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PRE-FEASIBILITY STUDY FOR THE ESTABLISHMENT OF AN INTEGRATED COCONUT PROCESSING COMPLEX

UC/PAN/86/022

PANAMA.

Technical Report: Investment opportunity study of an integrated coconut industry in Panama*

Prepared for the Government of Panama
by the United Nations Industrial Development Organization

Based on the work of P. Catanaoan and L. Koenigson,
UNIDO experts

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Abbreviations

All measurements are in accordance with the metric system. The currency denomination, $, used in the report is that of the US dollar.

INVESTMENT OPPORTUNITY STUDY
OF
AN INTEGRATED COCONUT INDUSTRY
IN
PANAMÁ

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STUDY SUMMARY AND CONCLUSIONS

A. Background

The Government of Panamá wishes to re-establish the coconut production and processing sector and therefore requested the UNIDO to assist in the preparation of an investment opportunity study. The study was carried out by Messrs L. Königson and P. Catanaoan in February and March 1986. It comprised a four week visit to Panama, industry contacts in Europe and the Philippines and compilation of data and the report in Vienna. The UNIDO Computer Model for Feasibility Analysis and Reporting (COMFAR) was applied to calculate the financial profitability of the proposed projects and to examine the impacts of major project parameters.

The identified development programme consists of three inter-related projects:

A. The rehabilitation of 500,000 coconut trees and the installation of 20 copra dryers to supply the existing domestic oil mills with 50 % of their copra demand.

B. The development of up to 2,500 ha of new coconut plantation including the installation of eight copra dryers to supply a coconut processing plant.

C. The establishment of a food grade processing plant entirely for export.

Major parameters, affecting the financial profitability of the projects, are world market prices for copra and coconut oil, coconut yield per tree and year and the cost effectiveness of coconut production and processing in Panamá.

B. Coconut Oil Prices

World market coconut oil prices have during the recent two years gone from a high of $ 1,430 to an unprecedented low of $ 260/ton. A substantial increase in production of competing palm oil coupled with technological changes make it unlikely that prices will regain the very profitable level of $ 1,000 or more per ton. Instead it is plausible that plentiful supply will maintain prices at a level where the cost effective major supplier, the Philippines, will sustain production. This would make it difficult for other countries to finance desired expansions of capacity unless it would be used for export substitution and possibly aided by protection or unless it would be further processed into food grade coconut products.

C. Rehabilitation

A project to rehabilitate an estimated 25 % of Panamá's trees with the aim of supplying the presently idle copra crushing plants with rawmaterial would partially circumvent the issue of price since it would revitalize what is at present sunk investments.

It is expected that a two year fertilizing and weeding programme would make it possible to raise average yield from the very low level of 10 nuts per tree and year to 60 nuts per tree and year. With a total of 500,000 trees, the annual national production would thus increase by 25 million nuts which would correspond to some 5,000 tons of copra or half the crushing capacity of the two existing mills.

In order for a rehabilitation project to succeed there would need to be properly located and equipped dryers available for converting the farmers' nuts into copra. This is not the case today. It would also be necessary to regulate and supervise the market so that the existing two financially strong buyers do not unilaterally enforce their conditions on a large number of small copra producers.

This and other aspects would necessitate an active Government involvement in the project.

A four year rehabilitation project would require total financing of $ 2.7 million in constant 1986 prices. At full production and at prices marginally higher than today's domestic price, the project would generate an average revenue of $ 2 million per year and a return on total investment of approximately 15 %. Intercropping with, for instance, fodder could increase this return even further.

At today's prevailing world market price for copra the project would, however, not be profitable and prolonged periods of such extremely low prices as those which prevail at present would necessitate protection in order to avoid abandonment of plantations.

D. New Plantation

The rehabilitation project would still make room for further production aimed at supplying the two local mills. Panamá, which would have a significant duty advantage over traditional Asian coconut products exporters to the US, could also develop additional plantations with a view to exploiting this advantage for high valueadded products and still retain the option of supplying the domestic mills.

A 2,500 ha plantation would be large enough to supply the balance to the copra mills. It would also be large enough to supply an economical size process plant producing desiccated coconuts and coconut cream.

It is recommended that a new plantation should make use of Panamá's two domestic varieties of coconut since those are more disease resistant and better adapted to local condition than would be hybrid varieties.

Their main disadvantage would be a longer gestation period prior to bearing fruit. A domestic variety would, on average, need five years of growth before first harvest and it would not reach maximum production until some 12 years after planting.

This fact also results in a high investment cost for a new plantation since it has to be maintained and fertilized for several years of no or little yield.

There is in Panamá ample land available in accessible locations for even such a large plantation as 2,500 ha. Soil conditions are, however, generally mediocre to poor with little topsoil and low pH as the major drawbacks. The eventual establishment of a plantation should be preceeded by careful soil analysis. Drainage is also an important factor for the growth of the coconut tree.

The investment needed to establish a 2,500 ha plantation and to maintain and nurse the trees until first harvest has been estimated at $ 6.6 million in constant 1986 prices and excluding the value of land.

The investment could possibly be reduced by the introduction of intercrops. Plantain is one example of a crop which could co-exist with coconut trees during the latters infancy and during this period generate several hundred dollars per ha in revenue. In subsequent years it may prove possible to grow a hardy grass for fodder for which there is a large demand in Panamá. The highly productive african elephant grass has been used as an example of what this could mean for annual plantation revenue. An increase in revenue by 10 % or more without any significant cost increases could prove possible.

On the assumption that the plantation would give 70 % of its production as nuts to a food grade processing plant and convert the balance into copra in its own dryers and that there would be no revenue from inter-crops the internal rate of return on total investment excluding land would be only 1.7 %. The plantation without profitable intercrops could thus not on its own service any debt.

The financial projection which yield this low rate of return assume that the nuts for the processing plant will sell at a 20 % premium as compared to those used for copra. The rational would be that of a transport advantage in case the processing plant, which is logical, is located at or within the plantation. The base price applied is marginally above the domestic price for copra which prevails today which in turn is substantially higher than the present world market price for copra.

A combination of favourable changes in the assumptions would be required in order to the plantation financially feasible. The most plausible such changes would be an interest rate, in terms of constant prices, of 5 % p.a., a 10 % increase in maximum coconut yield per tree and year and some income from inter-crops. Even though these changes may be justifiable the plantation project per se is unlikely to constitute an attractive investment opportunity. It would need to be integrated with a profitable processing project which should more than compensate for the plantation project's deficient cash flow.

E. Processing Plant

A Panamián coconut processing plant should produce and export to the US both desiccated coconut and coconut cream powder. The former is a well established product for which there exists a stable market in the US which is supplied almost exclusively by the Philippines. Prices for desiccated coconut tend to vary with those of coconut oil but with a processing margin of between $ 400 and $ 500 per ton.

Coconut cream is, however, a newer and substantially riskier product. The limited data available suggest that consumption of cream in the US has increased rapidly in recent years and that prices are unrelated to those of coconut oil.

There are at present very few producers and Panamá could thus have the possibility of becoming a major producer for an expanding US market. There exists also a market potential in neighbouring Colombia which could be substantial.

This study recommends the establishment of a plant with a daily capacity of 100 tons of nuts which is considered a minimum economic size. In order to limit risks it is proposed that 2/3 of the capacity be devoted to desiccated coconut with the balance being for coconut cream powder.

Total investment in constant 1986 prices and including working capital has been estimated at $ 3.6 million.

At current world market prices for desiccated and cream powder coconut this investment would yield an internal rate of return of 27.4 %. On the assumption that 60 % of the investment would be financed by a long-term loan at an interest rate of 9 % p.a. the resulting return on the remaining investment - assumed to be equity - would, ignoring possible tax liability, exceed 40 %.

The major operating costs would be nuts (35 % of turnover) followed by wages and salaries estimated on the basis of prevailing such costs in Panamá. The COMFAR projections suggests that the processing plant would have an annual cash generation which exceeds that required for servicing, financing for the plantation by a factor of three.

The investment opportunity study, for this reason, recommends the integration of the processing plant with the plantation and that an eventual integrated project is concieved in such a manner that there exists a common ownership interests between the two components. This implies that the plantation would have to be established and be approaching full production by the time a processing plant is built. With the gradual maturity of the trees this would mean that a processing plant should be built first 8 years after commencement of work on the plantation. Such a time lag adds a large element of uncertainty to the financial prospects of a processing plant and therefore makes a plantation/processing plant investment highly speculative.

There exists, however, the possibility of combining the processing plant with the rehabilitation scheme which would produce the required volume of nuts in only five years and which would thus make possible start of construction of a processing plant two years after commencement of the rehabilitation scheme.

This integration has the disadvantage of leaving the country's existing copra crushing capacity idle and of subjecting the processing plant to increased risks with respect to supply of nuts which would need to come from hundreds of small holders rather than from one large plantation.

Continued studies should seek to evaluate which type of integration between processing and coconut growing would be in Panamá's best interest.

I. INTRODUCTION AND BACKGROUND

A. General

Being a traditional coconut growing country Panamá not only has adequate land for coconut palm cultivation but it can also draw on considerable past experience in coconut production and processing. In the recent past, however, coconut production has slowed down due to several reasons among which are decrease in yields due to old age, lack of farm maintenance, plant diseases and pests, etc.

The relevant authorities of the Government of Panamá are, however, fully aware of the importance of coconuts as an agro-industrial raw material and the favourable impact appropriate coconut processing operations may have on the nations economy. Coconut products may find an export market and/or may be used as a substitute for imported oils. Coconut processing operations could also offer an opportunity for the production of coconut and coconut-based products for higher added-value and greater market flexibility.

The Government of Panamá, therefore, wishes to re-establish the coconut production and processing industries sector with a view of creating organized palm plantations using suitable planting varieties which would enable the country to revive the coconut industry and maintain viable production and processing operations. For this purpose an investment opportunity study in respect of an integrated coconut production and processing industry would need to be undertaken.

The authorities of the Government of Panamá has therefore requested the UNIDO for assistance in the preparation of an investment opportunity study to provide valid first hand information about the techno-economic feasibility of an integrated coconut production and processing industry to be the basis for further action.

B. Geography and Climate

The Republic of Panamá, with an area of 77,000 sq.km, is located near the equator, and occupies the isthmus connecting the North and South American Continents. The country borders to the north the Caribbean, to the south the Gulf of Panamá and the Pacific Ocean, to the east Colombia and to the west Costa Rica. The coast line on the Atlantic side is 763 km and on the Pacific side 1,227 km.

A single chain of mountains, the Cordillera Central, extends from east to west. There are many lateral ranges extending toward both the Caribbean and the Pacific, resulting in a number of dispersed plateaus. Elevations are uneven, and there are a few peaks, the highest being the Barú Volcan, in the province of Chiriquí (about 11,500 feet above see level). The Cordillera Central provides a natural watershed; there are 478 rivers in Panamá, 325 of which flow into the Caribbean Sea and 153 into the Pacific Ocean. The principal navigable rivers are in the Province of Darién where the Cordillera splits in two mountain ranges.

Panamá has a year-round tropical climate, and rainfall is heavy but seasonal. The dry season is from January to April and the heaviest rainfalls are usually during October and November. The Caribbean side has much higher precipitation and a less defined dry season than the Pacific side. The mean annual temperature is 29°C (81°F) in the lowlands and 23°C (73°F) at approximately 600 m elevation.

The population of Panamá, which was about 2,180,000 in 1985, is estimated to increase to about 2.4 million in 1990. The country's geographical position has resulted in the emergence and development of a localized urban and commercial type of economy which has caused an influx of population to the two main urban centres: Panamá City and Colon. Those metropolitan areas account for over a third of the population. Commerce, banking, and service facilities constitute the backbone of the economy of these two cities and they account for over fifty percent of the Gross Domestic Product.

The rest of the country is predominantly rural, with most of the lands on the Atlantic coast and in the east still unexploited and without road connection to the rest of the national territory. About a third of the population is engaged in subsistence agriculture and has little contact with the monetary economy. The urban centers in the interior (David, Santiago, Chitré, Los Santos and Las Tablas) are still rudimentary and relatively unrelated to the process of development of the main urban cities. The agricultural sector contributes about 20 percent of the GDP and employs 40 percent of the labour force. The main agricultural products are bananas, coffee, sugar, meat, rice, corn, beans and dairy products. Panamá imports about nine percent of its food requirement.

C. Coconut Farming

During the agricultural year 1980-81, there were about 75,000 farms with 2,956,000 trees recorded as planted (see Table 1). Of these about two million were fruit-bearing. The number of nuts harvested was estimated at 18.1 million corresponding to an average of about 9 nuts per tree per year. On the assumption that all the trees are now fruit-bearing, the annual nut production would be about 25 million nuts. San Blas, Colon and Bocas del Toro on the Atlantic Coast produced about 11.3 million nuts or about 45 percent of the country's coconut production. Average nut yields along the Atlantic coast is about 12 nuts per tree per year (see Table 2). This is likely, however, to be only a fraction of current volume of nuts available for harvesting. Several plantations appear to have been abandoned and many smallholder groves are seemingly not harvested.

There are two experimental coconut farms: one in Nombre de Dios, in the Colon province and the other in Bayano, in the province of Panamá. The Nombre de Dios farm is planted with the Alto Pacifico, Tres Picos, and hybrid PB-121 varieties. The farm was planted in 1979 and many of the trees are now fruit-bearing. The Bayano farm was planted in 1980 with the hybrid PB 121 and some of the trees are starting to bear fruit.

Panamá has a tropical climate suitable for coconut cultivation. Its long shoreline indicates that there is plenty of land suitable for coconut growth. The existing coconut plantations, though underdeveloped, can provide a basis for the further development of the coconut industry. The very low yields recorded for the existing plantations could most probably be increased substantially by relatively inexpensive weeding coupled with application of fertilizers and pesticides so that part of the country's demand can be met and seed nuts provided while new plantations are developed. Coconut production technology is not unknown to the country. Land area suitable for coconut cultivation is estimated to correspond to at least 50,000 hectares.

D. Coconut Processing

There are two factories which have equipment for oil milling and refining: Cia, Panamá de Aceites, and Industries Panamá Boston. Panamá de Aceites has French Oil equipment with a capacity of about 22 tons of copra per day, while the Panamá Boston plant has Anderson equipment with a daily milling capacity of about 24 tons of copra. Both factories have ceased milling operations due to lack of copra. They are both keen to expand their capacities when copra becomes available. Coconut oil can be used in their soap making and for their margarine, and edible oil production. At least 10,000 tons of coconut oil can be used by the two companies per year

Table 1 No. of farms, number of trees, and nuts harvested by province. Agricultural year - 1980-1981.

Province	No. of farms	No. of trees		No. of nuts harvested
		Total	Fruit-bearing	
TOTAL	74,907	2,956,399	1,993,408	18,128,032
Province:				
Bocas del Toro	1,098	50,077	20,917	160,348
Coclé	12,475	165,839	82,955	1,137,085
Colón	4,260	465,792	281,582	1,831,945
Chiriquí	16,330	166,376	97,212	2,452,914
Darién	1,021	56,039	36,868	241,941
Herrera	5,164	33,834	16,189	362,865
Los Santos	6,467	93,863	52,545	945,847
Panamá	17,592	194,016	89,238	1,066,087
Veraguas	7,656	158,372	80,228	614,664
San Blas	2,844	1,572,191	1,235,674	9,305,336

Source: Proyecto Agroforestal de la Zona Infuencia del Area Metropolitana, July 1985

Table 2 Calculation of coconut production measured as nuts per tree per year in Colón and San Blas for 1983

District	No. of farms surveyed	No. of trees		No. of nuts	Average yield per tree per yr
		Total	Fruit-bearing		
Colón Province					
Donoso	21	1,050	922	22,256	24.1
Chagres	8	400	337	5,722	17.0
Portobelo	4	200	184	1,873	10.2
Santa Isabel	94	4,669	3,684	32,435	8.8
Totals	127	6,319	5,127	62,286	12.1
Comarca de San Blas					
Ailigandi	52	2,228	1,591	30,018	18.9
Narganá	37	1,850	1,668	38,014	22.8
Tubuala	30	1,474	1,046	19,686	18.8
Puerto Obaldía	-	-	-	-	-
Totals	119	5,552	4,305	87,718	20.4

Source: Proyecto Agroforestal de la Zona de Influencia del Area Metropolitana, July 1985

There is no known industrial processing of coconuts in Panamá at present. Some of the coconuts from the Atlantic Coast are sold to Colombian traders who regularly visit the San Blas and Colón areas. It is alleged that the price of nuts range from $ 0.12 to 0.20 in cash or in value of barter goods from Colombia. There appears to be an uncertainty of the future of this market and a need for alternative outlets for coconuts since coconut sales constitute the main source of income for the people in San Blas. The rest of the harvested nuts are consumed as food nuts or sold in the local market.

E. Markets for Coconut Products

In 1983, Panamá imported 738.6 tons of coconut oil valued at $ 538,000. Imports of desiccated coconut was valued at $ 29,400. During the same year, the imports of other vegetable oil were about 20,000 metric tons, valued at $ 11.5 million (Table 3). Import statistics for 1984 suggest that only 700 tons of vegetable oil was imported in that year as importers postponed purchases in anticipation of lower prices. Soyabean oil has dominated imports in recent years on account of price. Imports of coconut oil has been limited to a few hundred tons per year.

The local market for coconut oil consists of the two abovementioned oil mills with a capacity to utilize at least 10,000 tons per year. The local market for other coconut products would comprise fresh nuts for household consumption. The small population makes this market insignificant in relation to the country's productive capacity.

Panamá is one of the countries which is intended to benefit by the Reagan administration's Caribbean Basin Initiative (CBI), which allows dutyfree entry of a list of products, including coconut products, into the United States.

In 1984 the U.S. imported 377,900 tons of coconut oil. In 1983, desiccated coconut import was 43,454 tons (Table 4). The U.S. also imports a significant quantity of coconut cream, probably at least 1,000 tons per year. The U.S. is thus the largest importer of coconut products in the world. The Colombian market is also likely to be substantial with respect to foodgrade coconut products such as desiccated coconut and coconut cream and it could possibly be developed further with respect to fresh coconuts from Panamá. This may also apply to the U.S. market. In 1983, Venezuela imported about 300 tons, while Argentina imported about 800 tons of desiccated coconut (Table 4).

Table 3 Imports of various vegetable oils into Panamá - 1983 and 1984

Year	Product	Quantity, tons	Value $ CIF	Origin
1983	Crude coconut oil	599	454,602	USA
	-"-	149	83,374	Philippines
	Crude soya oil	13,491	7,899,456	USA
	-"-	7,006	3,641,061	Brazil
	Soya oil (degummed)	3,000	2,490,000	"
	Soya oil (edible)	292	276,753	"
	Corn oil (edible)	158	282,987	"
	Total	24,695	15,128,233	
1984	Crude coconut oil	299	320,407	
	Groundnut oil (edible)	4	8,711	n.a.
	Soya oil (edible)	168	206,231	n.a.
	Corn oil (edible)	225	512,668	USA
	Total	696	1,048,019	

Source: Proyecto Agroforestal de la Zona de Influencia del Area Metropolitana, 1985

II. PRODUCTION AND PROCESSING

A. The Tree of Life

The coconut is a tropical plant. It is principally grown in the regions within 20° north and south of the equator. The major coconut-producing countries are: the Philippines, Indonesia, Sri Lanka, Thailand, Papua New Guinea, Tanzania, Vanuatu, Fiji, Western Samoa, Solomon Islands, Jamaica, and Ivory Coast. The estimated total coconut production in the world is about 40 billion nuts per year.

The coconut tree is sometimes called the "tree of life" because of the many products that can be derived from it and which can, literally, support human life, directly in the form of food or shelter, and indirectly from income earned from coconut products. The uses of the various parts of the coconut tree are chiefly, as follows:

Trunk:	coconut lumber as building material and fuel.
Leaves:	roofing material, handicraft articles, furnitures.
Sap:	beverage, alcoholic drink (when fermented)
Husks:	fibers for mattresses, cushions, ropes, nets, mats, etc.
Shells:	charcoal, activated carbon, buttons, handicrafts, filler for adhesives and plastics.
Water:	fermentation medium for the production of yeast, alcohol, and "nata de coco" (a jelly-like food).
Kernel:	source of oil and animal feeds, coconut cream, desiccated coconut; can also be a source of coconut flour, protein, and coconut "milk" (a possible dairy milk substitute).
Coconut oil:	food products - cooking oil, margarines, shortening, bakery fats, confectionary, ice cream, dairy substitutes; non-food uses - soaps, detergents, cosmetics, toiletries, chemicals, pharmaceuticals, plastics, paints, etc.

B. Conditions for Growth of the Coconut Tree

The coconut tree can thrive in a wide variety of soils, from sandy or alluvial to clayey soil. However, the soils should preferably be of a partly sandy texture with a loose friable structure allowing good rooting depth (at least 6 ft. for the tall trees). The tree does relatively well in poor soils due to its well-developed system of roots, and it responds well to both organic and mineral fertilizers. It is advisable to apply fertilizers containing nitrogen, phosporous, potassium and magnesium for faster tree-growth, earlier fruiting, and higher nut-yields. Coconut is known to grow both in slightly alkaline and in slightly acidic soils (pH 5 to pH 7.5). However, conditions beyond these limits tend to lessen the tree's response to soil nutrients. The coconut tree can withstand temporary flooding of both fresh and sea water for several days at a time. Long droughts, however, reduce nut yields significantly. Adequate soil moisture favours both tree growth and nut yields, but continuous flooding will impair aeration of the soil which can cause death to the tree. In areas with long dry seasons (3-4 months), the soil should have a good moisture retaining ability to offset the lack of rainfall during the dry months. Salt is not a requirement for coconut growth, as some believe. Coconuts are known to grow in areas as far as 50 kilometers from the sea.

A year-round low rainfall is ideal for coconut growth, but a short dry season in combination with at least 1,500 mm of rain per year is still suitable for coconut growing. Typhoons or hurricanes, earthquakes, and floods affect coconut yields since these disturbances affect the root-hold on the soil, thus reducing the nutrient supply to the tree.

C. The Fruits

The age at which the coconut bears fruit varies with the variety, although the fertility of the soil and other requirements for growth can influence the bearing age to some extent. The common earliest

bearing age for most tall varieties is 5 to 7 years and productivity tends to increase until 9 to 12 years of age. Trees some 100 years old are known to bear fruit. The dwarf trees bear fruit as early as the third year and peak at about 7 years of age. The economic life of the dwarf trees is, however, shorter than for the tall varieties.

The number of nuts that can be harvested per year and the size of the nuts are also dependent on the plant variety. However, fertilization can increase nut yields significantly and nut size to a limited extent. The tall trees yield about 50 to 150 nuts per year while the dwarf trees can yield as much as 300 nuts per year. The tall trees produce larger nuts (weighing 700-1,200 grams per nut, without husk) while the dwarf nuts weigh about 500-700 grams. The thickness of the kernel increases with fertilization while the oil content increases with maturity of the nuts.

D. Choice of Variety

The choice of variety to be planted is ususally dictated by the economics of production and processing. Other factors to be considered are: resistance to plant diseases, availability of foreign exchange for importation of fertilizer, as well as market requirements. The tall trees can survive better in poor soils and adverse rainfall conditions than can the drawfs or hybrids. The dwarfs have been found to be more resistant to "red ring" and "lethal yellowing" diseases. In "wet processing" such as for the production of desiccated coconut and coconut cream, the de-shelling and paring is labour intensive. For this reason, the large round nuts from the tall trees are preferred as they would result in lower labour cost per unit of product. For the fresh nut market, the larger nuts are also preferable.

E. The Products

Commercially traded coconut products are: copra, crude coconut oil; refined-bleached oil (RB); refined bleached, and deodorized coconut oil (RBD); desiccated coconut, and coconut cream. The processes for their production are briefly as follows:

Copra Making: Copra is dried coconut kernel with a moisture content of 5-10 percent. Copra making basically consist of separation of the kernel from the shell and subsequent drying. Drying can either be sun-drying or by the use of hot smoke or heated air. Dryer designs vary from simple platform dryers to forced-draft mechanical dryers, depending upon such factors as: sunlight conditions, quantity of nuts, copra price, availability and cost of capital, labour costs, etc. Copra dryers are usually very simple and inexpensive facilities located in or near coconut plantations. Husks and shells are frequently used as fuel.

Coconut Oil Extraction: This process separates the copra into crude coconut oil and copra cake. There are two basic processes: the mechanical process using screw presses (expellers), and the chemical process which uses solvents, usually hexane. A combination of the two processes exists in many coconut oil extraction plants, where the copra is first pre-pressed mechanically and the extraction is then completed with solvent. Small plants, with capacities less than 200 tons of copra a day usually use the mechanical process, while large capacity plants use the combined process. The choice of process depends on factors such as: capacity, price of coconut oil, power cost, investment capabilities, and continuity of copra supply. Investment per unit capacity is higher for solvent extraction plants but extraction efficiency exceeds that of the mechanical process.

Oil Refining: Oil refining is accomplished through three basic steps: neutralization to remove the free-fatty acids, bleaching to remove the colour, and deodorization to remove the odor. Removal of the free-fatty acids can be achieved either by chemical reaction (with caustic soda) or by steam stripping similar to deodorization).

Bleaching is the result of application of bleaching agents, such as activated carbon or Fullers Earth. Deodorization is by passing superheated steam through the oil under of high temperature and in vacuum. The oil may be neutralized and bleached to produce RB oil or further deodorized to produce RBD oil or edible oil.

Production of Desiccated Coconut: Desiccated coconut is food-grade dried and shreded kernel. It is used in candies, cakes, and other food preparations. The basic steps in the production of desiccated coconut are: de-shelling, i.e. peeling off of the shell, paring, i.e. removing of the brown skin of the kernel, cutting the white kernel to chunks, chemical treatment to destroy bacteria, grinding to reduce the kernel to desired sizes of shreds, blanching to completely destroy microorganisms, drying to remove moisture, and sifting or screening to separate the product into different grades.

Production of Coconut Cream: Coconut cream (also called coconut milk) is a popular ingredient in the foods of people in Asia, Polynesia, Micronesia, Malaysia, Indonesia, and some South American countries. Traditionally, coconut cream is prepared in the home by grating the kernel and squeezing the milk by hand after adding some water. Migration of people from the countries mentioned to the United States and the United Kingdom has created an export market for coconut cream. New uses for canned coconut cream have also evolved in recent years, such as coconut cream flavoured drinks, ice creams, and sweetened coconut creams. Commercial production of coconut cream consists of: shredding or grinding of the kernel, and squeezing out of the milk with the use of a hydraulic press or an expeller (screw press), filtering or screening, pasteurizing and canning or bottling. Some canned coconut creams are homogenized to minimize water separation. Coconut cream powder is produced by spraydrying of pre-concentrated coconut milk.

III. MARKETS AND PRICES FOR COCONUT PRODUCTS

A. Copra and Coconut Oil Prices

The coconut oil market has deteriorated dramatically in late 1985 and early 1986 when prices tumbled to an unprecedented low of $ 260/ton. The fact that copra prices declined proportionately less than did oil prices suggests, however, that oil prices will have to rebound eventually.

The reasons behind the drastic slump in prices are essentially substitution by less expensive palm oil and, to a lesser extent, by palm kernel oil as well as a technological shift of rawmaterial for surfactants (from vegetable oil to petroleum derivatives). Those changes have been prompted in part by recent very high prices for coconut oil, the market for which has been dominated by the Philippines. The price for coconut oil has thus gone from a high of $ 1,430/ton to a low of $ 260/ton in less than 24 months.

Monthly Average Prices of Coconut Products, 1976-1984

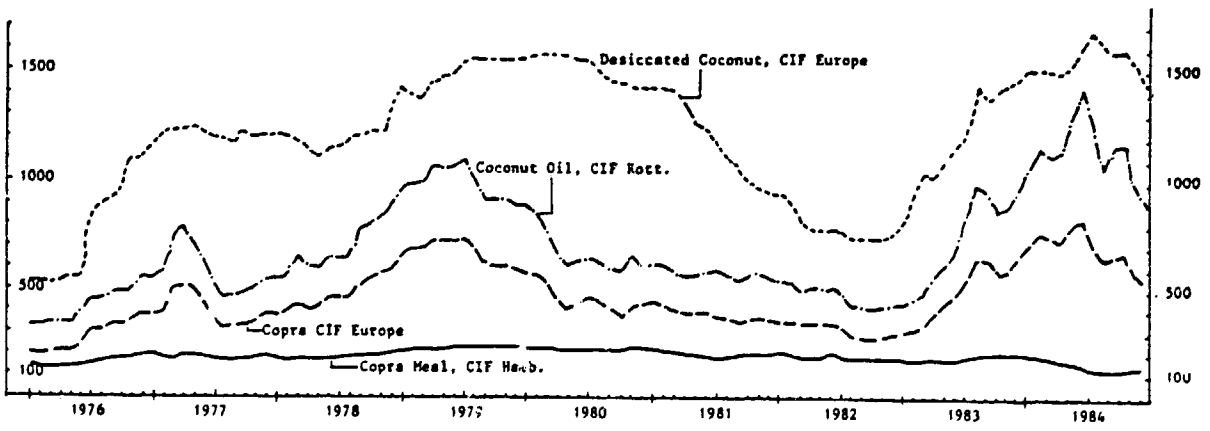


Table 4 World imports of desiccated coconut, 1974-1983 (in metric ton)

Country	1979	1980	1981	1982	1983
WESTERN EUROPE	54,584	51,064	50,964	53,153	58,237
EEC Countries	44,421	40,401	43,331	43,687	49,677
Belgium/Lux.	1,362	1,400	2,212	1,870	1,564
Denmark	1,653	1,801	2,103	1,960	2,271
France	4,112	4,694	4,794	4,857	5,633
Ireland	691	596	565	545	608
Italy	108	156	254	315	237
Netherlands	7,490	7,874	7,263	9,007	9,939
United Kingdom	19,114	15,143	15,986	15,631	20,145
West Germany	9,891	8,737	10,154	9,502	9,280
Other W. Europe	10,163	10,663	7,633	9,466	8,560
Austria	1,362	1,203	1,097	1,489	1,403
Greece	609	607	230	240	269
Norway	650	719	792	695	746
Portugal	571	752	1,227	1,213	1,100*
Spain	5,286	5,622	2,258	3,563	3,000*
Sweden	1,662	1,739	1,810	1,965	1,791
Others	23	21	219	301	251
AMERICA	49,015	46,891	47,427	47,639	51,042
Canada	5,815	5,150	5,474	5,192	5,889
USA	39,648	39,443	39,526	40,217	43,454
Argentina	2,664	1,472	1,267	986	800*
Venezuela	371	130	438	370	300*
Others	571	696	722	874	599
AFRICA	3,847	3,836	5,629	7,064	5,705
Egypt	1,519	1,203	2,974	4,347	3,000*
South Africa	2,051	2,498	2,600	2,499	2,705
Others	277	135	55	218	-
ASIA AND PACIFIC	20,893	24,242	32,784	34,149	31,134
Kuwait	428	738	700*	620*	700*
Iran	200*	388	800*	-	-
Israel	889	476	1,200*	1,200*	1,200*
Saudi Arabia	1,699	1,577	2,198	3,159	2,700*
U.A. Emirates	2,226	2,504	2,726	2,700*	2,700
China	1,019*	1,109*	1,492*	1,233*	1,100*
Hong Kong	862	745	1,174	830	1,147
Japan	2,263	1,731	2,015	2,007	1,763
Singapore	525	866	1,525	1,130	2,524
Australia	5,965	6,724	7,174	8,165	6,987
New Zealand	1,243	1,405	1,226	1,581	1,500*
Others	3,574	3,979	10,554	11,524	8,813
TOTAL	130,557	128,452	136,798	142,005	146,118

* estimate

Source: FAO Trade Yearbook

A/PANAMA

Table 5 Prices of Selected Oil and Oilseed, 1969-1986 ($/ton)

	OILS					OILSEEDS	
	Coco Oil Phil./ Indo Cif Rott.	Soybean oil Dutch Fob ex-mill	Palm oil Malaysian 5 % Cif Europe	Palm kernel oil Cif Rott.	Sunflower oil, a.o. ex-Tank Europe	Copra Cif Europe	Soybean U.S. Cif Rott.
1969	347	197	173	305	213	202	107
1970	379	286	260	367	330	222	121
1971	353	304	262	336	374	190	131
1972	254	241	217	219	326	142	144
1973	513	436	376	506	481	348	290
1974	998	832	672	1,046	977	670	277
1975	394	563	433	409	739	256	220
1976	418	438	405	433	581	275	231
1977	578	575	530	620	639	402	280
1978	683	607	600	764	665	471	268
1979	984	662	654	1,064	762	673	298
1980	674	598	584	698	633	453	296
1981	570	507	571	580	639	379	288
1982	464	447	445	458	529	314	244
1983	730	527	502	709	558	496	282
1984	1,155	724	729	1,027	767	710	282
Jan.	1,069	692	875	1,039	746	718	305
Feb.	1,158	669	875	1,176	689	765	293
Mar.	1,123	720	845	1,134	739	752	314
Apr.	1,150	772	845	1,134	739	752	314
May	1,314	914	951	1,250	955	808	338
June	1,431	844	783	1,294	892	836	308
July	1,273	697	580	1,048	776	723	270
Aug.	1,079	679	562	864	732	653	261
Sept.	1,170	694	611	928	734	665	245
Oct.	1,175	679	615	893	702	699	245
Nov.	993	698	616	886	726	602	250
Dec.	920	630	592	802	682	570	241
1985							
Jan.	856	630	583	734	659	540	243
Feb.	756	664	595	713	670	504	239
Mar.	843	667	651	770	661	504	239
Apr.	769	693	653	761	703	119	243
May	662	652	610	548	681	117	231
June	575	630	556	545	656	375	227
July	520	568	487	483	625	344	223
Aug.	456	518	404	428	565	315	211
Sept.	427	469	360	395	500	296	207
Oct.	430	448	356	389	471	286	205
Nov.	393	455	362	370	506	258	210
Dec.	395	470	390	378	532	238	213
1986							
Jan.	380	457	342	343	482	248	221

Source: OILWORLD

Future prices for coconut oil are therefore likely to be determined by the cost of competing oil derivatives and by the supply and demand for palm and palm kernel oil.

Soya bean oil constituting the largest volume of vegetable oil produced in the world has in part replaced coconut oil for cooking purposes partly on account of the latter's high content of unsaturated oil and partly because of discolouring of coconut oil when heated. It appears probable that unsaturated oil (claimed to cause high level of cholesterol in blood) will become more accepted, however, as recent research seems to suggest that cholesterol in blood has more complex origins and affects on veins and arteries than previously assumed. Modern refining processes also make it possible to avoid discolouring of coconut oil.

Even though coconut oil for cooking purposes might therefore become more popular it is unlikely that such increased demand would offset the probable price dampening effect of future sharp increases in palm oil production which will be the result of large new plantations in Malaysia.

It is probable therefore that future coconut oil prices would remain far below the high of recorded in 1984. The recently recorded price of $ 260/ton is, however, inadequate for sustaining production. It corresponds to a fob Manila price of approximately $ 160/ton which would translate into a copra factory gale price of less than $ 100/ton or some $ 0.02 per nut. The latter would correspond to the cost of harvesting and dehusking the nuts but would leave nothing to cover neither the cost of operating the copra dryer nor the cost of maintaining and fertilizing the plantation.

The lowest oil price at which copra production could be expected to be sustained in the largest producing country - the Philippines - would be around $ 450/ton cif at the presently prevailing exchange rates which would leave less than $ 200/ton fob to the copra producers and about $ 0.03 per nut to the coconut farmers.

Ample supply of coconuts in combination with increased production of palm oil make it probable that, in the long-term, the average price of coconut oil would remain fairly close to this minimum level, say at $ 500/ton. A review of past price statistics suggest that this is approximately the level at which prices levelled out during the period 1975 to 1985. The graph on page 13 also indicates that prices have been cyclical with pronounced peaks in 76/77, in 1979 and during 83 and 84.

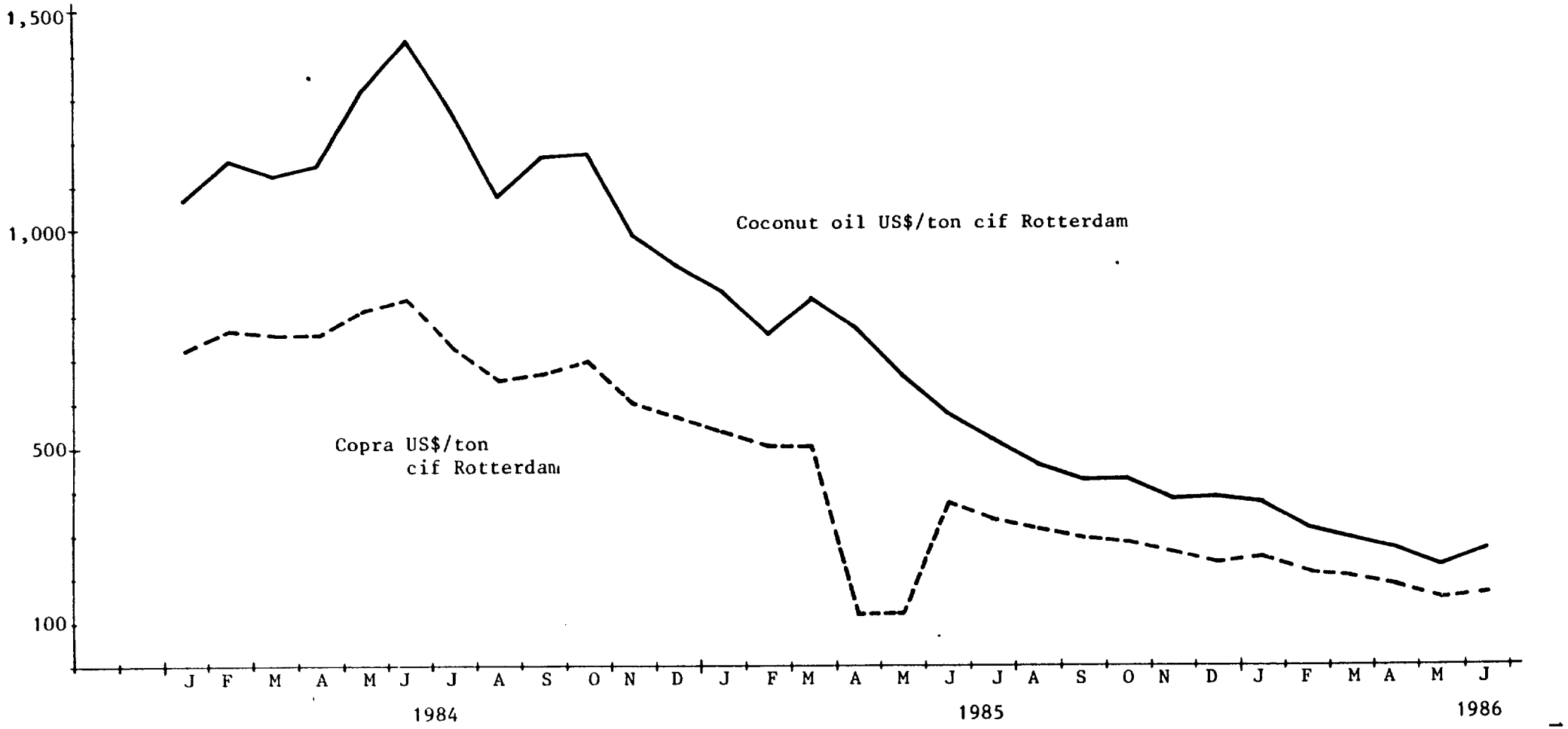
A price of $ 500/ton cif New York would correspond to a Panamá landed cost of slightly less than $ 600 per ton.

There is little pattern to the cyclical price movements but it appears that the amplitude has increased and that the period of low prices have become longer. The graph on the following page shows how prices for both coconut oil and copra have declined over the last two years.

B. Price Relationships; Nuts, Copra and Oil

In theory the export market for copra and for oil should offer near identical terms once transport and crushing costs has been accounted for. This used to be the case until the time when the Philippines sought to bar the export of copra for the purported purpose of increasing local value added.

The margin between oil and copra prices, on a cif Europe basis, have since ranged from a low of $ 100/ton to a high of close $ 600/ton. In March and April 1986 the difference reached a record low of barely $ 100 which makes it substantially more profitable to export copra than to export oil. In spite of recent price differentials there is, however, no inherent reason why, in the long run, it should be more profitable to export copra than to export oil.


1,500
1,000
500
100
Coconut oil US$/ton cif Rotterdam
Copra US$/ton
cif Rotterdam
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1984
1985
1986

Price data for recent years support the contention, however, that a copra exporter would face more stable prices than would an oil exporter. This is due in part to the stability of the expeller cake price. The price relationship between nuts, copra and oil and cake can, in a simplified form, be expressed approximately as follows:

4,500[1)] x price of nut + cost of drying + freight =
= value of 1 ton of copra,
and
value of 1 ton of copra + cost of crushing =
= 600 kg oil x price of oil + 380 kg of cake x price of cake

The latter relationship can be expressed mathematically as follows:

Copra price x C = 0.60 x oil price + 0.38 x cake price

Available price data from the Philippines suggest that cost of crushing (C) ranges between $ 60 to $ 75 per ton of copra.

Assuming a crushing cost of $ 70 and a cake price of $ 130/ton for Panama would yield the following relationship between copra and oil:

copra price = oil price x 0.60 - 20

This relationship is on a f.o.b. price basis. Since the value of 1 ton of copra would also equal cost of 4,500 nuts plus drying and freight oil price could be expressed as

$$\text{oil price} = \frac{20 \times 4{,}500 \text{ nuts} + \text{cost of drying} + \text{freight}}{0.6}$$

---

1) This assumes the larger nuts of the Altos Pacifico and Tres Picos varieties.

With cost of drying copra corresponding to approximately $ 0.02 per nut or $ 90 per ton copra and cost of freight in Panamá, equalling on the average $ 20 per ton of copra, the formula would be:

oil price = 7,500 x nut price + 217

The copra price could be expressed as 4,500 x nut price + 110.

The following table shows the fob prices required to cover all production costs at different nut prices:

	Panamá fob prices		US cif prices adjusted for CBI duty advantage	
Nut price ($/nut)	Copra price fob $/ton	Copra price cif $/ton	Oil price cif $/ton	Oil price fob $/ton
0.02	200	367	200	362
0.03	245	442	240	428
0.04	290	517	280	493
0.05	335	592	317	558
0.06	380	667	355	623
0.07	425	742	395	688

Included in the table are also cif US prices which take into account the fact that Panamá copra and oil under the so called Caribbean Basin Initiative (CBI) incentive scheme would be exempt from the 15 % ad valorem duty which applies to products from, for instance, the Philippines.

The freight cost Panama-US has ben assumed to be $ 30/ton for copra and $ 50/ton for oil. The cif price columns would thus be indicative of the world market price at which a Panamanian producers would receive the respective fob prices and a Panamanian farmer the corresponding nut price.

It can thus be seen that a $ 0.05 nut price to Panamanian growers would require a fob price of $ 317 per ton of copra and $ 558 per ton of oil.

The price statistics on page 15 suggest that fob copra prices have corresponded to better and more stable nut prices than have oil prices. It can thus be concluded that, on the basis of past price data, Panamá would be better positioned to pay its growers an adequate minimum nut price were it export copra rather than coconut oil. The margin between cif oil and copra prices tend to shrink with falling oil prices which implies that oilprocessors rather than nut growers absorb the losses.

C. Desiccated Coconut

Trade in food grade coconut products is mainly with respect to desiccated coconut for which the US and UK are the two largest markets and respectively the Philippines and Sri Lanka the two largest suppliers.

Total US imports ranges between 40,000 and 50,000 tons per year which corresponds to approximately 1/3 of total worldtrade in desiccated coconut. The Philippines in 1984 exported 68,000 tons which volume in 1985 fell sharply to 58,000 tons.

Most of the Philippine production is destined to the US market. It is generally considered as being of a superior quality than the Sri Lanka products which are exported to the UK.

The graph on page 13 suggest that prices for desiccated coconut tend to follow those of copra and coconut oil. The difference in recent years has approximately amounted to between $ 400 to $ 500 per ton. At a time with a cif coconut oil price of, for instance, $ 500 per ton the cif desiccated coconut price would thus have been $ 900 to $ 1,000 per ton.

In late 1985 and early 1986, when the oil price lowered around $ 350 per ton, prices, quoted by the Asian trade magazine Cocommunity, were stable at $ 750 per ton fob. Philippine price quotations, however, suggest that the fob price level for the same period would be between $ 0.50 och 0.60 per pound corresponding to between $ 1,100 to $ 1,300 per ton.

D. Coconut Milk or Cream

Another food grade export product is coconut milk and/or coconut cream powder. There are at present three industrial producers of coconut cream powder in respectively the Philippines, Thailand and Malaysia which together produce annually less than 1,000 tons. Coconut milk, which when dried yields coconut cream powder, has only recently been produced on an industrial scale and for export.

The Philippines being the largest producer in 1983 exported 316 tons of coconut milk and 53 tons of coconut cream powder. Production has since grown substantially but the exact volume of production and exports has not been published. Price data is also difficult to come by as the producers tend to regard this as trade secrets. Trade statistics for the period 1979 to 1983 suggest, however, that coconut cream powder has varied in price from a low of $ 1,175 per ton to a high of $ 2,650 per ton. Coconut milk, during the same period, started at a level of approximately $ 1,300 per ton which has gradually declined to reach $ 325 per ton in 1983. There appears to be little correlation between coconut oil and coconut powder prices. The latter peaked in 1982 when oil prices reached a low of approximately $ 400/ton.

IV. STRATEGY FOR DEVELOPMENT OF A COCONUT INDUSTRY IN PANAMÁ

A. General

Panamá is a market for coconut oil and at the same time a potential producer. Present imports of soybean oil can largely be substituted by locally produced coconut oil. Two copra mills with a combined capacity to produce coconut oil which would match present local demand are at present standing idle while existing coconut plantations are underutilized. In addition Panamá could have the potential for reaping export revenues from an expanded coconut industry.

The major obstacle to increased selfsufficiency with respect to coconut oil is low world market prices. The previous chapter concluded that $ 500/ton would be a likely average level of future coconut oil price. The cost of offloading in the US and transshipment to Panamá is approximately $ 100/ton which would bring the cost of imported oil to Panamá to approximately $ 600/ton. Even if Panamá could produce its own oil for $ 600/ton and thus substitute for imports such a price would likely need to be supported by tariffs or quotas during periods when the world market price drops below the corresponding level. Alternatively a viable coconut industry would need to earn a higher return from other coconut products than oil to offset losses during periods of weak oil prices.

Such a higher level of return could be by achieved expanding exports of fresh nuts and by exporting food grade coconut products such as desiccated coconut and coconut cream. There is a limited but lucrative market for such food products in the US and Europe. The higher value added for these products would improve Panamá's competitive advantage in the large US market in relation to that of other non-Caribbean producers. Virtually all producers have entered the market only recently which implies that they would have relatively modern but also costly plants and that Panamá would be less disadvantaged than with respect to the more mature oil industry. The market for foodgrade coconut is, however, limited in size and dominated by a small number of suppliers and few distribution channels.

The market for coconut oil, although at present unattractive with respect to price, has the advantage of being a commodity market in which any producer can be assured of his products being sold.

A strategy for Panamá's coconut industry could thus be to first and foremost seek selfsufficiency with respect to oil. Such selfsufficiency should be achieved in the most cost-efficient way possible, i.e. by improving yield on existing plantations.Further increase in production could primarily be oriented towards the higher value-added products of desiccated coconut and coconut cream. Capacity of the industry could be such that a fall back position would always be to supply the local industry with copra.

B. Major Factors

The major factors which would have a positive effect on a Panamanian coconut industry would be:

- existence and size of domestic market for coconut oil (with Panamá's limited population domestic market for other food grade coconut products can be ignored),
- proximity to and favourable trade treatment in respect of US market for coconut products,
- relative abundance of agricultural land for cultivation of coconuts,
- probable substantial under-utilization of existing coconut plantations,
- existence of disease-resistant and relatively high yielding local coconut tree varieties, and
- proximity to large potential Colombian market for food grade coconut products.

Panamá's three major relative disadvantages as compared to other existing producers would be:

- relatively high cost of labour (present agricultural labour cost in Panamá has been estimated to exceed that of the major producer - the Philippines - by a factor of 2.5 to 3),

- generally difficult to bad soil conditions on account of low pH, and

- expansion of coconut production to satisfy local milling demand and external demand would require costly new plantings (other producers could expand production by improved farming techniques and/or increased application of fertilizers and pesticide).

Other important factors which would have to be reckoned with for a coconut industry in Panamá would be:

- the possibility of relatively long periods when world market copra and coconut oil prices remain at levels below Panamanian production cost,

- possibility of stagnating demand for food grade coconut products in US and UK market on account of reduced immigration from coconut producing countries,

- long gestation period for investment in coconut plantations (5 years till first crop) and therefore possible high sensitivity to prevailing interest rate levels.

With market aspects as a starting point two issues can be identified as a consequence of this listing of factors. A first issue would be: can Panamá reverse underutilization of its existing coconut cultivations to satisfy wholly or in part the existing local demand for copra?

The second would be: to what extent can Panamá benefit from its proximity and CBI advantages in respect of the US market?

C. The Reasons for Underutilization

The reasons why Panamá's existing coconut cultivations appear to be substantially underutilized and generally inadequately maintained would at first glance appear to be essentially a matter of price. The few remaining active coconut planters and copra producers consider the business marginal at best at the copra price level ($ 0.16/lb) presently offered by the two milling companies. At the Government determined floor price of $ 0.125/lb losses to the planters would thus be substantial.

The high world market coconut oil price which prevailed for several years up until mid 1985 ought, however, to have induced local millers to offer copra prices in excess of $ 0.16/lb. It is not known whether or not this was done since there are no price statistics for the Panamanian copra. The fact remains, however, that the coconut planters did not respond by increasing plantation and production. Lingering fear of disease possibly created in part by the unhappy experience of the Jamaican coconut industry during the seventies has been quoted as one possible explanation for the lack of interest.

Another plausible explanation is that Panamá's coconut industry has traditionally been oriented towards supplying Colombia with fresh nuts. As a consequence there are hardly any copra dryers on the north coast where approximately 60 % of the country's coconut trees grow. For the same reason these existing coconut cultivations have been located with a view towards the exigencies of a seaborne trade rather than near roads for transportation to Panamá City where the copra mills are located.

A third reason could be that the entire local demand for copra is generated by only two mills each owned by large and financially resourceful groups. Two such buyers could, in practice, impose their conditions on a large number of small copraproducers. One - that is the Panamá

Boston group - in addition owns one of the larger coconut plantations on the southern coast.

D. The Key Issues

A project to supply the local millers with copra would thus have to address the following issues:

- improvement of yield for existing cultivations well located for transportation to Panamá City,
- increase in the number of copra dryers,
- improvement of prices for copra and as a consequence for nuts, and
- market regulation and/or supervision to safeguard against domination by buyers and to ensure that copra price improvements would benefit cultivators.

The first issue would be addressed by clearing of undergrowth, occasional but probably limited replanting and by increased application of fertilizer. The need to maintain low transport cost would suggest that most coconut cultivations on the north coast should be left out of a revitalization scheme but that a large part of the south coast plantations, which are generally much better served by roads, should be included initially.

An initial emphasis on the southern coast would also make it less costly to address the issue of copra dryers since the flatter terrain on this side would make it possible for one dryer could serve a relatively larger area of cultivation without excessive nut transportation cost. Dryers could still be of simple and inexpensive design using shells as fuel and with selfinduced draft furnaces which would obviate the need for electricity.

Improvement in prices for copra should be coupled with measures to regulate what could otherwise be a hazardous market for a small coconut farmer to depend on. There would need to be both a guaranteed minimum copra as well as nut price. The latter to ensure that price incentives would reach the producer. It would also be necessary to provide guarantees that the entire copra production would be bought. Such guarantees could be similar to those which have been instituted for palm oil which appear to function without the need for a complex system of controls. The palm oil production incentives are principally an imposed minimum oil price of at present $ 700/ton at which the two local industrial consumers have to buy all available local supply in order to be allowed to import oil. The two mills have an annual consumption far in excess of the local palm oil production which makes it necessary for them to import vegetable oil.

Together the two oil processors use approximately 50,000 tons of vegetable oil per year of which, in theory, up to 50 % could be coconut oil with the balance being mainly soyabean oil. For many applications palm oil could substitute for coconut oil for which reason it is probable that the oil mills maximum need for palm and coconut oil together would not substantially exceed 25,000 tons per year (specific data on this was not made available as this would imply divulging trade secrets). A price support mechanism for copra would thus need to complement that for palm oil and both would work only for as long as there would remain a gap to be filled by imports. The price protection formula and implementing mechanism would also need to take into account the expeller cake for which there would be a ready market among Panamá's cattle farmers. The present local price of $ 130/ton of cake would cover more than the cost of operating the crushing mill.

E. Export of Coconut Products

Compared with traditional coconut producing countries Panamá enjoys a favoured position vis-à-vis the very large US market. This favoured positions would apply for copra, oil and/or food grade coconut products.

The advantage with respect to copra and oil essentially means that Panamanian copra and oil would get a duty exemption which approximately equals the cost of shipping. At the anticipated future average price level of $ 500/ton oil cif this means an advantage of close to $ 100/ton since a Panamanian exporter would receive a fob price approximately equal to the cif US price of Philippine oil and since the freight cost for the latter is approximately $ 100/ton.

The Panamanian grower could, at this world market price be paid $ 0.04 per nut whereas the Philippine grower would receive only $ 0.03 per nut.

For desiccated coconut the advantage would be the same, 15 % of the fob value. A higher valueadded of the product would increase the nominal amount of the trade advantage. It is possible, however, that this could partly be offset by the fact that existing producers already possess wholesale and distributing channels as well as recognized trade names, etc. A Panamanian effort to enter the US market for desiccated coconut should therefore probably be limited in terms of sales volume (so as not to provoke a trade war) and be directed towards those areas where there are Panamanians and Panamanian business interests; that is to say towards the Gulf States and in particular towards Florida. Those are also the areas where a low freight cost for Panamanian products would add to the duty advantage. With a market penetration objective of less than 10 % of the entire market Panamanian desiccated coconut could likely co-exist with that from the Philippines without there being price wars. The largest risk with such a scenario could be competion from other Caribbean countries, notably that of Jamaica, which enjoy the same trade advantage as Panamá.

Coconut cream either in the form of a liquid or as dehydrated powder, may in the future develop into a profitable export product. A 1983 study by UNIDO (UNIDO/I.O.R.48, 7 January 1983) in respect of the industrial production of coconut cream, noted that:

"the overall constraint on expansion of export sales is that of total market size, currently estimated to be in the region of 2,100 tonnes for unsweetened coconut cream. Demand is very largely based upon immigrant communities in importing countries and is currently static or possibly following a declining trend as a result of reduced migration and changes in taste amongst second generation immigrants. It is also probable that consumer loyalty to products from countries of origin is declining and hence price competitiveness is assuming greater importance.

Market development beyond that of immigrant communities could arise either via a consumer product, or a bulk product supplied to local food industries directed towards a much more substantial non-migrant population. A bulk product could be more feasible from an economic viewpoint since it allows reduced costs of packaging per unit and greater flexibility in importing countries with regard to utilisation in final products. Which ever approach is adopted key problems arise with regard to the substantial risk involved in introducing new products, and the level of investment and marketing expenditure and expertise required."

Since this report was prepared a new plant for coconut powder was commissioned in the Philippines which thus increased its production and exports substantially. US imports of canned coconut milk has also increased substantially in recent years. The Philippines remains the largest supplier but other producers, such as Puerto Rico, have increased their market share. Liquid coconut cream in cans is likely to require sophisticated marketing and the establishment of brandname identification. For Panamá, were it to become a new entrant in the market, it would probably be wiser to introduce a less costly bulk product in powder form.

F. Other Products for Export

Panamá's present export of coconuts is for human consumption and in the form of fresh nuts bought by Colombian trading vessels on the Atlantic coast. Colombia, with a population of approximately 30 million people, represents a very large market for coconut products since those

have traditionally formed an integral part of the Colombian cuisine. High tariffs on imported products in combination with inadequate local supply has resulted in high prices for fresh nuts and it is probable that part of the Panamanian nuts are smuggled into the country.

Colombia has in recent years promoted local production of coconuts and this may be one reason why the imports from Panamá appear to have stagnated with declining prices as a consequence. Colombian prices for Panamanian nuts used to average $ 0.20 per nut, but they have shown a tendency to drop in recent years. It is unlikely that this very high pricelevel can be maintained for the future, since it probably relates to high coconut oil prices during 1984 and 1985 and in addition might have been affected by high Colombian duties.

An alternative to the Colombian fresh nut market could be that of the southern part of the US which todate imports its entire consumption of nuts. Coconut growers along the Atlantic coast have by tradition located their plantations so that they can be reached by boat rather than by road. For this reason their products would be well located to be exported fresh but more costly to process into copra for local oil milling.

As the viability of the Atlantic coast coconut farms could be impaired by reduced demand from Colombia it is recommended that Panamá institutes programs for the diversification of marketing of fresh nut. Such export programs should focus on the US market and in particular on the large urban centers in the southern part of the US. The main purpose of such programs would not be to expand coconut growing in Panamá but instead to ensure the existing coconut farmers which, due to location, cannot form part of an integrated coconut industry development program of a future market for their products.

An export promotion or market diversification program for existing north coast coconut farmers would, however, not constitute a re-establishment of coconut production and processing industries which is the objective of this investment opportunity study. It is therefore not included in the integrated coconut industry development program.

V. AN INTEGRATED COCONUT INDUSTRY DEVELOPMENT PROGRAM

A. General

The recommended program would consist of three inter-related development schemes to be implemented in sequence.

Phase I. The first would be rehabilitation of approximately 500,000 trees predominantly along the Pacific coast and the installation of approximately 20 dryers for processing the crop of the rehabilitated trees. The first phase would increase yields so that the existing oil mills can be supplied with approximately half their requirement of copra and thus be restarted. To this scheme should be coupled institutional reforms whereby farmers would be guaranteed a certain minimum price for their entire crop.

Phase II. The second scheme would consist of the development of approximately 2,500 ha of new coconut plantations at one and the same location and with a minimum of 8 copra dryers. It would either satisfy the demand of the local oil mills or supply rawmaterial for the third phase.

Phase III. The third and last scheme would be the establishment, preferably at the site of the 2,500 ha plantation, of a food grade coconut processing plant entirely for export. This phase would not occur until eight years after the commencement of Phase I and be made contingent on world market development for different coconut products. Export prices for oil could, at this time, be so attractive as to obviate an investment in a processing plant in which case the entire production of the new plantation could be for copra.

B. Complementing Program

This development program would likely concentrate the coconut development to the country's Pacific coast since it is best suited with respect to terrain and with respect to transport.

Panamá's northern Atlantic coast which can be reached by road from Panama City is generally very hilly and thus costly for the purpose of developing, harvesting and maintaining a large coconut plantation.

It is recommended that the existing coconut plantations on the Atlantic coast, which today sell most of their nuts to Colombian trading vessels, are encouraged to and assisted in developing a market for fresh nuts in the southern parts of the US. This would entail very little in terms of fixed investments but instead require the organization of systems for regular collection and onward shipping of nuts as well as proper marketing channels, advertising, possibly brand name promotion, etc, in the US.

C. Inter-cropping

Coconut farm development is characterized by long gestation periods (five years or more in case of new plantations) during which outlays accumulate and interest on borrowed funds accrue. Once in production a coconut farm could also be subject to the uncertainties the world market coconut oil price. In order to produce an early cashflow and to compensate for sharp swings in oil prices inter-cropping is often tried.

Problems can be many, however, for which reason inter-cropping is rare in Panamanian plantations. The coconut tree, for one, tolerates soils and drainage conditions which often are not amenable to production of cash crops. In the case of Panama a further difficulty is the limited size of the local market which severely restricts the possibilities for inter-cropping with, for instance, vegetables. The same would apply to pineapple which is otherwise well suited for inter-cropping with coconut. Cocoa is another plant often recommended for coconut inter-cropping but it has no local market in Panama. Plantain and groundnuts are two additional crops well suited for inter-cropping. Groundnuts, which in the past were grown in Panama but since abandoned, would need investment in processing facilities and the organization of export marketing systems since the local market would be much to small.

For plantain there is a local market but production is much higher and exports have grown in recent years. Plantain being a simple albeit diseaseprone crop, could be the best available inter-cropping cash crop alternative but care must be taken so that the export market would not be flooded.

The present practice in Panamá is one of grazing cattle in coconut plantations. This would both facilitate the clearing of undergrowth and provide the soil with manure. Recent studies suggest, however, that cattle grazing is detrimental to high yields of coconuts since it compacts the soil and thereby reduces its ability to absorb moisture and fertilizers. Fodder production with tolerant grass such as elephant grass may be an attractive alternative for which there would be a large market in Panamá.

In view of the complexities surrounding inter-cropping and the uncertainties with respect to market prospects for the various crops it is important to structure a development program with projects which are viable and feasible with minimum reliance on revenues from inter-cropping. A more detailed project analysis in the form of feasibility studies for the various projects recommended to form the program should, however, include an assessment of the costs and benefits of various inter-crops. This report limits this analysis of inter-cropping to plantain and elephant grass only. Those two crops are discussed and analysed in general terms in Appendix 1.

D. Implementation

The proposed program would require a total implementation period of 12 years. The first phase would require three years for implementation and full effect of the rehabilitation should be felt within a period of five years.

The second phase, that of the new plantation, could be initiated one year after commencement of the rehabilitation project since detailed studies, soil investigation, arrangement for financing, etc, would require an extra year. First coconut production from the plantation should become available the seventh year after commencement of the entire program. On the assumption that plantation development would be staggered over three years full production would be reached first in the 12th year.

The third phase, that of processing, should be scheduled so that adequate supply of nuts would allow for high initial capacity utilization of a processing plant. This would likely imply start of construction in the 8th year for commencement of production in early or midpart of year 9.

The total investment of the entire program including the processing plant would be approximately $ 14 million in constant 1986 prices. The largest single investment item would be that of the processing plant which would also be the last.

The program and its implementation is summarized in the table overleaf.

There are several alternatives to the above described implementation schedule which should be studied in the course of eventual feasibility studies. One alternative would be to construct the processing plant in time for commissioning in the 3rd year after start of the first phase. The premise in this case would be for the processing plant to be supplied by the rehabilitated smallholder farms. It may also be possible to increase the rehabilitation, i.e. the first phase, to encompass also trees on the north coast and to base the processing plant on raw material from this area. This could have the added advatage of providing an alternative outlet to that of the Colombian traders.

PROGRAM OF IMPLEMENTATION - INTEGRATED COCONUT DEVELOPMENT PROJECT

Year	1	2	3	4	5	6	7	8	9	10	11	12
1. Rehabilitation of farms ('000 trees)	100	200	200									
2. Increase in nut production ('000)			5,000	15,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
3. No. of copra dryers to be constructed		4	8	8						8		
4. New plantation (har)		500	1,000	1,000								
5. Nut production from new plantation ('000 nuts)							1,200	3,900	9,300	16,000	32,000	35,000
6. Total copra production (MT)			1,000	3,000	5,000	5,000	5,000	5,000	5,000	5,000	6,500	7,200
7. Operation of new plant (days)									90	150	250	250
8. Estimated total investments ($'000)	150	1,401	2,805	1,990	614	724	726	2,631	2,456	480	-	-
9. Start of construction of new plant								++				
10. Completion of plant - Start of Operations									++			

E. Government Support

The intiation and the first phase of the program would require substantial institutional involvement which would have to be provided by the Government.

The many small farmers which would rehabilitate their farms under the first phase would need to be identified, to be given advise and assistance in respect of agricultural practices, to be assured of a market for their products, etc. Issues with respect to location, operation and ownership of dryers would need to be resolved. Prices would need to be monitored and it would be necessary to supervise the servicing of loans for rehabilitation purposes.

The second phase should ideally be undertaken by one or several large investors which would also participate fully or partially in the possible processing plant. It may therefore not be necessary for the Government to play as dominant a role in the latter two phases. The issue of price and protection would, however, necessitate continuous Government monitoring. There may occur, as has been pointed out, periods during which world market prices for copra and oil would fall to a level below cost of production in Panamá. Since copra and coconut oil is used almost entirely for domestic consumption in the form of consumer goods, Panamá can afford copra and coconut oil producers with protection without there being any negative effects on any Panamanian export industry.

Doing so in an equitable and economically justifiable manner would, however, call for constant monitoring of production costs and world market prices.

VI. PHASE ONE - REHABILITATION

A. General

There are in Panamá about 2.8 million coconut trees, 62 % of which are estimated to grow on the Atlantic coast and the balance along the Pacific shores. Most trees on the Atlantic coast grow in remote and inaccessible areas, such as in the San Blas archipelago and in Chagres whereas a large proportion of the trees on the Pacific coast are located in areas which are served by roads. In 1981 a total of 1.9 million of these trees were considered as fruitbearing each yielding an average of 10 nuts per tree and year. Most of the remaining 1 million trees were, at that time, newly planted which implies that there now should be close to 2.8 million fruitbearing trees assuming that dead trees have been replaced by new plantings.

Experience from several Caribbean countries suggests that old and low yielding trees can be rehabilitated to increase production to over 60 nuts per tree per year. Rehabilitation consists of cleaning, fertilization, and pest control. It has been shown that the yield can increase to about 60 nuts on the third year after application of fertilizer[1)].

There are two oil processing plants in Panamá: Cia, Panamá de Aceites, and Industrias Panamá Boston, which have facilities for milling copra and processing coconut oil. The combined milling capacity of the plants is about 46 tons of copra per day corresponding to 10,000 tons per year. The mills have ceased to operate due to lack of copra. The oil processing plants could use about of 10,000 tons coconut oil per year for their soap, margarine and edible oils production.

[1)] Report for UNIDO in 1984 by Pedro Catanaoan on Coconut Development for the Caribbean and Feasibility Study for Rehabilitation of Coconut Plantation in St. Lucia by Caribbean Development Bank, 1983

This project envisions the production of about 5 million additional nuts in the third year, 15 million nuts in the fourth year and 25 million nuts in the fifth year and onwards. These nuts would be processed to 1,000 tons of copra in the third year, 3,000 tons in the fourth year and 5,000 tons in the fifth year on, i.e. corresponding to half the processing capacity of the two local mills. A project to rehabilitate coconut trees would thus both increase the income of the coconut farmers and reduce vegetable oil imports in a short period of time.

B. Investment

The project would comprise the rehabilitation of 500,000 viable coconut trees in a period of three years: 100,000 in the first year, 200,000 in the second year and another 200,000 in the third year. The area for rehabilitation may be expanded further if the situation warrants. The gradual expansion would make possible annual evaluation of the project for possible improvements or modifications, as well as a reassessment of its viability. The total number of trees expected to be rehabilitated would correspond to approximately half the estimated population on the Pacific coast.

First priority would be the rehabilitation of large scale plantations (at least 100 hectares). Second in priority should be cooperatives of farmers with a total farm area with at least 10,000 trees.

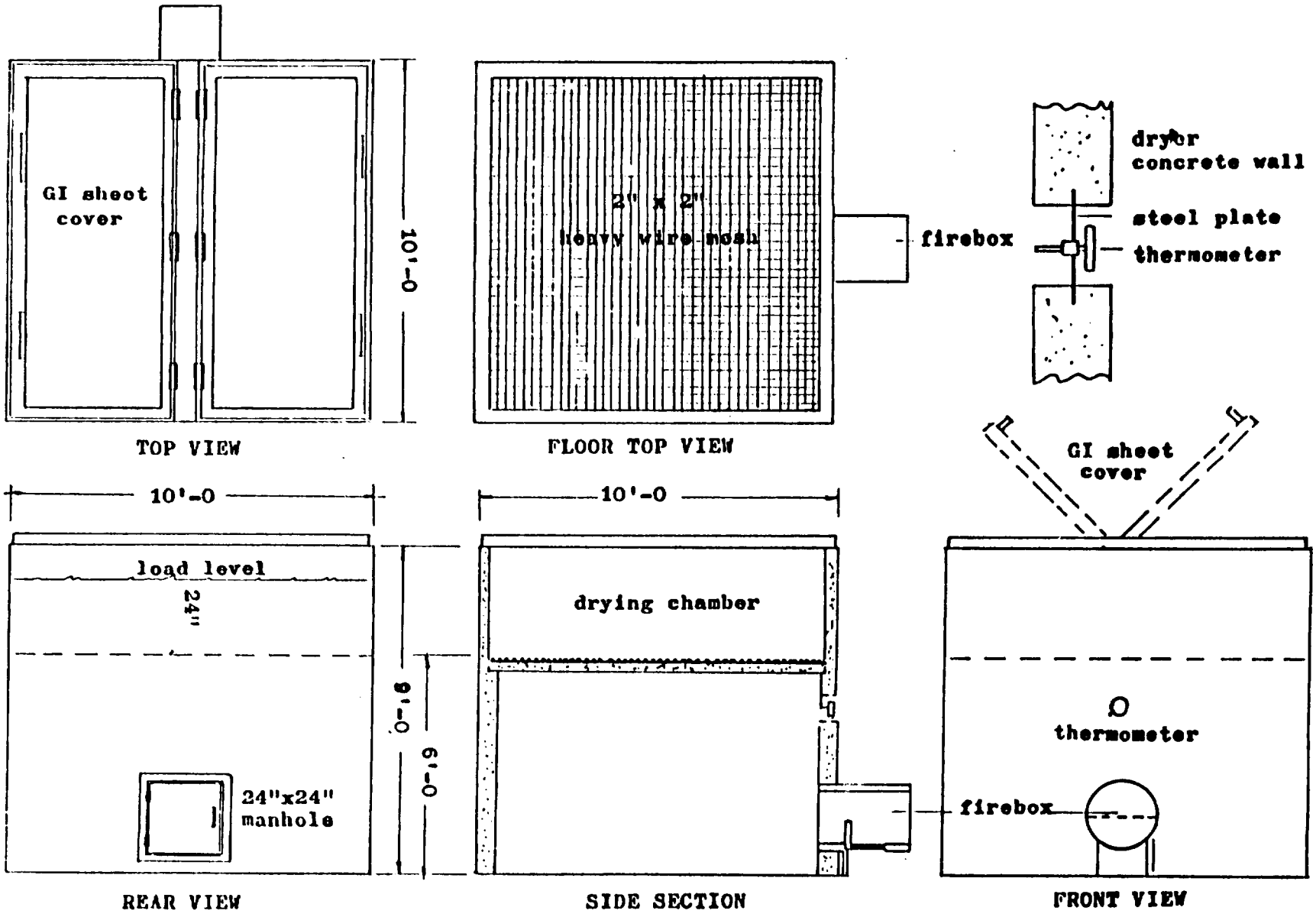
Cash investment for rehabilitation of trees is estimated at $ 1.50 per tree per year for two years for each tree, i.e., a total of $ 3 per tree, of this 80 cents would be for fertilizer, 50 cents for hired labour, and 20 cents for other expenses.

There are eight rainy months in Panamá, May to December. Copra making by the conventional sun-drying method is difficult during these months. Yields are highest during the rainy season, thus making drying loads the heaviest during this period. Much of the success of the rehabilitation project as a source of copra supply for the oil mills will depend on the existence of suitable copra dryers. At present there are very few dryers available and most of the country's copra is sun-dried.

The project should therefore also comprise the construction of a total of 20 simple copra dryers: four during the first year, eight during the second year and another eight during the third year. The schedule of construction of the dryers would be a year ahead of expected nut production from the rehabilitated farms.

Each dryer would have a capacity of 10,000 nuts per loading, with one loading every two days, which would mean an average production of one ton of copra per day. The dryers should be located in areas where there are sufficient nuts to supply the dryer capacity, at least 25,000 trees within a five kilometer radius. The dryer can be considered as a small plant consisting of a drying kiln, a tractor with trailer for hauling nuts from the farms to the dryer, a dryer shed and a small office building. It would be manned by two dryer operators, one tractor driver and two helpers which, at an average daily wage of $ 7 would cost $ 9,000 annually. Other operating costs cush as tractor fuel and maintenance could be estimated at $ 3,000 per drier and year.

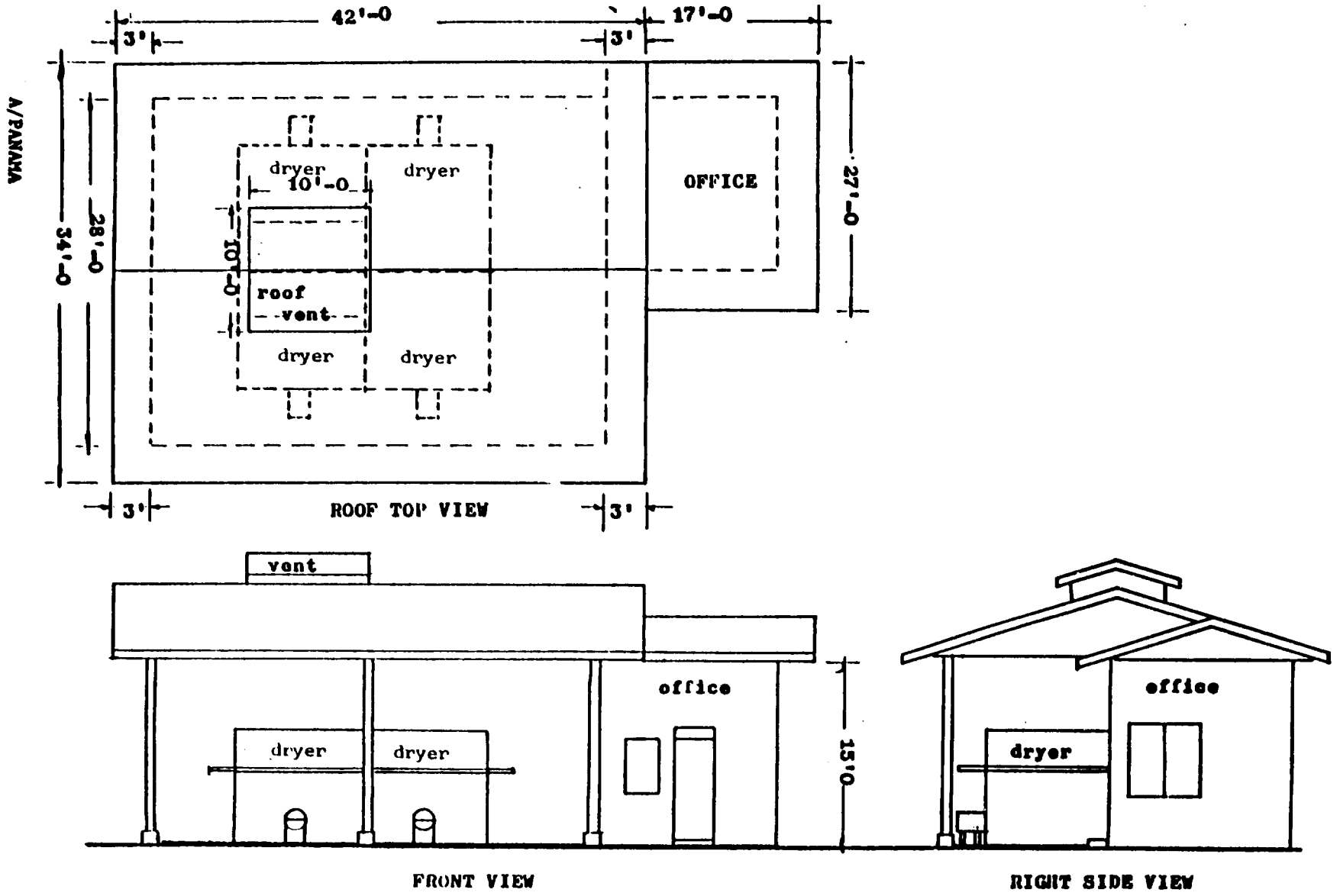
Design for a suitable dryer is shown on the following pages.



PCC COPRA DRYER

Scale: ¼" = 1'-0"

Designed by:
P.C. Catanaoan



COPRA DRYING STATION - BUILDING PLAN

Scale: 3/32" - 1'-0

Designed by:
P.C. Catanaoan

C. Marketing and Organization

The copra should be sold to the existing two oilmilling firms under a marketing arrangement which would need to be guaranteed and monitored by the Government of Panamá. This marketing arrangement would need to include a minimum price for copra and a mechanism which guarantees that the local oil millers would use locally produced copra to the maximum extent possible. Such a mechanism exists today with respect to locally produced palm oil. A marketing arrangement for copra would need to be developed in conjunction with the existing palm oil arrangement so that the two products do not compete but instead complement each other.

This arrangement, which would be of crucial importance for the success of the rehabilitation project, would require the active involvement of a branch of the Government. Such an involvement would be called for already in the project preparation phase when suitable plantations would need to be evaluated and financing applied for. Many farmers may not find themselves in a position to prepare the type of information typically required for soliciting finance for which reason assistance would be required. The project would therefore likely require the establishment of a Coconut Rehabilitation Department within the appropriate ministry. Such a Department, which could have a mandate during a specific period of time only, should assume responsibility for 1) informing eligible farmers of the project, 2) selecting farms suitable for rehabilitation, 3) identifying suitable locations for dryers, 4) arranging for suitable long-term funding, 5) establishing marketing arrangements for copra, 6) setting up of a copra marketing monitoring unit, and 7) assisting individual farmers in preparing and documenting their projects.

Another important organizational aspect which should be carefully reviewed at a detailed project preparation stage or in the course of a feasibility study is that of ownership and operational responsibility of the dryers in case it shall service more than one plantation.

In such a case a dryer can be owned and operated by a farmers cooperative, by an independent entrepreneur or by the copra buyer, i.e. the oilmiller. The ownership and operating responsibility becomes an important issue since the dryer, due to its location, has a virtual monopoly on the drying of nuts from neighbouring plantations. It is therefore often beneficial for there to be a common interest between owners of dryer and owners of plantations. On the other hand, experience has shown that farmers cooperatives as owners of dryers frequently tolerate inefficiency and inadequate maintenance. The best ownership and operating structure for the dryers would have to be determined on a case by case basis.

D. Principal Cost and Revenue Assumptions

UNIDO's COMFAR program has been used to prepare detailed financial projections for the rehabilitation project in total. The projected results scaled down in proportion would also apply to what has been assumed to be a typical unit, namely a plantation with 10,000 trees. The projections assume that yields will increase by 50 nuts per rehabilitated tree and year to reach 60 nuts per tree and year in three years. This corresponds to a relatively low yield by Caribbean standards where well maintained plantations can be expected to yield in excess of 80 nuts per tree and year[1)].

The coconut varieties which dominate in Panamá today are Altos Pacifico and Tres Picos which both have large and heavy nuts weighing on average 900 grams each and yielding 220 grams of copra.

[1)] See UNIDO study on Caribbean Coconut Development by Pedro Catanaoan

The investment required in order to achieve the higher yield would consist of clearing of undergrowth and of application of fertilizers and pesticides. Maintenance of yield would require continued clearance and fertilizer applications at approximately the same rate as would apply for the rehabilitation. The schedule of investment assuming 20 % equity financing and 80 % loans would be as follows:

Investment ($ '000)

Year	Equity	Loan area 1 drawdown	Loan area 2 drawdown	Loan area 3 drawdown	Total
1	30	120			150
2	90	120	240		450
3	120		240	240	600
4	60			240	300
	300	240	480	480	1,500

It should be noted that cost of own labour has not been included in the investment cost. This implies that the equity portion is in reality somewhat higher than the nominal 20 %.

The dryers have been estimated to each cost $ 55,000 to which should be added an estimated $ 5,000 as working capital.

Dryer cost	Per dryer	For 20 dryers
Drying kiln	$ 5,000	$ 100,000
Dryer shed	15,000	300,000
Office	3,000	60,000
Tractor	14,000	280,000
Trailer	4,000	80,000
Misc. tools & equipment	500	10,000
Site development	5,000	100,000
Installation	3,500	70,000
Contingency	5,000	100,000
Total dryer cost	55,000	1,100,000
Working capital	5,000	100,000
Total project cost	$ 60,000	$ 1,200,000

The operating costs are based on 1986 prices in Panamá those being for, for instance, farm labour $ 5/day and for NPK fertilizer $ 0.16/lb, etc.

Revenue calculations use a copra sales price of $ 350/ton at the dryer. Today's price is slightly lower at $ 0.16/lb delivered at the oil mill. The table on page 20 suggests that the farmer at this copra price would get slightly more than $ 0.05 per nut and that this sales price would allow him to cover his costs and generate a profit.

It deserves to be noted that the financial projections are in constant 1986 prices. Today's international interest rates at approximately 9 % for US dollars reflect the fact that there has been and still is inflation. For projections in constant prices it could be argued that the interest rate should be the real, i.e. net of inflation, interest rate which is likely to prevail for the future. The projections in this report are conservative in that they apply an interest of 9 % per annum.

E. Summary of Financial Projections

The financial projections suggest that the rehabilitation project would be quite profitable in total as well as for the individual farmer even though the copra price is only marginally higher than that which is being paid today. Projected return on total investment would be 14.4 %. At the assumed interest rate of 9 % the return on the cash equity investment would be close to 24 %. These results, although aggregate for the entire project, would suggest that very few farmers would need to risk losses.

The possibility of increasing revenue by inter-cropping could further improve the attractiveness of the scheme. The data provided in Appendix 1 suggest that fodder production could yield an average annual revenue per hectare of in excess of $ 100. Plantain, which is generally more profitable than fodder, but also more labour intensive and riskier, is not well suited as an inter-crop for a mature coconut plantation with limited sunshine at the ground.

Cashflow Tables, construction in 000$

Year	1986	1987
Total cash inflow . .	150.00	690.00
Financial resources .	150.00	690.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	155.40	725.64
Total assets	150.00	690.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	5.40	35.64
Repayment	0.00	0.00
Corporate tax . . .	0.00	0.00
Dividends paid . . .	0.00	0.00
Surplus (deficit) .	-5.40	-35.64
Cumulated cash balance	-5.40	-41.04
Inflow, local	30.00	138.00
Outflow, local	0.00	34.00
Surplus (deficit) .	30.00	104.00
Inflow, foreign . . .	120.00	552.00
Outflow, foreign . . .	155.40	691.64
Surplus (deficit) .	-35.40	-139.64
Net cashflow	-150.00	-690.00
Cumulated net cashflow	-150.00	-840.00

Cashflow tables, production in 000#

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total cash inflow	1391.00	1791.00	1788.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00
Financial resources	1080.00	780.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax	311.00	1011.00	1788.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00
Total cash outflow	1446.36	1766.32	1660.13	1828.56	1828.56	1828.56	1828.56	1828.56	1828.56	1828.56	1590.13	1430.00
Total assets	1080.00	780.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs	267.00	820.00	1392.00	1430.00	1430.00	1430.00	1430.00	1430.00	1430.00	1430.00	1430.00	1430.00
Cost of finance	99.36	166.32	194.40	187.76	168.79	148.11	125.58	101.01	74.23	45.04	13.22	0.00
Repayment	0.00	0.00	73.73	210.79	229.76	250.44	272.98	297.55	324.33	353.52	146.91	0.00
Corporate tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit)	-55.36	24.68	127.87	115.45	115.45	115.45	115.45	115.45	115.45	115.45	353.87	514.00
Cumulated cash balance	-96.40	-71.72	56.15	171.60	287.04	402.49	517.94	633.38	748.83	864.27	1218.15	1732.15
Inflow, local	527.00	1167.00	1788.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00
Outflow, local	245.00	616.00	936.00	970.00	970.00	970.00	970.00	970.00	970.00	970.00	970.00	970.00
Surplus (deficit)	282.00	551.00	852.00	974.00	974.00	974.00	974.00	974.00	974.00	974.00	974.00	974.00
Inflow, foreign	864.00	624.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign	1201.36	1150.32	724.13	858.56	858.56	858.56	858.56	858.56	858.56	858.56	620.13	460.00
Surplus (deficit)	-337.36	-526.32	-724.13	-858.56	-858.56	-858.56	-858.56	-858.56	-858.56	-858.56	-620.13	-460.00
Net cashflow	-1036.00	-589.00	396.00	514.00	514.00	514.00	514.00	514.00	514.00	514.00	514.00	514.00
Cumulated net cashflow	-1876.00	-2465.00	-2069.00	-1555.00	-1041.00	-527.00	-13.00	501.01	1015.01	1529.01	2043.01	2557.01

Cashflow Discounting:

a) Equity paid versus Net income flow:
- Net present value ..... 815.94 at 10.00 %
- Internal Rate of Return (IRRE1) .. 23.98 %

b) Net Worth versus Net cash return:
- Net present value ..... 693.83 at 10.00 %
- Internal Rate of Return (IRRE2) .. 22.01 %

c) Internal Rate of Return on total investment:
- Net present value ..... 655.65 at 10.00 %
- Internal Rate of Return (IRR) .. 14.38 %

Net Worth = Equity paid plus reserves

Net Income Statement in 000$

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total sales, incl. sales tax	311.00	1011.00	1788.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variable margin	311.00	1011.00	1788.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00	1944.00
As % of total sales	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	308.00	913.00	1522.00	1560.00	1560.00	1560.00	1560.00	1560.00	1560.00	1560.00
Operational margin	3.00	98.00	266.00	384.00	384.00	384.00	384.00	384.00	384.00	384.00
As % of total sales	0.96	9.69	14.88	19.75	19.75	19.75	19.75	19.75	19.75	19.75
Cost of finance	99.36	166.32	194.40	187.76	168.79	148.11	125.58	101.01	74.23	45.04
Gross profit	-96.36	-68.32	71.60	196.24	215.21	235.89	258.43	282.99	309.77	338.96
Allowances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable profit	-96.36	-68.32	71.60	196.24	215.21	235.89	258.43	282.99	309.77	338.96
Tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net profit	-96.36	-68.32	71.60	196.24	215.21	235.89	258.43	282.99	309.77	338.96
Dividends paid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Undistributed profit	-96.36	-68.32	71.60	196.24	215.21	235.89	258.43	282.99	309.77	338.96
Accumulated undistributed profit	-96.36	-164.68	-93.08	103.16	318.36	554.25	812.68	1095.67	1405.44	1744.41
Gross profit, % of total sales	-30.98	-6.76	4.00	10.09	11.07	12.13	13.29	14.56	15.93	17.44
Net profit, % of total sales	-30.98	-6.76	4.00	10.09	11.07	12.13	13.29	14.56	15.93	17.44
ROE, Net profit, % of equity	-25.09	-12.65	13.26	36.34	39.85	43.68	47.86	52.41	57.37	62.77
ROI, Net profit+interest, % of invest.	0.16	3.63	9.85	14.22	14.22	14.22	14.22	14.22	14.22	14.22

VII. PHASE TWO - NEW PLANTATION

A. The Market

The rehabilitation project cannot be expected to increase yields to the extent that the local demand for copra would be fully satisfied. To do so would require new plantings. Such new plantings would need to be in the form of one or several large and partly mechanized farm developments in which economies of scale should be applied to reduce production cost as far as possible.

The rehabilitation project could be expected to cover approximately half of today's annual potential local demand for copra or 5,000 tons. Although growth in local demand for oilbased products has been sluggish in recent years it appears likely that consumption for the future would approximately keep pace with population growth. This would imply that present demand for copra by the local oil millers would, 10 years from now, have increased from 10,000 tons per year to 12,000 tons, of which approximately 7,000 tons would have to be supplied by new developments. This would in turn require the cultivation of close to 400,000 coconut trees each yielding about 90 nuts per year each with an average copra content of 220 grams.

Such a development could alternatively make it possible to integrate coconut farming with production of potentially more lucrative high quality food grade products destined for the US market in which Panamá enjoys a competive advantage which increases with the valueadded of the product. A large scale plantation which could supply at least 100,000 nuts per day or about 25 million nuts per year would make possible the establishment of an economical size coconut processing plant. Whole, husked nuts could be supplied regularly as the raw material for the plant. The plantation should be located as near as possible to the plant to minimize cost of transporting the nuts and to reduce nut breakage in transport. If possible, the plantation should be on flat land.

B. Investment

The plantation project would be recommended to consist of the development of approximately 2,500 hectares of coconuts, in one area, during a period of three years; 500 hectares during the first year, 1,000 during the second year, and another 1,000 hectares in the third year. To meet the requirements of "wet processing", the "pacific tall" variety, Altos Pacifico, should be planted. With a distance of 8 meters the tree density would be 156 trees per hectare. With proper farm management, the pacific tall could be expected to yield about 80 to 100 nuts per tree per year at the age of eight to ten years, and it would start bearing at the age of five. A likely annual progression yield would be as follows:

Age	Nuts per tree per year	Nuts per ha per year
5	15	2,340
6	20	3,120
7	50	7,800
8	70	10,290
9	90	14,040
10	90	14,040

The costs incurred for the development of a plantation are essentially operating costs (labour, fertilizer, etc) during the long gestation period and interest on loans for this purpose during the same period. The cost of the first year's development of the land has been estimated at $ 673 per ha, as follows:

	Per ha	2,500 ha
Land clearing and preparation - 54 man-days x $ 5.00	$ 270	675,000
Seedlings - 156 x 1.10 x $ 0.25	43	107,500
Labour for transfering and planting seedlings - 6 man-days x $ 5.00	30	75,000
Hand-weeding - 40 man-days x $ 5.00	200	500,000
Tractor fuel and miscellaneous costs	70	175,000
Contingencies	60	150,000
Total	673	1,682,500

Subsequent annual maintenance cost would increase gradually year by year from $ 180 in the first year to $ 280 per year and ha in year 7 on account of increased application of fertilizer per tree. Total cost of land development planting and maintenance during early non-productive years has been estimated at $ 6.3 million to which should be added $ 0.3 million for farmbuildings, equipment and working capital. It should be noted and emphasized that this investment cost is exclusive of the value of land.It is probable that some presently idle land or otherwise inexpensive grazing land could be used in large part for the plantation.

C. Production and Processing

Harvesting would be by "hooking" or climbing since half-ripe nuts would be required for processing. Husking would be done at the plantation and the husked nuts would be hauled to roadside in tractor-drawn trailers. From there the nuts would be transported by trucks to the plant.

Nut production would start five years after first planting and level out at 35 million nuts per year seven years later when all trees would have reached full maturity.

The project should, if a coconut processing plant with an annual processing capacity of 25 million nuts is constructed, include a minimum of eight copra dryers for processing the remaining 10 million nuts into copra for the local oil mills. If the entire production would be converted into copra, a total of approximately 30 dryers would need to be installed.

D. Location

A possible location for a plantation of this size could be the canefields of the closed-down Felipillo sugar factory, some 50 km east of

Panamá City. The sugar plantation has a total area of 6,136 hectares formerly planted with sugar cane, of which some 50 % could be suitable for coconut. The soil is sandy near the seashore but becomes more clayey inland.

There are three fresh water rivers: Rio Cabra, Rio Tatare, and Rio Pacora, which can be tapped for irrigation. The land is relatively flat but the soil is slightly acidic. The existence of roads formerly used for hauling crane would reduce the development cost.

Another possible location of a plantation of this size could be in Cocle Province and on the plains surrounding the city of Cocle where coconut trees in scattered stands appear to grow well. Land in this area is used mainly for grazing.

In Veraguas Province, on the eastern shore of the Gulf of Montigo near Mariato, Panamá Boston owns a large coconut plantation which in the past was reported to have given very high yields. South of this plantation, which is now served by a good road, there would likely also be adequate virgin land for a large plantation.

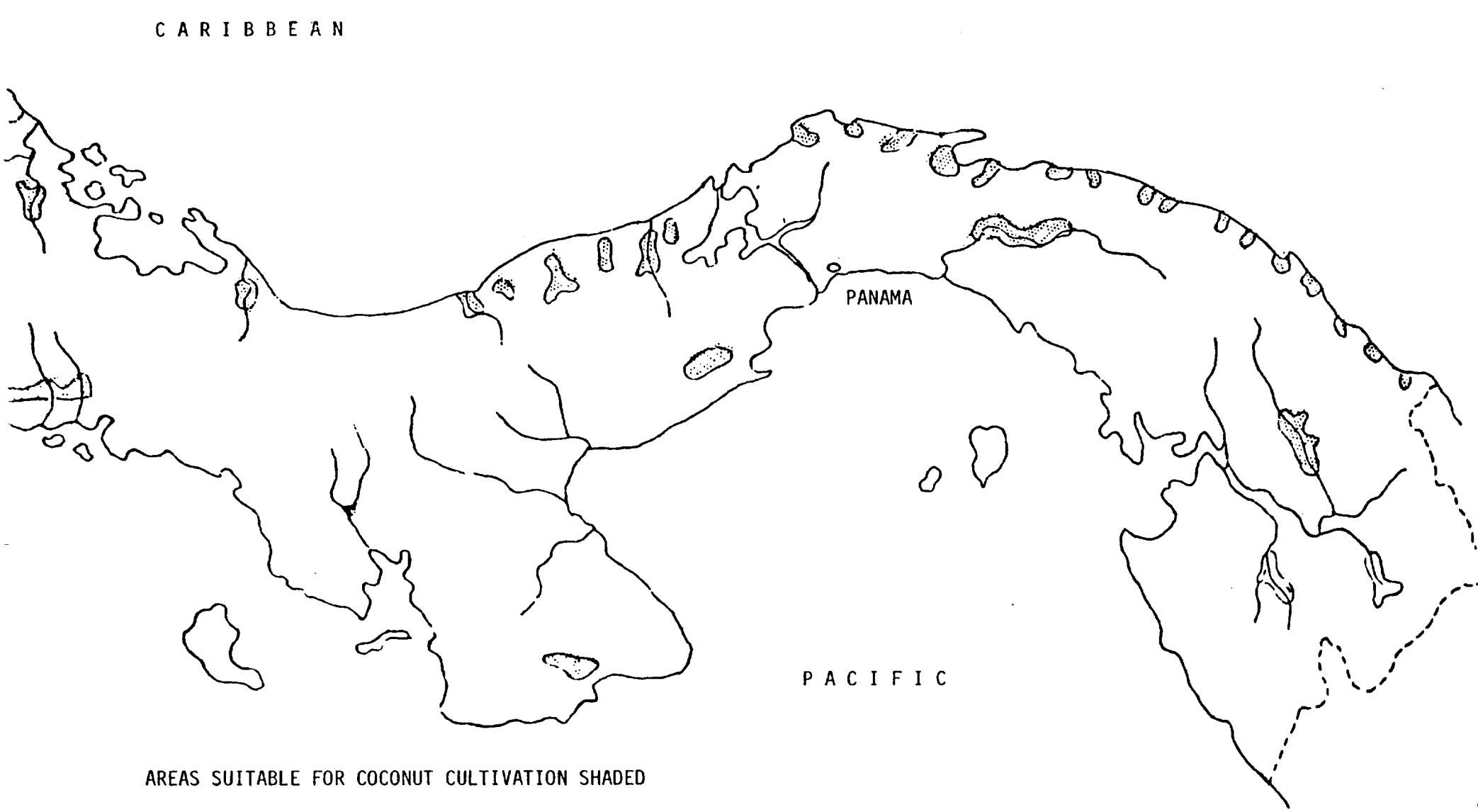
Suitable land and locations for coconut plantations in Panamá have been investigated by FAO and documented in a report "The Suitability of the Republic of Panamá for the Cultivation of Coconuts" by D.H. Romney.

Mr Romney's study points to the fact that the best locations from a climatic point of view are along the northern Atlantic coast which has a high and evenly distributed rainfall but very few roads and hilly terrain. The Pacific coast, well served by roads and with flat and easily managed plains, has generally lower rainfall and a more pronounced dry season during which growth would be limited.

The FAO report also notes that Panamá in general has acidic soils which reduces the plants' ability to absorb nutrients. Mr Romney has identified a number of areas with alluvial and thus non-acidic soils which would be well suited for coconut plantations. Most such areas are also located in narrow valleys along the northern coast and beyond

the reach of roads. This points to a need to carry out very thourough soil investigations and possibly trial plantings before commencing on developing and planting large areas.

The map overleaf, taken from the FAO study, shows some areas of alluvial soils in Panamá.



AREAS SUITABLE FOR COCONUT CULTIVATION SHADED

E. Inter-cropping

Tentative data presented in Appendix 2 suggest that a plantation could improve its cash flow during the early years by planting plantain which appears to be one of the relatively few cash crops which grows well in Panamá's poor soils and for which there is ready market and functioning distribution channels.

This inter-cropping possibility would likely only exist when the coconut tree's foliage is still limited; that is during the first three to four years after planting. It is also probable that plantain yields would decline as the coconut tree grows bigger.

The initial investment in planting plantains has been estimated at $ 700 ha which in one year's time would start yielding a return which should approximate $ 750/ha. Subsequent years should provide an income after cost of production of $ 940/ha. (See Appendix 1 page 3). It may be, however, that increased interference from coconut trees reduces this and that a more realistic result would be the same as the first year, i.e. $ 750/ha. The third and forth year should see a gradual reduction so that a fifth year would have given no return. The third year would under this assumption contribute $ 500/ha and the fourth $ 250.

For an entire 5-year cycle of planting followed by four years of harvesting, the total income after deducting cost of planting could thus amount to $ 2,000/ha or $ 400/ha and year.

In the years following plantain fodder could be planted. It is probable that a hardy grass, such as the African elephant grass, could yield between 600 and 1,200 bales of dry roughage per year and ha. At a value of $ 0.50 per 25 kg bale the net result after amortizing the initial planting cost over four years would be $ 100 per ha. For a 2,500 ha coconut plantation this would mean increasing annual revenue by more than 10 %.

F. Summary of Financial Projections

The COMFAR financial projections for a 2,500 ha coconut plantation project which would produce and sell, at full capacity 25 million nuts and 770 tons of copra, are shown overleaf. The projections do not include any revenues from inter-crops.

The projections assume that the plantation would operate in conjunction with a processing plant which would buy the nuts for a price of $ 0.055 per nut for further processing into desiccated coconut and coconut cream powder. The sales price is slightly higher than that which the rehabilitation project implicitly assumes would be paid to small farmers. This is on account of nut transport cost which would be practically nil in case the processing plant is located at the site of the plantation.

Cashflow Tables, construction in 000$

Year	1986	1987	1988	1989
Total cash inflow . .	724.00	1032.00	1237.00	614.00
Financial resources .	724.00	1032.00	1237.00	614.00
Sales, net of tax . .	0.00	0.00	0.00	0.00
Total cash outflow . .	724.00	1110.03	1386.49	821.81
Total assets	724.00	1032.00	1237.00	614.00
Operating costs . . .	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	78.03	149.49	207.81
Repayment	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00
Surplus (deficit) .	0.00	-78.03	-149.49	-207.81
Cumulated cash balance	0.00	-78.03	-227.52	-435.33
Inflow, local	218.00	310.00	371.00	184.00
Outflow, local	65.00	0.00	0.00	0.00
Surplus (deficit) .	153.00	310.00	371.00	184.00
Inflow, foreign . . .	506.00	722.00	866.00	430.00
Outflow, foreign . . .	659.00	1110.03	1386.49	821.81
Surplus (deficit) .	-153.00	-388.03	-520.49	-391.81
Net cashflow	-724.00	-1032.00	-1237.00	-614.00
Cumulated net cashflow	-724.00	-1756.00	-2993.00	-3607.00

Cashflow tables, production ia 000$

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total cash inflow . .	787.35	940.50	1264.80	1675.90	1855.00	1952.50	2145.00	2145.00	2145.00	2145.00
Financial resources .	723.00	726.00	750.00	775.00	480.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	64.35	214.50	514.80	900.90	1375.00	1952.50	2145.00	2145.00	2145.00	2145.00
Total cash outflow . .	1044.93	1211.56	1382.05	1749.10	2669.71	2399.54	2437.54	2437.54	2437.54	2437.54
Total assets	724.00	726.00	751.00	776.00	480.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	71.00	190.00	289.00	583.00	1472.00	1622.00	1660.00	1660.00	1660.00	1660.00
Cost of finance . . .	249.93	295.56	342.05	390.11	414.54	421.81	389.80	354.90	316.87	275.40
Repayment	0.00	0.00	0.00	0.00	303.17	355.73	387.74	422.64	460.68	502.14
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	-257.58	-271.06	-117.24	-73.20	-814.71	-447.04	-292.54	-292.54	-292.54	-292.54
Cumulated cash balance	-692.91	-963.97	-1081.22	-1154.42	-1969.13	-2416.17	-2708.71	-3001.25	-3293.80	-3586.34
Inflow, local	281.35	432.50	739.80	1132.90	1471.00	1952.50	2145.00	2145.00	2145.00	2145.00
Outflow, local	71.00	190.00	289.00	583.00	1472.00	1528.00	1528.00	1528.00	1528.00	1528.00
Surplus (deficit) .	210.35	242.50	450.80	549.90	-1.00	424.50	617.00	617.00	617.00	617.00
Inflow, foreign . . .	506.00	508.00	525.00	543.00	384.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	973.93	1021.56	1093.05	1166.10	1197.71	871.54	909.54	909.54	909.54	909.54
Surplus (deficit) .	-467.93	-513.56	-568.05	-623.10	-813.71	-871.54	-909.54	-909.54	-909.54	-909.54
Net cashflow	-730.65	-701.50	-525.20	-458.10	-577.00	330.50	485.00	485.00	485.00	485.00
Cumulated net cashflow	-4337.65	-5039.15	-5564.35	-6022.45	-6599.45	-6268.95	-5783.95	-5298.95	-4813.95	-4328.95

Cashflow Discounting:

a) Return on Equity 1:
Net present value ..... -1821.33 at 10.00 %
Internal Rate of Return (IRRE1) .. not found

b) Return on Equity 2:
Net present value ..... -3968.63 at 10.00 %
Internal Rate of Return (IRRE2) .. not found

c) Internal Rate of Return on total investment:
Net present value ..... -2987.73 at 10.00 %
Internal Rate of Return (IRR) .. 1.74 %

Equity 1 = Total equity paid : Net income
Equity 2 = Initial equity paid : Net cash return

Net Income Statement in 000$

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total sales, incl. sales tax	64.35	214.50	514.80	900.90	1375.00	1952.50	2145.00	2145.00	2145.00	2145.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variable margin	64.35	214.50	514.80	900.90	1375.00	1952.50	2145.00	2145.00	2145.00	2145.00
As % of total sales	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	87.90	212.90	311.90	605.90	1494.90	1665.30	1703.30	1703.30	1703.30	1703.30
Operational margin	-23.55	1.60	202.90	295.00	-119.90	287.20	441.70	441.70	441.70	441.70
As % of total sales	-36.60	0.75	39.41	32.75	-8.72	14.71	20.59	20.59	20.59	20.59
Cost of finance	249.93	295.56	342.05	393.11	414.54	421.81	389.80	354.90	316.87	275.49
Gross profit	-273.48	-293.96	-139.15	-95.10	-534.44	-134.61	51.90	86.80	124.83	166.30
Allowances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable profit	-273.48	-293.96	-139.15	-95.10	-534.44	-134.61	51.90	86.80	124.83	166.30
Tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net profit	-273.48	-293.96	-139.15	-95.10	-534.44	-134.61	51.90	86.80	124.83	166.30
Dividends paid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Undistributed profit	-273.48	-293.96	-139.15	-95.10	-534.44	-134.61	51.90	86.80	124.83	166.30
Accumulated undistributed profit	-273.48	-567.44	-706.58	-801.69	-1336.13	-1470.74	-1418.84	-1332.05	-1207.21	-1040.92
Gross profit, % of total sales	-424.99	-137.04	-27.03	-10.56	-38.87	-6.89	2.42	4.05	5.82	7.75
Net profit, % of total sales	-424.99	-137.04	-27.03	-10.56	-38.87	-6.89	2.42	4.05	5.82	7.75
ROE, Net profit, % of equity	-21.04	-19.36	-7.98	-4.82	-25.81	-6.50	2.51	4.19	6.03	8.03
ROI, Net profit+interest, % of invest.	-0.54	0.03	3.49	4.48	-1.70	4.07	6.25	6.25	6.25	6.25

Projected Balance Sheets, construction in 000$

Year	1986	1987	1988	1989
Total assets	724.00	1834.03	3220.52	4042.33
Fixed assets, net of depreciation	0.00	671.00	1781.03	3167.52
Construction in progress	671.00	1110.03	1386.49	821.81
Current assets	53.00	53.00	53.00	53.00
Cash, bank	0.00	0.00	0.00	0.00
Cash surplus, finance available	0.00	0.00	0.00	0.00
Loss carried forward	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00
Total liabilities	724.00	1834.03	3220.52	4042.33
Equity capital	218.00	529.00	899.00	1083.00
Reserves, retained profit	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00
Long and medium term debt	506.00	1228.00	2094.00	2524.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	78.03	227.52	435.33
Total debt	506.00	1306.03	2321.52	2959.33
Equity, % of liabilities	30.11	28.79	27.91	26.79

Projected Balance Sheets, Production in 000s

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total assets	5022.91	6019.97	6887.22	7735.42	8726.96	8818.28	8774.98	8679.78	8549.68	8361.54
Fixed assets, net of depreciation	3672.43	4673.53	5376.53	6104.73	6657.63	7254.53	7211.23	7167.93	7124.63	7081.33
Construction in progress	724.00	726.00	751.00	776.00	440.00	0.00	0.00	0.00	0.00	0.00
Current assets	53.00	53.00	53.00	53.00	93.00	93.00	93.00	93.00	93.00	93.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward	0.00	273.48	567.44	706.58	801.69	1336.13	1470.74	1418.84	1332.05	1207.21
Loss	273.48	293.96	139.15	95.10	534.44	134.61	0.00	0.00	0.00	0.00
Total liabilities	5022.91	6019.97	6887.22	7735.42	8726.96	8818.28	8774.98	8679.78	8549.68	8361.54
Equity capital	1300.00	1518.00	1743.00	1975.00	2071.00	2071.00	2071.00	2071.00	2071.00	2071.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00	51.90	86.80	124.83	166.30
Long and medium term debt	3030.00	3538.00	4063.00	4606.00	4686.83	4331.11	3943.36	3520.72	3060.05	2557.91
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	692.91	963.97	1081.22	1154.42	1969.13	2416.17	2709.71	3001.25	3293.80	3586.34
Total debt	3722.91	4501.97	5144.22	5760.42	6655.96	6747.28	6652.08	6521.98	6353.84	6144.25
Equity, % of liabilities	25.89	25.22	25.31	25.53	23.73	23.49	23.60	23.86	24.22	24.71

The operational costs would comprise of maintenance cost, cost of farm administrative staff estimated at $ 75,000 per year and the cost of operating eight copra dryers. The latter would be identical to those projected for the rehabilitation project.

The other assumptions are derived from the same base as those for the rehabilitation project but the higher investment per hectare in combination with the long gestation makes the plantation project much less profitable. The projected internal rate of return for the entire investment is only 1.74 %. With a capital cost for borrowed funds of 9 % this means that the project would be unable to repay its debt.

With a lower interest rate of, for instance, 5 % which may be available for agricultural project the internal rate of return would increase only marginally to 3.7 % and the project would still not be able to generate enough funds to retire the debt. It has been assumed that the debt would correspond to approximately 70 % of the total required funding of $ 6.6 million.

Improved coconut yields from a maximum of 90 nuts per tree and year to 100 nuts or revenue from, for instance, fodder inter-crops would, however, improve the plantations' financial viability substantially.

As will be seen below, a substantial surplus would likely be generated by the processing plant. Since the latter would be conditional on the plantation, it would be advisable to have an ownership structure for the plantation and the processing plant which would allow for the latter to support the former financially until the debt on the plantation has been repaid.

VIII. PHASE THREE - COCONUT PROCESSING

A. The Market

If the world market prices do not improve sufficiently to make locally produced coconut oil competitive with imported oil, the establishment of a coconut food grade processing plant could yield returns required to cover the cost of producing nuts at the new coconut plantation. The two commercial coconut food grade products in the market today are desiccated coconut and coconut cream. The added value in the processing of these products is at least twice that of coconut oil, at present prices.

The main importer of desiccated coconut and coconut cream products is the US. Significant quantities of desiccated coconut are also imported into the UK to meet demand generated by its Asian population. Another potential market for coconut cream could be Colombia where local production of fresh nuts appear inadequate to meet an increasing demand. Since Panamá is within the CBI area and is near to both the US and Colombia, it would enjoy an advantage over the traditional Asian suppliers of coconut products.

Today's total US market for desiccated coconut is approximately 45,000 tons per year. Growth has been erratic with three stagnant years (1979 to 1981) whereafter followed modest increases totalling 10 % during two years. Export data drom the Philippines suggest that a large increase was recorded for the following year - 1984 - but that volumes declined substantially in 1985. It is thus unlikely that growth has averaged more than 3 % during the last decade and a conservative assumption for the future would be an annual average growth of 2 % which after 10 years should leave total US imports at about 55,000 tons. A mere 5 % of this market would correspond to 2,750 tons per year which would also equal the total increase in imports during a period of 2.5 years. It would appear to be a prudent and

realistic market share for a new entrant such as Panamá in particular in view of the trade advantages which it is likely to continue to enjoy at this time. It could well be that a higher market penetration could be achieved for which reason a possible future plant should be designed with a flexibility to change production from, for instance, coconut cream powder to desiccated coconut. This should, however, not present any problem since the process is largely similar. The possible volume of sales of coconut cream is more difficult to estimate. It is probable that US imports, which are still very low, have increased by several hundred tons per year in recent years.

At this stage it appears likely that the market for coconut cream powder will continue to expand and that a Panamanian production in approximately 10 years time of over 1,000 tons per year could be absorbed by the US market.

B. Investment

The plant should, in order to be economic and competitive, have a daily capacity to process 100 tons of husked nuts into about 11.4 tons of desiccated coconut 5.5 tons of coconut cream powder and 4.6 tons of dried copra-like residues. The pasteurizing and spraydrying equipment determines the appropriate minimum size of a plant of this nature. The desiccated coconut could be packed in 100 lb. kraft paper bags lined with polyethylene while the coconut cream powder could be packed in two sizes: for instance, a household-size in 250 gram aluminum foil pouch, and a 100 lb. bulk pack in polyethylene-lined kraft paper bags.

Nuts would be delivered to the plant freshly dehusked from the plantation and weighed through a weighbridge. The nuts could be stored in nut-bins prior to processing through the plant's three process

departments: kernel preparation department, desiccated coconut department and coconut cream department. In addition, there could be a residues dryer for drying the parings and the residues from the coconut cream department. A coco-shell fired boiler could supply process steam and steam for running a turbinedriven electric generator. The exhaust steam could be used in the dryers. Water could be supplied from a deep-well pump or from treated river water. The waste water should be used to irrigate the coconut plantation.

The daily and annual production of the plant would be as follows:

	Capacity, ton	
	Daily	250 days
Nuts processed	100	25,000
Desiccated coconut (DCN)	11.39	2,848
Coconut cream powder (CCP)	5.49	1,373
Dried coconut residues (DCR)	4.65	1,163

The dried parings and residues, which contain about 50 % oil in the mixture, would be sold to the oil milling factories.

A flow diagram along with a plant layout is attached below.

The project cost estimate in constant 1986 prices is as follows:
($'000)

Machinery and Equipment	
Kernel preparation	50
DCN plant	400
CCP plant	600
Steam boiler	150
Turbine generator	120
Miscellaneous equipment	100
Total	1,420
Engineering and installation	210
Sub-total, installed machinery and equipment	1,630

Land	20
Buildings	400
Site development	120
Vehicles	150
Office and miscellaneous tools	20
Contingency	230
Total Fixed Capital Investment	2,570
Working Capital	
5 days nut inventory	40
30 days supplies inventory	20
15 days products inventory	530
1 month salaries	100
Cash reserves	250
Total Working Capital	940
Pre-operating expenses	50
Total Project Cost	3,560

The total investment of $ 3.6 million has been assumed to be financed with 40 % equity 60 % loan financing. The latter would carry an interest rate of 9 % and be repayable over 12 years with three years of grace.

C. Principal Assumptions

The current price of desiccated coconut is at present about $ 0.45 per lb., fob. A price of $ 750 per metric ton, ex-factory is likely therefore to be realistic. It would correspond to an oil price of between $ 250/ton and $ 350/ton which is in keeping with today's market. Price indications for coconut cream powder are uncertain as mentioned above. A price of $ 1,200 per metric ton, exfactory is likely to be lower than the prevailing market price of a similar products. Nuts would be priced at $ 55 per 1,000 delivered to the plant, while the dried residues would be priced at $ 180 per metric ton, delivered to the oil factories.

The plant would have the following principal categories of operating costs:

- rawmaterial, i.e. coconuts at $ 55/1,000,
- supplies, comprising packaging material, chemicals, fuel and lubricants, etc, estimated at $ 170,000 per year at full production,
- power, being electricity generated by internal steam turbines,
- salaries and wages for an estimated 27 managerial and administrative staff, 30 maintenance and support staff and 320 production staff including supervisors and foremen. The plant has been assumed to operate three shifts per day during 250 days per year. Total annual cost of salaries and wages at full production would be % 886,000.
- repair and maintenance which has been assumed to correspond to between 5 % and 10 % of initial asset value, and
- miscellaneous overhead costs such as insurance, depreciation, etc, totalling $ 273,500 per year.

D. Summary of Financial Projections

The COMFAR projections for cash flows, income statements and balance sheets are shown on the following pages. It should be noted that the COMFAR program does not allow for the scheduling of the investment as outlined on page 36 above.

Total investment, in constant prices, has been estimated at $ 3.6 million for a plant which would have a total turnover at full capacity of $ 4 million. Nuts, at an annual cost of approximately $ 1.4 million corresponding to $ 0.055 per nut, would be the dominant cost followed by wages $ 0.6 million, utilities $ 0.17 million. Annual fixed costs have been estimated $ 634,000, which together with interest at a maximum of $ 192,000 per year would be more than covered by a net income (after factory costs) of $ 1.8 million per year.

COMFAR 2.0 UNIDO

---------- COMFAR 2.0 - IO/FEAS - UNIDO, Vienna -----

Total Initial Investment in 000$

Year	1986	1987
Fixed investment costs		
Land, site preparation, development	140.00	0.00
Buildings and civil works	400.00	0.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets	150.00	230.00
Plant machinery and equipment . . .	1140.00	510.00
Total fixed investment costs	1830.00	740.00
Pre-production capital expenditures.	50.00	0.00
Net working capital	0.00	940.00
Total initial investment costs . . .	1880.00	1680.00
Of it foreign, in %	92.55	100.00

KC5 COCONUT PROCESSING PLANT --- 30.5.86

Total Production Costs in 000$

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1	495.00	825.00	1375.00	1375.00	1375.00	1375.00	1375.00	1375.00	1375.00	1375.00
Other raw materials	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utilities	61.00	102.00	170.00	170.00	170.00	170.00	170.00	170.00	170.00	170.00
Energy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Labour, direct	214.00	356.00	593.00	593.00	593.00	593.00	593.00	593.00	593.00	593.00
Repair, maintenance	40.00	66.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00
Spares	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Factory overheads	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs	810.00	1349.00	2248.00	2248.00	2248.00	2248.00	2248.00	2248.00	2248.00	2248.00
Administrative overheads	413.00	504.00	504.00	504.00	504.00	504.00	504.00	504.00	504.00	504.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	93.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00
Financial costs	146.88	192.24	192.24	177.48	161.38	143.84	124.72	103.88	81.17	56.41
Total production costs	1462.88	2175.24	3074.24	3059.48	3043.38	3025.84	3006.72	2985.88	2963.17	2938.41
Costs per unit (single product)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Of it foreign, %	15.99	14.56	10.29	9.85	9.38	8.85	8.27	7.63	6.92	6.14
Of it variable,%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total labour	214.00	356.00	593.00	593.00	593.00	593.00	593.00	593.00	593.00	593.00

Cashflow tables, production in 000s

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total cash inflow	3116.97	2393.19	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94
Financial resources	1680.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax	1436.97	2393.19	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94
Total cash outflow	3049.88	2045.24	3108.28	3108.28	3108.28	3108.28	3108.28	3108.28	3108.28	3108.28
Total assets	1680.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs	1223.00	1853.00	2752.00	2752.00	2752.00	2752.00	2752.00	2752.00	2752.00	2752.00
Cost of finance	146.88	192.24	192.24	177.48	161.38	143.84	124.72	103.88	81.17	56.41
Repayment	0.00	0.00	164.04	178.81	194.90	212.44	231.56	252.40	275.12	299.88
Corporate tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit)	67.09	347.95	884.66	884.66	884.66	884.66	884.66	884.66	884.66	884.66
Cumulated cash balance	67.09	415.04	1299.70	2184.36	3069.01	3953.67	4838.33	5722.99	6607.65	7492.30
Inflow, local	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, local	1223.00	1853.00	2752.00	2752.00	2752.00	2752.00	2752.00	2752.00	2752.00	2752.00
Surplus (deficit)	-1223.00	-1653.00	-2752.00	-2752.00	-2752.00	-2752.00	-2752.00	-2752.00	-2752.00	-2752.00
Inflow, foreign	3116.97	2393.19	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94
Outflow, foreign	1826.88	192.24	356.28	356.28	356.28	356.28	356.28	356.28	356.28	356.28
Surplus (deficit)	1290.09	2200.95	3636.66	3636.66	3636.66	3636.66	3636.66	3636.66	3636.66	3636.66
Net cashflow	-1466.03	540.19	1240.94	1240.94	1240.94	1240.94	1240.94	1240.94	1240.94	1240.94
Cumulated net cashflow	-3346.03	-2805.84	-1564.90	-323.96	916.98	2157.92	3398.86	4639.80	5880.74	7121.68

Cashflow Discounting:

KCS COCONUT PROCESSING PLANT --- 30.5.86

a) Equity paid versus Net income flow:
   Net present value ..... 4689.48 at 10.00 %
   Internal Rate of Return (IRRE1) .. 41.60 %
b) Net Worth versus Net cash return:
   Net present value ..... 4867.02 at 10.00 %
   Internal Rate of Return (IRRE2) .. 43.23 %
c) Internal Rate of Return on total investment:
   Net present value ..... 4828.79 at 10.00 %
   Internal Rate of Return (IRR) .. 27.42 %

Net Worth = Equity paid plus reserves

Net Income Statement in 000$

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total sales, incl. sales tax	1436.97	2393.19	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variable margin	1436.97	2393.19	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94	3992.94
As % of total sales	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1316.00	1983.00	2882.00	2882.00	2882.00	2882.00	2882.00	2882.00	2882.00	2882.00
Operational margin	120.97	410.19	1110.94	1110.94	1110.94	1110.94	1110.94	1110.94	1110.94	1110.94
As % of total sales	8.42	17.14	27.82	27.82	27.82	27.82	27.82	27.82	27.82	27.82
Cost of finance	146.88	192.24	192.24	177.48	161.38	143.84	124.72	103.89	81.17	56.41
Gross profit	-25.91	217.95	918.70	933.46	949.56	967.10	986.22	1007.06	1029.77	1054.53
Allowances	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taxable profit	-25.91	217.95	918.70	933.46	949.56	967.10	986.22	1007.06	1029.77	1054.53
Tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net profit	-25.91	217.95	918.70	933.46	949.56	967.10	986.22	1007.06	1029.77	1054.53
Dividends paid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Undistributed profit	-25.91	217.95	918.70	933.46	949.56	967.10	986.22	1007.06	1029.77	1054.53
Accumulated undistributed profit	-25.91	192.04	1110.74	2044.20	2993.76	3960.86	4947.08	5954.13	6983.91	8038.44
Gross profit, % of total sales	-1.80	9.11	23.01	23.38	23.78	24.22	24.70	25.22	25.79	26.41
Net profit, % of total sales	-1.80	9.11	23.01	23.38	23.78	24.22	24.70	25.22	25.79	26.41
ROE, Net profit % of equity	-1.82	15.31	64.52	65.55	66.68	67.91	69.26	70.72	72.32	74.05
ROI, Net profit+interest, % of invest.	3.40	11.52	31.21	31.21	31.21	31.21	31.21	31.21	31.21	31.21

Projected Balance Sheets, Production in 000$

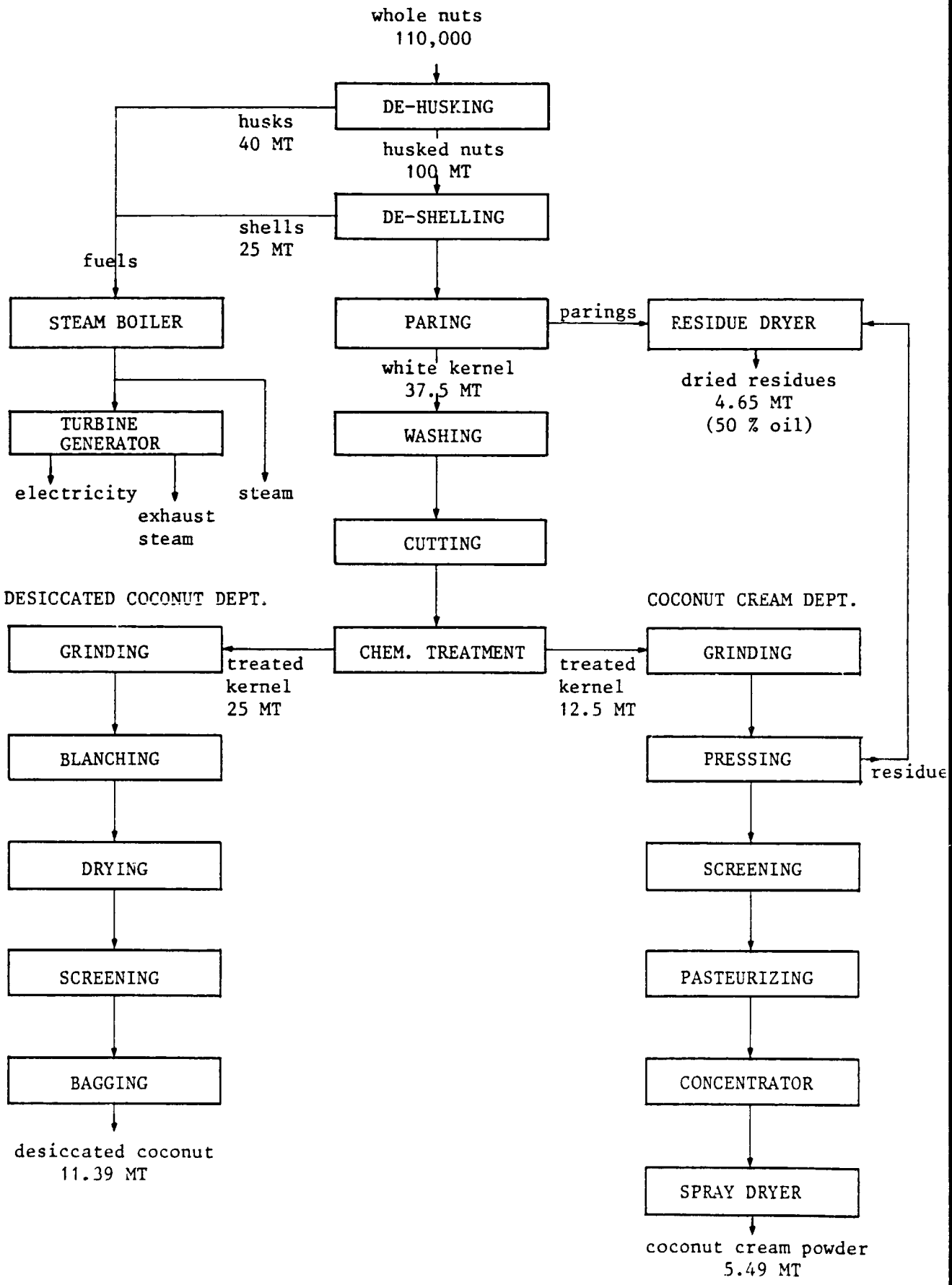
Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total assets	3560.00	3777.95	4506.70	5261.36	6016.01	6770.67	7525.33	8279.99	9034.65	9789.30
Fixed assets, net of depreciation	1787.00	2397.00	2267.00	2137.00	2007.00	1877.00	1747.00	1617.00	1487.00	1357.00
Construction in progress	740.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	940.00	940.00	940.00	940.00	940.00	940.00	940.00	940.00	940.00	940.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	67.09	415.04	1299.70	2184.36	3069.01	3953.67	4838.33	5722.99	6607.65	7492.30
Loss carried forward	0.00	25.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loss	25.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	3560.00	3777.95	4506.70	5261.36	6016.01	6770.67	7525.33	8279.99	9034.65	9789.30
Equity capital	1424.00	1424.00	1124.00	1424.00	1424.00	1424.00	1424.00	1424.00	1424.00	1424.00
Reserves, retained profit	0.00	0.00	192.04	1110.74	2044.20	2993.76	3960.86	4947.08	5954.13	6983.91
Profit	0.00	217.95	918.70	933.46	949.56	967.10	986.22	1007.06	1029.77	1054.53
Long and medium term debt	2136.00	2136.00	1971.96	1793.15	1598.25	1385.81	1154.25	901.86	626.74	326.86
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	2136.00	2136.00	1971.96	1793.15	1598.25	1385.81	1154.25	901.86	626.74	326.86
Equity, % of liabilities	40.00	37.69	31.60	27.07	23.67	21.03	18.92	17.20	15.76	14.55

The processing plant, with the assumed coconut price and prevailing sales prices for desiccated coconut and coconut cream powder would thus be highly profitable and would generate large annual cash surpluses which would more than outweigh the cash deficits of the plantation project.

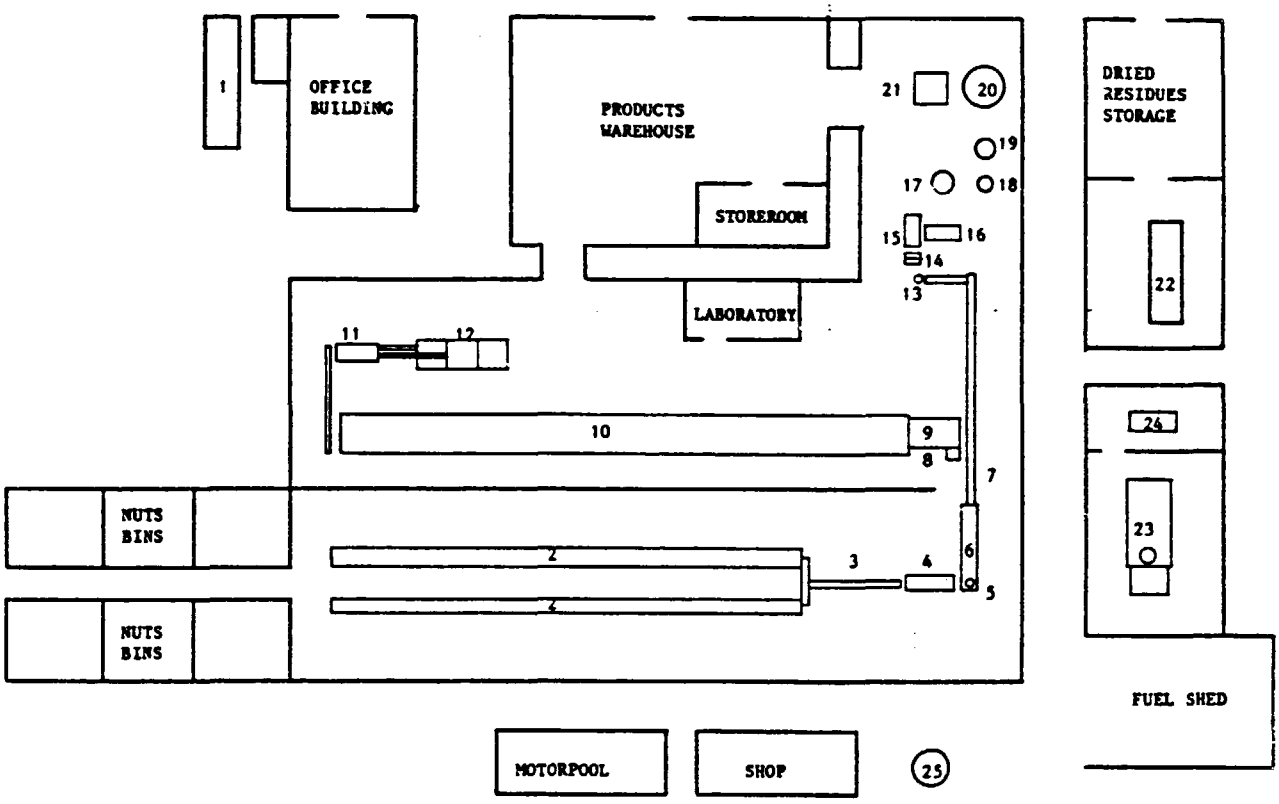
The internal rate of return on the entire investment would be 27.4 %. The return on the equity investment, without taking into account taxes, however, would exceed 40 %.

The annual cash flow, again without taking into account possible tax payment, would at full capacity utilization correspond to approximately $ 900,000. This result would, of course, only be possible with a steady and reliable supply of rawmaterial, i.e. nuts. At full production the plantation is projected to generate an annual cash deficit of $ 300,000 to be compared with above mentioned surplus.

KERNEL PREPARATION DEPT.



PROCESS FLOW DIAGRAM - COCONUT PROCESSING PLANT



LAYOUT PLAN - COCONUT PROCESSING PLANT

Scale: 1/4" = 10'

Key to Layout Plan - Coconut Processing Plant

1. Weighbridge
2. De-shelling and paring benches
3. Kernel washer
4. Picking table
5. Cutter
6. Chemical Treatment tank
7. Conveyor - Rinser
8. Grinder
9. Blancher
10. DCN Dryer
11. Sifter
12. DCN Bagging bins
13. Grinder
14. Roller
15. Screw press
16. Vibrating screen
17. Cream pasteurizing tank
18. Evaporator
19. Slurry tank
20. Spray dryer
21. Cream powder bin
22. Residues dryer
23. Steam boiler
24. Turbine-generator
25. Water tank

A/PANAMA

IX. SUMMARY OF DEVELOPMENT PROGRAM

A. Summary of Findings

The above analysis has suggested that Panamá's investment opportunities, with respect to coconut production and processing, are primarily two.

The first and foremost would be a rehabilitation program which would both re-establish a large number disused plantations and at the same time make it possible to re-start the two existing oil expelling mills. This project, which would require substantial Government involvement, would not be very risky in spite of the volatile nature of the world vegetable oil market. This is because both the plantations and the oil mills already exist and the project would essentially consist of vitalizing sunk investment.

The second project, which would comprise of an extension of the coconut producing capacity of Panamá, is, however, highly speculative. Its success would depend entirely upon the profitability of a coconut food grade processing plant installed 8 years after commencement of the plantation project. This plant would partly be for the purpose of producing a product for which there is at present a very limited market. If the country's coconut producing capacity is increased and it subsequently transpires that the processing plant will not be viable, Panamá would, however, still have the option of using the increased production for the substitution of imported oil. Future market prospects with respect to coconut oil are, however, such that it is unlikely that such substitution would be economically benefical for the country.

There exists also, however, the possibility of combining the processing project with the rehabilitation scheme. The latter would increase annual nut production by an estimated 25 million from the fifth year and onwards which would make possible commissioning of a processing plant in year 4 and start of construction in year 2. The thousands of smallholders envisaged to participate in the rehabilitation would, however, constitute a much riskier source of raw-

material supply than would a plantation. Yet another possibility could be to enlarge the rehabilitation scheme to encompass, say, another 500,000 trees on the morth coast, possibly in combination with a smaller plantation which could guarantee a certain break-even volume of rawmaterial for a processing plant. The data and financial projections contained in this report make it possible to evaluate the consequences of several combinations of processing plants and coconut production schemes.

B. Summary of Investment Opportunities

This study has identified three investment opportunities.

The first would be a national coconut rehabilitation scheme for an estimated 500,000 trees and requiring approximately 20 additional copra dryers.

Total investment would be $ 2.7 million over a period of four years. Of this 20 % would be expected to be farmers' equity and the Balance loan funds. This project would, at full production, generate an annual additional income of approximately $ 1.95 million and have a return on total investment of slightly less than 15 %.

The second project would be new coconut plantation with eight driers at a total investment cost of $ 6.6 million of which 30 % has been assumed to be equity. This project would at maturity have an annual revenue of $ 2.15 million and negative cashflow of approximately $ 0.3 million. Its rate of return on total investment would only be 1.74 %. This project would need to be complemented by either a processing plant or by approximately 23 more driers.

At presently prevailing prices and operating costs the processing plant would likely be highly profitable An investment of $ 3.6 million would result in annual revenues of $ 4 million and an annual cash flow surplus of $ 0.9 million. The return on total investment would be in excess of 27 %.

The other alternative - 23 driers - would not, on the basis of likely future prices, be justifiable since it would not suffice to compensate for the plantations' negative cash flow. Each year 23 driers would produce 5,500 tons of copra from 25 million nuts which, at a price of $ 350/ton, would give a revenue of $ 1.9 million. The cost would be nuts for $ 1.3 million (25 million at $ 0.055 per nut) and operating expenses at $ 0.4 per year, which would leave $ 0.2 million to service the investment in 23 driers ($ 1.3 million) and to cover the plantation's negative cash flow. This alternative would therefore not constitute a financially attractive investment opportunity.

C. Summary of Development Activities and Schedule

I. Status: Year 0

A. Agricultural Sector
   1. Estimate of number of trees - 2.6 million
   2. Estimate of number of nuts produced - 24 million
   3. Average yield per tree - 9 nuts per year

B. Industrial Sector
   1. Two oil mills existing - estimated capacity 46 ton copra per day
   2. Mills not in operation due to lack of copra supply

C. UNIDO Pre-feasibility study completed

II. Proposed Development Activities

Year 0

A. Agricultural Sector
   1. Feasibility studies and program formulation
   2. Soil surveys and tests
   3. Setting up of small test-farms in selected areas
   4. Policy formulation (floor price, etc)

B. Industrial Sector
   1. Feasibility studies

Year 1

A. Agricultural Sector

1. Rehabilitation of 100,000 coconut trees
2. Setting up of additional test farms
3. Financing search/negotiations for new plantation development

Year 2

A. Agricultural Sector

1. Rehabilitation of 200,000 coconut trees
2. Development of 500 hectares of new coconut plantations
3. Construction of copra dryers for 1,000 ton copra per year

B. Industrial Sector

1. Rehabilitation/preparation of existing oil mills (if necessary)
2. Market study for crude and refined coconut oils

Year 3

A. Agricultural Sector

1. Rehabilitation of 200,000 coconut trees
2. Development of 1,000 new coconut plantations
3. Production of additional 5 million nuts from rehabilitated trees
4. Construction of copra dryers for additional 2,000 ton copra per year

B. Industrial Sector

1. Milling of 1,000 ton of copra
2. Market study for other coconut products but crude and refined oils

Year 4

A. Agricultural Sector

1. Development of another 1,000 hectares of new plantation
2. Production of 15 million nuts from rehabilitated trees for copra
3. Construction of additional copra dryers for 2,000 ton copra per year

B. Industrial Sector

1. Milling of 3,000 ton of copra per year

Year 5

A. Agricultural Sector

1. Production of 25 million nuts from rehabilitated trees to produce 5,000 ton of copra

B. Industrial Sector

1. Milling of 5,000 ton copra

Year 6

A. Agricultural Sector

1. Production of 25 million nuts - 5,000 ton of copra

B. Industrial Sector

1. Milling of 5,000 ton copra
2. Updating of feasibility study for coconut processing plant

Year 7

A. Agricultural Sector

1. Production of 25 million nuts from rehabilitated trees
2. Production of 1.2 million nuts from new plantation
3. Production of 5,200 ton of copra

B. Industrial Sector

1. Milling of 5,200 ton copra
2. Preparation of plans for integrated coconut processing plant
3. Negotiation of financing for project coconut processing plant

Year 8

A. Agricultural Sector

1. Production of 25 million nuts from rehabilitated trees
2. Production of 3.9 million nuts from new plantation
3. Production of 5,000 ton of copra

B. Industrial Sector

1. Milling of 5,000 ton copra
2. Start construction of coconut processing plant

Year 9

A. Agricultural Sector

1. Production of 25 million nuts from rehabilitated trees
2. Production of 9.3 million nuts from new plantation
3. Production of 5,000 ton copra

B. Industrial Sector

1. Milling of 5,000 ton of copra
2. Completion of construction of coconut processing plant
3. Start operation of integrated plant (90 days) processing 9.3 million nuts

Year 10

A. Agricultural Sector

1. Production of 25 million nuts from old trees - 5,000 ton copra
2. Production of 16 million nuts from new plantation

B. Industrial Sector

1. Milling of 5,000 ton copra
2. Construction of 8 dryers at new plantation
3. Normal operations of integrated plant (150 days) processing 16 million nuts

Year 11

A. Agricultural Sector

1. Production of 25 million nuts from old trees
2. Production of 32 million nuts from new plantation
3. Production of 5,000 ton copra from old trees and excess from new trees

B. Industrial Sector

1. Milling of 6,500 ton copra
2. Full production of integrated plant (250 days) processing 25 million nuts

Year 12

A. Agricultural Sector

1. Production of 25 million nuts from old trees
2. Production of 35 million nuts from new plantation
3. Production of 7,200 ton of copra

B. Industrial Sector

1. Milling of 7,200 ton of copra
2. Full production of integrated processing plant (250 days) processing 25 million nuts

COCONUT INTER-CROPPING

A. The Case of Plantain

General

Plantain, or so called cooking banana, is a banana crop which thrives on faily poor soils in tropical climates. The crop has an export as well as a local Panamanian market. Exports are to the US where plantain is a daily quoted commodity.

The fruit grows in bunches like the banana. One bunch containing approximately 30 fruits would mature in approximately 10 months. Each plant yields one bunch at a time.

Cropping Pattern

A typical planting density in Panamá would be with a density of 3 m to 3.5 m between each row and with a distance of 1.5 m between each plant in a row corresponding to approximately 1,700 plants per ha.

In the case of inter-cropping in a coconut plantation with a density of 156 trees per ha (8 m between each tree) double rows with plantain could be planted with 2.5 m between them in the midst of each row space of coconut trees. If the distance between each plant in a row is increased to 2 m the density per ha would be 1,150 plants per ha.

The first crop comprising one bunch of 30 fruits per plant or 34,500 plants per ha would be ready for harvesting one year after planting.

Subsequent annual crops would correspond to 1.25 bunches with each 30 fruits per plant or 43,125 fruits per ha.

Plantain is a disease prone plant easily affected fungus (Sigatoka Negra) which is spread by windborne spores. For this reason actual yields even under strictly controlled conditions are typically only between 60 % to 70 % of the theoretical optimum.

Revenues and Costs

Plantain is quoted daily on the New York City Wholesale Fruit and Vegetable Market. Present prices (early 1986) cif for a 50 lb carton, typically containing 90 fruits, have ranged between $ 14,00 to $ 17.00. The average price during 1986 was approximately $ 15.00 per carton.

The local Panamanian official wholesale pri- in early 1986 was $ 0.08/lb but actual prices paid have tended to be slightly lower or $ 0.07/lb corresponding to approximately $ 0.035 p- -it.

A well managed farm could aspire to exp- % to 80 % of its annual marketable crop. The balance would be sold on the local market. Export facilities for Panamanian plantain fra rs are reported to be adequate. Cartons for packing are easily available at a cost of $ 0.50 a carton to which should be added local transport averaging approximately $ 10 per ton of product or $ 0.04 per carton. The freight, including handling, from Panamá City or Colon to New York in refrigerated containers would cost approximately $ 100 per ton or $ 4 per carton.

Cost of production comprises an initial investment in land preparation, seeds and planting estimated at $ 700 per ha.

The cost of farming, including pesticides, fungicides, insecticides, fertilizers and farm labour, has been estimated at approximately $ 500 per ha the first year and $ 700 per ha each following year.

The cost of harvesting annually up to 10 tons per ha and packing some 65 % of the harvest has been calculated to amount to approximately $ 1,000 to which should be added farm supervision and miscellaneous overheads, etc, at say $ 250 per ha and year.

Operating Results

The above assumptions and cost data which refer to the situation in Panamá in early 1986 would yield the following projected annual operating result ($ '000 per ha):

Annual crop	(cartons equivalent)	480	
Marketable crop	(-"-)	310	
Export volume	(-"-)	235	= 5.3 tons
Local sales	(-"-)	75	
Export revenue	$ 15/carton	3,525	
Local sales	$ 3/carton equivalent	225	
Total revenue		3,750	
Cost of farming		700	
Cost of harvesting and packing		1,000	
Supervision and overheads		250	
Picking material and local transport		130	
Ocean freight		530	
Cost of production		2,610	
Amortization of initial investment		150	
Interest		50	
Other costs		200	
Operating result		940	

This suggests that inter-cropping with plantain could add substantially to the revenue of a coconut plantation. It should be noted, firstly, that data on costs and revenues have been collected from a very limited number of sources and that they should therefore be considered as indicative only, and, secondly, that no provision has been made for return on the investment in land.

It is also important to note that there is not actual experience of coconut plantain inter-cropping in Panamá. Yield data, which are derived from the growing of plantains only, are therefore probably relevant primarily for the first 3 to 4 years after planting of coconut trees when foliage does not reduce the plantain's exposure to the sun.

B. The Case of Fodder

An Alternative to Pastures

Panamá along with several other Central American countries suffers from overgrazing of marginal lands. Coconut plantations are therefore frequently used as pastures although this may have a detrimental effect on coconut yield. An alternative to grazing could be to grow fodder as an inter-crop. The grass which could be planted would need to be adapted to the relatively poor soils, to be drought resistant and to yield high volumes of green matters.

Elephant Grass

African elephant grass which grows well on poor laterite soils, and which tolerates long periods of low rainfall, could be well suited as a fodder inter-crop. Once planted elephant grass could be harvested several times a year for several years without replanting.

If planted as an inter-crop in a coconut plantation in an area with 1,000 mm annual rainfall, elephant grass could produce up to 100 ton of green matter per ha. This would correspond to 1,200 bales of dry roughage. Minimum production should be no less than 50 tons per ha or 600 bales of roughage.

Revenues and Costs

The planting cost including ripping with tractor, plants and fertilizers could approximate $ 1,000/ha which cost should be amortized over four years. At $ 0.50 per dry bale and after deducting $ 100/ha per year for fertilizing and possible miscellaneous costs, the result after amortizing planting cost would range from a loss of $ 50/ha to a gain of $ 250/ha.

A plausible average result would be a gain in excess of $ 100/ha. It should be noted that the very hardy nature of the grass makes it less risky to grow in dry climates and meagre soils than would be the case with many other high protein fodders, such as alfa-alfa, lucerne, sorghum, etc.

STATISTICS

Table 1 WORLD; Production and Stock of Oilseeds 1983/1984-1985/1986 ('000 tons)

	1983/1984	1984/1985p	1985/1986f
Production:	162,251	186,312	188,288
Soybeans	82,922	92,114	95,475
Cottonseeds	26,344	34,550	30,300
Groundnuts, shelled	12,582	13,340	13,272
Sunflowerseed	15,483	17,821	18,050
Rapeseed	14,327	16,929	18,747
Sesameseed	1,941	1,979	1,943
C o p r a	3,581	4,076	4,365
Palm kernels	1,799	2,067	2,351
Linseed	2,312	1,059	1,110
Opening Stock	21,964	16,684	21,347
Total Supplies	184,215	202,996	209,635

p: preliminary f: forecast

Source: OILWORLD

Table 2 PHILIPPINES; Exports of Coconut Products, Jan.-Dec. 1985

	Volume (tons)			Value ($'000 fob)		
	1985[1] p) (Applied)	1984[2] (Actual)	% Change	1985[1] p) (Applied)	1984[2] (Actual)	% Change
C o p r a	-	-	-	-	-	-
Coconut oil	641,854	586,134	+ 9.5	346,369.78	576,404.56	- 39.9
Copra meal	445,701	375,610	+ 18.7	35,758.39	43,020.51	- 16.9
D C N	58,240	68,485	- 14.9	69,161.50	95,561.21	- 27.6
Shell Charcoal	33,046	28,550	+ 15.7	6,079.76	5,447.95	+ 11.6
Act. Carbon	7,046	7,569	- 6.0	7,978.51	8,643.27	- 7.7
Fatty Alcohol	21,109	21,520	- 1.9	22,142.24	27,788.75	- 20.3
Methyl Ester	11,853	12,822	- 7.5	7,865.50	13,732.23	- 42.7
Fatty Acid	29,957	20,152	+ 48.6	18,077.87	20,177.80	- 10.4
Total	1,215,093[3]	1,127,875[3]	+ 7.7	513,433.56	790,776.28	- 35.1

1) January-November actual plus cumulative volume applied for December (as of December 27, 1985)

2) January-December actual

3) Aggregate of copra, coconut oil, desiccated coconut, fatty alcohol, methyl ester and fatty acid in copra terms at 63 %, 64.68 %, 57.41 %, 65.56 % and 58.33 % conversions for oil, desiccated coconut, fatty alcohol, methyl ester and fatty acid, respectively.

Source: UCAP

Table 3 SRI LANKA; Exports of Coconut Products, January-October 1985

	Volume (tons)			Value (S.L. Rs. Mln.)		
	Jan.-Oct. 1984	Jan.-Oct. 1985	% Change	Jan.-Oct. 1984	Jan.-Oct. 1985	% Change
Coconut Oil	4,530	49,906	+1.000	148.59	771.54	+ 419
D.C.	21,675	43,242	+ 100	776.42	1,144.59	+ 47
Copra[1]	1,646	4,943	+ 200	49.37	73.61	+ 49
Fresh Nuts	3,075,871	7,278,250	+ 136	20.17	28.26	+ 40
Coconut Seed Nuts	139,869	125,560	- 10	2.02	1.57	- 44
Coconut Poonac	-	19,280	-	-	40.73	-
Coconut Cream	-	233	-	-	7.60	-
Sub-Total Kernel Products[2]	194.95 (in mln.nut equivalent)	725.04	+ 272	997.32	2,068.90	+ 107
Mattress Fibre	32,118	30,715	- 4	116.69	122.60	+ 5
Bristle Fibre	7,205	6,362	- 11	93.57	86.52	- 8
Twisted Fibre	22,081	23,242	+ 5	125.25	134.22	+ 7
Coir Yarn	930	2,191	+ 135	9.95	28.54	+ 186
Coir Twine	1,137	1,591	+ 40	22.62	34.12	+ 50
Sub-Total Fibre Products	63,471	64,101	+ 1	368.08	406.00	+ 10
Cocnut Shell Charcoal	22,330	18,199	- 18	98.76	106.14	+ 7
Coconut Shell Flour	336	202	- 38	1.41	1.20	- 15
Coconut Shells	811	1,486	+ 83	1.50	3.18	+ 112
Act. Carbon	1,313	2,673	+ 103	38.10	87.00	+ 128
Sub-Total Shell Products	24,780	23,560	- 5	139.77	197.52	+ 41
Coconut Ekels	7,049	8,263	+ 17	17.66	19.58	+ 11
Finished Prod.	-	-	-	54.01	45.98	- 15
Other By-Prod.	-	-	-	2.55	3.94	+ 55
Sub-Total Non-Kernel Products	-	-	-	582.07	673.02	- 16
Total Value of All Products	-	-	-	1,579.44	2,741.92	+ 74

[1] Milling grade, estate and edible

[2] Poonac and coconut cream not taken into account for calculation of nut equivalent

Source: Coconut Development Authority

Table 4 Price of Coconut Products - Selected Oils and Oilseed, March 1986

European Markets	Unit	March 20	March 11	March 4	March '85
Phil. copra, Cif Rott. bulk	US$/ton	200.00	185.00	180.00	530.00
Phil. coconut oil, Cif Rott.	US$/ton	295.00	285.00	270.00	843.00
Copra exp. pel, 26% Cif Hamb.	US$/ton	132.00	130.00*	132.00**	118.00
Phil. desiccated coconut, spot fine	£/ton	500.00*	500.00*	510.00**	
Sri Lanka desiccated coconut, spot fine	£/ton	500.00	500.00*	500.00**	1,105.00
Coir fibres (baled), Cif. Cont. ports	US$/ton	240.00	240.00*	240.00**	253.00
Malaysian palm kernel oil Cif. Rott.	US$/ton	280.00	250.00	230.00	770.00
Malay/Sumatra palm oil, Cif. Rott.	US$/ton	257.50	230.00	230.00	651.00
US soybean, Cif. Rott.	US$/ton	222.15	185.00	180.00	241.00
Dutch soya oil, ex-mill, Fob.	F1/100kgs	95.50	91.00	87.00	251.00
UK soya meal	£/ton	152.00	151.00*	143.00**	160.00
Any origin, sunseed oil	US$/ton	375.00	380.00	377.50	661.00
US Markets					
Coconut oil, N. Orleans Cif[1)]	USc/lb	13.50	13.25	12.75	35.00
Palm oil rbd. N. Orlans	USc/lb	13.75	12.88	12.25	28.00
Soybean oil, decatur	USc/lb	17.49	17.22	16.99	29.24
Singapore Market					
Copra fair merch, mixed	S$/100kgs	28.00	28.00	28.00	85.00
Coconut oil in drum	S$/100kgs	67.00	67.00	67.00	172.00
Coconut oil in bulk	S$/100kgs	50.00	50.00	50.00	155.00

Rate of Exchange

March 4 US$ 1 = £ 0.6845 or F1 2.4950 or S$ 2.1575

March 11 US$ 1 = £ 0.6766 or F1 2.5515 or S$ 2.1607

March 20 US$ 1 = £ 0.6664 or F1 2.5365 or S$ 2.1615

* March 8

** March 1

1) April-May shipment from Philippines

Table 5 RP Annual Exports of Non-traditional Coconut By-products, 1979-1983
(Volume in ton, value in FOB $)

	1979		1980		1981		1982		1983	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Coconuts	773	289,067	763	240,657	1,249	430,352	1,831	428,399	2,334	383,710
Fresh coconut preparations	24	29,926	19	28,955	10	4,667	10	2,595	2	2,063
Coconut chips	-	-	5	8,658	23	33,305	29	49,991	41	61,999
Coconut milk	56	71,438	58	98,366	5	6,688	30	19,010	316	102,448
Cococream powder	-	-	-	-	32	37,600	37	98,587	53	123,407
Hydrogenated coco oil	765	985,968	727	826,583	150	136,223	177	150,215	403	334,482
Paring Oil	763	709,571	1,806	1,124,402	1,175	578,564	516	236,401	1,337	653,592
Paring cake	4,572	751,125	1,009	159,082	500	55,500	-	-	-	-
Crude glycerine	1,850	1,139,150	830	641,800	429	330,533	2,862	2,151,371	3,241	2,119,975
Coco methyl ester	4,380	4,326,296	3,570	2,293,432	5,550	3,307,070	12,492	6,544,717	15,241	8,298,742
Fatty alcohol	1,670	2,448,988	1,195	1,569,785	443	457,561	8,990	9,282,408	3,241	2,119,975
Lauryl alcohol	-	-	2	5,355	20	22,845	-	-	-	-
Alkanolamide	-	-	-	-	-	-	445	422,024	918	778,721
Coco moneothanolamide	-	-	-	-	-	-	4	5,348	-	-
Fatty acid	-	-	-	-	-	-	900	931,000	-	-
Acidulated coco oil	2,694	1,759,701	-	-	-	-	55	16,520	155	58,727
Fatty acid oil	350	125,549	3,115	1,181,120	4,395	1,088,183	3,264	816,629	4,150	1,356,348
Coco shell chips	12	850	798	84,161	-	-	-	-	-	-
Coco shell flour	110	31,005	-	-	50	20,720	255	16,060	388	22,630
Other coco by-products	118	133,254	30,698	19,245,175	611	642,530	78	47,343	31	20,014
Total	18,315	12,970,638	44,595	27,507,531	14,942	7,399,341	33,130	22,339,988	33,397	17,823,064

NOTES ON COCONUT YIELDS IN PANAMÁ

A. Nombre de Dios

There are two experimental coconut farms in Panamá. The largest and the oldest is at Nombre de Dios east of Portobelo on the Atlantic coast. The other is on the grounds of the Felipillo sugar cane plantation in the Bayano area on the Pacific coast. There is as yet no yield data for the lastmentioned farm which is planted with a hybrid variety which is just beginning to bear fruit.

The Nombre de Dios plantation, which was planted with three varieties, Altos Pacifico, Tres Picos and the hybrid PB 121 in 1979 and 1980, is thus the plantation in Panamá which has provided verifiable yield data.

The plantation comprised 2,289 trees, 134 of which have died. 18% of the planted trees were the Altos Pacifico variety planted in August 1979 from 1978 seedlings.

The records for the Altos Pacifico plants are as follows:

Year	General	Fertilizer	Fruits
1979	planting	5 lb/tree	-
1980		5 lb/tree	-
1981	drought	-	-
1982	"	-	most 11 %
1983	"	-	50 % flowering
1984		2 lb/tree	5 nuts/tree
1985		3 lb/tree	30 -"-
1986	estimate		80 -"-

During January and February the 184 trees gave a total of 2,200 nuts. The responsible Ministry of Agriculture department thus expects average annual yield per tree to reach 80 nuts in 1986.

The department also concedes that the plantation was badly managed for several years when no fertilizer was applied. It is probable, however, that clearing of undergrowth has been tended to throughout the period of growth.

It is also probable that soils and permeability conditions are favourable since the plantation is located in a valley with alluvial soils.

The records for the Tres Picos and PB 121 plantations are as follows:

Tres Picos:

Year	General	Fertilizer	Fruits
1979	planting	5 lb/tree	-
1980		5 lb/tree	-
1981	drought	-	-
1982	"	-	most 18 %
1983	"	-	40 % flowering
1984		2 lb/tree	3 nuts/tree
1985	"	3 lb/tree	13 -"-
1986	estimate		50-60 nuts/tree

PB 121:

Year	General	Fertilizer	Fruits
1980	planting	5 lb/tree	-
1981	drought	-	most 4 %
1982	"	-	-
1983	"	-	92 % flowering
1984	no information		
1985		3 lb/tree	93 nuts/tree
1986	estimate		110 -"-

It is probable that soil conditions and/or cane has been better for the Altos Pacifico part of the experimental farm which would explain the higher yield for this variety.

Llano de Mariato

One of Panamá's largest plantations is located in the Veraquas province near the village of Mariato. It is owned by the Panamá Boston corporation which company used to produce copra for local crushing in the dryer which exists at the site. Copra production has since been abandoned and the plantation is no longer maintained for maximum yields.

It consists of the two local varieties of Altos Pacifico and Tres Picos and some trees seem to be more than 50 years old. There are signs of disease.

Officials of the Panamá Boston corporation reports that random sampling of annual yields dating from the time when the plantation was commercially operated revealed minimum annual yields of 150 nuts per tree and year. There were, however, no records to substantiate this survey for which reason Panamá Boston promised to make new measurements of yields.

C. Coconut - Points of Interest in Panamá

The following locations are of particular relevance for the coconut industry in Panamá:

1 Patino Point (Punta Patino). Abandoned plantation. Local varieties (100-200 ha).

2 Mariato Lane (Llano de Mariato). Abandoned plantation. Local varieties (+400 ha).

3 The mouth of the Bayano River. New plantation (300 ha).

4 The upper coast of Colon (Costa Arriba de Colón). Experimental lots PB 121 and small farmers with tall varieties.

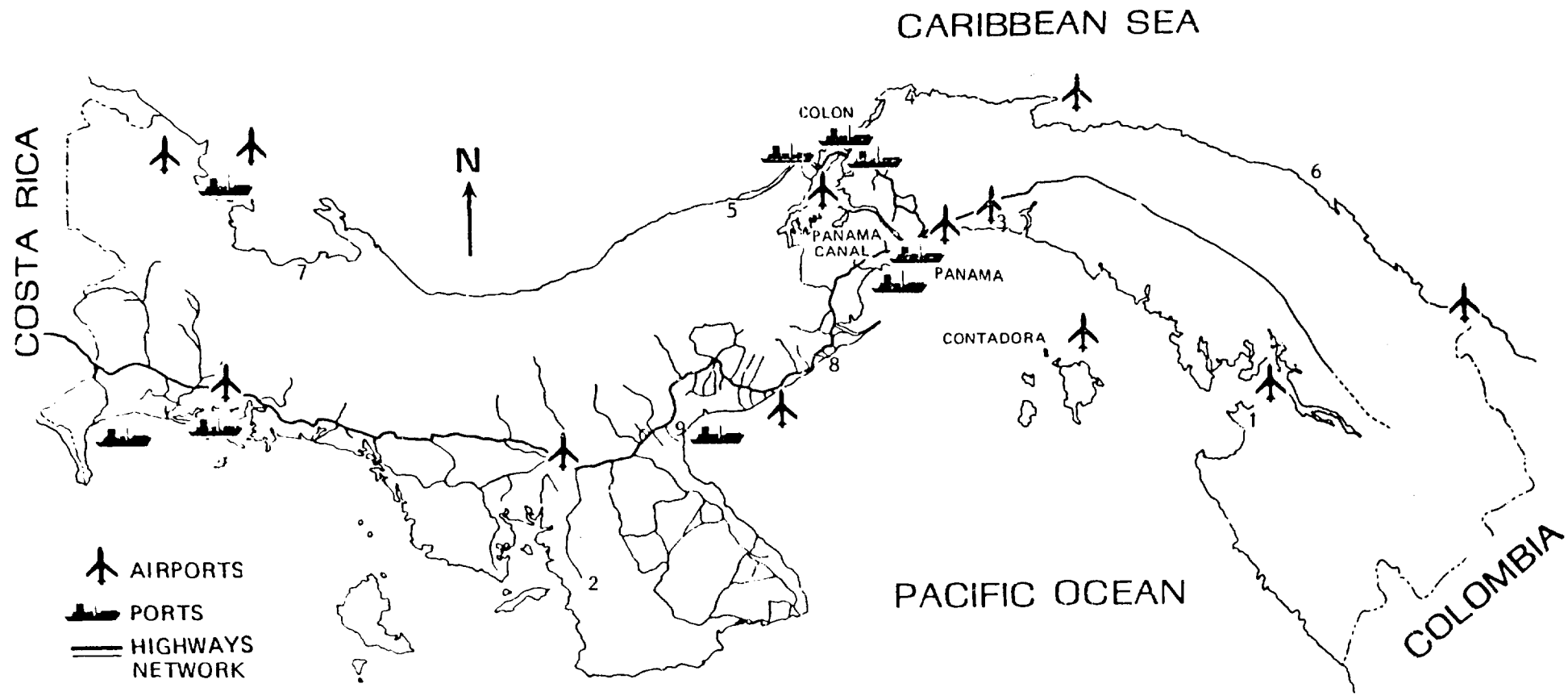
5 The lower coast of Colón (Costa Abayo de Colón). Small farmers with tall varieties. Location of oil palm project.

6 San Blas Indian Reserve (Comarca de San Blas). Old non-organized coconut groves. Main producer in Panamá.

7 Bocas del Toro province (Provincia de Bocas del Toro). Small farmers with tall varieties and some lots with new varieties.

8 San Carlos plantation (Panamá Province).

9 Aquadulce plantation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