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APPROPRIATE TECHNOLOGY FOR THE MANUFACTURE OF PULP AND PAPER PRODUCTS

APPROPRIATE TECHNOLOGY IN DEVELOPING THE PULP AND PAPER INDUSTRY IN PANAMA ,

Background Paper

id. 78-6989

APPROPRIATE TECHNOLOGY IN DEVELOPING THE PULP AND PAPER INDUSTRY IN PANAMA

by

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PREFACE

The author of the present paper acknowledge the honour granted to him by the United Nations Industrial Organization on inviting him to participate in the

Technical Meeting on

Paper Products and Small Pulp Mills

to be held during the first part of the Forum on Appropiate Technology, organized by UNIDO in co-operation with the Government of India.

The first part of the Forum will consist of a week-long expert panel meeting in selected industrial sectors in New Delhi from 20 to 25 November 1978 of officials, experts and institutional representatives concerned with the practice and application of appropriate industrial technology. The second part of the Forum, which will immediately follow from 28 to 30 November 1978 in Anand, India, will be a meeting of ministers of selected developed and developing countries, which will consider the results and conclusions of the preceding techno-economic meeting at a policy level.

C O N T E N T S

1. DEVELOPMENT OF THE PULP AND PAPER INDUSTRY IN PANAMA

The development of the pulp and paper industry, in Panama, is considered, in this document, in two steps: (1) Substitution of import, or medium term development and (2) Export or long term development This two steps development contemplates the use of non traditional raw materials and the necessity of new technologies or adaptation of normal technologies to the specific conditions of Panama, in other words the introduction of appropriate technology.

1.A. PRESENT SITUATION

Graph 1 Shows the present situation of the paper industry in Panama

This situation can be summarized as follows

i. There is no pulp manufacture

ii. The existing paper manufacture industry depends on: local waste paper, imported pulp and imported waste paper;

iii. The existing paper conversion industry depends on importation of paper, board and Bristol-Board, as well as on locally manufactured paper;

iv. Gray board production is very low and erratic,

v. There is no production of Bristol-Board;

vi. Waste paper, which includes large amounts of corrugated boxes, is partially recycled, some one is exported and a large quantity is distroyed.

1.B. PROPOSED DEVELOPMENT

Proposed development is to be carried in two basic steps: 1st Step At medium term and 2nd. Step At long term.

1 C. FIRST STEP: Medium Term Development

Graph 2 shows the future situation to be reached, at medium term.

The differences between the present situation and the one to be reached, at medium term, are:

i. Pulp manufacture, using local raw materials;

ii. Local production of part of paper required by some conversion operations; and

iii. Higher recuperation of waste paper, with possibility of export.

1.D. SECOND STEP: Long Term Development

The future situation to be reached, at long term will include the pulp production for export.

2. CHARACTERISTICS OF THE PAPER DEMAND, IN PANAMA

2.A. DEMAND OF PULP, SECONDARY FIBRE AND PAPER, IN PANAMA

Basic figures of this demand are:

	1973/74/74 (Average) Metric Tons	Increment Per Year	1985 (Estimated) Metric Tons.
a. Raw Material Demand			
-Imported Pulp	2,395	10	4.790
-Imported secondary Fibre	1.157	5	1.730
-Local Secondary Fibre	9.000		16.980
-Total	12.552		23.500
b. Local Paper Production			
-Wrapping	6.000	10	12.000
-Medium	2.000	10	4.000
-Tissue	2.500	5	3.750
-Writing	2.500	5	3.750
-Total	13.000		23.500
c. Paper Demand			
c.1. Wrapping Paper for:			
Banana Boxes	32.410		49.502
Bags	3.144		8.319
Others	13.632	10	35.351

	1973/74/75 (Average) Metric Tons.	Increment %Per Year	1985 (Estimated) Metric Tons.
c.2 Printing and Writing			
-Newsprint	4.420	5	7.198
-Others	7.640	5	12.444
Sub-total	12.060		19.642
c.3 Other Products			
-Board	5.430		8.832
Special Papers & Board	4.304		8.608
-Tissue	4.315		8.630
-Sub-total	14.049		26.070
Total Paper Demand	75.295		138.884

d. Future Necessity of Import

128.884 - 23.500 105.384

2.B. GEOGRAPHICAL DISTRIBUTION OF THE PAPER DEMAND, IN PANAMA

The paper demand has two basic geographical components:

a. Paper for banana boxes:

In 1985, this component will be 39.502 Tons. and will represent 30% of the total national demand;

50% of this component will be concentrated in Changuinola and 50% in Puerto Armuelles;

about 2/3 of this component will be liner and 1/3 medium;

Actually, some corrugate boxes are exported from Panama City to Costa Rica

b. Paper and paper products for industry, commerce and other activities

These activities are mostly concentrated in or near Panama City and, including the ones located inland, they are basically suplied by conversion plants and importers located in this city;

It is likely, that this component of the demand will continue being supplied from Panama City, or at least from an area located at a maximun distance of about 30 Km. from this city.

2.C. CLASSIFICATION OF PAPER DEMAND, ATTENDING TO PAPER QUALITY AND GEOGRAPHICAL DISTRIBUTION OF DEMAND, IN 1985

	Banana Area (Metric Tons)	Panama Area (Metric Tons.)
c.1 Wrapping Paper Qualities		
-Liner	33 001	6.000
-Medium	16.501	4.000
-Bags		8.319
-Others		25.351
Sub-total	49.502	43.670
c.2 Printing and writing Qualities		
-Newsprint		7.198
-Others		12.444

	-Sub-total		19.642
c.3	Other Products		
	-Distributed Among a Large Number of different Qualities		26.070
c.4	-Sub-totals	49.502	89.382
c.5	Total	138.884	

2.D PULP PRODUCTION POSSIBILITIES, IN ACCORDANCE WITH THE CLASSIFICATION OF THE DEMAND SHOWN IN (2.C.)

Basic figures for the determination of these possibilities are:

		Banana Area (Metric Tons.)	Panama Area (Metric Tons.)	Total (Metric Tons)
d.1	Wrapping Qualities for corrugating			
	Liner	33.001	6.000	39.001
	Medium (Note1)	16.501	4.000	20.501
	for bags (Note 2)		8.319	8.319
	Others		25.351	15.351
d.2	Printing and Writing Qualities		19.642	19.642
d.3	Other Products (Note 3)			
d.4	Totals	49.502	62.812	112.814

Note 1. The 4.000 Tons. of medium will be manufactured with local waste paper and some part will be sent to Changuinola.

Note 2. The 8.319 Tons. for bags will be manufactured with imported pulp

Note 3. Other products are not considered, because they include a large quantity of differente qualities.

The possibilities indicated by the previous figures must be submited to other considerations, mostly the characteristics of pulps obtainable from panamaniam raw materials.

3. ORGANIZATION OF THE PAPER INDUSTRY, IN PANAMA

The next table shows the panamanian plants devoted to paper industry. The number of these plants are:

a. Pulps Production 0

b. Paper Production 3

c. Paper Conversion (Note A)... 14

c.1. Corrugated Boxes 4

c.2. Multiply Bags 1

c.3. Bags 4

c.4. Cups and Plates 4

c.5. Gray Board and Bristol Board Boxes 3

c.6. Copy Books 2

c.6. Sanitary Towels 1

c.7. Toilet Paper and Towels 1

d. Gray Board Production 1

Note A. The number of conversion plants is 14 instead of 19, because some of them are manufacturing different products

Some of the conversion plants are economically and financially related with two of the paper mills.

PULP, PAPER & BOARD

MANUFACTURES AND CONVERTERS

		LOCATION	BASIC RAW MATERIALS	MAIN PRODUCTS
1	**PULP PRODUCTIONS** No			
2	**PAPER PRODUCTIONS**			
2.a.	Industria Panameña de Papel, S.A.	Panama City	Imported Pulp Local Wastes Imported Wastes	Kraft Paper Mimeograph Paper Medium
2.b.	Industria Papelera Nacional, S.A. (Has conversion department)	Panama City	Imported Pulp Local Wastes Imported Wastes Imported Paper	Tissue Towels Bags
2.c.	Molino Panameño de Papel, S.A.	Panama City	Imported Pulp Local Waste Imported Waste Imported Paper	Tissue Towel
3	**CONVERTERS**			
3.a	Corrugated Boxes			
3.a.1	Corrugado Panamá, S.A.	Changuinola (Bocas del Toro)	Imported Liner Imported Medium	Banana Corrugated Boxes
3.a.2	Chiriquí Land, Co.	Puerto Armuelles (Chiriquí)	Imported Liner Imported Medium	Banana Corrugated Boxes
3.a.3	Envases Industriales, S.A.	Panama City	Imported Liner Imported Medium Local Medium	Corrugated Boxes
3.a.4	Corporación Industrial, S.A.	Panama City	Imported Liner Imported Medium Local Medium	Corrugated Boxes

		LOCATION	BASIC RAW MATERIALS	MAIN PRODUCTS
3.b	Other Conversions Plants			
3.b.1	Manufactura Papelera, S.A.	Panama City	Imported Kraft Paper	Multiply Bags
3.b.2	Firgos Panamá, S.A.	Panama City	Imported Kraft Paper	Bags
3.b.3	Bolsas y Cartuchos, S.A.	Panama City	Kraft Paper	Bags
3.b.4	L. Rodríguez y Cía. S.A.	Panama City	Imported Paper Bristol Board	Bags Cups
3.b.5	Convertidores de Papel, S.A.	Panama City	Imported Paper Bristol Board	Bags Boxes
3.b.6	Solo Container de Panamá, S.A.	Panama City	Imported Board	Plates & Cups
3.b.7	Envases Modernos, S.A.	Panama City	Imported Board	Cups
3.b.8	Copel, S.A.	Panama City	Imported Bristol Board	Cups
3.b.9	Industrias Panameñas, S.A.	Panama City	Imported Board Bristol Board	Boxes
3.b.10	Cajetas Plegadizas DILCYS, S.A.	Panama City	Imported Board Bristol Board	Boxes
3.b.11	Cuadernos Escolares, S.A	Panama City	Imported Paper Imported Bristol Board	Copy Books
3.b.12	Productos Panameños, S.A.	Panama City	Imported Paper Imported Bristol Board	Copy Books

		LOCATION	BASIC RAW MATERIALS	MAIN PRODUCTS
3.b.13	Kimberley Clark, S.A.	Panama City	Bleanched Pulp Tissue Paper	Sanitary Towels Paper Handkerchied
3.b.14	Papelera Istmeña, S.A.	Panama City	Tissue Towel Paper	Toilet Paper Towels
4.	Board Production			
4.a.	Grupo Industrial Panamá, S.A.	Los Santos	Local Waste	Gray Board

4. RAW MATERIALS,FOR PULP AND PAPER MANUFACTURE, TO BE CONSIDERED IN PANAMA

Several sources of raw materials, for pulp and paper manufacture can be considered, in Panama, the most important are indicated in the following list.

Wastes:

- -Social Wastes ..... Waste Paper
- -Industrial Wastes ..... Waste Paper
  Sugar cane Bagasse
  Sawmills Wastes
- -Agricultural Rejects ..... Rice Straw
  Banana Stems
  Others

Special Crops

Reforestation

Natural Forests:

- -Homogeneous Forests
- -Heterogeneous Forests

4.A. WASTE PAPER

The panamanian availability of waste paper can be estimated as follows:

	1973/74/75 (Average) Metric Tons.	1985 (Estimates) Metric Tons.
i. Total Paper Conversion	75.295	128,884
ii. Banana Boxes, for Export	32.410	39.502
iii. Diference	42.885	89.382
iv. Trimming of Banana Boxes	1.600	2.000

v.	Other Wastes	12.400	27.000
vi.	Total of Waste	14.000	29.000

The most important sources of waste paper, in Panama, are:

-Corrugate Boxes Factories	Trimmings
-Colon Free Zone	Corrugated Boxes and Wraping Papers
-Commerce (Mostly in Panama City)	Corrugated Boxes and Wrapping Papers
-Conversions Plants	Trimmings
-Printing	High Grade white cuttings
	Coloured wood free cuttings
-IBM Machines	IBM Cards
-Goverment Offices, banks, offices	Miscellaneous
-Home	Miscellaneous
	Newpapers and Magazines.

4.B.SUGAR CANE BAGASSE

1. Sugar cane cultivated in Panama

Average contnts of sucrose and fibre, of sugar cane varieties normally cultivated in Panama, are:

sucrose	8 to 9%
fibre	18 to 16%

2. Sugar cane products obtained in Panama

The most important are:

a. Raw sugar, refined sugar and molasses	in two sugar mills, having each one a crushing capacity of about 7.000 Tons. per 24 hours
b. Raw sugar and molasses	in three sugar mills, having each one a crushing capacity of about 7.000 tons. per 24 hours and in a sugar mill, having a crushing capacity of 2.500 tons. per 24 hours
c. Fancy Molasses	in two small sugar mills connected with rum factories
d. Non Centrifuged sugar	in several hundred very small mills operated with one or two horses, a little motor or by hand; these mills are irregularly operated, their total production is low.

3. Lengh of the "zafra"

In Panama, it is relatively short: 4 to 4.5 months.

4. Present uses of bagasse

Actually, in Panama, bagasse is used as a fuel and constitutes the main energy source of sugar mills.

Due to the high fiber content, the three sugar mills, producing only raw sugar and molasses, have an excedent of about 17% of their total bagasse production.

5. Disponibility of Bagasse

Two concepts of bagasse disponibility can be considered:

a. The totality of the bagasse obtained, and

b. The excess bagasse or excedent of bagasse, after covering all the energy demand of the sugar mill.

5.a. Disponibility of bagasse, on base of the totality of bagasse

For the 3 sugar mills, of 7.000 tons capacity, indicated in (2 b.) the disponibility estimate is·

-Crushing: 7.000 Tons. of sugar can/day of 24 hours

-Zafra 120 days/year

-Fibre content: 17%

-Totality of bagasse in a sugar mill·

7.000 x 120 x 17% = 142,800 Tons./year

-Totality of bagasse in 3 sugar mills:

142 000 x 3 = 438 000 Tons./year

5.b. Disponibility of Bagasse, on Base of excess Bagasse

For the 3 sugar mills, of 7.000 Tons. capacity, indicated in (2.b) the disponibility is·

in a sugar mill:

142 000 x 17% = 24.000 Tons./year

in three sugar mills:

438.000 x 17% = 72 000 Tons./year

6. Distances between the 3 sugar mills previously considered

For a first estimate, figures are:

a. Ingenio de Alanje	475 Km west of Panama City
b. Ingenio de Veraguas	255 Km west of Panama City
c. Ingenio de Pacora	35 Km east of Panama City

The concentration of all the bagasse in one pulp and paper plant, locate at the center of gravity of these 3 sugar mills will represent transport distances of 250 Km for the two sugar mills of Alanje and Pacora. This will represent problem of cost, logistic and intensive use and congestion of roads.

4.C. SAWMILL WASTES

The most important species processed in Panamanian sawmills are:

Prioria copaifera	Cativo
Callophyllum Brasillensis	María
Vitairea sp	Amargo
Copaifera Amoratica	Cabimo
Nectandra sp	Aguacatillo
Bombacapsis Quinata	Cedro Espino
Cedrella Mexicana	Cedro Amargo
Anacardium Excelsum Skeels	Espavé

In or near Panama City, are located the two most important sawmills of the contry. The basic data of their operations are:

-Total production (of the two sawmills) 30.000.000 board feet/year.

-Total waste Production: 20,000.000 board feet/year
1.700.000 cubic feet/year

-Specific Gravity 10 to 20 Lbs./Cubic feet

-Waste: Total weight per year 11,000 Metric Tons.

Actually, all these sawmill wastes are burned and represent some operating cost. Consequently there is the possibility of obtaining them at a very low price.

The main difficulties are two: (1) Small Quantity and (2) Mixture of several species.

In addition to the rejects of these two sawmill, the possibility of adding the rejects of the Bayano sawmill can be considered.

4.D. RICE STRAW

General Data

Region	Hectares	Production Wet rice Grain Met. Ton./year	Begening of Harvest	End of Harvest
Chiriquí	4,625	11,487	22 Ago.	28 Enero
Veraguas	1,313	3,366	7 Sep.	13 Enero
Herrera	819	1,645	8 Nov.	16 Enero
Coclé	1,579	3,574	16 Nov.	10 Enero
Capira	1,155	2,593	27 Sep.	30 Dic.
Colón	60	148	8 Nov	
Chepo	229	295	17 Oct.	23 Dic.
Los Santos	207	800	23 Nov.	12 Enero
TOTALS	10,084	23,907		

Present Uses of Rice Straw

Normally left in the field. Small quantity is used for cattle feeding.

Harvesting Method

Mechanical

Rice Straw Production

At small scale operation, the following results have been reached: 1 hectare produces 175 to 200 bales of 25 pounds each one.

Minimun Estimate:

175 x 25 x 10.083 : 2204 = 20.000 Tons. wet rice straw/year

Maximum Estimate:

200 x 25 x 10.083 : 2204 = 23.900 Tons. wet rice straw/year

Observations

a. Rice plantations are not concentrated, but scatered in practically all the country.

b. There is a tendency for varieties of lower height and consequently of low rice straw production.

c. A project based on rice straw will require:

-Change the harvesting machines;

-Transport the rice straw,sometimes at long distances;

-Store the rice straw, because the rice crop varies from 4 to 5 months per year.

4.E. BANANA STEMS

Basic data regarding banana production, in Panama, are:

a. Area ..... 15.000 Hectares
of which about 50% on the Atlantic Coast, next Costa Rica and 50% on the Pacific Coast, next Costa Rica;

b. Density: ..... about 1.500 plants per hectare

c. Population: ..... 22.500.000 Banana Plants

d. Weight of Stems .... 40Kg.

e. Dry Substance in Stem 8.35%

f. Cellulose in dry Subtance 29.03

g. Total weight of cellulose per year
22.500.000 x 40 x 8.35% x 29.03% = 22.000 Tons.

Previous figures, mostly of (e) and (f) are the result of a very limited number of samples and result (g) must be considered as tentative.

Actually, banana stems are cut and let in the field where they decay, after harvesting the banana bunches.

4.F. BANANA BUNCH STEMS

Basic data regarding banana bunch stems availability are:

a. Number of bunches harvested per year 22.500.000

b. Weight of a banana bunch stem ..... 1.5 Kg.

c. Dry substance in bunch stem 6.32%

d. Cellulose in dry substance 45.74%

e. Total weight of cellulose per year

22.500.00 x 1.5 x 6.32% x 45,74% = 975 Tons.

Previous figures, mostly of (c) and (d) are the results of a very limited number of samples and result (e) must be considered tentative.

The banana bunches are transported to the packing stations, where hands are separated of bunch stems. Consequently the banana bunch stems are concentrated in 64 packing stations.

Not all packing stations have the same capacity, but their average production is of approximatively 527 Tons. of bunch stems per year.

4.G. OTHER AGRICULTURAL WASTES

Other agricultural wastes, such as pineapple leaves and others would be difficult to be considered at present time or would have to be considered at very low levels of production.

4.H. SPECIAL CROPS

The use of special crops, as source of raw material, for pulp and paper production, would be difficult to be considered, because of the relative scarcity of land able for mechanized and intensive agriculture; economically it would be necessary

to compare these special crops with the normal uses of land, that is: rice, beans, corn, sugar, cassava, yams, potatoes, cattle-grazing, etc.

4.1. REFORESTATION

This source of raw materials, must be considered for future developments, in Panama, of the pulp and paper industry, as well as to avoid the increasing destruction of land.

Basic data for the estimation of this resources are:

a. Area presently available for reforestation: 1,200.000 Hectares;

b. Present destruction rate of forests: 40.000 Hectares/ year

c. RENARE (Recursos Naturales Renovables), a branch of the Panamanian Government, is carring out a reforestation program and some of its results are the following ones;

i. Area which has been reforested·

Veraguas Province·

-La Yeguada ..... 2.700 Hectares

-Santa Fé .....400 to 500 Hectares

-Los Valles de Cañazas .. 400 to 500 Hectares

-Total ..... 3.500 to 3.700 Hectares

Other Provinces:

20 Parcels of 3 to 5 Hectares each one

ii. Spacies used for reforestation:

-In Veraguas Province Pinus Caribensis V Hondurensis

-In other Provinces Pinus Caribensis V Hondurensis

Eucaliptus

Cedro Espino

Gemina Arborea

Albicia Falcata

Terminalia Aborensis

Bamboo has never been used

iii. Results·

-Production: 20 to 30 cubic meters per hectare per year

-Average growing time: 10 to 15 years with Pinus c.

8 to 10 years with other species

4.J. HOMOGENEOUS FOREST

This forest is located in Bocas del Toro Province, on the Atlantic coast, next Costa Rica. It is not exactly homogeneous, but there is a predominant species, called "orey" Camnosperma panamiensis.

The exact volume of this forest is not well known, mostly due to two causes: (1) an accurate survey has not been carried out and (2) it has been submited to some timber extraction for sawmilling and for woodwool cement board manufacture.

There are different data regarding orey disponibility, but they do not concord among themselves.

Haldridge presents the following ones:

-Area 10.185 ha

-Density 212 m^3/ha

-Volume 2.159.220 m^3

Other report shows:

-Area 43.200 ha

-Density 360 m^3/ha

-Volume 15.192.000 m^3

Apparently, differences are nostly due to concepts regarding the extension of the area where an economic forest exploitation can be carried out.

According to a more recent report the area and volumes are given by the next table.

Forest	Density	ha	1.000 m^3
Mixed (without cuipo)	high	327.150	57.312
Mixed (without cuipo)	low	562.400	42.113

Protection	high	328.150	6.609
Orey	high	51.650	19.794
Orey	low	10.850	1.580
Small tree-top species		106.000	
Totals		1.386.200	127.408

Note: Cuipo is Cabanillesia plataniefolia

4.K. HETEROGENEOUS FORESTS

With the only exception of Boca del Toro province, which has a predominantly homogeous forest, the other panamanian ones are heterogeneous. The most important, from a pulp and paper stand point are:

4.K.1. DONOSO FOREST

Donoso district is located on the Atlantic coast, at approximatively 1/5 distance of Colon City and 4/5 of Changuinola.

Most important data of its forest are:

-District area 153.500 ha

-Covered with trees 82% 126.050 ha

-Wood availability

species	diameter (cm)	volumen (m^3)
All	(-) 40	4.118.000
All	(+) 40	6.146.000
All	All	10.264.000
10 dominant	(-) 40	971.000
10 dominant	(+) 40	2.651.000
10 dominant	All	3.622.000

Other	(-) 40	3.147.000
Other	(+) 40	3.495.000
Other	All	6.642.000

4.K.2. DARIEN

Darien represents the largest and most important forest resources of Panama and has a very large number of species of different genera and families.

Darien area represents the possibility of a complex project including: sawmilling, veneer, particle board and pulp.

Because of the lack of sufficient hydro-electric possibilities, ports and other circumstances, this complex project requires a careful study.

4.K.3. BAYANO

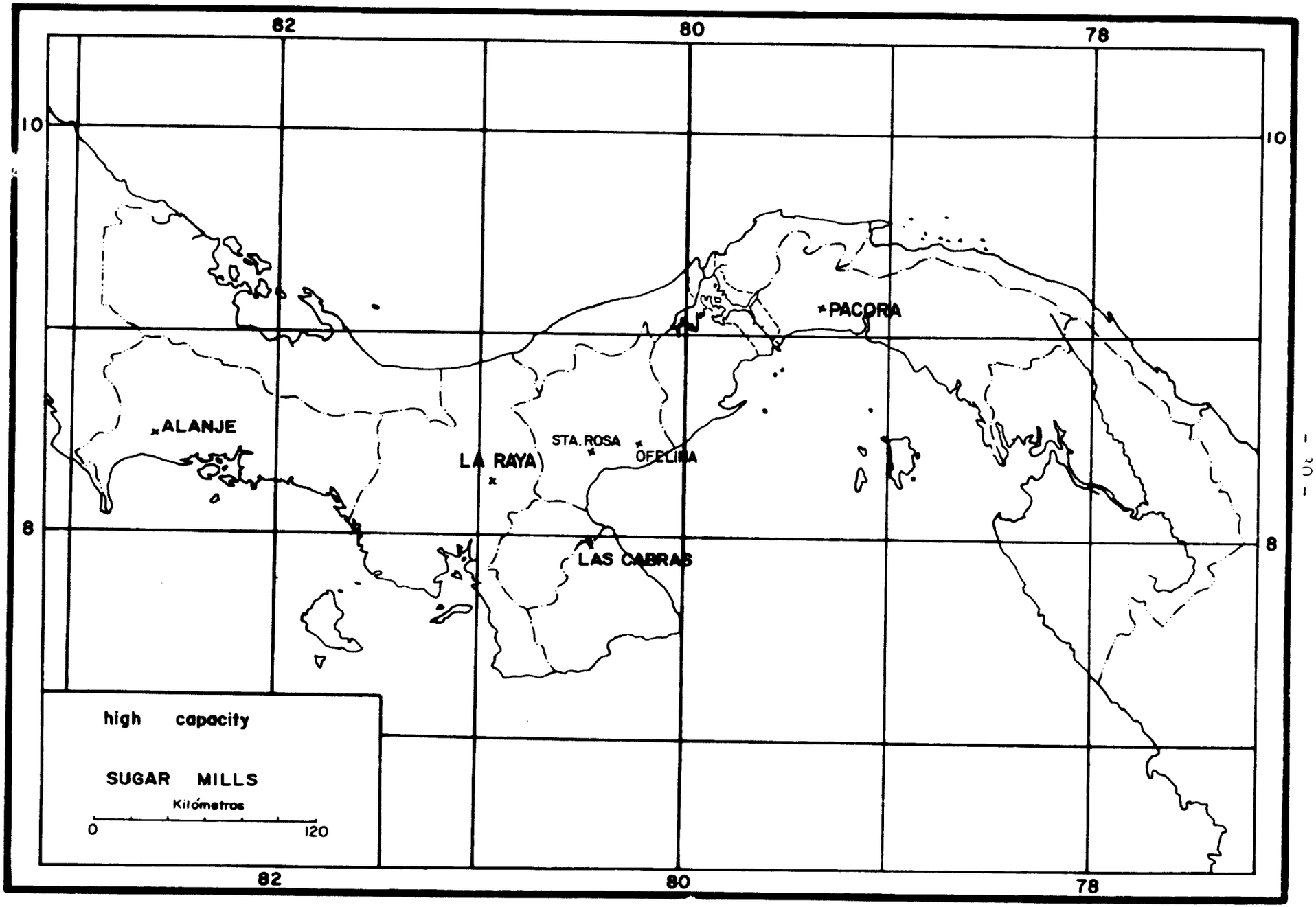
Bayano area present several peculiarities, the most important of them are: (1) its forest has an estimated area of 320.000 ha, (2) it is the site of important source of wood for Panama City industry and (3) an hydro-electric project has been implemented very recently, the most important characteristics of this project are:

Reservoir	300 km^2
Reservoir	4.000 x 10^6 m^3
Electric plant power	150 MW

There are several different opinions regarding the size of the forest to be reserved exclusively for protection of the Bayano river basin, for protection against erosion and to avoid filling of the reservoir with alluvion.

A sawmill, with a capacity of 18,000 boardfeet per day has been recently built in Bayano area.

PANAMA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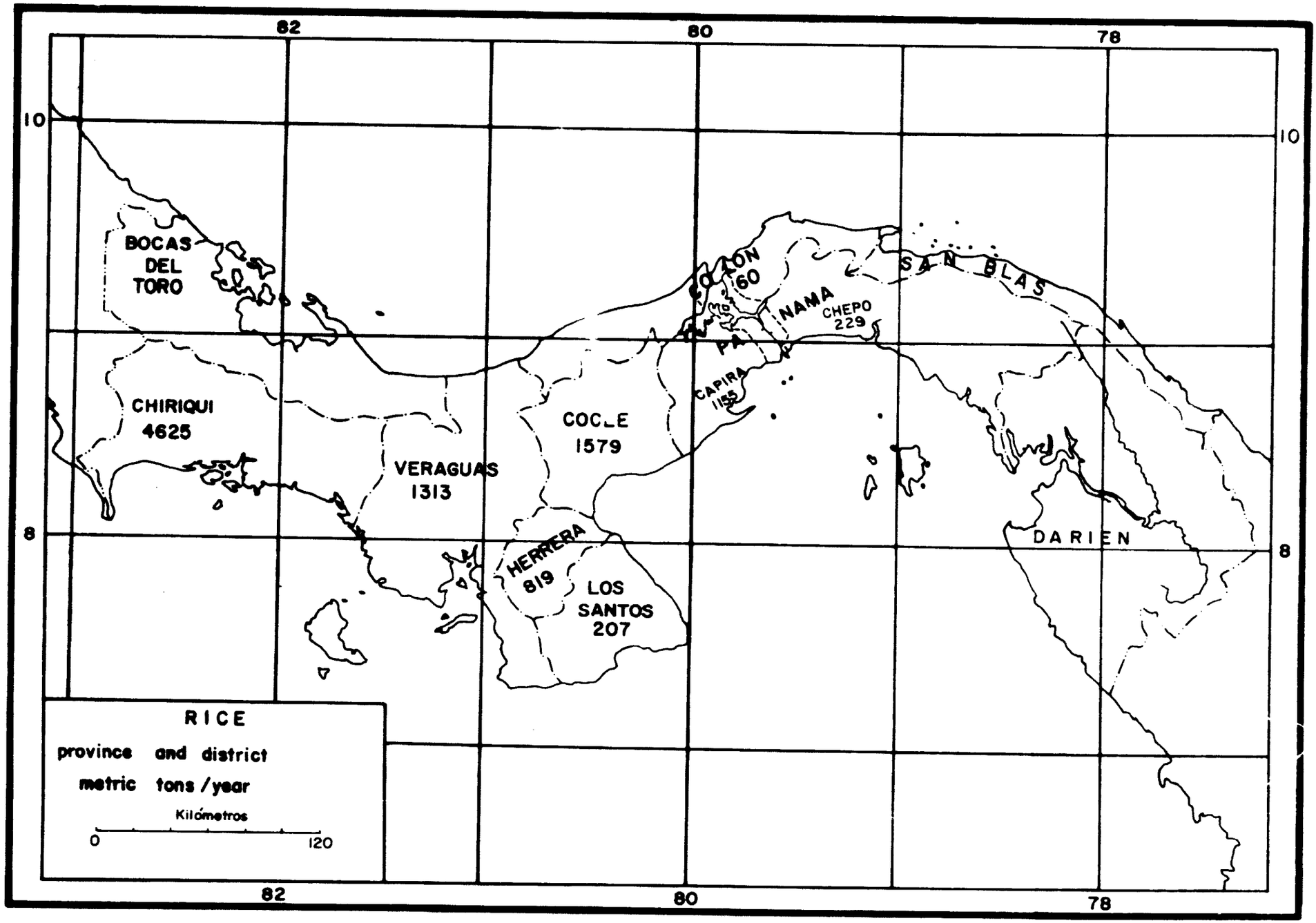
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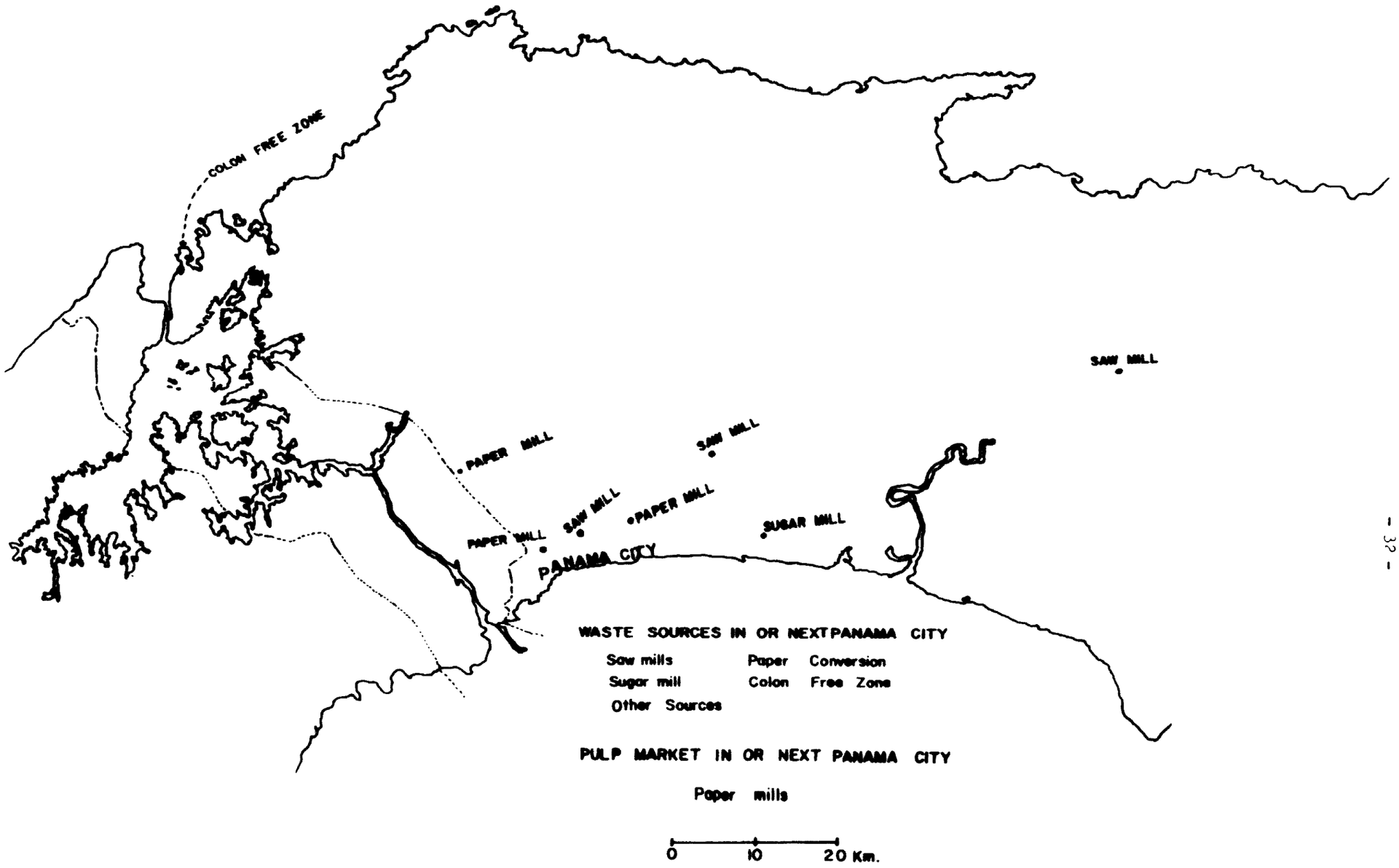
CAPIRA 1155
SAN BLAS
DARIEN
RICE
province and district
metric tons / year
Kilómetros
0
120


COLON FREE ZONE
SAW MILL
PAPER MILL
SAW MILL
PAPER MILL
SAW MILL
PAPER MILL
SUGAR MILL
PANAMA CITY
WASTE SOURCES IN OR NEXTPANAMA CITY
Saw mills
Paper Conversion
Sugar mill
Colon Free Zone
Other Sources
PULP MARKET IN OR NEXT PANAMA CITY
Paper mills
0
10
20 Km.

5. PULP PROJECTS

Several projects are under consideration. The most important ones are discussed bellow.

5.A. "OREY" PROJECT

Its main characteristics are:

a. Main raw material: "orey" Camnosperma panamensis;

b. Ancillary raw materials: Imported pulp and corrugating plant wastes;

c. Pulp quality: Unbleached;

d. Final products: Liner (made with orey pulp and imported pulp), and medium (made with orey pulp and wastes;

e. Market: the four corrugated boxes plants located at:

- -one in Changuinola and representing approximatively 40% of the market;
- -one in Puerto Armuelles and representing approximatively 40% of the market, and
- -two located in Panama City and representing approximatively 20% of the market;

f. Projected capacity: 130 to 150 Tons. of finished products;

g. Location: next Changuinola and the "orey" forest;

h. Present stage: feasibility studies on progress;

i. Proponent: private enterprise.

5.B. DONOSO PROJECTS

Its main characteristics are:

a. Main raw material: mixed tropical wood of Donoso forest, on the Atlantic coast;

b. Other characteristics: not yet defined;

this project is mostly based on the following facts:

i. Donoso forest is more important that the "orey" forest;

ii. Donoso inventory has been completed and "orey" inventory need to be actualized;

iii. Donoso project will not represent polution problems for "Laguna de Chiriquí" and "Bahia Almirante";

iv. Donoso is a midle distance between Panama City and Changuinola;

c. Present stage: Very Preliminary.

5.C. "OREY" PROJECT, ON BASE OF CHEMICOTHERMOMECHANICAL PROCESS

Its main characteristics are:

a. Main raw material: "Orey"

b. Ancillary raw materials: Imported bleached pulp;

c. Pulp quality: Bleached

d. Final products: Newprint 24.000 Tons./year

Printing & writing 20.000 Tons./year

e. Market: mostly Panama City

f. Present stage: Preliminary

g. Proponent: Cocument FO: DP/INT/74/026 FAO

5.D. MIXED TROPICAL BROADLEAVED WOOD PROJECTS

There are two:

5.D.1 Bayano Project

Its main characteristics are:

a. Main raw material: Mixed tropical woods;

b. Quality pulp: Chemical pulp;

c. Location: Bayano;

d. Stage: Preliminary;

e. Proponent: Document FO: DP/INT/ 74/026 FAO

5.D.2 Darien Project

a. Main raw material: mixed tropical wood

b. Quality pulp: Chemical pulp

c. Location: Darien

d. Stage: A report has been prepared by a consultant firm.

5.E. RICE STRAW PROJECT

Its main characteristics are:

a. Basic raw material: Rice straw;

b. Pulp quality: Unbleached;

c. Final Products: Liner and medium;

d. Market: Corrugated boxes plants;

e. Present stage: Preliminary

f. Proponent: Private enterprise.

5.F. BAGASSE PROJECT

Its main characteristics are:

a. Basic raw material: Sugar cane bagasse;

b. Ancillary raw materials: Imported pulps;

c. Quality Pulp: Unbleached and bleached;

d. Final Products: Corrugating paper and cultural paper;

e. Location: Pacora, next a sugar mill;

f. Capacity: 50.000 Tons. paper per year;

g. Present stage: Feasibility study completed;

h. Proponent: Corporación Financiera Nacional.

5.G. SAWMILL REJECT PROJECT

Its mains characteristics are:

a. Main raw materials: Sawmill wastes and trimmings;

b. Present Stage: Laboratory tests are being carried out, using two species, in accordance with a UNIDO project; it could be convenient to consider the possibility of expanding laboratory tests to other species;

c. Proponents: Ministerio de Comercio e Industrias.

5.H. PROJECT ON BASE OF SEVERAL REJECTS

Its main characteristics are:

a. Main raw materials: Sawmill rejects and trimming, excess gabasse of some sugar mill and other rejects;

b. Products: Unbleached and bleached pulps;

c. Location: Between Panama City and Pacora;
the three existing papermills are located in Panama City; the two most important sawllmills are located in or next Panama City;
the Bayano sawmill is located more or less a 70 Km east Panama City and
the Pacora sugar mill is located about 35 Km east Panama City;
there is some rice production at relatively short distance;

d. Present Stage: Very preliminary.

6. NECESSITY OF A RESEARCH & DEVELOMENT PROGRAM

Nine projects are presented in the previous chapter of this report.

Most of them, if not all of them will require, in higher or lower degree of R. & D.

6.A. R & D. PROGRAM

The R. & D. program to carry out will have to cover at least the following aspects.

a. Determination of the "structure" of the country.

At the effects of this report, the word"structure" includes all the elements (more or less constant) whose knowledge is necessary due to their economic importance.

b. Compilation of data and complementary survey, if necessary, of raw material sources

1.c. Determination of R. & D. to be carried out

i. In the field,

ii. At laboratory scale and

iii. At pilot plant scale.

R & D. has to be carried out to determine the most "appropiate tecnology", in accordance with the "structure" of the country.

Examples of R. & D. to be carried out are indicated under paragraph 6.B.

1.d. Implementation of R. & D.

1.e. Evaluation of Experimental Results

1.f. Sellection of Projects to be Evaluated

1.g. Feasibility Studies of sellected Projects

1.h. Comparison Study of sellected Projects

1.i. Conclusions and Recommendations

6.B. EXAMPLES OR R. & D. TO CARRY OUT

a. For Banana Stem

a.1. Compilation of available data (report, publications, etc.)

a.2. Experimental Research

From the stem, in the banana plantations, up to the pulp production, the following steps have to be considered:

i. Cutting of the stem;

ii. Transport of the stem to the site of the "1st. operation";

iii. "1st. operation": Separation of the fibrous parts from the central part of the stem;

iv. Transport of the fibrous parts to the site of "2nd. operation";

v. "2nd. operation" separation of fibre (in the textile meaning) from parenchima and bonding materials;

for this step several processes are possible:

mechanical, chemical and biological;
the mechanical and chemical processes would require a more complicated technology;
the spontaneous biological process (if possible) would require a less complicated techonology;
the controlled biological process (if possible) would be a little more complex than the previous one but less than de mechanical and chemical ones;

vi. Transport of fibre (in the textile meaning) to the pulp plant;

vii. Pulp Production: This step will require a careful research; for the determination of the most convenient or appropiate technology, in accordance with local conditions.

b. For Banana bunch Stems

b.1. Compilation of available data (report, publication, etc.).

b.2. Experimental Research

From the banana bunch stem, in the packing planta, up to the pulp production, the following steps have to be considered:

i. Transport of the bunch stems to the site of "1st. operation"

ii. "1st. operation": separation of the fibre (in the textile meaning) from parenchima and bonding materials;

comments as per "2nd. operation for banana stems;

iii. Transport of fibre (in the textile meaning) to the pulp plant;

iv. Pulp production: Same comments as per "pulp production" from banana stems.

c. Bagasse

Complete revision of parenchima separation methods and experimental research for development of new methods for parenchina and bonding materials separation.

7. ORIENTATION OF THE R. & D. PROGRAM

The goals of preparation and evaluation of industrial projects have suffered rapid variations and it is logical to accept the possibility of new ones in the present and future orientation of these projects and consequently of P. & D. Programs.

As the writter's experience has been reached very mostly in developing countries, where the free enterprise system was accepted, at the same time than mixed enterprise and government enterprise systems, it is evident that the following exposition presents only a partial aspect of the evolution of basic ideas in industrial projects. The chronological order of these ideas is hereinafter presented.

1. Technology and Enterprise Economy

From the stand point of pure technology, some of the goals to be reached are:

i. Higher yield (quantity of products/quantity of raw materials);

ii. Best quality of products;

iii. Minimum o no variation of product quality;

iv. Higher productivity (quantity of products in relation with the material factor to be considered);

v. Higher % of use of installed capacities;

vi. Best use of energy;

vii. Higher mechanization or automation, and other goals.

But, experience has shown that a higher technological efficiency is not always synonim of higher economic efficiency, measured, in example, by return on capital.

2. Technology and plant location

Surveys carried out in several countries have shown the economic convenience of specific projects (bassed on the same raw materials, the same process, the same technology and the same products) varies from a country to another one, in accordance with local costs of:

i. Electric energy

ii. Fuels (thermic energy);

iii. Chemicals

iv. Other material imputs;

v. Labour;

vi. Depreciations;

vii. Financing, etc.

In other words a project can be economically convenient in a country and not in other ones.

3. Enterprise Economic Convenience and National Economic Convenience

The economic convenience of an industrial project, from

The enterprise stand point, is normally measured through several instruments such as:

i. Profit and loss statement
ii. Break-even point;
iii Cash flow
iv. Internal return rate and other ones

But the economic convenience of the enterprise is not always coincident with the national economic convenience. This last one can be determined through different methods and instruments, in accordance with the specific conditions of each contry and the Government policy. In Panama, at present moment, the instruments used for determination of the nacional economic convenience of specific industrial projects are:

i. Effects on Government revenue
ii. Effects on balance of trade;
iii. Effects on employement;
iv. Effects on use of national raw materials and other material inputs;
v. Gross added value, at market price,
vi. Net added value, at market price
vii. Effects on consummer.

4. Transitory and Permanent Effects

From the enterprise and the national stand point, an industrial project can have present or transitory convenient effects and by the contrary can have noxious future or permanent effects for the country, for a region or for the world.

The noxious effects of industrial projects can be easily established and, in most of the cases, there are well known methods for avoiding these effects, even when such methods can be of expensive or difficult implementation.

There is the imperative and urgent necessity of establishing objective and quantitative methods or instruments able to determine if an industrial project is or not convenient from the stand point of transitory and permanent effects.

7.A. ORIENTATION OF A R. & D. PROGRAM FOR PULP AND PAPER INDUSTRY

What has been previously indicated, in this report, can probably to establish the orientation of a R. & D. program organized to lead a plan for promotion of the pulp and paper industry in a country as Panama, as well as in other countries where special plants can be requiered for the promotion of the pulp and paper industry.

Panama offers several interesting and sometimes complicated aspects from the stand point of industrial development and specially for the development of pulp and paper industry. Some of these aspects are:

-Panama is a small country, its"structures' are well known and are quite similar to the ones of other third world countries;

-There is the availability and possibility of diversified sources of pulp raw materials these raw materials can be considered for a first stage consisting in the construction and operation of a pilot plant and for a second stage, at industrial scale

-The existing papermills offer the possibility of processing the pulps obtained in the pilot plant;

-The existing conversion plants offer the possibility of processing the papers manufactured with pilot plant pulps;

-The paper market is small, but complex, and offers the possibility of studying the demand reaction to papers and paper products manufactured at experimental stage.

Consequently, Panama can be used as a site for a R. & D. pilot program, which would include such aspects as:

-Technological works, using local and / or foreign research facilities;

-Economic studies, at enterprise level,

-Economic studies, at national level,

-Studies of transitory and permanent effects at national and wider levels, and

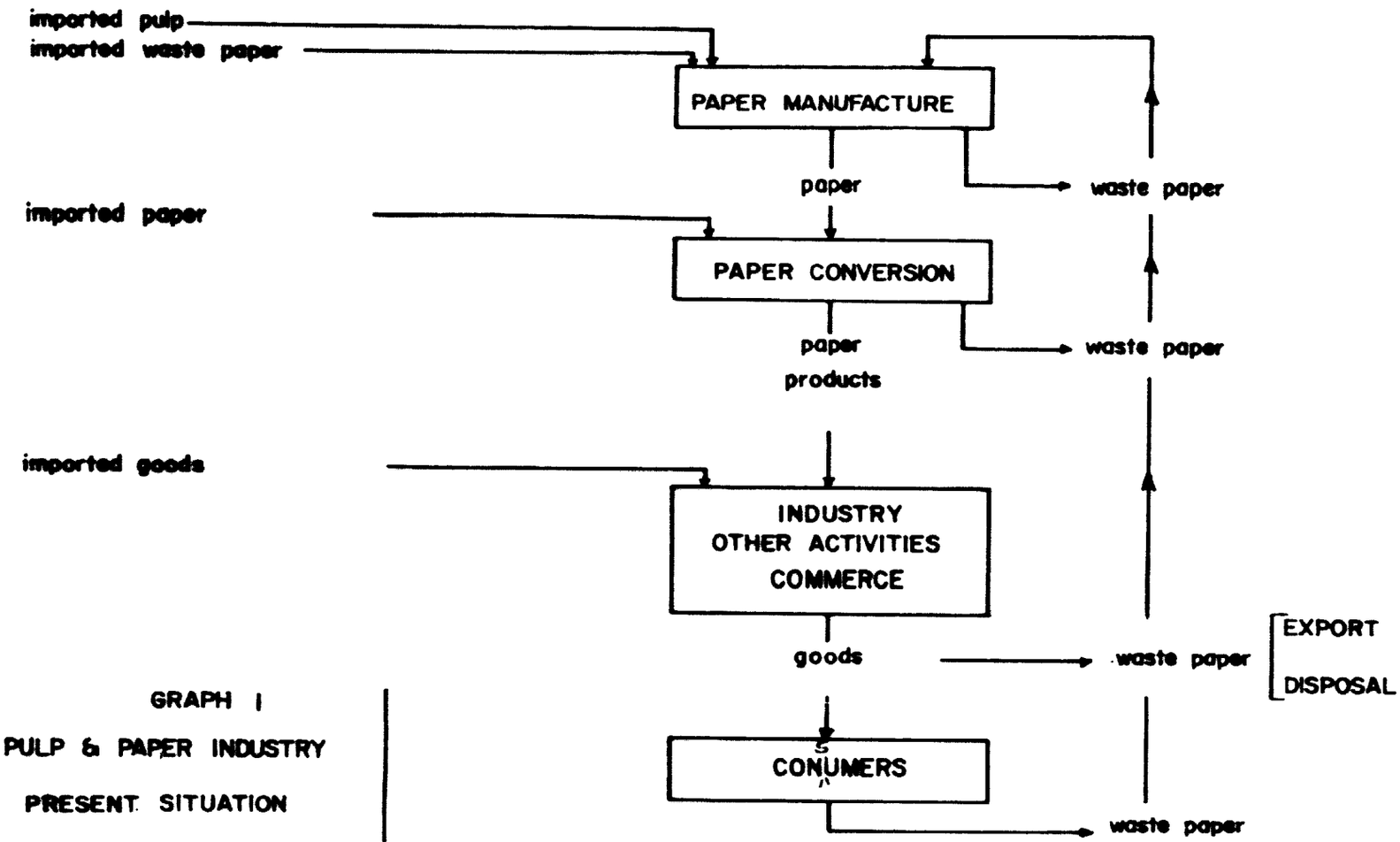
-Implementation of a pilot plant project.

This R. & D. program would be oriented not only as a local panamanian program, but as a world program, in search of the "most appropiate technology" to be applied in each country, in accordance with its own circumstances.

Some of the most important objectives of the R. & D. program would be:

-Use of local raw materials, able to yield high quality pulps;
-Development of processes able to allow the construction of pulp plants, having capacities much lower than the normally considered "minimum economic capacities", and
-Design of plants and equipment having common characteristics, in order to reach minimum investment costs.

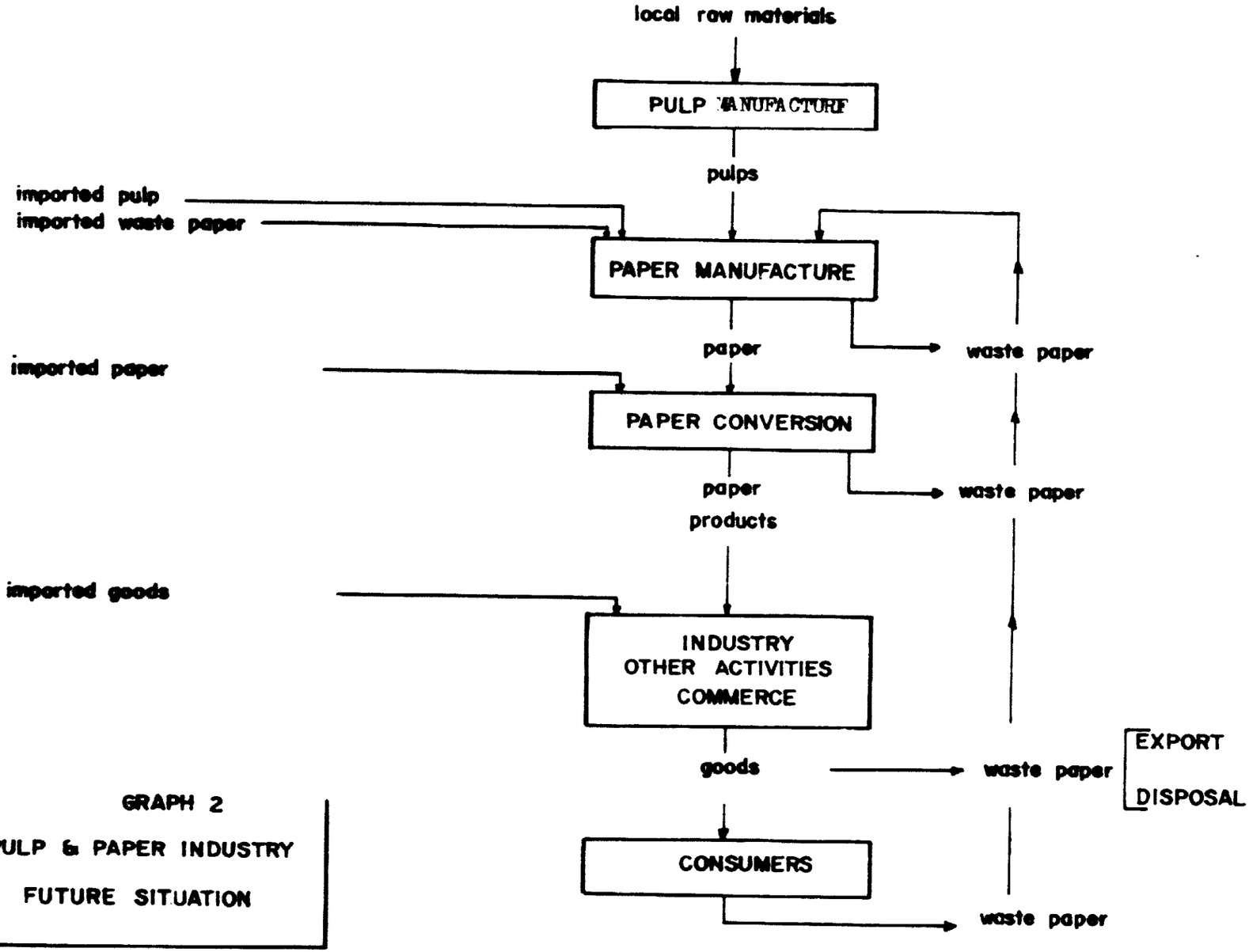
Evidently, for a serie of well known reasons, it will not be easy to reach such objectives, but it will not be impossible and the implementation of the program is highly recommended, due to its great importance for the developing countries.



GRAPH 1

PULP & PAPER INDUSTRY

PRESENT SITUATION



GRAPH 2

PULP & PAPER INDUSTRY

FUTURE SITUATION

ANNEX 1

POSSIBILITIES OF "APPROPRIATE TECHNOLOGY" IN PANAMA

1.1. GENERAL CHARACTERISTICS OF "APPROPRIATE TECHNOLOGY"

In accordance with several authors, the general characteristics of "appropriate technology" are:

a. Low capital investment
b. Small capacity of industrial plants;
c. Use of traditional technologies;
d. Use of local raw materials·
e. Use of locally manufactured industrial equipment;
f. No requirements of complicated training·
g. Low consumption of fossil fuel and preference for use of inexhaustible and reproducible sources of energy;
h. Not harmful to the eco-system;
i. Not materially harmful to human society;
j. Not psycologically noxious.

The possibilities of finding, in Panama, propitious conditions for these general characteristics are discussed and special references are made to pulp and paper industry.

1.2. DISCUSION

A. SMALL CAPITAL INVESTMENT

Funds, for enterprises requiring small capital investment, are available in Panama. The most important lending sources, for such enterprises, are the following ones:

A.1. "PROGRAMA DE FINANCIAMIENTO PARA LA PEQUEÑA INDUSTRIA"

Operated in the Ministerio de Comercio e Industrias

Fund Disponiblility ..... US$ 348.000

This fund was established, on 1965, as a "pilot" operation, with US-AID/Panama and DISA' help and it has been progressively increased with Government grants;

Range of loans:

From 1.000

Up to 15.000

This program can be considered a "pilot" operation.

A.2. "PROGRAMA PARA LA PEQUEÑA Y MEDIANA INDUSTRIA"

Operated by the Banco Nacional de Panamá (BNP)

Fund Disponibility

	IDB Loan	BNP Funds	Total
For Small Size Industies	US$ 3.000.000	1.500.000	4.500.000
For Medium Size Industries	2.000.000	1.000.000	3.000.000
Totals	5.000.000	2.500.000	7.500.000

Range of Sub-loans:

From ..... US$ 25.000

Up to ..... Not Established

A.3. "PROYECTO URBE"

Totality of fund is US$ 28.700.000. This fund is divided in several parts. The ones dealing or related with industrial projects are:

a. Financiamiento a Pequeños Negocios

(Small Business Financing)

Fund Disponiblility ..... US$ 3.800.000

Range of Sub-loans:

From 1.000

Up to 50.000

This fund will operate, starting January 1979, in the Provinces of Herrera, Los Santos, Veraguas and Chiriquí. The other Provinces will be covered, after January 1979, by Programme (A.1).

b. Préstamos a Proyectos Agro-Industriales

(Loans to Agro-Industrial Projects).

Fund Disponibility ..... US$ 4.600.000

Range of Sub-loans:

From ..... Not yet Established

Up to 500.000

c. Industrial Parks

Fund Disponibility ..... US$ 2.400.000

Range of Sub-loans: .....Not Established.

Proyecto URBE has been established in collaboration with US-AID Panama.

A.4. "BANCO DESARROLLO INDUSTRIAL, S. A." (DISA).

DISA has been established with US-AID/Panama loans and Panamanian private sector capital.

DISA can be considered as a source of loans for medium and large size industrial projects.

A.5. "CORPORACION FINANCIERA NACIONAL" (COFINA)

COFINA is a relatively new Government Organization.

It can act as investor (buying stocks) and /or as lender.

Range of Sub-loans:

From ..... US$ 15.000

Up to ..... Not Established.

A.6. CREDITS OF MACHINERY IMPORTERS

Machinery importers use to grant credits to small industrialists, using sold machinery and other collaterals as security. normally these credits are extended to only two or three years.

A.7. COMMERCIAL BANKS

Commercial banks loans are available to small industrialists, but enough securities are required and terms are normally limited to a few years.

A.8. CREDITS OF FORFING SUPPLIERS

These credits are only available for large operations.

A.9. INTERNATINAL FINANCING ORGANIZATIONS

These organizations use to loan to local financing institutions and these ones are in charge of sub-lending.

B. SMALL SCALE OR SMALL CAPACITY OF INDUSTRIAL PLANTS

In Panama there is no traditional or legal difficulties for the operation of small scale industrial plants.

Next table presents some data corresponding to year 1971. (There is no available data for factories having less than 5 employes, for dates posterior to 1971), it must be added that after 1971 several medium and large industrial plants have been opened and other ones have increased their capacities.

	Factories with more than 5 employes	Factories with less than 5 employes	
Number of factories	722	550	
Number of employees	26.665	1.190	
Salaries (US$)	56.699.000	676.000	Per Year
Sales of Products (US$)	430.415.000	5.001.000	Per Year
Employees/Factory	37	2.2	
Salary/Employees	2.126	568	
Sales/ Factory (US$)	596.143	9.093	Per Year
Sales/ Employees (US$)	16.152	4.202	Per Year

B.1 SCALE OF PAPER PLANTS AND PAPER CONVERTERS IN PANAMA

Regarding paper manufacture and conversion in Panama, the following figures are illustrative regarding the scale plant aspect.

Paper Mills:

Number: 3

Total Production (Average 1973/74/75) ..... 13.000 Tons./Year

Average Production Per plant ..... 4.333 Tons./Year

Total Demand of Liner and medium for corrugated boxes

-For Banana boxes in Changuinola and Almirante	49.502 Tons/Year
-For other boxes	10.000
-Total	59.502

Total Demand of Wrapping Paper Qualities

-For Corrugated Boxes	59.508 Tons/Year
-For bags	8.319
-For others	25.351
-Total	93.172

Demand of Printing and Writing Qualities

-Newsprint	7.198 Tons/Year
-Others	12.444
-Total	19.642

Demand of other papers, distributed among a large number of different qualities 26.070 Tons/Year

The possibility of very small pulp and paper plants for the production of 93.172 Tons./per year of wrapping papers and of 19.642 tons. per year of printing and writing papers must be considered at the light of several aspects such as:

-Total investment: thecost of a large number of very small pulp plants can be higher than the cost of one or two plants having the same total

capacity;

-The Production Cost: US$ Per Ton of pulp.

-The quality of papers: The banana boxes are submited to specific quality standards, consequently the liner and medium papers also submited to specific standards. the same must be said for printing and writing papers; it is evident, that a revision of standards is required to avoid the necessity of unnecessary high qualities;

-Total consumption of energy and chemicals: It must be determined if the total consumption of energy and chemicals, as well as the possibility of energy and chemical recovery through processing of black liquors can be considered in very small pulp plants. the convenience of continuous process from the raw material, through the pulp and up to the paper must be considered from an energy saving stand point.

C. USE OF TRADITIONAL TECHNOLOGY

Regarding the possibility of using, in Panama, traditional technologies of this country, it is convenient to present a brief of their history.

C.1. PRECOLOMBIAN ERA

When Columbus arrived, in 1.502, at the Atlantic coast of what is today Panama, the aborigines of this region were at the stone age, with a total unknowledge of metals, with exception of gold. Their technological progresses were limited to a few activities such as pottery, use of earthly and vegetable pigments, stone carving, production of a few vegetable fibre objects and some uses of wood.

C.2. COLONIAL ERA

During the colonial period (1502 to 1821) and principally during its first decades, there has been some important developments in the construction of buildings (fortresses, churches, convents and official buildings) and vessels based on European imported technologies.

Of this period, is the slow development of several crafts: home construction, carts, low quality furnitures, tannery, blacksmith shops, etc., based on Spanish tradition.

C.3. COLOMBIAN ERA

From 1821 to 1903, when Panama was part of Colombia, the technological development has continued to be very slow and limited to a few activities, one of them introduction of printing.

C.4. REPUBLICAN ERA

From 1903 to 1914, the Panama Canal has been contructed, in accordance with U. S. A. technology. The Canal construction has had relatively very little influence on the development of new industrial or craft activities, in Panama.

From 1914 up to the end of the second world war, the technological development of Panama, continued to be very slow.

After the end of that war and due mostly to the effects of Government Incentive Laws and to the promoting action of new generations, the industrial development of the country has brought up, but always based on foreign imported technology.

In the special field of paper industry, the development has had the following chronological pattern·

i Conversion, on base of imported paper;

ii Paper production, based on local waste paper, imported pulp are imported waste paper· and

iii. Conversion of imported paper, board and Bristol board for the production of more sophisticated products

Logically, the next steps will be:

iv. Combined pulp and paper production, for local consumption at medium term; and

v Pulp production, for export, at longer term.

D. MAXIMUM USE OF LOCAL RAW MATERIALS

Maximum use of local raw materials and of other material inputs is highly recommended, because of its multiplier effects on economy. But it must be submited to special conditions, mostly·

quality, price and delivery time.

In the specific field of pulp and paper, the most important material inputs to consider are:

i. Raw materials (waste paper, industrial rejects, agricultural rejects and wood);
ii. Chemicals for pulping and bleaching; and
iii. Chemicals for sizing.

D.1. DISPONIBILITY OF LOCAL RAW MATERIALS

See chapter 4. raw materials, for Pulp and Paper Manufacture, to be considered, in Panama.

D.2. DISPONIBILITY OF LOCAL CHEMICALS

At present, the Panamanian manufacture of chemicals is almost nil. Among the activities, more or less, related with chemical industry, the following ones can be indicated:

D.2.a. Sea Salt

About 20.000 Tons. of sea salt are produced annually and exclusively sold in the internal market for: home consumption, few industrial applications, cattles, and tuna fish boats. If necessary, the panamanian production of sea salt can be notably increased.

D.2.b. Lime

There are several limestone deposits, some of them

of great importance. All of them of high calcium and low magnesium content.

Actually there are two very small capacity quick lime plants and one of 30.000 Tons. production per year on construction.

Panama has very important chalcopyrite deposits and it is very likely there will be under exploitation in a few years. At this time it will be necessary to build up a large lime crushing and quick lime production plant to cover the demand of the coper plant.

D.2.c. Sulphur Dioxide and Derivatives

Roasting of chalcopyrite will produce large amounts of sulphur dioxide and will oblige to the ancillary installations for its recuperation as well as the complementary production of some basic chemicals and fertilizers.

D.2.d. Sulphur Trioxide and sulphuric acid

Actually there is a local production of these products, but limited by the requirements of detergent manufacture and some other minor demands.

D.3. Reference to the Pulp Industry

To produce pulp, in Panama, it will be necessary to consider possibilities, as the following ones;

i. Use the more convenient chemicals; and very likely to import them;

ii. Use a modification of the Pomilio process, at a very high electricity cost;

iii. Use the old lime process and

iv. Consider the necessity of black liquor treatment, for chemicals recovery.

F. USE OF LOCALLY MANUFACTURED INDUSTRIAL FIXED ASSETS

The possibilities of manufacturing, in Panama, industrial fixed assets are mostly limited to civil engineering works and some metal-mechanical activities.

F 1. Construction Materials

The most important construction material manufactures in Panama are:

a. Portland cement: high quality, in accordance with ASTM specifications

b Cement products premixed concrete, prestressed parts prefabricated modulus (walls, slabs, stairways, etc.) concrete blocks, slabs, asbestos-cement parts etc.

c Clay products: bricks, tubes, sanitary parts

d. Steel bars;

e. Steel wire products barded wires, nails, screw, etc.;

f Timber and wood products

g. Roofing materials: galvanized steel, aluminium, asbestos-cement, tiles, impregnated board

h. Cast iron parts: tubes;

i. Aluminium Extrusions: profiles for window and door manufacturing, etc

F.2. CONSTRUTION OF BUILDINGS AND OTHER CIVIL WORKS

Construction of buildings, roads, bridges and other normal civil works are carried out by local architects, civil engineers and specialized workers.

More specialized civil works, such as important dams and tunnels for hydroelectric plants are normally contracted with foreign specialists.

F.3. STEEL PRODUCTS

Steel products such as structures, tanks and other ones are manufactured in Panama, on base of imported materials.

F.4. MACHINERY MANUFACTURE

There are some machine shops able to manufacture simple machines.

H.5. SHIPYARD AND DRY DOCK

There is a small shipyard, able to build up fishing boats.

At the entrance of the Panama Canal there is a drydock, with capacity for any ship able to cross the Canal.
Next to this drydock there is large capacity machine shop.

F. NO REQUIREMENTS OF COMPLICATED TRAINING

The problem of training difficulties of Panamanian workers does not exist, in a higher grade that in any other country.

Regarding intellectual preparation, in the fields of science and technology, it is relatively easy to contract from common workers (able to read and write) up to university graduates.

Regarding possibilities of being trained, native Panamanians are perfectly adaptable and do not require more intensive programms for their capacitation.

There is an evident lack of industrial experience, but this is due to the low industrial development of the country.

G. LOW CONSUMPTION OF FOSIL FUEL AND PREFERENCE FOR USE OF INEHAUSTIBLE AND REPRODUCIBLE SOURCES OF ENERGY.

G.1. SOURCES OF ENERGY IN PANAMA

Until now no oil deposits have been discovered. There are few known poor quality coal deposits, of very little economic importance.

During this century and specially after 1903 (independence from Colombia) and 1914 (end of the Canal construction), the energy demand has been covered in the following ways:

a. Imported oil and imported oil products: Since 1956 there is an oil refinery (Refinería Panamá, S. A.) able to cover the national demand and to export some oil products, on base of imported oil;

b. Lighting gas: Today substituted by liquid gas, sold in portable tanks;

c. Firewood and Charcoal: mostly in rural areas;

d. Sugar cane bagasse: In sugar mills;

e. Hydroelectricity: Its intensive use is relatively recent: until 10 years ago, all the electric energy was generated in thermoelectric plants (boilers and turbo-generators or gas turbines or diesel) recently an hydroelectric plan has been undertaken and, it is expected, on 1990 or 1995, when the most important hydroelectric resources will be totally employed, they will cover the totality of the national electric demand, in accordance with the historical trend; it is logical to expect that at this time the present thermo-electric plants will be practically out of service.

Actually, several energy projects are more or less considered, such as:

f. Geothermia: Advanced studies, their results will be known in a relatively short time

g. Alcohol (ethanol): Sugar cane product, as a partial substitute of gas, for automobiles:

h. Solar energy: Very few has been done;

i. Mini-dams: Small hydro-electric plants, for isolated areas

j. Biogas.

Other energy sources (nuclear, eolic, tides and thermo-oceanic has been considered theoretically or at very low scale).

Another interesting source of proposed energy source for electricity generation, in some special areas is the use of firewood.

G 2. ENERGY AND THE PULP AND PAPER INDUSTRY

In a near future (in 10 or 20 years) there will be no hydro-electric power, generated by the Public Service Company (Institute de Recursos Hidráulicos y Electricidad), available to supply any great pulp and paper development. Consequently it will be necessary to consider the following possibilities:

i. Usehydro-electric resources (not interesting from a national stand point in connection with pulp and paper plants;

ii. Use of processes and capacities able to allow recuperation of energy and chemicals

iii. Include in the pulp and paper projects departments of steam and electric generation;

iv. Go to the simultaneous use of (i), (ii) and (iii) as it can be convenient

v. Go directly, so much as it would be possible, from the raw materials to the pulp and the paper, to avoid uses of energy for pulp drying and its rehydration

F. NO HARMFUL TO THE ECO-SYSTEM

In relation with the pulp and paper industry the most important effects on the eco-system would be

H.1. Using waste paper

Reduction of garbage quantity, of pollution possibilities and disposal costs.

II.2. Using industrial rejects

Reduction of polution possibilities and disposal costs.

II.3. Using agricultural wastes

The most important effects would be:

i. No humus formation;

ii Lost for the fields, of the chemicals present in transported wastes;

iii. Necessity of higher fertilizer costs.

II.4. Using wood

It will require a rational use of this resource to avoid forest destruction or will require adequate reforestation programs.

II.5 Pulping

Pollution effects wil depend, in first place on the pulping processes In some cases, as with the sulphate process, there will be two main problems (1) Gases and fumes and (2) Black liquors

Technical solutions of these problems are well known their application depends mostly of costs (investment and operation), which are closely related with plant capacities

Other solutions, requiring studies and evaluation, would consist in the use of pulping chemicals able to transform the black liquors into fertilizers.

I. NOT MATERIALLY HARMFUL TO HUMAN SOCIETY

For the pulp and paper industry, this characteristic is closely related to the previous one

J. NOT PSYCHOLOGICALLY NOXIOUS

The psychological effects of industry are consequences of the civilization systems developed and accepted by human societies

Civilization, industry and technology have their disadvantages and their advantages It corresponds particularly to each country and the humanity to decide the kind and degree of civilization they want and their decision will include not only the profits but also the disadvantages corresponding to their decisions.

The pulp and paper industry does not represent any peculiar or significant psychological effects but, it must be remembered that the disappearance or limitation of paper production would represent a very hard impact to the universality of culture

ANNEX 2

SOME BASIC DATA ON PANAMANIAN ECONOMIC STRUCTURE

1. GEOGRAPHICAL DATA

1.a. Latitute: Between 07°12'09.4" N and 09°37'57.7" N

Longitude: 77°09'24.0" W and 83°03'07.0" W

Greenwich

1.b. Limits: N: Caribbean Sea

S: Pacific Ocean

E: Colombia

W: Costa Rica

1.c. Area: 77.082 Km^2, including Canal Zone

1.d. Length of Coasts: Caribbean Sea 1.246.2 Km.

Pacific 1.634.5 Km.

Total 2.880.7 Km.

1.e. Higher Altitudes:

Volcán Barú	Chiriquí	3.475 M
Cerro Fábrega	Bocas del Toro	3.335 M
Cerro Itamut	Bocas del Toro	3.279 M
Cerro Echandi	Bocas del Toro	3.166
Cerro Picacho	Bocas del Toro	2.974

1.f. Climate: Maritime tropical with two seasons: dry season (called summer) from January to April, rainy season (called winter) from May to December.

2. POULATION

1971 1.434.400 Inhabitants

1972	1.478.300
1973	1.570.100
1974	1.618.100
1975	1.667.700
1976	1.718.700
1977	1.771.300

3. MONEY

Monetary unit is the Balboa (B/.).

Balboa is equivalent to US$: 1 B/. = 1 US$.

There are coins of 0.01, 0.02. 0.05, 0.10, 0.25, 0.50 and 1.00 B/. There is no Panamanian paper money of any value. The Balboa paper money was issued in 1941, but it has been very shortly in circulation.

U S paper money is the normal circulating currency.

In several occasions, silver and gold coins have been issued, but they are out of circulation and have a numismatic value.

4. NO EXCHANGE CONTROL

There is no exchange control.

There is no limit or control on import or export of money.

Any person, natural or judicial, can export or import money,

5. INDUSTRIAL INCENTIVE LAWS

Since 1950, several general industrial incentive laws have been promulgated. Special incentive laws have also been promulgated, in different occasions.

Incentives given by these laws mostly deal with tax exemptions for: imports of machinery, equipment, raw materials and other material inputs not manufactured in Panama· on profit generated by exportation of industrial goods manufactured in Panama; to industrial plants erected in some special areas, called "development poles", on reinverted profits. Special accelerated depreciation rates and others.

6. INDUSTRIAL FINANCING

A resume of industrial financing sources, available in Panama, is presented in Annex 1.

7. LABOUR

There is a labour code, some data regarding labour costs are presented.

7.a. Minimum Salary

Examples of minimum salaries.

	Normal US$/hr	Apprendice US$/hr
In Cities of:		
50.000 or more inhabitants	0.55	0.45
25.00 to 50.000	0.50	0.35
Less than 25.000	0.40	0.30
In Specific Sites:		
Chitré and Santiago	0.45	
Puerto Armuelles & Changuinola:		
Wholesale Commerce	0.50	
Other Activities	0.45	

7.b. Salaries in some specific activities in Panama City and Colón

	US$/hr
Drivers (Small commercial vehicles)	0.75
Drivers (2.5 up to 12 Tons. vehicles)	0.95
Drivers (lifttrucks)	0.85

7.c. In paper mills, in Panama City

	(Average por Person) U.S.$/Year
Direct Labour	4.046
Direct Inspection	8.092
Maintenance	4.046
Office Employees	7.750
Sales	3.480
Managers	25.000
Average	5.286

Previous figures include fringe benefits paid to workers, but not to Government.

7.d. Fringe benefits, paid by enterprise

	% of Salary	Paid to
Social Security	8.75	Government
Education Insurance	1.25	Government
Professional risks (Variable, average)	2.1	Government

13rd month	2.78	Government
	5.55	Workers
National Holidays	3.	Workers
Vacations (1 month/year)	9.10	Workers
Sickness (maximum)	5	Workers
Seniority (Variable, average)	2	Workers)
Discharge Indemnization (variable)		Workers

ANNEX 3

SUMMARY OF PANAMANIAN "STRUCTURES"

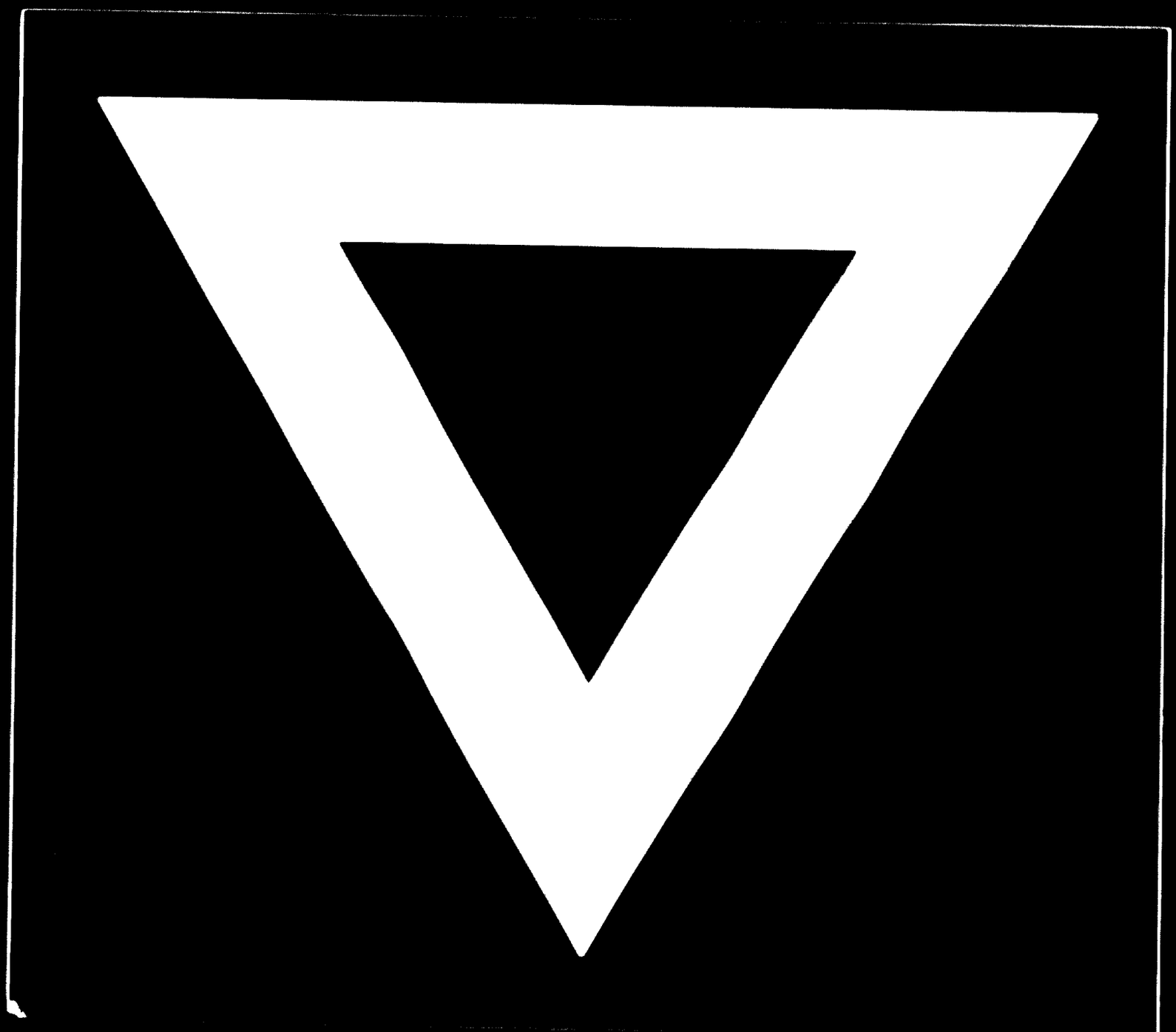
REGARDING POSSIBILITIES OF PULP AND PAPER DEVELOPMENT, ON BASE OF FORESTS

SELLECTED FORESTS "STRUCTURES"	BOCAS DEL TORO	DONOSO	BAYANO	DARIEN
1. MATERIAL STRUCTURES				
1.a. No or slightly variable				
1.a.1. Geographical situation	well known	well known	well known	well known
1.a.2. Topography	well known	well known	well known	well known
1.a.3 Geology	not well known	not well known	known	not well known
1.a.4 Soils	known	known	known	not well known
1.a.5 Hydrology	not well known	not well known	well known	not well known
1.a.6 Flora Forests	known	well known	well known	not well known
1.a.7 Fauna	not well known	not well known	well known	not well known
1.b. Variable				
1.b.1 Cities, villages, etc.	small cities	small villages	villages	small cities & villages
1.b.2 Roads connecting with other regions	projected	projected	existing	projected

	local	existing	no	existing	projected
	forest	no	no	no	no
1.b.3	Railroad	in banana area	no	no	no
1.b.4	Maritime transport	large ship port	no	no	small ship port
1.b.5	River transport	possible	possible	possible	possible
1.b.6	Reservoir (hydroelectric)	no	no	existing	no
1.b.7	Airport	existing	no	existing	existing
1.b.8	Industrial estate	no	no	no	no
2.	ECONOMIC & FINANCING STRUCTURES				
2.a	Economic structures				
2.a.1	Agriculture	large scale	very small scale	small scale	small scale
2.a.2	Cattle raising	small scale	very small scale	small scale	small scale
2.a.3	Hunting	not important	not important	not important	not important
2.a.4	Fishing	small scale	very small scale	no	small scale
2.a.5	Industry	banana packing, banana purée & few ancillary shops	no	sawmilling	no
2.a.6	Construction	important projects will depend on local facilities			
2.a.7	Commerce	small scale	very small scale	very small scale	small scale
2.a.8	Transport, Storage, Communications	small scale	no	small scale	small scale

2.b.	Financing structures				
2.b.1	Commercial banks	existing	no	existing	existing
2.b.2.	Development financing institutions	depending of existing facilities in Panama City			
3.	INSTITUTIONAL STRUCTURES				
3.a.	Political organization	Constitution and laws			
3.b.	Economic organization	Constitution and laws			
3.c.	Social organization	Constitution, laws and tradition			
4.	TECHNOLOGICAL STRUCTURES				
4.a.	R. & D. development centers	Depending on National resources			
5.	HUMAN STRUCTURES				
5.a.	Intellectual structures				
	primary schools	yes	yes	yes	yes
	jr. high school	yes	no	no	no
5.b.	Ethical structures	Constitution, laws and tradition			

B-35



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