used for roof structures
- coconut lumber is used for wall partitions and parquet flooring.

For interior furniture:

Cocowood is always used with finishes such as lacquer and varnish

For housing construction (both for low and medium income families) and making furniture in Thailand cocowood is now used only in the coastal rural areas in the southern provinces.

The Ministry of Agriculture, Agricultural Research Department has carried out a pilot project for replantation of coconut palms to replace the cut-down old coconut palms with high-yield varieties.

The Forestry Department of the Ministry of Agriculture, with the cooperation of FAO, has been working on setting up a research centre for coconut wood technology in Surattani province of the southern region of Thailand.

Comments and recommendations

1. The Philippines, as the leading country in research and development of cocowood technology and utilization should keep on conducting this type of training programme for researchers, technicians, architects and engineers from cocowood countries.
2. Standards and regulations for coconut lumber utilization should be set up as soon as possible.
3. The research agencies in private and government sectors should be invoked to carry on research and development in cocowood technology with UNDP/UNIDO providing funds, grants and finance.
4. Recommended organizations for cocowood promotion as a building material are the following:

-Research and Development Agencies:

1. Thailand Institute of Scientific and Technological Research
2. Forest Product Research Division and Agricultural Research Dept., Ministry of Agriculture.

-Lumber producers:

3. Forest Industry Organization, Forestry Dept., Ministry of Agriculture
4. Thailand Sawmill Industry Association.

-Implementation and Utilization Agencies

5. National Housing Authority (NHA)
6. Public Welfare Dept., Ministry of Interior.

KIRIBATI: THE COCONUT WOOD INDUSTRY

A coconut sawmill operation was established in Kiribati in 1981 and has been reasonably successful in its primary objective of milling coconut timber released through the Coconut Replanting Scheme.

The timber produced has been of good quality and has been used by P.W.D. for non-structural work and by the Technical Training Institute for two small buildings. P.W.D. are at present constructing a major building where the majority of the timber is coconut. This includes trusses of 10 metre span, timber framing, floor boards, studs and noggings. Our experience is that it can be usefully used as a substitute for imported timber in construction.

However, the success of the industry depends on economies more than practical considerations. To establish a financially viable coconut wood industry may not be possible without greater usage. There has been a reluctance in the past both from the general public and P.W.D. to accept the product. Following some vigorous marketing by the Government which included the production of a Utilization Manual and a total ban on government importation of timber, the usage is increasing. Moreover, I foresee that until the cost of coconut wood is substantially cheaper than conventional timber there will be a reluctance to use it.

The Government is at present in the process of reviewing the timber industry and is considering a proposal to set up a timber authority. Unfortunately there is a major delay in the Coconut Replanting Scheme at present so the review cannot be completed.

There is now (February 1985) approximately 400 m<sup>3</sup> of sawn coconut timber in store; this will probably be enough to satisfy P.W.D. needs during the review period.

P.W.D.'s policy is to use coconut timber whenever possible and we are developing techniques for its usage in the design office and the site. We will be closely monitoring the performance of the coconut timber elements in our buildings and in our building maintenance schedule.