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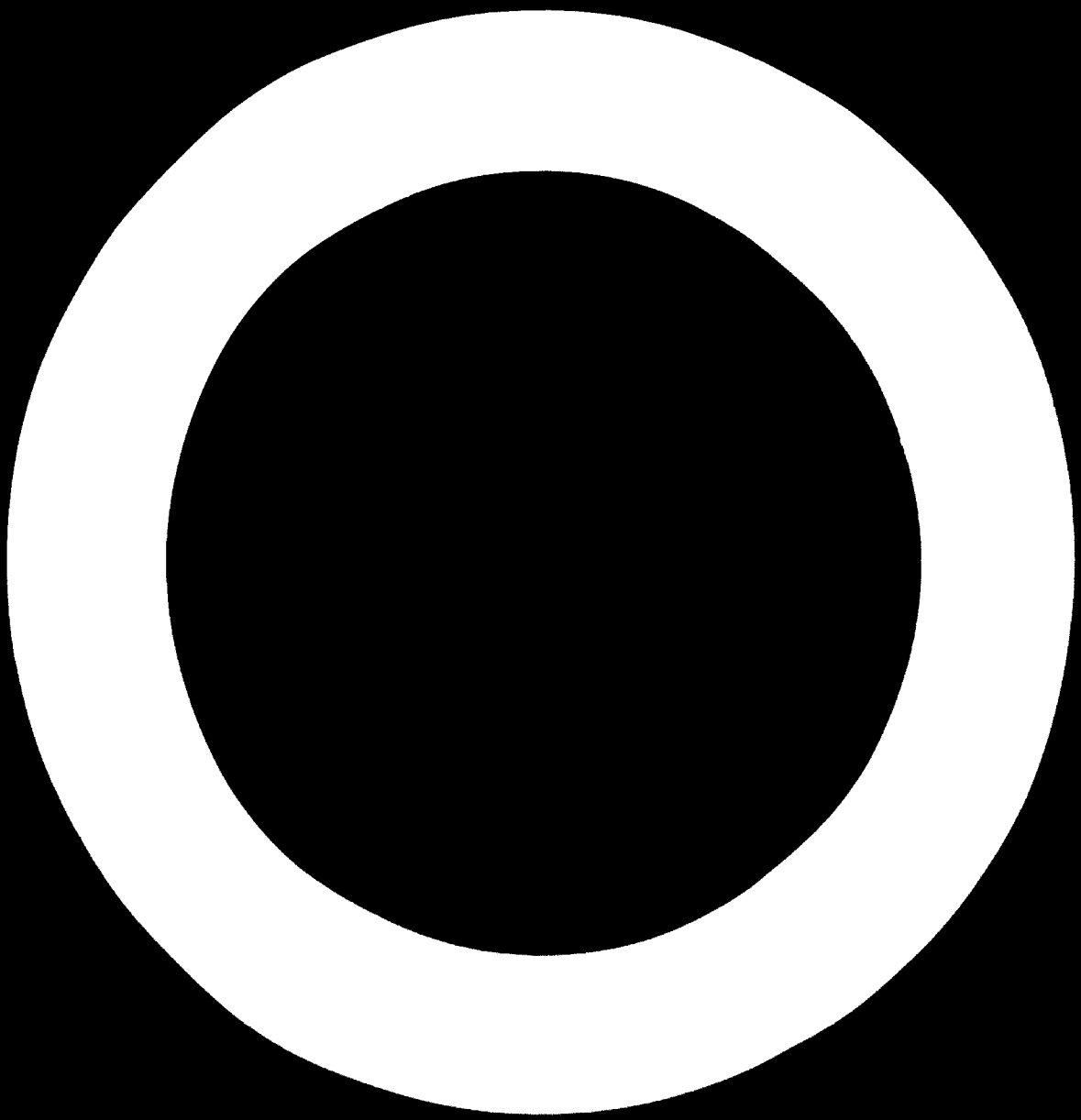


A P P E N D I C E S

SUMMARY

a. The sawmill industry is suffering from excessive fragmentation, over capacity, and an inadequate and undependable timber supply. Archaic government timber sale policies have contributed to this condition, and are now being reviewed. Essential consolidation and modernization of the sawmill industry awaits this reform.

b. The quality of locally produced lumber needs improvement, and is adversely affecting the quality and price of furniture and other refined products. CARIRI can assist the industry by developing lumber and log grades, and seasoning, manufacturing, and preservative standards for Trinidad Woods.

c. Sawmill efficiency could be improved by streamlined material flows, waste disposal systems and certain auxiliary equipment. Furniture plants could reduce costs, improve quality, and become more competitive in domestic and export markets by using batch or assembly-line techniques, streamlined material flows, conveyors, waste removal, quality control and production scheduling systems. CARIRI can provide

Industrial and Mechanical Engineers to assist in this process improvement.

d. Sawmills and furniture plants are usually equipped with adequate machinery to repair and maintain saws, knives and cutting equipment, but lack the refined skills to keep them in top condition. Many furniture plants have the basic machinery needed to benefit from batch and assembly-line manufacturing techniques, but lack the knowledge. CARIRI could provide vocational training in sawdoctoring, and modern furniture manufacturing techniques.

e. Furniture is the country's most important wood product export and its success should be fully exploited. Assistance is needed in designing furniture specifically for export. CARIRI can make this service available.

f. Technical information is needed on the properties, uses, and advantages of Trinidad woods. Research is needed to design timber structures utilizing local woods. CARIRI can develop and publish this information.

GLOSSARY

Abbreviations

B. F.	Board foot or feet.
C. F. T.	Cubic foot or feet.
M^3	Cubic Meter or Meters.
MBF	Thousand board feet.
MCFT	Thousand cubic feet.
SITC	Standard International Trade Classification.

Assembly-line. An arrangement of machines, tools and workers in which a product is assembled by having each worker perform a specific, successive operation on an incomplete unit as it passes by in a series of steps organized as a direct line.

Batch-type operation. Similar to an assembly-line operation, but intended for a specific number of similar products (i.e., one order for 200 identical chairs), after which the assembly-line is changed to run a different group of similar products (i.e., 150 desks).

Board. Originally applied to a piece of lumber one inch thick, several inches wide, and several feet long. Now also commonly applied to panel products, such as plywood, softboard, particle-board and hardboard.

Breakdown Saw. The major saw in a sawmill. Its purpose is to cut cylindrical logs into flat or rectangular pieces for further processing. It is normally used in conjunction with a wheeled carriage, which transports the log back and forth past the saw as each piece is cut off.

Custom shop. The traditional workshop where a single craftsman builds an entire unit of production (i.e., a desk).

Cutstock. Lumber is usually supplied in standard sizes, to be cut into smaller pieces for use. Customers sometimes prefer to have this cutting done at the mill by the supplier and to be supplied with pieces exactly fitting their needs - these pieces are cutstock.

Cut-to-size. Cutstock as defined above, but normally applied to pieces cut from board products, such as plywood, particleboard, etc.

Edger. A machine that cuts the edges of lumber parallel to the long axis of the piece.

Jig. A plate, box or open frame for holding work and for guiding a machine tool to work.

Knocked down. A finished product shipped not completely assembled to save shipping space and assembled at the destination.

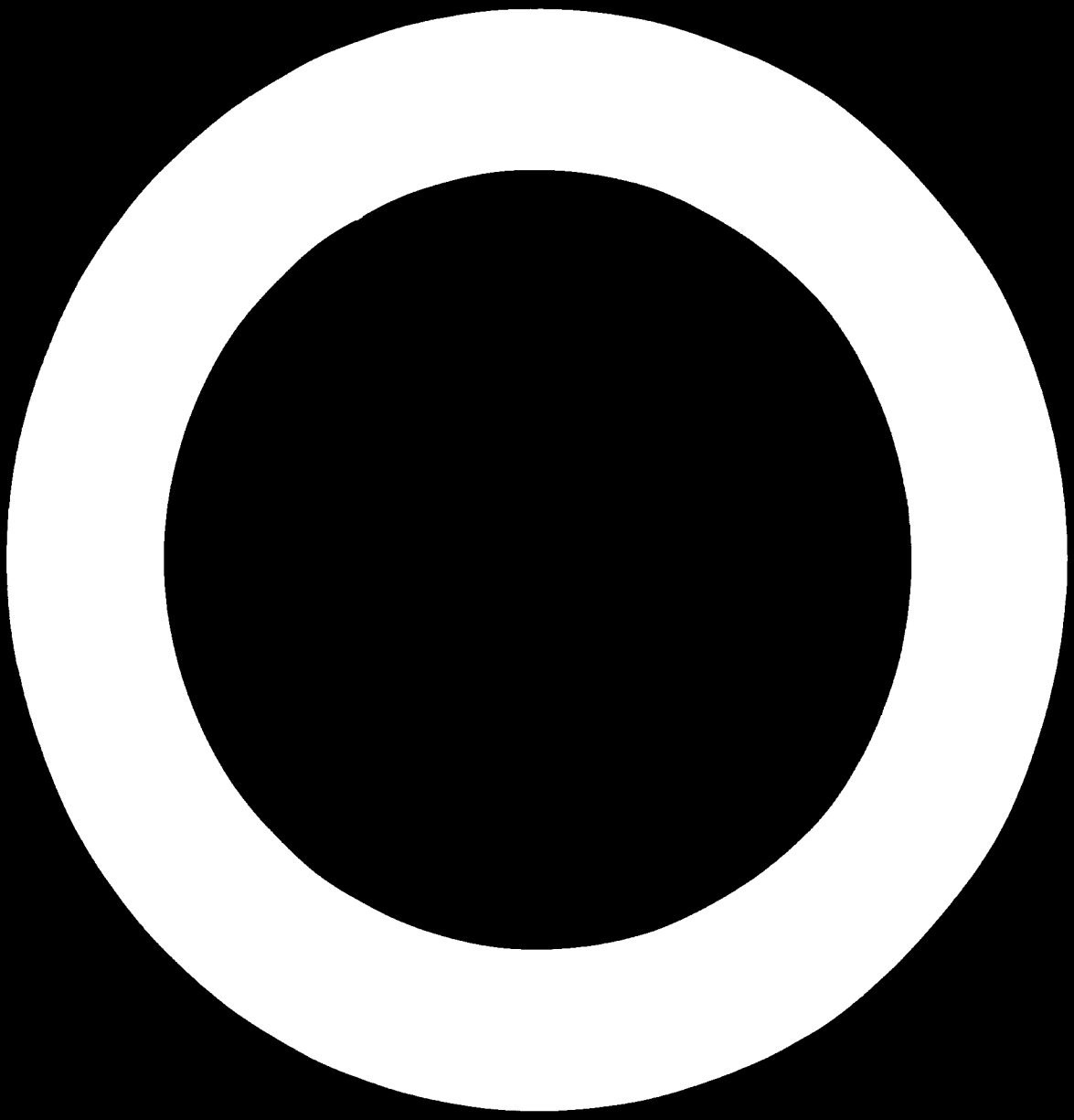
Parquet flooring. A floor covering composed of small wooden blocks - often of several shades or colours - oriented to form decorative patterns.

Planer. A machine that removes the rough or excess surface from a piece of lumber using rotating knife blades.

Plantation thinnings. Tree seedlings are planted more closely together than mature trees. As they grow, weak, defective and excess individuals are removed to allow only the best trees to mature - these are thinnings.

Resaw. Usually a bandsaw that cuts thick pieces of lumber into thinner pieces parallel to the long axis of the piece.

Strickers. Narrow strips of wood that separate layers of lumber in a pile so that air can circulate between them.



PURPOSE

1. The expert services [illegible] with a request from the [illegible] ment Organization of the United Nations [illegible] attached to the Caribbean Industrial [illegible]

2. This organization was established [illegible] and consulting institution to serve the region's [illegible] The expert's primary assignment was to evaluate the [illegible] country and advise the Management of CARIRI how [illegible] and modernizing those industries (see Appendix I for Terms of Reference).

3. The author would like to acknowledge the friendly assistance and co-operation received from Mr. P.A. Durgnat, Assistant Conservator of Forests (Utilisation), (OPEX), Mr. Selwyn Dardaine, Ag. Deputy Conservator of Forests, and Dr. T.I.W. Bell, Management and Planning Officer of the Forest Department; Mr. Saran Sampath, President of the Sawmillers Association; Mr. Eiliv Södahl, Director and Project Manager of CARIRI; Mr. Hollis Charles, Co-Director of CARIRI; and my Counterpart, Mr. Norris Bhagan of I.D.C.

GENERAL INFORMATION

4. Timber resources, manufacturing capabilities, and markets are integral components of the forest products industry - no one component can be meaningfully analyzed without some consideration of the other two. The status and problems of the timber resources and the sawmill industry of Trinidad and Tobago have been analyzed and reported in detail by Messrs. McVeigh (1) and Durgnat (2). This report will deal only with those aspects of these subjects having the most critical impact upon the wood industries.

5. A brief general discussion of the markets for Trinidadian wood products will be followed by a more detailed analysis of markets for each wood industry

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(1) "Report to the Government of Trinidad and Tobago on some aspects of the sawn timber industry". TA 2560. 1968.

(2) Dept. of Forestry. "1971 Annual Report". Ministry of Agriculture, Govt. of Trinidad and Tobago, Port-of-Spain, Trinidad. Section 8.

Timber Resources

6. There were 326,706 acres of forestland in Trinidad and Tobago in 1971.

They were distributed as follows :

Intensively managed mixed hard woods	14,593	Acres	4.5 %
Plantation - Teak	19,013	"	5.8
Plantation - Pine	8,541	"	2.6
Plantation - Other	1,311	"	0.4
Total Managed Area	43,456	Acres	13.3 %
Mainly Protective	36,032	Acres	11.1 %
Swamp	8,128	"	2.5 %
Other	239,088	"	73.1 %
Total Forest Area	**326,706**	**Acres**	**100.0 %**

7. No extensive inventories have been made of the native hardwood forest areas since 1940, and the volume presently available for commercial exploitation cannot be accurately estimated. The major species is Mora (Mora excelsa Benth). Intensive studies of this species in the Matura Forest Reserve and other areas by Dr. Bell (3) indicate that forests predominantly Mora forests may cover up to 90,000 acres in the country. On good sites the net sound volume of Mora was found to average 1,600 cubic feet per acre.

8. The relative abundance of other commercial species must be estimated from annual timber harvest statistics. In 1971, the major commercial species harvested were (see Appendix II):

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(3) Bell, T.I.W. "Management of the Trinidad Mora Forests with special reference to the Matura Forest Reserve, Port-of-Spain, Trinidad. Forestry Division, Gov't of Trinidad and Tobago 1972. Pgs. vii and 61.

	MCFT (Hoppus)	%
Mora (Mora excelsa benth)	346.2	21.5
Crappo (Carapa guianensis)	186.0	11.5
Cedar (Cedrela mexicana)	174.5	10.8
Olivier (Terminalia amazonia)	109.2	6.8
Teak (Tectona grandis)	66.1	4.1
Lepinet (Santhoxylum martinicense)	64.0	4.0
Cajuca (Virola surinamensis)	48.8	3.0
Mahoe (Sterculia caribaea)	44.8	2.8
Balata (Manilkara bidentata)	44.2	2.7
Chenet (Melicocca bijuga)	40.8	2.5
All other 108 species	497.4	30.8
Total	1,618.2	100.0

8. With the exception of the better Mora stands and Teak and Pine plantations, individual trees of these species are widely scattered throughout the forest in the typical tropical hardwood pattern.

10. Extensive damage has been done to the indigenous forest [illegible] cultivation in the hills, especially near the [illegible] inroads have also been made on the more valuable trees [illegible] access roads.

11. Teak has been planted on a [illegible] rate has been 700 acres since 19[illegible]. Thinning [illegible] poles and split picket fences.

12. The Pine plantations (Pinus Caribaea) were instituted in [illegible] to 1000 acres per year. The first thinnings will [illegible]

13. The mahogany (Swietenia Macrophylla King and S. Mahagoni (L.) [illegible] in the country are from private estates where they were planted for ornament [illegible] shade. The volume of this wood available is unknown.

14. [illegible]

SAWLOGS

Year	Natural Plantation Forest	Teak	Private Land	Total	Fuel	Teak Poles	Grand Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

15. [illegible]

16 [redacted]

[redacted]

17 [redacted]

18 [redacted]

19 [redacted]

The actual mechanics of this timber sale system are as follows:

(1) Licensee goes to the forest and selects ten trees.

(2) Arrangements are made for a forest officer to approve and mark the trees for felling.

(3) The licensee fells the trees and cuts them into logs.

(4) Arrangements are made for a surveyor by the forest officer to measure and mark the logs.

(5) The licensee sells the logs to the nearest road, or arranges with other licensees to share the services of a skidding contractor.

(6) He then waits beside the road to sell his logs to the highest bidder among the 50 sawmill operators who must continually drive the roads in search of logs.

20. Logs are often left in the forest or along the roads for several months while the administrative arrangements are made. During this time they dry and split and are attacked by insects and fungus. Much volume and value is lost to degrade and the

resulting trim waste. Drying splits and cracks in the logs often [illegible] to reopen later in furniture and other expensive finished wood products.

21. An adverse change in the species composition and quality of the growing stand is another negative effect of the present timber [illegible] selects the ten best trees of the most desirable species to cut. This leaves poor trees and less desirable species in the residual growing stock. This process has gone on for many years and the results are reflected in the declining volumes of [illegible] in the mixed hardwood forests.

22. Finally, dividing the logging work among a thousand or more [illegible] prevents the economies and efficiencies of even labour intensive larger scale operations. Small licensees are without the resources to remove and market [illegible] trees, dispose of logging wastes, build logging and access roads, reforest, or [illegible]

other vital tasks commonly done by logging contractors in other countries. The job has grown too big. Even this horde of wood cutters cannot keep pace with the productivity of the forest, utilise the available sawmill capacity, or satisfy the nation's demand for wood.

23. There is an urgent need for more and better forest access and logging roads to open inaccessible forest areas to more intensive management and markets. Bridges and surfaces of many secondary roads are inadequate for heavy loads. Consequently, articulated lorries (log trucks with trailers) are prohibited on all but major highways. This condition prevents the use of larger, more economical trucks, and the economics of loading and hauling tree length logs. Longer lumber from these logs bring premium prices on the market, and are required for many construction uses.

24. The Government presently reserves the right to build access and logging roads.

Unfortunately, their limited road-building resources are required to make repairs on the major roads, and the forest access roads are neglected. Larger logging contractors working under carefully supervised contracts could do much to alleviate this situation.

25. The major Trinidad woods are shown in Appendix II. The most abundant species, Mora, is a useful general purpose wood, but is quite abrasive to cutting edges. Crappo, Cedar, Teak, Mahogany, Cypre and Apamate are prized furniture woods. Olivier, Mohoe, and Balata are used in general construction. Jereton(Didymopanax morototon) is used for matches. Purple heart and Saman are highly prized for their unique colour and grain, but are available in very limited quantities.

26. Most of the timber species found in Trinidad are also native to South and Central America, and considerable information is available on their basic mechanical and physical properties.

The best references are the "Present and Potential Commercial Timbers of the Caribbean" (4), and the "Properties of Imported Tropical Woods" (5) by the U.S. Department of Agriculture, and a review of literature on the mechanical and physical properties of woods common to Trinidad by Professor J. L. Atrops (6).

27. There is an urgent need to consolidate this basic technical data and present it in a form understandable and useable to Architects, Engineers, Contractors, furniture manufacturers and other wood users.

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(4) Longwood, F.R. "Present and Potential Commercial Timbers of the Caribbean". Washington, D.C. Agric. Handbook No. 207. U.S. Dept. of Agriculture. March 196

(5) Kukachka, B.F. "Properties of Imported Tropical Woods." Madison, Wisc. U.S.D. Fox Service Res. Paper FPL 125. Forest Products Laboratory. March 1970.

(6) Atrops, J.L. "Strength Properties of Trinidadian Timbers". St. Augustine, Trinid University of the West Indies. Fac. Public. No. 12/1970 (Available from the Dept. of Engineering).

Forest Products Markets

28. Trinidad and Tobago is a country of 1.1 million people with an annual population growth of 1.33 per cent (7). It is a relatively prosperous country. Its per capita Gross Domestic Product (GDP) of TT$1,553 is the highest in CARIFTA, and its total GDP of TT$1,582 million is second only to Jamaica in the region. The economy grew in real terms at a rate of 8 per cent per annum during the period 1955 to 1965 (8).

29. Oil and Asphalt mining and processing, manufacturing, and construction made up over 40 per cent of the GDP in 1968. A wide array of consumer goods are available and although unemployment is 14 per cent, most people seem to have a reasonable share of the prosperity.

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(7) "Annual Statistical Digest" 1970. Central Statistical Office. Gov't of Trinidad and Tobago. 1971. Table 21.

(8) "Third Five Year Plan" 1969-73. Gov't of Trinidad and Tobago. Gov't Printery Port-of-Spain. 1968. Page 21.

30. Unfortunately, not all sectors of the forest products industry are sharing this increasing wealth. Sporadic timber supply, high costs due to low utilization of capacity and inefficiency, and mismanufacturing have resulted in a steady decline in the use of domestic timber (see table in paragraph 14). Instead, the furniture and construction sectors are turning increasingly to imported lumber and board, and to substitute materials such as concrete, steel, aluminum and plastic.

31. Sawtimber, poles, fuel and matches are the only domestic wood products for which production records are available. Also paper, plywood, veneer, particleboard and other products used in the country are not produced here. For these reasons, quantitative information about many domestic wood products markets can best be obtained from an analysis of foreign trade statistics.

32. Trinidad and Tobago is a leading member of the Caribbean Free Trade

Association (CARIFTA), an economic association presently composed of twelve member countries. (9) It was created on 1 May 1968, to deal with regional problems. Of relevance to this report is the imposition of a series of progressively increasing tariffs which should encourage forest products trade within CARIFTA.

33. The CARIFTA countries has a total population of 4.4 million in 1970 (excluding Belize, which joined in 1971). This population is growing at an average rate of 1.52 per cent annually. The combined GDP in 1969 was TT$4,549 million, with a per capita average of TT$988 (see Appendix III).

34. In 1969, Jamaica and Trinidad and Tobago had 65 per cent of the CARIFTA population, and 78 per cent of the GDP. Most of the timber resources of the region are located in Guyana, Trinidad and Tobago and Belize. The Food and Agriculture Organi-

(9) Antigua, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Kitts/Nevis, St. Lucia, St. Vincent, and Trinidad and Tobago. (See Map in Appendix).

tion of the United Nations (FAO) lists the following production figures for 1968 (10) :

Log exports

Guyana	11,800 M^3
Belize	600 "

Industrial Roundwood Production

Guyana	212,000 M^3
Trinidad and Tobago	71,000 "
Belize	61,000 "
Jamaica	6,800 "

Sawnwood Production

Guyana	82,000 M^3
Trinidad and Tobago	35,000 "
Belize	32,000 "
Jamaica	400 "

35. In addition, Jamaica produces 16,000 tons (metric) of Bagasse Particleboard annua

(10) "1969 Year Book of Forest Statistics". FAO, Rome. 1970.

Foreign Trade in Forest Products

36. Honduras (35.8%), Canada (21.1%), Surinam (7.6%), and the U.S.A. (6.) were the major suppliers of wood products imported into Trinidad during 1971 (see Appendix IV). CARIFTA countries accounted for only 3.6 per cent of these imports.

37. The total value of wood imports (excluding paper) appeared to rise from TT$9.3 million in 1960 to TT$11.2 million in 1971. However, much of this apparent 20 per cent increase in value could probably be attributed to inflation, as reflected by a 36 per cent increase in the retail price index during the same period (b)

38. Imports from Honduras (Pitch Pine) increased from 5.9 per cent of the total in 1960 to 35.8 per cent in 1971; while those from the USA declined from 39.0 per cent to 6.2 per cent, and those from the United Kingdom declined from 12.0 per cent to 2.1 per cent.

(b) "Annual Statistical Digest 1970". Central Statistical Office. Gov't of Trinidad and Tobago, Port-of-Spain. Dec. 1971, Table 165a.

39. The imports are shown below by use groups (per cent): (15)

	1960	1965	1966	1967	1968	1969	1970	1971
Lumber	56.8	49.5	57.4	57.6	58.7	60.3	58.3	54.1
Boards	12.4	17.6	19.7	23.6	25.6	24.3	26.2	25.3
Containers	14.8	16.3	8.8	7.3	4.0	3.0	5.9	6.1
Furniture	3.1	4.3	1.7	2.3	3.0	3.1	2.0	3.6
Construction Material	.5	.6	.8	.6	1.1	1.1	.8	.5
Matches	.1	.2	.2	.2	.1	.5	.7	.2
Other	12.3	11.5	11.6	8.2	8.5	8.7	6.2	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

40. While lumber maintained its position at just over half of all forest products imports, boards doubled from 12.4 per cent to 25.3 per cent, and containers dropped from 14.8 per cent to 6.1 per cent. All other groups remained constant.

(15) See Appendix V for additional information.

47 The major wood products imported [illegible]

Pitch Pine lumber	(240.02)	TT$ [illegible]	[illegible]
Plywood	(631.02)	[illegible]	[illegible]
Western Red Cedar lumber	(243.01)	[illegible]	[illegible]
Particle board	(631.04)	[illegible]	[illegible]
Veneer, crates & parts	(632.01)	[illegible]	[illegible]
Other import products		3,097,929	27.7
		TT$ 11,211,234	100

48 Of these major import products, those showing the greatest growth between 1960 and 1971 were particle board (830%) and plywood (141%).

49. CARIFTA countries bought 60.6 per cent of Trinidad's wood exports in 1971

(28) "Overseas Trade. Monthly Report". Central Statistical Office. Govt of Trinidad and Tobago. Port-of-Spain. Dec. 1971.

(see Appendix VI). Barbados (24.5%), Grenada (10.0%), St. Lucia (10.0%) and Guyana ([illegible]) were the chief buyers and accounted for 64.3 per cent of the total. The major [illegible] supplying [illegible] play a very minor role in moving Trinidad's exports. Canada ([illegible]) and the USA (2.4%) accounted for only 3.1 per cent while Honduras and Surinam bought virtually nothing. This distribution of countries in the export market has remained relatively unchanged since 1960.

44. The total value of wood products exported has increased 198 per cent from TT$375,360 in 1960 to TT$1,118,879 in 1971.

45. The exports are shown below by use groups (per cents):

	1960	1965	1966	1967	1968	1969	1970	1971
Lumber	31.5	27.2	20.1	23.0	19.8	22.0	16.9	16.[illegible]
Boards	1.1	.2	.0	.9	.9	1.3	1.6	.[illegible]
Containers	8.5	3.4	1.7	2.7	1.8	.8	.6	.[illegible]
Furniture	18.8	5.9	10.0	7.9	19.7	36.1	50.7	40.[illegible]
Construction Material	2.6	1.8	7.1	10.2	6.4	8.2	5.9	5.[illegible]
Matches	30.8	16.0	18.0	18.8	30.3	28.9	17.3	33.[illegible]
Other	9.0	46.5	30.7	41.6	18.1	0.9	8.3	5.[illegible]
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.[illegible]

46. The decade has seen a steady decline in the importance of lumber exports [illegible] per cent, and of containers from 6 [illegible] per cent. Furniture was the [illegible] moving up from 1[illegible] to 4[illegible] per cent. The other groups [illegible]

47. The other CARIFTA countries must be using more board products in their construction programmes, but are no doubt importing them directly from the supplying countries. Wooden containers have lost major markets to cardboard boxes and plastic containers.

48. The major wood products exported during 1971 were:

	Wooden furniture	([illegible])	TT$ 531,146	47.6%
	Wooden matches	([illegible])	261,501	23.4
	Caribbean cedar Lumber	([illegible])	58,031	5.2
(14)	Wood manufactures NES	([illegible])	49,021	4.4
(15)	Builders woodwork	([illegible])	45,972	4.1
	Other export products		17[illegible]	15.3
	Total		TT$1,116,879	100.0%

(14) A miscellaneous category for manufactured wood products not elsewhere shown in the statistics.

(15) Includes sash and doors, window frames, flooring, louvres etc.

49. The greatest growth among these products during 1960-71 was Furniture (668%), Wood Manufacturers NES (433%), Builder's Woodwork (388%), and Wooden Matches (126%). Although the apparent value of Caribbean Cedar exported rose 36 per cent, this just kept pace with the 36 per cent increase in retail prices during the period.

THE WOOD USING INDUSTRIES

[illegible]

50. There are presently [illegible] sawmills operating in Trinidad [illegible] annual log [illegible] [illegible]ately 25 million B.F. (1). This is an average of only [illegible] MBF per [illegible] from an average of 44[illegible] MBF per mill cut by 75 sawmills in 1966 (2). [illegible] of these mills could cut 1-2 million B.F., or more, annually, with a [illegible] ment and improved management. These figures are indicative of the [illegible] excessive fragmentation and over capacity existing in the industry today.

51. There is an urgent need to consolidate the industry into fewer [illegible] more economical and efficient units. This calls for the preparation of economy of scale studies and proposals for alternative employment within the forest industry. CARIRI, when it has developed the necessary capacity, could assist in such studies.

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(1) Annual Report 1971. Forest Department. Gov't of Trinidad and Tobago, Port-of-Spain. Para 8.1.1.

(2) Annual Statistical Digest. Central Statistical Office. Gov't of Trinidad and Tobago. Dec. 1971. Table 128 & 129.

52. The breakdown saw most commonly used in Trinidad sawmills is a 44 inch "Brenta" bandsaw and carriage imported since 1954. Mills are seldom equipped with edgers or resaws. Edging is done by piling lumber on the carriage and running it through the breakdown saw. In larger mills, two or more expensive breakdown saws are used for work that could be done faster and more accurately with much less expensive edgers and resaws. The introduction of these machines, would enable the breakdown saw to be concentrated on the task for which it was designed, cutting round logs into square timbers for further processing.

53. In larger mills with more equipment, the material flow becomes very confused, violating the basic production principle of raw material in one end and finished products out the other end. This condition, together with the general lack of any provisions for getting rid of mill wastes, results in a great amount of expensive and non-productive re-handling of lumber and mill wastes. The efficiency of most sawmills could be substantially increased without any additional equipment by simplified and streamlined

material flows.

54. In sawmills and other wood processing plants, expensive equipment stands idle much of the time awaiting material from overloaded key operations. Time and motion studies are needed in most mills to balance machine capabilities in the process and remove these "bottlenecks".

55. Mills generally have adequate equipment to maintain their saws, sawblades and planer knives. However, mill maintenance men lack training in the more refined skills of sawdoctoring required to obtain really top results from their equipment. More advantage could be taken of the capabilities of carbide-tipped saws, especially when cutting Mora and other hard abrasive woods.

56. Much mis-sawing of lumber is caused by improper or inappropriate setting or swaging of sawteeth, tooth cutting angles, sawblade tensioning, and poor adjustment and

positioning of saw guides during sawing. Most of these deficiencies can be corrected with little extra expense through sawdoctor training and better supervision.

57. There presently is a severe shortage of lumber in the country as a result of the inability to get logs out of the forest, as described earlier. This shortage has created such an urgent demand for the better species - especially the furniture woods - that sawmills sell their output as soon as it can be cut. There is no time for drying and mis-sawn lumber is tolerated by furniture manufacturers desperate for wood to keep their plants running. The result is much unnecessary waste and the use of improperly seasoned wood, which will reduce the quality of the finished furniture, and reduce the ability of this leading wood product export to compete in international markets.

58. As soon as the timber supply problem is resolved, proper machining and seasoning practices must be established. All lumber should be air dried in stickered and covered piles for at least three months at the sawmill. Facilities should be developed for kiln drying of the higher quality furniture wood.

[illegible] There are very few adequately constructed and operated lumber drying kilns [illegible] at present. Several have been poorly built by people unfamiliar with [illegible] of this kind. Others are in the planning stage or under construction.

[illegible] The few good kilns are being used far below their productive capacity. The basic reasons seem to be insufficient supplies of good lumber available to the [illegible] with the kilns, difficulty in accumulating an adequate supply of [illegible] species to make a complete kiln charge, lack of experience in kiln operation, a lack of [illegible] adapted to native species and specific kilns, and the strong present demand for [illegible] lumber.

[illegible] These problems can be solved through a rationalized timber supply, [illegible] of furniture woods within the industry to utilise available kiln facilities, better co-operation between lumber producers, users and Government to define seasoning requirements for different uses, through the development and publication of technical information on the

construction and operation of lumber kilns and drying schedules for local woods.

62. Local lumber is not normally planed at the sawmill, as most of it goes into furniture or rough construction. The lumber that is planed is improperly dried and the planing is of very poor quality. An important factor contributing to this situation is the practice of importing softwood lumber planed to a very high standard, or rough, at the same price. This is possible because the freight savings on surfaced lumber offset the planing costs. But the result is that people are unwilling to pay more to have local lumber surfaced, especially when the planing quality is so poor.

63. There is definitely scope for a few high quality planers or moulders in Trinidad to supply good quality surfaces on kiln dried lumber, as well as decorative hardwood panelling, flooring and ceiling lumber, beadings and mouldings. The availability of quality surfacing facilities could form the basis of a future laminated beam industry based on plantation Teak and Pine.

64. As with dry kilns, co-ordination and co-operation between producers, architects and users will be needed to consolidate volumes of high quality lumber adequate to support high speed quality planing mills.

65. Log and lumber grades need to be developed for local woods and uses. Architects, furniture manufacturers and other wood users should be shown the advantages of ordering grades of lumber appropriate for specific uses, and a price structure must be developed corresponding to the utility of those grades. Loggers can then be trained to cut trees into logs in such a way as to maximize the value of the lumber within them. Similarly, sawyers can be trained to obtain maximum value from Trinidad timber by sawing the logs to yield the highest possible grade.

66. A considerable volume of useable furniture wood could be salvaged from mill off-cuts and sold as "cutstock". Furniture manufacturers could place standing orders for several specific size rough blanks for common size parts, such as chair legs, backs,

fronts, seats, etc. These could be cut out of slabs, edgings, shorts, etc. at the sawmill as they develop. The same system could be used by builders for truss parts, sash and door parts, etc.

67. Most refined wood uses involve cutting large pieces of lumber into small pieces for use. Sawmills generate large volumes of small pieces they cannot sell as lumber. Great wood savings can be obtained by co-ordinating the symbiotic needs of furniture makers and construction contractors with those of the sawmill.

68. These improvements will cost money and will have to be based on an adequate and dependable supply of timber. Substantial investments in sawmill improvement are presently very poor risks because of the lack of assurance that any mill will have timber a week hence, let alone far enough in advance to repay the investment.

69. The present conditions of inefficiency and low utilization of mill capacity are

creating high lumber costs without producing profits from which improvement funds could be generated. No one benefits from money spent on waste and inefficiency.

70. Current timber prices are shown for representative woods within each species class in Appendix VII.

71. An analysis of prices at each stage of manufacture gives a rough idea of the costs at each step. (See Appendix VIII). The much higher cost margins for Class I woods reflect the strong demand for them, and the greater relative cost of obtaining them. The actual costs and profits of each mill will differ depending on the proportion of the different woods being sawn in that mill at a given time, the mill equipment and management, its location relative to markets and timber, etc. The costs of producing Douglas Fir in Oregon are irrelevant to conditions in Trinidad, except to illustrate the high costs of logging and milling local timber under the present conditions.

72. There are presently three pressure treating plants for wood preservatives operating in the country. They all use copper salts treatments. Present production of treated lumber is around 1.5 million B. F. per year. These three plants have a one shift capacity of approximately 3.5 million per year, if they could obtain adequate supplies of suitable local timbers for treating. A very large portion of their present production is composed of imported softwood.

73. The promotion of the use of treated lumber in housing is presently encountering difficulty due to the absence of a specific definition of treated lumber in Government specifications. This omission enables anyone to dip lumber in a green liquid and sell it as "treated lumber". The ensuing termite feast discredits the advantages of properly pressure treated lumber. In addition to the pressure treating plants, there is a very well equipped facility at Brickfield Forest Industries for the creosote treatment of posts, poles, and fence staves using the hot-cold bath treatment.

74. Standards are badly needed and widely desired in the lumber industry. Of critical importance are specifications for air and kiln dry lumber moisture contents, machining tolerances, and preservative treatment penetration and retention. Local requirements and capabilities need to be studied, along with international usages, to develop practical and attainable standards for Trinidad wood products. A Government or co-operative private organization will be needed to enforce these standards.

(see also par. 173 for recommendations)

Plywood

75. Plywood is not produced in Trinidad at present. Imports have remained at about 5 million square feet (SF) since 1960. (3)

	Quantity (MSF)	Value (TT$000's)
1971	5,787	1,312
1970	5,027	1,167
1969	4,825	925
1968	3,998	843
1967	5,580	597
1966	N.A.	666
1965	4,136	664
1960	N.A.	545

Although the quantity has not changed appreciably, the value has increased.

(3) "Overseas Trade". Central Statistical Office, Gov't of Trinidad & Tobago, 1960-71. Port-of-Spain, Trinidad.

76. In 1971, the chief sources of plywood imports were:

Formosa	2,744	MSF	TT$410,434
Surinam	1,120	"	333,014
Spain	156	"	31,182
Rest of World	1,198	"	330,587
Total	5,787	MSF	1,312,270

77. Lauan plywood from Formosa is mostly 3 or 4 mm in thickness, and is used for door skins, drawer bottoms, cabinet backs, etc. Plywood from Surinam is primarily Baboen (Virola surinamensis) and is used in furniture, panelling, and some types of general construction. Douglas Fir plywood is imported from Canada and used in furniture (especially as underlay in counter tops), concrete boxing and general construction. Plywood from the U.S.A. is primarily specialities, such as decorative panelling.

78. A plywood mill of minimum economic size would require a net volume of at least 100 MCFT of plywood quality timber annually. Timber suitable for plywood seldom exceeds 20 per cent of the sawlog volume. Thus, at least 500 MCFT of suitable species would be required to supply the 100 MCFT necessary for a small mill. This volume would come out of the present supply of furniture and construction woods.

79. "Baboen" is known as "Cajuca" in Trinidad and has long been an important wood for lumber. Local production of Cajuca was 18,800 CFT in 1971 (Appendix II). However, as accessible Cajuca has been picked over for years, it is very difficult to estimate what volume might be available for plywood. It is possible that other local woods would be suitable for plywood, but specific information about their suitability and availability will have to be developed.

80. The minimum plywood mill would produce approximately 3.2 million SF of

plywood annually. This would be approximately 2/3 of a rather stable market. Careful feasibility studies would be required to determine if a local mill could be economically competitive with 3 or 4 mm plywood from Formosa, or if the strength and water resistance would be sufficient to replace Douglas Fir plywood for exterior and general construction uses.

81. Another factor to consider is the portion of the plywood market that will be captured by the Bagasse board plant now under construction in Trinidad. Estimates of this portion run as high as 50 per cent.

82. Careful feasibility studies will need to be made of all aspects of timber supply, production costs, and markets, before a plywood mill can be considered for Trinidad.

83. There is widespread interest in the possibilities of producing decorative veneers from the limited supply of high quality furniture woods in Trinidad. However, excellent

quality wood grain plastic laminates are rapidly replacing wood veneer for low cost

applications, as clearly shown by import statistics for wood veneer:

1971	50 MSI	TT$14,07[illegible]
1970	73 "	12,851
1969	193 "	33,928
1968	156 "	27,246
1967	242 "	24,59[illegible]
1966	N.A	25,06[illegible]
1965	252 "	21,57[illegible]

84 Plastic overlays can be applied by semi-skilled workers with a large measure of equipment. They are impervious to moisture and much tougher than wood veneer. Considerable skill and equipment is necessary to apply wood veneers and they are easily damaged in service.

85. Investment in decorative veneer slicing equipment - separate from a plywood mill - does not seem to be an attractive proposition at this time.

Particleboard

86. Particleboard imports have increased spectacularly during the past decade, as shown below (3)*

	Quantity (MSF)	Value (TT$000's)
1971	6,435	946
1970	5,469	769
1969	3,442	592
1968	2,088	365
1967	2,508	331
1966	-	223
1965	965	163
1960	33	91

87. Particleboard is chiefly used in furniture and cabinets as a sub-strata for plastic overlays. It is cheaper than plywood, has many similar strength properties, and is more uniform in density and thickness. It is overlaid with high pressure laminates of the "Formica-type" for counter tops, or other horizontal surfaces which must resist hard wear and abrasion. For vertical surfaces, such as the sides of TV cabinets, dressers and desks, it is increasingly overlaid with a low pressure vinyl laminate, often with a decorative wood grain.

*Particleboard is shown in the Overseas Trade Statistics as 631-00000 Artificial Wood N.E.S.

88. The main technical advantage of particleboard over plywood for use with overlays is the absence of core gaps. Plywood is stronger in bending and is normally used for bookshelves and other load bearing application in furniture.

89. A particleboard mill is currently being built south of Couva by a group of private investors with Government participation. Bagasse will be the raw material, instead of wood planer shavings. However, the bagasse board will have properties similar to a wood-based board and will supply the same market.

90. The mill is designed to produce 10,000 tons of bagasse board annually, with provision for future expansion to 13,000 tons per annum. Finished boards will be 6' x 15.5'. Densities can be varied from 20 to 47 lbs/CFT. (4). Board thicknesses can be varied from

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(4) Composite boards are classified by density:

Insulation board	16-25	lbs/CFT.
Particleboard	25-55	" "
Hardboard	55-80	" "

$\frac{1}{4}$ inch to $1\frac{3}{4}$ inches. There will be facilities for supplying "cut-to-size" and "pre-laminated" pieces.

91. Assuming a good quality board, the co-operation of the board users, and an active promotion programme, the new bagasse board should be able to replace other imported board products as follows (5) :

Hardboard	(641-05000)	50	per cent
Particleboard	(631-09000)	100	"
Softboard	(631-03000)	80	"
Plywood	(631-02000)	20	"

92. Based on these percentages, the market volumes that could have been supplied by a domestic particleboard mill over the past decade were :

	Short Tons
1971	7661
1970	6507
1969	5227
1968	4085
1967	4547
1966	3699
1965	3591

(5) An estimate by the author.

93. Start-up for the new mill is planned for late summer or early fall of 1972. If the bagasse board penetrates the other board markets as estimated above, the market should be adequate by the time the new mill achieves its full production of 16,000 tons annually.

94. There have been very tight restrictions on the import of all board products since November 1971. These restrictions are intended to prevent hoarding and minimize competition for the bagasse board plant. However, they are being applied to types of board that cannot be supplied by the new plant. The result is a serious shortage of boards in Trinidad that is delaying home construction and furniture production, and creating abnormally high prices.

95. Import restrictions on boards should be relaxed until the new mill is up to full production and actually needs the protection. All import restrictions should be removed immediately from all plywood, softboard under 20 lbs/CFT, hardboard over 55 lbs/CFT,

and from blockboard. Restrictions can be considered in the future for specific products should the bagasse mill need extra markets and protection.

Wooden Matches

96. Wooden matches have been produced in Trinidad for 35 years by the "Trinidad Match Factory. The present plant has been in operation since 1952. It is highly mechanized and very well managed. Production has been quite stable over the past ten years, as shown below (6) :

1970	391,190	Gross Boxes
1969	379,440	" "
1968	423,080	" "
1967	333,610	" "
1966	320,070	" "
1965	296,400	" "
1961	348,330	" "

97. Matches and boxes are made of Jereton (Didymopanax morototoni), a soft local hardwood. Wood performs much more dependably for these uses in the humidity of the

(6) "Annual Statistical Digest 1970". Central Statistical Office. Gov't of Trinidad and Tobago. Dec. 1971. Table 108.

tropics than does cardboard. This is especially true when the matches are carried in a sweaty shirt pocket.

98. As previously mentioned, Matches were Trinidad's second most important wood product export in 1971 (142,877 Gross Boxes valued at TT$261,571), as well as one of its most rapidly expanding (126 % growth during 1960-71). Match exports for the past decade are shown below :

	Gross Boxes (000's)	Value TT$
1971	143	261,571
1970	129	230,861
1969	136	234,701
1968	151	268,621
1967	57	85,520
1966	62	87,912
1965	-	79,747
1960	99	115,680

99. These countries bought most of the matches exported in 1971 :

	Gross Boxes (000's)	Value TT$
Guyana	42	109,627
St. Lucia	29	47,304
Grenada	26	44,976
Dominica	12	22,348
Antigua	5	8,750
Barbados	6	6,680
Rest of World	23	21,886
Total	143	261,571

100. Jamaica was formerly a major customer for Trinidad matches, but a domestic plant commenced operations there in 1966. Guyana has a match factory that produces wooden matches in cardboard boxes, but Trinidad matches can still compete in that country because of their wooden boxes.

101. The cost of producing matches is rising and the company must expand production to minimize their unit costs. Tariffs planned for Phase II of the CARIFTA agreement will give welcome protection ot Trinidad matches within the CARIFTA market, but it is uncertain when they will go into effect. The northern CARIFTA countries will find

it advantageous to continue to buy their matches from Jamaica, North America or U.K., even with the new tariffs.

102. The availability of Jereton is the other major factor restricting expansion of plant production. The match factory shares with the sawmills the problem of an undependable timber supply. Approximately 60 per cent of the Jereton used by the mill comes from private lands and constitutes a relatively dependable supply. But the remainder comes from Government forest land and must be purchased at roadside. A small amount of Canadian Aspen match splints are kept on hand to keep the mill running for short periods when the local Jereton supply fails.

103. This is the kind of efficient, modern, well run plant that most countries are trying to build. It produces a valuable and expanding export product from local wood that otherwise would go into low quality furniture, crates and dunnage. Means should be devised to reserve an annual supply of at least the 80 MBF of Jereton presently required for this mill.

Wooden Furniture

104. The manufacture of wooden furniture is an old and well established industry in Trinidad. Generations of craftsmen have supplied countries of the Caribbean and Europe with high quality, custom built furniture made from valuable local woods. Furniture shops ranging in size from fifty or more employees down to father-son operations are found throughout the land.

105. The large number and diversity of such shops make it impossible to estimate the volume or value of the furniture they produce, and no Government statistics are available on domestic furniture production. However, in addition to supplying the domestic market with a wide selection of furniture, the industry is providing the country's most valuable and rapidly expanding wood product export, as discussed above.

This outstanding export record is shown below (7) :

1971	TT$ 544,829
1970	676,[illegible]
1969	379,[illegible]
1968	137,976
1967	52,[illegible]
1966	73,[illegible]
1965	31,221
1960	69,304

106. The major customers for wooden furniture from Trinidad in 1971 were :

Barbados	216,281
Grenada	79,665
Dominica	65,575
St. Lucia	54,100
Antigua	29,823
Rest of World	99,384
Total	TT$ 544,829

107. A combination of high raw material, production and freight costs are presently restricting the majority of the furniture exports to nearby CARIFTA countries (see map in Appendix).

(7) These figures include both Wooden Chairs (SITC 821-01010) and Wooden Furniture (SITC 821-01090).

108. The furniture industry shares many problems with the lumber industry. This particularly applies to difficulties in obtaining dependable and adequate supplies of acceptably manufactured and reasonably dried furniture woods. This timber situation, plus an urgent need to consolidate and modernize, are the major factors restraining an even larger expansion of the domestic and export furniture markets.

109. Because of the shortage and high price of local furniture woods, imported substitute materials, such as plywood and plastic overlaid particleboard, are rapidly replacing solid wood for many furniture applications. Indeed in many cases, metal and plastic furniture is replacing wooden furniture altogether.

110. The trend is towards the use of boards for the front, sides, top and back of furniture and cabinets. Solid wood is used for the frame, legs and trim. One big reason for the strong demand for locally grown Teak is the availability of imported Teak veneer plywood, and Teak grain plastic overlays to use with solid parts made locally.

111. Most furniture shops in the country are custom operations. Good quality general purpose woodworking machinery is widely available, but much of the work is the careful fitting of parts and pieces by craftsmen using hand tools. There is a general shortage of such men, as younger men are going into higher paying, less tedious types of work requiring much less training.

112. Batch-type production techniques are being used by only a few of the largest and most progressive furniture manufacturers (Lumber Industries Ltd. and Kirpalani's Furniture Plant). However, interest in converting from custom to batch or assembly-line operation is widespread within the industry. Introduction and use of such modern techniques are becoming imperative due to the high cost of labour, shortage of craftsmen, and in order to obtain large scale export orders.

113. Batch or assembly-line production is more a concept than a maze of sophisticated machinery. The better equipped and larger custom shops could convert to batch production with very little additional equipment, merely by streamlining their process flows and

adopting assembly-line techniques.

114. Scarce craftsmen could be more productively used to construct furniture prototypes and to build precision jigs for mass or batch production of standardized furniture lines. Assembly lines would utilize the much more numerous, more modestly paid, semi-skilled workers, and would be less affected by high labour turnover.

115. The most immediate need would be for technicians and managers capable of setting up and supervising mass production operations. Trained maintenance and quality control technicians would be needed to maintain the machinery and quality standards. Eventually Industrial and Mechanical Engineers would be required as consultants to design more efficient processes and more highly automated machinery as the assembly line concepts become established and the ensuing benefits make themselves felt.

onstruction

116. The shortage of housing in Trinidad is the largest deficiency in a relatively high standard of living. In 1966, the national housing deficit was estimated at 50,100 three bedroom units (8). To keep pace with the country's housing needs, the following number of units must be built annually :

To house the population increase	6,000 3 BR units
Slum clearance and to replace obsolete units	4,000 " "
Total	10,000 3 BR units

117. The annual building rate averaged 3,300 units during the last five year plan. The Government contribution was 1,000 units, with the private sector supplying 2,300 units annually.

118. The National Housing Authority's five year housing plan is based on an TT$8.6 million loan from the Inter-American Development Bank to build 2,000 new

(8) "Third Five Year Plan 1969-73". Gov't of Trinidad and Tobago. Port-of-Spain, Dec. 1969. Pages 299-300.

housing units and 860 slum clearance apartments .

119 . Current information on the number of housing units actually built is not available. Several large tracts of low cost houses have been built recently, but most of them appear to be unoccupied for reasons inscrutable.

120. Based on approved building plans data, the building rate for all types of construction has remained constant or declined slightly since 1965 (9). From this information one must conclude that the national housing deficit continues to increase at an annual rate of approximately 7,000 units.

121. Buildings in Trinidad are designed and built to use the minimum amount of wood. That wood which is used is generally imported. Houses are normally built of concrete block with reinforced concrete floors. Lumber and plywood are used for concrete

(9) "Annual Statistical Digest 1970." Central Statistical Office, Gov't of Trinidad and Tobago. Port-of-Spain. Dec. 1971. Table 109.

formwork, doors and windows, louvres, decorative wall panelling, beadings and mouldings, partitions, ceilings, trusses and structural roof systems.

122. The quantities of lumber and most other wood construction materials produced locally or imported have remained relatively unchanged since 1969. However, the value of Builders' Woodwork (SITC 632-03010) exported has increased 385 per cent during this period to TT$45,972 in 1971. It goes to Grenada, St. Lucia and the other nearby CARIFTA countries. The export of prefabricated houses and parts was valued at TT$246,871 in 1967 but has dropped to nil since.

123. The reluctance of Architects and Engineers to use local woods in building construction, while based partially on the undependable supply situation, is primarily due to their inability to order what they need, and to get what they order. Lumber grades and standards, and building codes dealing with wood materials are sorely needed.

Standards are needed for lumber moisture contents, manufacturing tolerances, densities and preservative retention. Available data on the Mechanical and physical properties of local woods need to be made available to building designers. Finally, research and development is needed on timber structure designs using local woods.

124. Wood is ideally suited to efficient, modern, high volume home construction techniques. When used in combination with other materials, in houses designed for local conditions, it can provide comfortable homes at minimum prices. If the necessary information and standards are developed and applied, and with the close co-operation of lumber producers, home designers, and government agencies, wood products can play a critical role in overcoming the present shortage and providing good housing for the people of Trinidad.

Parquet Flooring

125. Wooden parquet flooring is an excellent product for use with the concrete slab floors popular in Trinidad. The process utilizes small pieces (1" x 5/16" x 36") of furniture wood that can be obtained from pieces too short to sell as lumber, and from mill offcuts. The preferred local species are Tapana, Galba, Crappo, Oliver, Purple heart and "Basoo". This capability for using small pieces makes it possible to utilize poor trees of high quality species that do not contain a high per cent of wood suitable for full size lumber. Removal of such trees from the forest frees space for the growth of more desirable trees.

126. There is one parquet flooring plant in Trinidad, Parquetry Ltd. It is equipped with highly automated machinery capable of producing flooring of export quality. It also has one of the best lumber dry kilns in the country. Unfortunately, the output of this plant has been very meagre to date. Its 1971 production of 5,000 sq. yds. is less than ten per cent of its capacity. Only TT$170 was exported to "stores and bunkers" in 1971.

127. The major difficulty seems to be the problem of getting lumber. With the present low utilization of capacity and corresponding high unit production costs, the plant is unable to compete with furniture plants for regular furniture lumber. Without a dependable wood supply, the mill cannot go after the big domestic and export orders necessary to utilize its capacity and reduce its production costs to competitive levels.

128. Parquet flooring is a good product for Trinidad and means should be found to help the plant get established. This is an instance where diligent outside technical assistance and better communication within the lumber industry could provide benefits for all. The placing of orders for cutstock blanks should be encouraged. Assistance in getting established in the CARIFTA export markets could be arranged through the Export Promotion Department of the Government.

Wooden Containers and Pallets

129. The value of wooden container imports fell heavily from TT$1,373,939 in 1960

to TT$282,038 in 1969 (see paragraph 38). This decline was due to the replacement of wooden barrels and boxes by plastic containers, cardboard boxes, and paper sacks. Since 1969, wooden container imports have increased 133 per cent to TT$6[illegible] in 1971. This increase was due to gains in the imports of boxes, crates, and parts (SITC 632-01000).

130. Boxes, crates, and parts were the fifth largest wood product import in 1971 and constituted 94 per cent of the wood container category. These imports were primarily soft drink trays made of Parana Pine in Brazil and shipped knocked down for assembly in Trinidad, and Yellow Pine citrus crates from the U.S.A. The import statistics are shown here:

Brazil	TT$317,333
U.S.A.	155,237
Rest of World	173,920
Total	TT$646,490

Both of these products could be made in Trinidad from Pine plantation thinnings, or medium density hardwoods of minor or little known species.

131. Exports of boxes, crates, and parts were valued at TT$6,331 in 1971. Grenada and Barbados were the principle buyers.

132. Agriculture is a large and often overlooked market for wood products of this type. The uses for wood are often relatively non-sophisticated and frequently present opportunities to utilize many species that are unsuitable for more refined products. A careful study of the potentials for wood products of the box, crate and pallet type in the agricultural economics of the CARIFTA countries should be most rewarding.

Paper and Paper Products

133. Paper and paper products is the largest and fastest growing industry associated with wood products in Trinidad. It is relevant to this report because paper is made partially or entirely from wood fibres. Wood, therefore, has a potentially critical role to play in the future domestic production of this dynamic family of products now being imported at the rate of TT$22,037,822 annually.

134. The spectacular growth in imports of paper can be seen below :

	Paper (SITC 641)	Paper Products (SITC 642)	Total Paper Imports
1971	TT$ 18,666,894	TT$ 3,370,928	TT$22,037,822
1970	15,309,981	3,734,638	19,044,619
1965	6,199,987	4,657,400	10,857,387
1960	4,109,787	3,909,141	8,018,928

135. Paper imports increased 354 per cent during the period, while paper manufactures declined by 14 per cent. The latter was due to the expanding output of the domestic cardboard box, paper bag, and toilet tissue plants. These are increasingly supplying domestic needs and providing for the rapid growth in the export of paper manufactures.

The leading paper products imported in 1971 were (see Appendix IX):

Paper & Paperboard, Coated, Impregnated, etc. (641-07000)	TT$	3,341,803	15.2%
Printing & Writing papers Nes (641-02000)		2,490,980	11.3
Newsprint paper (641-01010)		2,004,366	9.1
Wrapping paper (641-03010)		1,742,560	7.9
Cardboard boxes (642-01090)		1,233,050	5.6
Other Paper and paper products		11,225,063	50.9
Total (SITC 641* & 642)	TT$	22,037,822	100.0%

The first category is the fastest growing, moving from TT$232,855 in 1960 up to the present TT$3,341,803.

* Excluding STIC 641-05000 Building board.

136. North America was the major source of these 1971 paper and paper product imports, as shown below :

U.S.A.	TT$ 7,220,933	32.8 %
Canada	4,456,551	20.2
United Kingdom	3,264,095	14.8
Finland	1,164,233	5.3
Sweden	944,126	4.3
Rest of the World	4,987,884	22.6
Total	TT$22,037,822	100.0 %

137. The major paper and paper product exports during 1971 were :

Cardboard boxes (642-01090)	TT$ 3,077,580	63.1 %
Paper bags without handles (642-01010)	749,426	15.4
Toilet paper rolls (642-09020)	593,373	12.2
Exercise books, registers, etc. (642-03000)	118,157	2.4
Envelopes, etc. (642-02000)	52,014	1.1
Other paper & paper products	289,042	5.8
Total	TT$ 4,879,592	100.0 %

The top three products are manufactured in Trinidad from imported paper.

138. Thirty five per cent of these paper and paper product exports went to CARIFTA countries (see Appendix X). Guyana and Barbados were the best single customers

buying TT$601.771 and TT$ 601.173 respectively.

139. There are no paper mills operating in the country at present. A small mill was established in 1967 to make toilet paper, napkins and similar papers from bagasse. Unfortunately, it expired after a few months for numerous reasons.

140. In 1968, Dr. Julius Grant, a UNIDO expert, evaluated the prospects for establishing a paper industry in Trinidad. He proposed a two stage programme based on renovating and improving the machinery from the late mill.

141. In stage I the mill would produce 4,000 tons of sulphite paper annually. The proposed product mix would be :

(1) Writing papers - excluding the highest grades.

(2) Printing papers - excluding coated and specially treated papers.

(3) Wrapping papers - excluding Kraft papers.

(4) Bag papers - excluding Kraft papers.

(5) Corrugating medium - inside layer.

(6) Toilet tissues.

142. The suggested proportions would be :

Writing & Printing papers	2,000	Tons p.a.
Wrapping & Bag papers	1,000	" "
Corrugating medium	1,000	" "
Total	4,000	Tons p.a.

143. Stage I raw material requirements would include 20,000 tons of crushed bagasse (50% M.C.) and 1,000 tons of imported long-fibre wood pulp per annum.

144. Stage II would involve an additional paper machine and auxiliary equipment to expand production of products similar to Stage I to 24,000 tons annually. Raw material requirements would rise to 135,000 tons of crushed bagasse (50% M.C.) and 6750 tons of imported long-fibre wood pulp annually.

145. No action has been taken on Dr. Grants' recommendations to date. The status of the paper mill equipment is unknown.

146. The total volume of paper and paper products imported in 1971 was 40,658 tons (see Appendix IX). However, a given paper mill can only make a relatively few related products out of this broad array. Even within the product groups it does make, there will be requirements for special paper characteristics beyond one mill's capabilities. A paper mill supplying primarily the domestic market and part of the CARIFTA market would probably operate within this group of paper products :

641-02000	Printing & Writing papers Nes.	3,155 tons p.a.
641-03010	Wrapping paper	4,698 " "
641-03020	Packing paper	15 " "
641-07000	Paper & Paperboard, coated or impregnated (50%)	3,046 " "
641-19000	Paper & Paperboard Nes (25%)	4,203 " "
642-01010	Paper bags without handles (25%)	80 " "
642-02000	Envelopes (50%)	7 " "
642-03000	Exercise books, registers (50%)	104 " "
642-09090	Paper & Paperboard Nes (25%)	90 " "
	Total Potential market	15,398 Tons p.a.

147. The portion of this 15,000 tons p.a. market that a domestic paper mill could capture would depend on the capabilities of the mill, raw materials used, government

protection, and the willingness of the people to substitute certain lower quality local papers for some of the high grade imported papers they had been accustomed to using.

148. The consumption of paper and paper products is growing rapidly in Trinidad and CARIFTA. The feasibility of a domestic paper mill should be continually re-assessed in view of this market growth, steady advances in pulp and paper mill equipment and technology, and to alleviate the steadily mounting cost of paper imports.

149. As Dr. Grant has pointed out, a domestic pulp and paper mill will probably be based on a combination of bagasse and imported long-fibred pulp. This latter pulp comes from Pine and other coniferous woods that could be grown in Trinidad.

150. Pulpwood plantations of rapid growing conifers are normally harvested at 25 year intervals (Vs 35 - 50 years for coniferous sawlogs), bring a higher return on investment than sawtimber plantations, and can usually be financed at relatively low

interest rates with international money.

151. Selection of coniferous pulpwood species suitable for Trinidad should be an integral part of the exotic timber species evaluation programme discussed earlier. As part of the accelerated afforestation programme, consideration should be given to ensuring that coniferous species used in plantations are suitable for both long-fibred pulpwood and sawtimber. New and more thorough tests should be made of the pulping characteristics of locally grown Pinus caribaea. These tests should be made in North American laboratories with extensive experience with this species.

152. Future pulpwood plantations should be planned and established on the basis of a specific mill location and pulpwood requirement. Such planning and prior preparation will do much to enhance the attractiveness of Trinidad to prospective pulp and paper mill investors.

Other Wood Products

153. There is one plant making Wooden Pencils in Trinidad. The New Yorker Company Ltd. of Chaguanas. They supply most of the pencils used locally and export to the nearer CARIFTA countries, where they are encountering very stiff competition from mainland Chinese pencils.

154. The company is presently importing 85 MBF of Incense Cedar annually from California, but they are installing lumber processing facilities to utilize local cedar and cajuca. They need technical information (kiln drying schedules, machining properties, etc.) on other local woods of potential use to them.

155. More should be done to encourage organized Wood Carving in Trinidad, as this is one obvious way of achieving the Government's goal of establishing a pride and identity in the nation's history and culture. Many local woods are superb for carving.(*) The market is there as is attested to by the large number of wood carvings from

(*) See Appendix XVII

Kashmir, Kenya and Haiti on sale at all craft stores. Finally, no one who has witnessed the staggering release of imagination and creativity at the annual Carnival could deny that the talent is there waiting to be utilized.

156. Balsa (Ochroma pyramidale) is a wood with very special properties that grows scattered across Trinidad. (10) It grows very fast, maturing in less than ten years. The wood is extremely light weight and is highly efficient where buoyancy, insulation against heat or cold (especially at extremely low temperatures used with liquidized gases), or absorption of sound and vibration is important. It is used in all types of floatation gear, core stock in metal-faced sandwich construction, sound modifiers, air craft models and novelties. The tree also produces an industrial fibre similar to kapok in its seed pods.

(10) Kukachka, F. Properties of Imported Woods. Res. Paper FPL 125. U.S. For. Prod. Lab., Madison, Wisc. Mar. 1970. Pgs. 34-35.

157. Commercial Balsa is normally supplied from Equador. But a more favourable investment climate, a better location in respect to North American and European markets, and the economies of plantation growth could possibly make Trinidad an attractive source of supply. It might also permit the establishment of light, high technology domestic industries based on the above uses of Balsa.

158. Potential markets for Balsa should be investigated along with the feasibility of establishing Balsa plantations.

PROBLEMS AND OPPORTUNITIES

Timber Sales

159. The overwhelming need in the forest products industry is for a change in the Governments' timber sales policies that will provide authorized mills with an adequate and dependable supply of timber. A proposal to accomplish this through the granting of timber concessions is under consideration by the Government at this time. It is of primary importance to the industry that these reforms are not delayed.

160. With the timber sales reformed, the necessary consolidation of logging and sawmill operations can take place. This conversion will take place over a period of several years, as forests are inventoried and concessions sold by auction to reputable companies whose plans for modernizing their mills and utilizing the concession timber have been approved by the Forest Department.

Standards

[illegible] equipped sawmills that result from consolidation of the [illegible] producing lumber equal in quality to that presently being [illegible]. Standards will be needed to obtain the full benefits from these new capabilities [illegible] grades need to be developed and applied to local woods. Standards are [illegible] moisture content of air and kiln dried lumber, manufacturing tolerances, [illegible] and for minimum preservative [illegible]. A new price structure will be needed to accurately reflect the [illegible] new grades and standards.

[illegible] and standards will require a high [illegible] between the government, lumber producers, [illegible]. The reward will include higher quality and [illegible] for finished, a better competitive position in World export [illegible] for the wood products industry.

Process Improvement

163. An increase in the capacity and efficiency of remaining wood processing plants must accompany consolidation of the sawmill and furniture industries. Much of this improvement can be achieved by making more effective use of present equipment. In the sawmills, streamlined material flows, waste removal systems, and certain auxiliary equipment will largely achieve the necessary results. In the furniture plants, the introduction of batch or assembly-line production techniques will initially require new and streamlined material flows, some conveyor systems, waste removal systems, quality control and production scheduling systems. Later more complex equipment will be needed as operations become more sophisticated and efficient. A considerable amount of Industrial and Mechanical Engineering assistance will be required to achieved these changes.

Vocational Training

164. Inherent in process improvement and the introduction of new production

techniques will be the requirement for more highly trained technicians. Of critical importance will be trained sawdoctors to maintain saws, knives, and cutting equipment in a condition adequate to achieve the new manufacturing standards. Equally important will be training for the technicians, maintenance men, and foremen who set up and operate the new furniture production processes.

165. The modernization of these industries with the concurrent increase in more challenging and better paying technician jobs, should help attract some of the bright young men who have been leaving the industry for more exciting occupations.

Wood Promotion

166. Wooden furniture plays a dominant role in both export and domestic markets for wood products. Priority should be given to further exploiting the success of this industry, particularly in export markets.

167. There is need to develop a "Trinidad line" of furniture by wedding local art and culture with furniture design. This style would appeal to West Indians and to ethnic groups in North America and Europe. Local handicrafts could be worked into the style as part of the furniture construction, such as woven bamboo mats used for the fronts of wooden HiFi speaker cabinets. They could also be used as furniture accessories, such as lamps, art objects, wall hangings, etc.

168. Export furniture should be engineered for world markets. It should be designed for shipment disassembled, or "knocked down" to reduce shipping costs. Moisture contents must be carefully regulated and finishes developed to protect the products during the transition from tropical to temperate climates. Close co-ordination will be needed between local manufacturers and foreign buyers to enable designers to stay abreast of style changes in export markets. Export possibilities for finished or semi-finished furniture parts should be investigated.

169. Export orders for furniture from the larger countries are often much larger than can be supplied by one company. A co-ordinating group should be established to form ad hoc task forces or consortiums of companies to handle these large orders. Members of the committee formed to co-ordinate lumber grades and standards could form the nucleus of this export co-ordinating group.

170. Most of the important commercial woods of Trinidad are common to South and Central America. The mechanical and physical properties of many of these woods have been tested, but the results are not widely published. This information should be consolidated, additional testing done to fill in gaps and adapt it to local growing conditions, and the results made available to Architects, Engineers, builders and other wood users. Promotional literature is needed on the uses and advantages of Trinidad woods. Research is needed in timber engineering and building design utilizing native woods.

RECOMMENDATIONS

1. Timber sales.

171. The Government timber sale policy must be changed to provide the wood products industry with adequate and dependable supplies of timber. CARIRI cannot directly assist in changing this po icy.

2. Standards.

172. CARIRI can play a valuable role in helping to establish standards and grades for the lumber industry. Personnel and equipment should be procured to develop:

a. Lumber and log grades for local woods.

b. Standards for the moisture contents of air and kiln dried lumber, manufacturing tolerances, density ranges for each common species and grade of lumber, and for minimum retention of preservatives in treated wood products.

c. A price structure for lumber to accurately reflect the utility of these new grades and standards.

173. CARIRI should assist in organizing an industry committee to assist in forming standards, co-ordinate the application of standards, and to make provisions for their

use and enforcement. CARIRI should provide a representative for this committee. It should not be the function of CARIRI to enforce standards.

3. Process Improvement

174. A programme should be established to assist in increasing the capacity and efficiency of wood processing plants. Assistance to the furniture industry can start now and should include:

a. Introduction of batch, or assembly-line production techniques.

b. Simplified and streamlined material flows.

c. Conveyor systems.

d. Waste removal systems.

e. Quality control systems.

f. Production scheduling systems.

g. Assistance in ordering or designing complex production equipment.

175. Sawmills can use limited assistance now but significant improvements must await consolidation of the industry that will follow revision of the timber sale policy. Assistance to the sawmills will include :

a. Simplified and streamlined material flows.

b. Waste removal systems.

c. Ordering or designing certain essential auxiliary equipment.

d. Up-grading machinery to attain the new standards.

4. Vocational Training

176. In co-operation with other national and international agencies, CARIRI should provide industrial training in critical areas to include :

a. Sawdoctor training in the proper care and maintenance of saws, knives and cutting equipment.

b. Training for technicians, maintenance men and supervisors in setting up and operating assembly-lines.

5. Wood Promotion

177. CARIRI should assist the wooden furniture industry in promoting domestic and

export markets by providing help in :

a. Designing a "Trinidad Line" of furniture and furnishings.

b. Designing export furniture for world markets, incorporating such features as "Knockdown" capabilities to reduce freight costs.

c. Co-ordinating the desires of foreign markets with local design and production of furniture.

d. Investigating export markets for finished, or semi-finished furniture parts.

e. Establishing a co-ordinating committee within the furniture industry to co-ordinate the filling of large export orders.

178. Technical information on the properties of Trinidad woods should be developed and published through :

a. Consolidating and evaluating available information on the mechanical and physical properties of Trinidad woods.

b. Conducting tests to fill gaps in the technical information, and to adapt it to local conditions.

c. Publishing the results in a form usable by Architects, Engineers, Builders, and other wood users.

d. Publishing promotional literature on the uses and advantages of Trinidad woods for the general public.

e. Conducting research in timber engineering and building design utilizing native woods.

6. Staffing

179. a. Wood Technologist - will manage and co-ordinate CARIRI's assistance to the wood products industry, and will be head of the Wood Technology programme (see Appendix XI for Job Description). He will be a U.N. Expert recruited for a period of two years.

180. b. Structural Engineer - will conduct timber design studies and wood property tests in co-operation with the Wood Technologist. He will be a permanent CARIRI staff member assigned to the Wood Technology programme for a period of one year (see Appendix XII for Job Description).

181. c. Sawdoctor - A short-term U.N. Expert to conduct sawdoctor training. He will initially visit Trinidad for one month to evaluate training needs and order equipment. Some months later when the equipment arrives, he will return for three months to conduct the training (see Appendix XIII for Job Description).

182. d. Furniture Manufacturing Expert. A short-term U.N. Expert to conduct training in assembly-line techniques of furniture production, to include jig and process design, machine setup and maintenance, and supervision of modern furniture production. He will be recruited for a three month period. (See Appendix XIV for Job Description).

183. e. Furniture Designer - will work in close co-operation with local designers and export promotion personnel to develop furniture competitive in world markets. He will be a U.N. Expert recruited for one year, with possible extensions. (See Appendix XV for Job Description).

184. f. Industrial and Mechanical Engineers - Personnel to perform these services are available elsewhere in CARIRI. They will be used, when required, in co-operation with the Wood Technologist.

186. g. Scheduling - The Wood Technologist should be recruited three months in advance to allow time for him to start the programme and prepare for using the rest of the staff. (See Appendix XVI for Programme Schedule).

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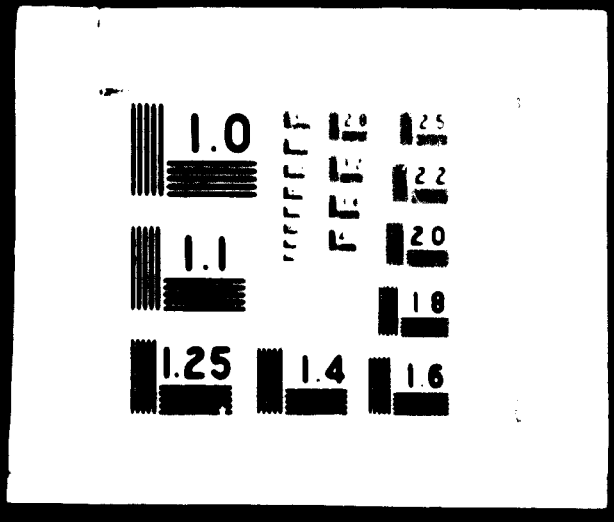

APPENDIX I

TERMS OF REFERENCE

The consultant, Mr. Clark, was recruited by the United Nations Industrial Development Organisation (UNIDO) to advise CARIRI on how it most effectively assist the forest products industries of Trinidad and Tobago.

His terms of reference are:

"The expert who will be attached to the Caribbean Industrial Research Institute (CARIRI), will co-operate with the local counterpart staff in undertaking a survey of the sawmills and lumber finishing industries in the country, visiting the consumers of wood and wooden products such as architects, contractors and consultants, furniture producers, producers of wooden house-building materials and pre-fabricated house-building components, in order to identify the need for the introduction of modern wood technology, such as artificial curing, chemical preservation, wood modification, surface treatment, lamination and gluing, introduction of modern machinery, etc. Additionally he will be expected to:

1. identify those techniques which are now either not used or little used but which are considered necessary for promoting the production of wood products;

2. identify wooden products which are not made or made in a primitive way or on a small scale which are considered worthwhile to manufacture;

3. recommend steps to be taken by CARIRI to establish a permanent activity in the field of wood technology."

APPENDIX II

1971 SAWLOG OUTTURN BY SPECIES
(Volume in Hoppus feet)

	Local Name	Botanical Name	Crown Land & Forest Reserve Volume (Hoppus cu. ft.)	Private Land (Class I only) Volume (Hoppus cu. ft.)
1.	Mora	Mora excelsa	346,200	
2.	Crappo	Carapa guiaenensis	186,000	
3.	Olivier	Terminalia amasionia	109,200	
4.	Teak (B.F.I.) logs	Tectona grandis	65,000	1,200
5.	Lepinet	Santhoxylnm martinicenss	64,000	
6.	Cajuca	Virola surinamensis	48,800	
7.	Mahoe	Sterculia canbaea	44,800	
8.	Balata	Manilkara bidentata	43,000	1,200
9.	Chenet	Melicocca bijuga	40,900	
10.	Cedar	Cedrela mexicana	39,300	135,200
11.	Toporita	Hernanda Sonora	35,500	
12.	Hog Plum	Spondias monbin	28,600	
13.	Manaara	Brosimum alicastrum	27,900	
14.	Pois Doux	Inga. spp.	26,700	
15.	Laurier	Ocotea & Nectandra spp.	24,900	
16.	Tapana	Hieronyma caribaea	23,400	
17.	Silk Cotton	Ceiba pentandra	22,700	
18.	Sandbox	Hura crepitans	21,800	

APPENDIX II

(Continued)

	Local Name	Botanical Name	Crown Land & Forest Reserve Volume (Hoppus cu. ft.)	Private Land (Class I only) Volume (Hoppus cu. ft.)
19.	Bois D'orme	Guazuma ulmifolia	19,000	
20.	Serrette	Byrsonima spicata	17,200	
21.	Galba	Calophyllum Lucidum	17,000	
22.	Figuier	Ficus tobagensis	12,000	
23.	Guatacare	Eschweilera subglandulosa	11,800	
24.	Blackheart	Clathrotropis brachypetala	11,400	
25.	Mangue	Symphonia, Marila and Tovomita spp.	11,300	
26.	Angeline	Andira inermis	10,600	
27.	Jiggerwood	Bravaisia interrigium	11,000	
28.	Sardine	Laetia procera	10,000	
29.	Jereton	Didymopanax morototoni	8,200	
	All other (89 species)		128,494	8,900
			1,465,694	222,600
	TOTAL RECORDER SAWLOG OTTURN			1,612,174
	*To nearest 100 H. c. ft.			
	Total in true cubic feet (x 1.27)			2,047,000

APPENDIX III

CARIFTA POPULATION & ECONOMIC DATA[1]

POPULATION

	1970 Total	Annual Increase 1960-70 %	1969 GDP Total (M TT$)	1969 GDP Per Capita (TT$)
Antigua	73,900	2.65	38.9	537
Belize	119,600	2.83	91.1	741
Dominica	70.300	1.61	26.4	377
Grenada	94,500	.64	41.3	437
Montserrat	12,300	.08	8.0	537
St. Kitts/Nevis	45,800	(.83)	26.5	516
St. Lucia	101,100	1.62	49.1	423
St. Vincent	89,100	1.09	33.9	363
Total Less Develop	606,600	1.40	315.2	495
Barbados	238,100	0.26	216.7	816
Guyana	714,000	2.45	447.0	633
Jamaica	1,861,400	1.46	1987.7	1017
Trinidad & Tobago	945,200	1.33	1582.0	1553
Total More Developed	3,758,700	1.53	4233.4	1068
Total CARIFTA	4,365,300	1.52	4548.6	989

(1) "CARIFTA and the New Caribbean." Commonwealth Caribbean Regional Secretariat. Georgetown, Guyana. May 1971. Tables 1,3, and 4.

APPENDIX IV

FOREST PRODUCTS TRADE - IMPORTS

	1960 TT$*	%	1965 TT$	%	1970 TT$	%	1971 TT$	%
Honduras	544,230	5.9	1,161,228	14.9	3,117,645	31.7	4,009,795	35.8
Canada	1,602,391	17.3	1,417,220	18.2	2,356,740	24.0	2,363,246	21.1
Surinam	266,293	2.9	362,511	4.7	521,443	5.3	854,113	7.6
U.S.A.	3,613,558	39.0	3,217,166	41.4	930,667	9.5	699,352	6.2
CARIFTA	443,035	4.8	475,151	6.1	431,385	4.4	399,703	3.6
Guyana	440,327	4.7	458,906	5.9	395,160	4.0	390,192	3.5
Jamaica	1,385	.1	120	-	36,105	.4	8,219	.1
Barbados	706	-	16,565	.2	120	-	227	-
Dominica	5	-	420	-	-	-	-	-
Grenada	600	-	40	-	-	-	-	-
St. Vincent	72	-	-	-	-	-	505	-
St. Lucia	-	-	-	-	-	-	560	-
United Kingdom	1,111,061	12.0	338,794	4.4	126,507	1.3	231,353	2.1
Australia	344	-	83,884	1.1	190,736	1.9	203,684	1.8
Rest of World	1,692,077	18.1	723,375	9.2	2,152,441	21.9	2,452,978	21.8
Total	9,272,988	100.0	7,779,329	100.0	9,827,764	100.0	11,214,224	100.0

*U.S.$1.00 = TT$1.80

APPENDIX V

FOREST PRODUCTS TRADE - MISCELLANEOUS

Year	(1) Retail Price Index	Imports	Exports
		(2)	
1971	-	TT$ 11,214,224	1,116,879
1970	135.7	9,827,764	1,332,314
1969	130.7	9,383,876	1,024,709
1968	130.0	7,674,169	701,587
1967	117.9	6,599,527	669,799
1966	116.5	8,219,007	686,485
1965	111.0	7,779,329	530,673
1960	100.0	9,272,988	375,360

(3) Product Group include these Standard International Trade Classification catagories.

Lumber

243-02010 Lbr. Douglas Fir
-02020 Lbr. Pitch Pine
-02030 Lbr. White Pine
-02040 Lbr. West. Red Cedar
-02090 Lbr. Other, Conifer
-03010 Lbr. Caribbean Cedar
-03020 Lbr. Greenheart
-03030 Lbr. Mahogany
-03040 Lbr. Mora
-03090 Lbr. Other, Non-Conifer

Boards

631-02000 Plywood
-03000 Softboard
-09000 Particleboard
641-05000 Hardboard

Construction Materials

632-03010 Bldgr's Woodwork
-03020 Parquet Flooring blocks
-03030 Beadings & Mouldings
-03090 Bldgr's Woodwood NES
-09030 Wooden Shingles

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(1) Annual Statistical Digest 1970. Central Statistical Office, Government of Trinidad & Tobago, Port of Spain. December 1971. Table 163a, pg.159

(2) US$ 100 = TT$180.

(3) Overseas Trade 1960 - 1971. Central Statistical Office, Government of Trinidad & Tobago.

/Continued

A P P E N D I X V (Continued)

Containers

632-01000 Boxes, crates & parts
-02010 Shooks, staves, etc - Oak
-02020 Cooperage products - Oak
-02030 Shooks, staves, etc - Non-oak
-02040 Cooperage products - Non-oak

Chairs & Furniture

821-01010 Wooden chairs
-01090 Other wooden furniture NES

Matches

899-02000 Wooden matches in boxes under 80

Other

241-02000 Charcoal
242-09010 Potes, posts, etc - Conifer
-09020 Poles, posts, etc - Non Conifer
631-01000 Veneer sheets
632-09010 Household and kitchen wooden ware
-09020 Tools of wood
-09090 Wood manufacturers NES
811-01000 Pre-fabricated buildings & parts

APPENDIX VI

FOREST PRODUCTS TRADE - EXPORTS

	1960		1965		1970		1971	
	TT$	%	TT$	%	TT$	%	TT$	%
CARIFTA	343,621	91.5	478,065	90.1	273,857	20.6	899,792	80.6
Barbados	108,788	29.0	127,545	24.0	90,104	6.8	273,152	24.5
Grenada	60,875	16.2	43,427	8.2	87,617	6.6	211,221	18.9
St. Lucia	35,230	9.4	38,179	7.2	-	-	120,901	10.8
Guyana	42,197	11.2	40,664	7.7	963	-	111,421	10.0
Dominica	9,382	2.5	62,846	11.8	35,774	2.7	87,923	7.9
St. Vincent	20,446	5.4	16,292	3.1	17,752	1.3	51,503	4.6
Antigua	2,907	.8	85,091	16.1	41,647	3.2	42,227	3.8
Jamaica	58,655	15.6	2,665	.5	-	-	1,344	.1
S . Kitts/N/A	4,446	1.2	59,016	11.1	-	-	100	-
Montserrat	693	.2	2,340	.4	-	-	-	-
U.S.A.	3,417	.9	10,722	2.0	46,562	3.5	31,008	2.8
Canada	386	.1	2,447	.5	4,259	.3	6,392	.6
Stores & Bunkers	7,042	1.9	11,799	2.2	2,026	.1	4,323	.4
United Kingdom	9,734	2.6	14,823	2.8	7,019	.5	990	.1
Rest of World	11,160	3.0	12,817	2.4	*995,585	75.0	174,274	15.5
Total	375,360	100.0	530,673	100.0	1,332,314	100.0	1,116,878	100.0

* The author was unable to determine what caused this large value

APPENDIX VII

1971/72 TIMBER PRICES

Species	Species Class	Unit of Value	(1) Royalty	(2) Roadside Price	(3) Wholesale Price	Retail Price
Mahogany Cypre Saman Apamate	I	TT$/MBF (US$/MBF)	20 (11)	167-208 (93-116)	550 (306)	700 (389)
Crappo Laurier	II	TT$/MBF (US$/MBF)	10 (6)	75-100 (42-56)	300 (167)	380 (211)
Mahoe Cajuca Sandbox	III	TT$/MBF (US$/MBF)	4 (2)	33-67 (18-37)	180 (100)	220 (122)
Hog Plum Silk Cotton Rubberwood	IV	TT$/MBF (US$/MBF	2 (1)	33-50 (18-28)	160 (89)	200 (111)
Mora	Special	TT$/MBF (US$/MBF)	7 (4)	75-100 (42-56)	260 (144)	320 (178)
Douglas Fir	Imported	TT$/MBF (US$/MBF)	- -	- -	(4) 400 (222)	440-530 (244-294)
Pitch Pine	Imported	TT$/MBF (US$/MBF)	- -	- -	(4) 386 (214)	420 (233)

(1) Ramdial, B.S. "Progress Report 1968-70" Forestry Division, Port of Spain. page 25. 1970

(2) Forest Department Annual Report. 1971. Appendix II.

(3) 1971/72 Sawmillers Association Prices.

(4) "Overseas Trade" Monthly Report. Central Statistical Office. Government of Trinidad & Tobago. December 1971.

APPENDIX VIII

ANALYSIS OF LUMBER PRODUCTION COSTS

Species	Species Class	Unit of Value	Stumpage Cost	Logging Margin	Transp & Milling	Sales & Distribution
Mahogany Cypre Saman Apamate	I	TT$/MBF US$/MBF % Retail	20 (11) 3	147-188 (82-104) 21-27	175-383 (97-213) 49-58	150 (83) 21
Crappo Laurier	II	TT$/MBF US$/MBF % Retail	10 (6) 3	65-90 (36-50) 17-24	200-225 (111-125) 53-59	80 (44) 21
Mahoe Cajuca Sandbox	III	TT$/MBF US$/MBF % Retail	4 (2) 2	29-63 (16-35) 13-28	113-147 (63-82) 52-67	40 (22) 18
Hog Plum Silk Cotton Rubberwood	IV	TT$/MBF US$/MBF % Retail	2 (1) 1	31-48 (17-27) 16-24	110-127 (61-71) 55-63	40 (22) 20
Mora	Special	TT$/MBF US$/MBF % Retail	7 (4) 2	68-93 (38-52) 21-29	160-185 (89-103) 50-58	60 (33) 19
Douglas Fir (1)	Imported	TT$/MBF US$/MBF	72 (40)	45 (25)	54 (30)	72 (40)

(1) Representative costs from a cost study recently performed by the author on a sawmill cutting Douglas Fir in Oregon.

APPENDIX IX

1971 IMPORTS OF PAPER AND PAPER PRODUCTS INTO TRINIDAD AND TOBAGO

SITC No.	Description	Tons*	Value (TT$000)	Average Price/Ton (TT$)
641-01010	Newsprint	6,977	2,004	287
641-01020	Other newsprint	297	121	408
641-02000	Printing & Writing papers NES	3,155	2,491	790
641-03010	Wrapping paper	4,698	1,743	371
641-03020	Packing paper	15	9	598
641-04000	Cardboard	534	273	511
641-06000	Paper & P. board bituminized	96	33	348
641-07000	Paper & P. board coated or impreg.	6,092	3,342	549
641-08000	Wallpaper	4	11	2,731
641-11000	Cigarette paper	113	212	1,880
641-12000	Blotting paper	13	46	3,503
641-19000	Paper & P. boards NES	16,810	8,382	499
Total Paper & Board (641)		38,804	18,667	481

* 1 Ton = 2,000 lbs.

APPENDIX IX
(Continued)

SITC No.	Description	Tons	Value (TT$000)	Average Price Per Ton (TT$)
642-01010	Paper bags w/o handles	318	431	1,356
642-01020	Paper bags w/ handles	11	17	1,583
642-01090	Cardboard boxes	757	1,233	1,629
642-02000	Envelopes	14	65	4,619
642-03000	Exercise books, Registers	208	429	2,062
642-09010	Paper napkins	187	296	1,584
642-09020	Toilet paper rolls	-	1	4,178
642-09090	Paper & P. board NES	359	899	2,504
Total Paper & P. Board Manufacturers		1,854	3,371	1,818
Grand Total		40,658	22,038	542

APPENDIX X

1971 PAPER & PAPER PRODUCTS EXPORTS BY COUNTRY

CARIFTA	TT$ 1 720,342	35.3 %
Guyana	601,771	12.3
Barbados	601,173	12.3
Grenada	196,689	4.0
St. Lucia	108,179	2.2
Antigua	94,064	1.9
Jamaica	84,609	1.7
Dominica	22,705	.5
St. Kitts/N/A	9,580	.2
St. Vincent	1,321	-
Montserrat	251	-
Surinam	102,503	2.5
Rest of World	3,056,748	62.2
Total	TT$ 4,879,592	100.0

APPENDIX XI

SPECIAL FUND PROJECT IN TRINIDAD & TOBAGO

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI)

JOB DESCRIPTION

POST TITLE: Wood Technologist

DURATION: Two years

DATE REQUIRED: As soon as possible

DUTY STATION: St. Augustine, Trinidad, with travel within the country.

DUTIES: The expert will be a member of the CARIRI staff and will head the Wood Technology program. He will be expected to establish close working relationships with members of the wood products industry, the Forest Department, and other relevant Government Departments. He will provide technical assistance to industry and Government in the areas of lumber standards, process improvement, vocational training and wood promotion. Specifically he will be expected to:

1. Develop lumber and log grades for Trinidad woods.
2. Develop seasoning manufacturing and preservative standards for local woods.
3. Recommend a price structure corresponding to the lumber and log grades.
4. Assist in organizing a committee within the industry to develop and apply lumber standards.
5. Co-ordinate the work of Industrial and Mechanical Engineers in increasing the capacity and efficiency of wood processing plants - especially furniture plants and sawmills.
6. Utilize the expertise of short term experts to provide:

APPENDIX XI
(Continued)

(a) Vocational training for saw doctors.

(b) Training for technicians, setup men, maintenance men and operating assembly-lines in furniture plants.

7. Work with a Structural Engineer to develop and publish technical information on Trinidad woods, and conduct research in timber engineering and building design utilizing native woods.

QUALIFICATIONS: University degree in Wood Technology and training in Industrial Engineering. Extensive practical experience at a senior level in a variety of wood industries, preferably dealing with tropical woods. Experience in wood products research would be an asset.

LANGUAGE: English

BACKGROUND: In 1971, the 58 sawmills of Trinidad produced just over 2 million CFT of lumber from the country's tropical hardwood forests and Teak plantations. These sawmills are small, usually consisting of only a band breakdown saw and carriage with no auxiliary processing equipment. Timber is difficult to obtain. Lumber prices are very high, although quality is very low.

Most furniture is produced in custom shops of varying size. It is the most important wood export product. Eighty per cent of the furniture exported goes to other CARIFTA countries.

APPENDIX X
(Continued)

CSIRI started operations in 1970, and now has a staff of over 40, as well as good laboratory and library facilities. The Institute undertakes sponsored research for the Government and industry, gives advice and undertakes testing and performing feasibility studies. It receives support from UNIDO in the form of equipment and expertise.

A P P E N D I X XII

SPECIAL FUND PROJECT IN TRINIDAD & TOBAGO

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI)

JOB DESCRIPTION

POST TITLE: Structural Engineer

DURATION: One year

DATE REQUIRED As soon as possible

DUTY STATION: St. Augustine, Trinidad, with travel within the country.

DUTIES: The expert will be a member of the CARIRI staff assigned to the Wood Technology program. He will conduct timber building design studies and wood property tests in co-operation with the Wood Technologist. Specifically he will be expected to:

1. Consolidate and evaluate available information on the mechanical and physical properties of Trinidad Woods.
2. Conduct tests to fill gaps in the technical information, and to adapt it to local conditions.
3. Conduct research in timber engineering and building design utilising native woods.
4. Publish the results in a form usable by Architects, Engineers, Builders and other technical wood users.
5. Publish promotional literature on the uses and advantages of Trinidad woods for the general public.

QUALIFICATIONS: University degree in Structural or Civil Engineering with emphasis on the design of timber structures. Training or experience in materials testing, architecture, or wood technology would be highly desirable.

APPENDIX XII
(Continued)

LANGUAGE: English

BACKGROUND: Most of the commercial timbers of Trinidad are common t South and Central America. A lot of research has been done on their mechanical and physical properties. However, this data needs to be verified for local timber and made available in useable form to Architects, Engineers, and others.

Local lumber could play a much greater role in fulfilling the country's housing requirements, if houses, trusses and other structures were designed to utilise local timber species.

APPENDIX XIII

SPECIAL FUND PROJECT IN TRINIDAD & TOBAGO

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI)

JOB DESCRIPTION

POST TITLE: Saw Doctor

DURATION: Four months

DATE REQUIRED: As soon as possible

DUTY STATION: St. Augustine, Trinidad, with travel within the country.

DUTIES: The expert will be attached to CARIRI, and will conduct advanced training for local saw doctors in the care and maintenance of saws, knives, and cutting equipment used in the wood products industry.

He will initially visit Trinidad for one month to evaluate training needs and order equipment. Some months later when the equipment arrives, he will return for three months to conduct the training

QUALIFICATIONS: Many years of experience working as a saw doctor.

LANGUAGE: English

BACKGROUND: Most sawmills in Trinidad are small, usually consisting of only a band breakdown saw and carriage. Edgers, resaws and trimmers are very uncommon.

Sawmills normally have adequate equipment for repairing, sharpening and maintaining saws, knives, and cutting equipment. However, very few local saw doctors have had any advanced

APPENDIX XIII
(Continued)

training, and lack the skill to keep the cutting tools in really top shape.

The country has several important species, especially Mora, which are very abrasive to saw teeth and knife edges. More use should be made of Carbide tips.

A P P E N D I X XIV

SPECIAL FUND PROJECT IN TRINIDAD & TOBAGO

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI)

JOB DESCRIPTION

POST TITLE: Furniture Manufacturing Expert

DURATION: Three months

DATE REQUIRED: As soon as possible

DUTY STATION: St. Augustine, Trinidad, with travel within the country.

DUTIES: The expert will be attached to CARIRI. He will conduct training in furniture production by batch or assembly-line techniques to members of the industry now producing custom made furniture. Specifically he will be expected to include these subjects in the training:

1. Batch or assembly-line techniques of furniture production.
2. Jig and process design.
3. Machine setup and maintenance.
4. Supervision of modern furniture production.
5. Problems involved in converting from custom to assembly-line furniture production.

QUALIFICATIONS: Considerable experience in the batch and assembly-line production of furniture as a worker and supervisor. Additional experience in a custom furniture shop is highly desirable. Industrial Engineering or Wood Technology training or experience would also be an asset.

LANGUAGE: English

APPENDIX XIV
(Continued)

BACKGROUND: The manufacture of wooden furniture is an old and well established industry in Trinidad. Generations of craftsman have supplied countries of the Caribbean and Europe with high quality custom built furniture made from valuable local woods. Furniture shops of various sizes are found throughout the land. Rising wood and labour costs are making it imperative that the larger of these plants convert to batch or assembly-line production to keep their products competitive in domestic and export markets. There is widespread interest within the industry in modernising their plants and shifting to more efficient techniques.

APPENDIX XV

SPECIAL FUND PROJECT IN TRINIDAD & TOBAGO

CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE (CARIRI)

JOB DESCRIPTION

POST TITLE: Furniture Designer

DURATION: One year

DATE REQUIRED: As soon as possible

DUTY STATION: St. Augustine, Trinidad, with travel within the country.

DUTIES: The expert will be a member of the CARIRI staff, assigned to the Wood Technology program. He will work in close co-operation with local designers and export promotion personnal to develop furniture competitive in world markets. Specifically he will be expected to:

1. Work with local designers to develop a "Trinidad line" of furniture and furnishings.
2. Design export furniture for world markets, incorporating such features as "Knockdown" capabilities to reduce freight costs.
3. Design export furniture to minimise dimension change problems when shipped out of the tropics.
4. Co-ordinate the desires of foreign markets with local design and production of furniture.

QUALIFICATIONS: University degree. Considerable experience and training in the aesthetics and structural design of furniture and interior decoration.

LANGUAGE: English

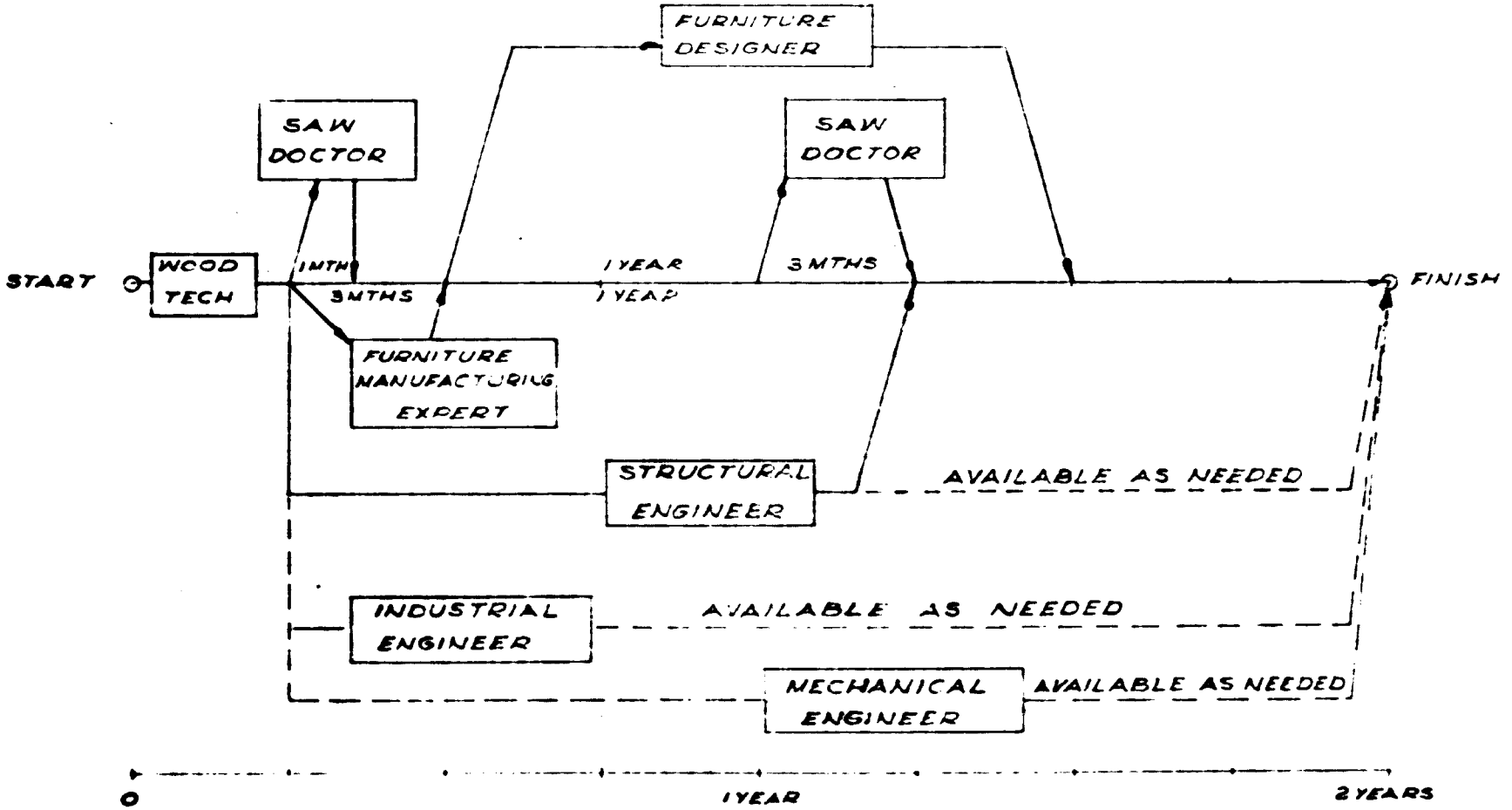
APPENDIX XV
(Continued)

BACKGROUND: Wooden furniture plays a dominant role in both export and domestic markets for wood products. Priority should be given to further exploit the success of this industry, particularly in export markets.

There is need to develop a "Trinidad line" of furniture by wedding local art and culture with furniture design. This style could appeal to West Indians and to ethnic groups in North America and Europe. Local handicrafts could be worked into the style as part of the furniture construction. They could also be used as furniture accessories, such as lamps, art objects, wall hangings, etc.

APPENDIX XVI

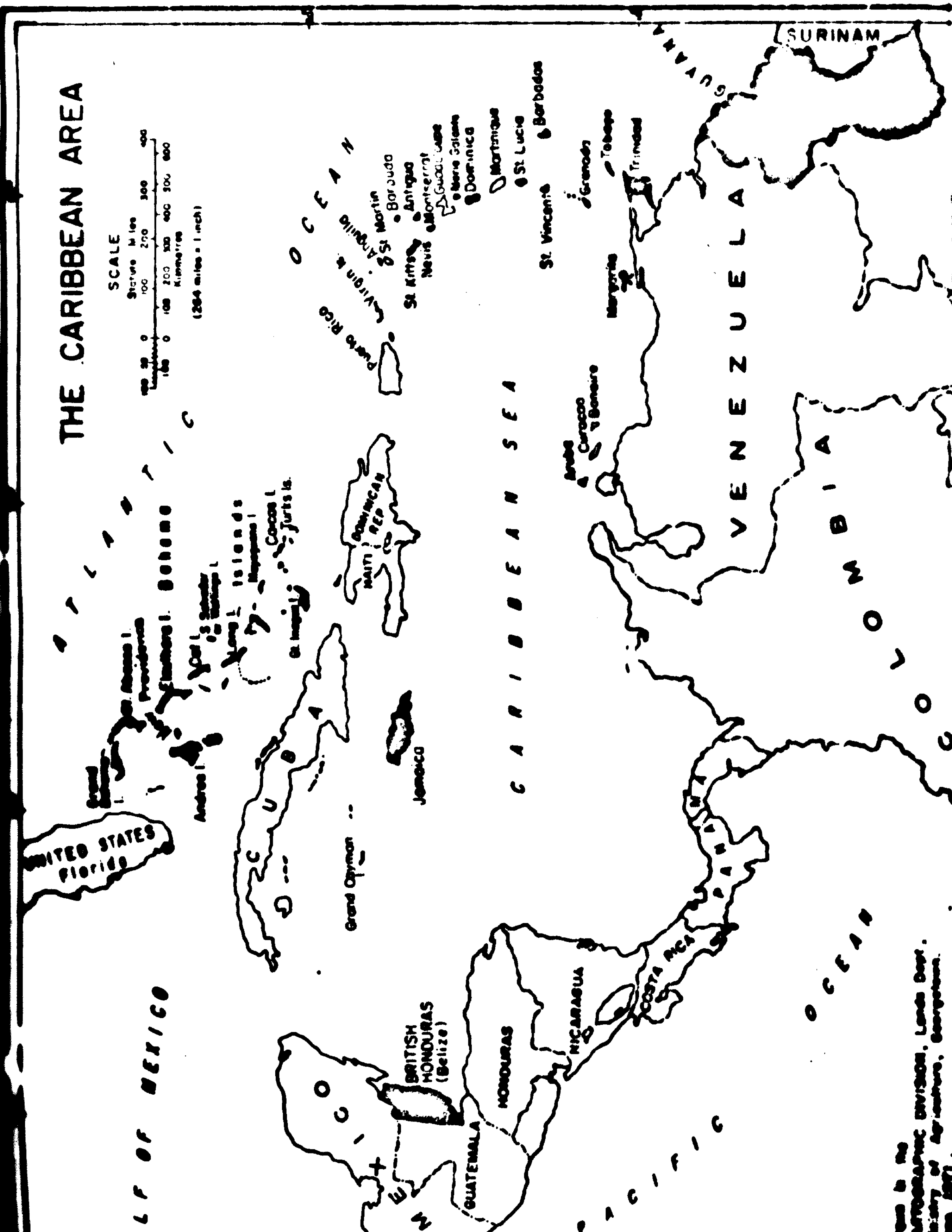
SCHEDULE FOR THE WOOD TECHNOLOGY PROGRAM

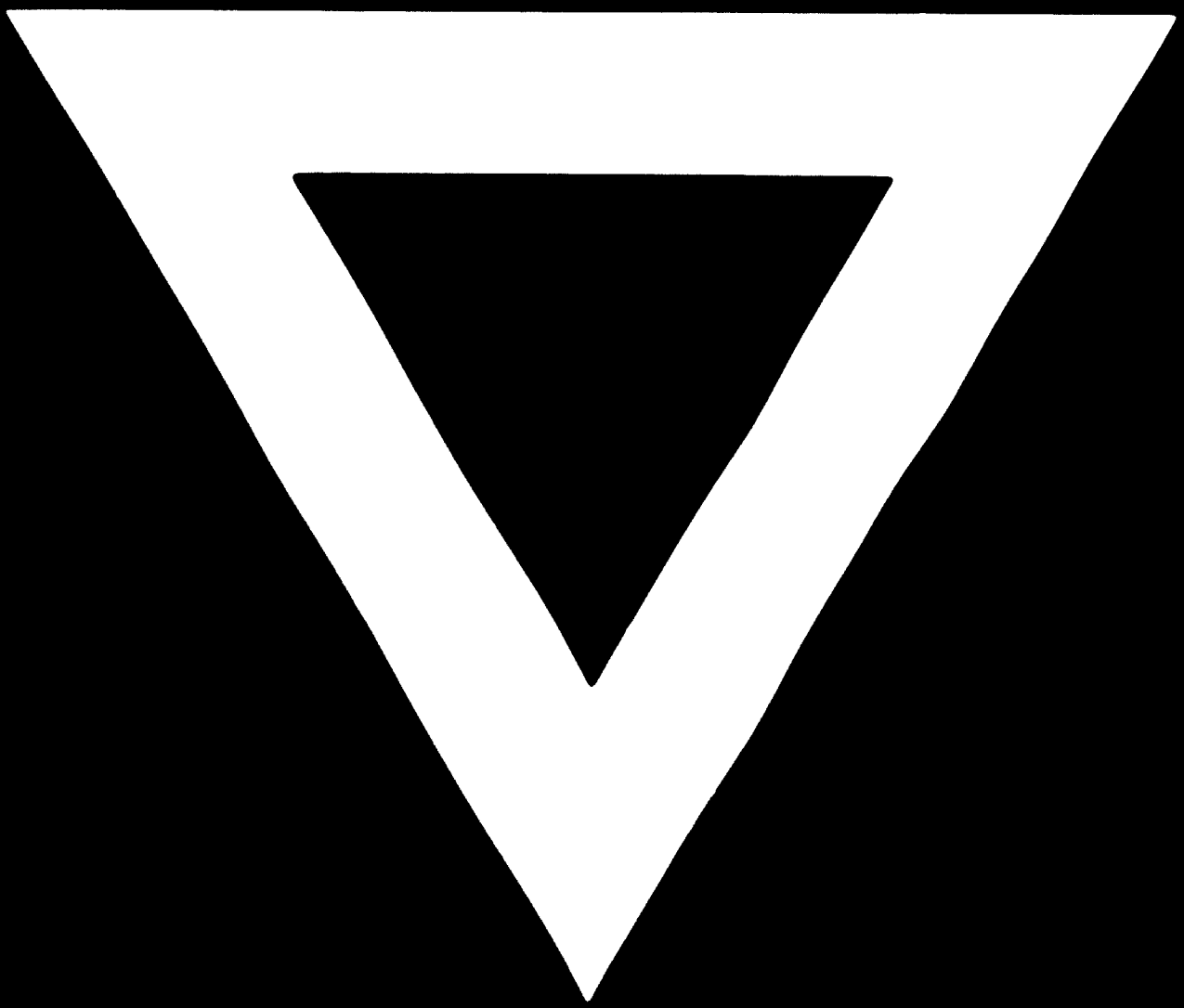


APPENDIX XVII

The following woods are of medium density, have a uniform grain, bright colour or decorative figure, machine well, and should make excellent carving woods:

Mahogany	Swietenia macrophylla
Teak	Tectona grandis
Crappo	Carapa guianeneneis
Balata	Manilkara bidentata
Cedar	Cedrela mexicano
Laurier	Ocotea and Nectandra sp.
Tapana	Hieronyma caribaea
Calba	Calophyllum lucidum
Saman	Samanea saman (Jacq.)
Pink Poui	Tabebuia rosea


THE CARIBBEAN AREA
SCALE
Statute Miles
Kilometres
(284 miles = 1 inch)
ATLANTIC OCEAN
CARIBBEAN SEA
GULF OF MEXICO
PACIFIC OCEAN
UNITED STATES
Florida
Grand Bahama
Providence
Eleuthera I.
Andros I.
Cat I.
Long I.
Islands
Turks Is.
CUBA
Grand Cayman
Jamaica
HAITI
DOMINICAN REP
Puerto Rico
Virgin Is.
Anguilla
St Martin
Barbuda
Antigua
St Kitts
Nevis
Montserrat
Dominica
Martinique
St Lucia
Barbados
St Vincent
Grenada
Tobago
Trinidad
Margarita
Aruba
Curacao
Bonaire
VENEZUELA
COLOMBIA
GUYANA
SURINAM
PANAMA
COSTA RICA
NICARAGUA
HONDURAS
GUATEMALA
BRITISH HONDURAS (Belize)
MEXICO
CARTOGRAPHIC DIVISION, Lands Dept.
Georgetown.



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