CASSAVA PROCESSING OPERATION IN CENTRAL VISAYAS, PHILIPPINES: A FEASIBILITY ANALYSIS

by

ROSSENI M. MANALO

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CHAPTER 1

INTRODUCTION

In recent years, the use of cassava[1] as a component in animal feed has gained recognition in Philippine agriculture. It is well known to have great potential as low-cost carbohydrate substitute especially in feed rations. The significance of cassava as carbohydrate substitute in feed mixes emerges from some of the increasingly important factors viz., (1) the need to increase and match the availability of animal feed with the projected growth of its demand in the feed market, (2) saving of a considerable amount of foreign exchange as a result of substituting cassava for imported yellow corn, (3) the projected growth in poultry and livestock population due to the intensive livestock development program in the Philippines and (4) ultimate benefits to farmers due to an eventual drop in the price of animal feed as a result of substitution of low-cost cassava in place of high-cost imported yellow corn.

Though the importance has been recognized, insufficient time and resources have been devoted to study the feasibility of developing facilities for processing cassava as an animal feed ingredient. At a time when the benefits of greater self-sufficiency in animal feed production and the possibility of dollar savings are being appreciated, it is prudent to look into the viability of developing the proposed operation.

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[1]The botanical name of cassava is Manihot esculenta Crantz. This crop is also called by a variety of names like manioc, tapioca, yuca, mandioca in other tropical countries and "balinghoy" or kamoteng kahoy in the Philippines.

Demand Potential

In a strict sense, potential demand for cassava constitutes four different markets including human food, starch, animal feeds and industrial alcohol. Over the last 15 years, cassava has become an important energy feed ingredient for the compound feed manufacturers of the European Economic Community (EEC). World records on cassava show a significant demand for this crop. There are indications that the EEC demand for cassava will continue to grow up to 6 million tons by 1985.[2]

In the Philippines, cassava's use as animal feed has not yet reached commercial proportions. The crop is firstly used for human consumption, secondly for starch production and animal feeds come third. Being aware that the human food market and the starch market are already developed, while feed market is still under exploitation, a strong push to study the latter segment is deemed necessary.

The following table (Table 1) consolidates the demand projections of cassava in the country for all the markets excepting industrial alcohol. It can be observed from the table that the percentage growth for each market varies from 3.02% for human food, 4.89% for starch and 4.87% for livestock feeds. Estimated total tuber requirements for feeds amount to 90,316 metric tons in 1981 and 228,124 metric tons for the year 2000. These projections from 1981-1990 were based on 1977 data of 73,396 metric tons assuming a 5% growth each year.[3] The Master Projection Program using

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[2]T.P. Phillips, Prospects for Processing and Marketing Cassava Products as Animal Feed, School of Agricultural Economics and Extension Education, Guelph University, Ontario, Canada, World Animal Review, 1979, p. 36.

[3]Bureau of Agricultural Economics, Ministry of Agriculture, Manila, Philippines, 1979.

TABLE 1: DEMAND PROJECTIONS OF CASSAVA IN THE PHILIPPINES FROM 1981 TC 2000 (IN MT)

LOGARITHM PROJECTION

PERIOD NO.	YEAR	POP. (000)	PER CAP. (GRAMS)	H. FOOD (MT)	STARCH (MT)	FEEDS (MT)	TOTAL (MT)
1	1981	48860	16160	789578	125763	90316	1005657
2	1982	49980	16320	815674	132051	94832	1042557
3	1983	51030	16480	840974	138654	99574	1079202
4	1984	52100	16640	866944	145587	104853	1117384
5	1985	53190	16810	894124	152866	109787	1156777
6	1986	54310	16980	922184	160509	115270	1197963
7	1987	55450	17150	950967	168534	121034	1240535
8	1988	56500	17320	978580	177061	127086	1282727
9	1989	57570	17490	1006899	185914	133440	1326253
10	1990	58660	17660	1035936	195210	140112	1371258
11	1991	60017	17839	1070643	204964	147118	1421813
12	1992	61249	18016	1103476	215227	154466	1471681
13	1993	62506	18196	1137316	226004	162181	1523298
14	1994	63788	18377	1172192	237320	170281	1576725
15	1995	65097	18559	1208139	249203	178786	1632027
16	1996	66433	18744	1245189	261680	187716	1689269
17	1997	67796	18930	1283373	274783	197092	1748518
18	1998	69188	19119	1322730	288542	206936	1809845
19	1999	70607	19309	1363292	302989	217272	1873322
20	2000	72056	19501	1405099	318160	228124	1939026
LOG	YBAR	10.8907	9.7347	13.7176	11.9619	11.6309	13.9778
	B(%)	0.0203	0.0099	0.0302	0.0489	0.0487	0.0345
	RSQ	0.9888	0.9733	0.9882	0.9971	0.9984	0.9867
	SYZ	0.0069	0.0053	0.0106	0.0085	0.0062	0.0129
	SB	0.0008	0.0006	0.0012	0.0009	0.0007	0.0014

SOURCE:
1981 TC 1990 PROJECTED BY THE NATIONAL CASSAVA PROGRAM, MA
1991 TC 2000 PROJECTED BY THE MPJ PROGRAM

logarithm projections was applied for the demand for the years 1991-2000. Figure 1 shows the graphical presentation of the demand for feeds.

Import Substitution

As shown in Table 2, the yearly importation of yellow corn for commercial feed production requires a substantial amount of the country's dollar reserves. The potential reserve savings resulting from import substitution makes the development of the feed market segment for cassava attractive to government planners.

Area and Production

Cassava is the second leading rootcrop in the Philippines, and can be grown in almost all parts of the country. There is no doubt that there are large areas primarily engaged in cassava production. The major producing regions are Bicol, Central and Eastern Visayas and Western, Northern and Central Mindanao. Central Visayas, where the proposed operation will be located ranks third in both area and production of cassava. It is believed that such region is suitable for this kind of operation for it is an area programmed for cassava production by the government. As of August 1980, it was reported that Central Visayas region specifically the Bohol area has about 1,194 hectares planted to cassava with a relatively high yield of 17.25 metric tons per hectare compared to the national average of about 12.0 metric tons per hectare.[4] Such indications support Bohol, Central Visayas as the suitable area for the project.

Nationwide, an increasing trend during 1969-1979 crop years in total area planted and production is shown in Table 3. Marked increases are

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[4]Pilot Cassava Feed Project, National Food and Agriculture Council, August, 1980, Quezon City, Philippines.

FIGURE 1

PLOT OF OBSERVED AND ESTIMATED DATA

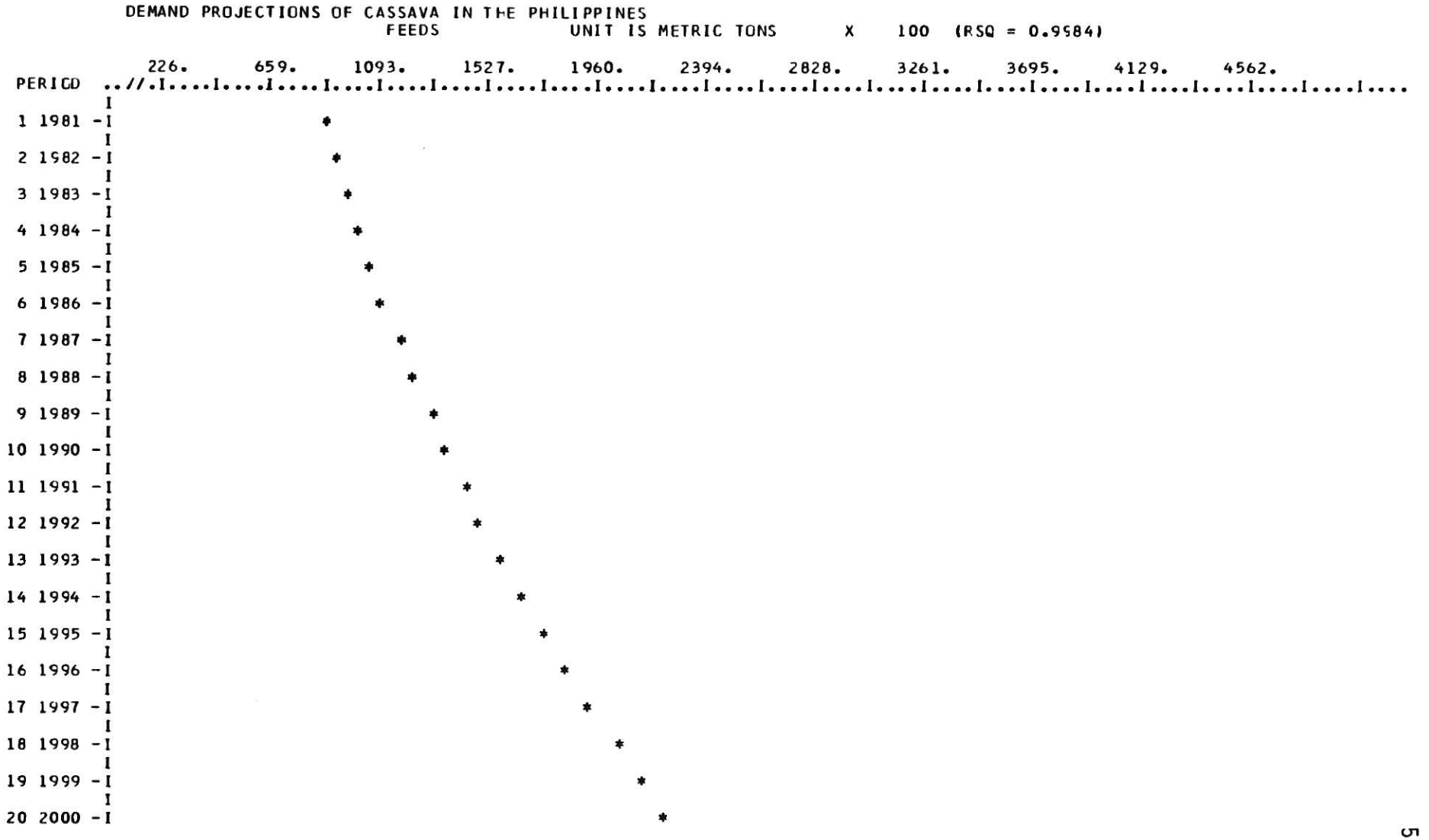

Table 2

ESTIMATED COMMERCIAL FEEDS PRODUCTION AND IMPORTATION
IN THE PHILIPPINES (1970-1985)
(In Metric Tons)

YEAR	POULTRY FEEDS*	HOG FEEDS*	TOTAL FEEDS	YELLOW** CORN(%IMP.)	TOTAL IMPORTATION
1970	262,700	60,000	322,700	.3	968
1971	255,500	61,100	316,600	17	53,822
1972	329,100	106,600	435,700	37	161,209
1973	355,900	69,300	425,200	19	80,788
1974	374,000	75,800	449,800	24	107,952
1975	450,599	125,720	566,319	21	118,927
1976	462,858	191,190	654,048	15	98,107
1977	490,630	217,660	708,290	20	141,658
1978	540,165	214,793	754,958	20	150,992
1979	581,235	239,435	820,670	20	164,134
1980	622,515	264,203	886,718	20	177,344
1981	665,505	289,997	955,502	20	191,100
1982	709,755	316,547	1,026,302	20	205,260
1983	755,295	343,871	1,099,166	20	219,833
1984	802,185	372,005	1,174,190	20	234,838
1985	850,665	401,093	1,252,758	20	250,352

*Source: Bureau of Animal Industry, Ministry of Agriculture, Philippines.

**Foreign Trade Statistics, Manila, Philippines.

Table 3

CASSAVA AREA AND PRODUCTION IN THE PHILIPPINES
CROP YEAR (1969-1979)

YEAR	AREA (Has.)	PRODN. (M.T.)	AVE. YIELD (mt)
1969-1970	85,690	487,327	5.69
1970-1971	82,620	442,223	5.35
1971-1972	81,820	427,054	5.22
1972-1973	82,680	439,697	5.31
1973-1974	87,420	444,710	5.09
1974-1975	96,710	480,015	4.96
1975-1976	119,310	684,507	5.73
1976-1977	114,650	1,133,958	7.83
1977-1978	179,270	1,710,767	9.54
1978-1979	192,360	2,249,024	11.69

Source: Bureau of Agricultural Economics, Ministry of Agriculture, Manila, Philippines.

observed in 1977-1979 crop years where average yields per hectare increased simultaneously.

On the regional level, Western Mindanao exhibited the highest area and production during the mid-70's as well as highly marked per hectare yield due to the presence of starch milling companies and feed milling companies which encouraged the growers to produce more.

In terms of the required land area needed to meet the demand projections, a realistic expected yield per hectare should be assumed. Thus, assuming 15 metric tons yield, the total feed demand for 1982 at 94,832 metric tons requires a land area of 6,322 hectares. Adopting a similar assumption on the yield per hectare for the proposed processing operation of 4,800 metric tons of pellets per year, requiring 12,000 metric tons of tubers as raw materials, a total of 800 hectares would be required to be planted.

Objectives and Limitations of the Study

The overall objective of this study was to evaluate the economic feasibility of commercial cassava chipping and pelletizing in Bohol, Central Visayas, Philippines. Though production of cassava is concentrated in Bohol, there are no processing plants located in or near the production areas; rather they are located in cities like Cebu and Cagayan de Oro which are far from production areas. Establishing a cassava processing plant in Bohol would reduce the marketing costs involved, improve farm prices and encourage the marketing of high quality pelletized cassava.

For the proposed 4,800 MT cassava chipping and pelletizing facilities the specific objectives of the study were to:

(1) Estimate the cost and potential benefits associated with establishing facilities for processing cassava into pellets.

(2) Determine the potential internal rate of return (IRR) on total capital.

(3) Work out a practical and sound financing plan for the proposed operation.

(4) Determine the potential financial rate of return (FRR) to equity capital.

Reliable data needed for the analysis are scarce from Philippine sources and had to be supplemented with data from other sources. This posed the major constraint on this study. However, for obtaining precise and realistic results of the analysis, some refinements and modifications of input data used will be made by the author after her return to the Philippines. This can easily be done since the computer package program used in this study is available at the Ministry of Agriculture's Computing Center.

CHAPTER 2

REVIEW OF LITERATURE

This chapter reviews some of the relevant literature on the production, storage, processing and use of cassava as an ingredient in animal feed.

Production and Storage

The cassava crop is easy to grow and can be planted at any time of the year. It thrives best in warm and humid areas with even rainfall. Its popularity is due to its drought tolerance, ability to grow on poor soil and its unmatchable carbohydrate production. Cassava's productivity in terms of calorie/unit-land/unit-time is significantly higher than other staple food crops. Advincula et al. (1979)[5] indicated that cassava can produce more calories per land unit than other crops--some 250,000 calories per hectare compared to about 176,000 for rice, 110,000 for wheat and 200,000 for maize.

Panaligan[6] noted that in the selection of variety, one should consider the adapatability of the variety to the locality. Generally, two groups of varieties are grown in the country, those intended for food and those grown for starch production. Varieties that are generally low in Hydrocyanic Acid Content (HCN) and have local acceptability both for food

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[5]Eduardo Advincula et al., Feasibility Study on a 30 MT Cassava Starch Plant, UPLB, Philippines, 1979.

[6]Dante R. Panaligan, Cassava, ANI, Magazine of the Ministry of Agriculture Personnel, Philippines, August, 1979, p. 10.

and as animal feed are Golden Yellow, Katabang, Macan, and Brazil. Other varieties such as Java Brown and Hawaii 5 are used for starch purposes.

The time to harvest tubers depends on the variety and the purpose for which the crop is grown. Usually, cassava can be harvested 8-10 months after planting. Golden Yellow, commonly called the Miracle Cassava[7] can be harvested as early as 4 months after planting before the tubers become fibrous. Harvesting can either be complete, partial, or progressive. It is done by pulling the plants by hand or digging out the tubers with hand tools. In harvesting, Magboo and Yabes[8] (1979) emphasized that injury to tubers should be avoided because broken or bruised tubers deteriorate rapidly. If tubers cannot be processed immediately deterioration is minimized by storing at a temperatore of 30° to 40°C and at relatively high humidity. This can be achieved by using clamp storing method or by storing the tubers in boxes filled with damp sawdust. The field clamp storage method is a circular bed of straw or other material, such as dried grass or dry sugar cane leaves (approximately 1.5 meters in diameter and 15.0 centimeters thick) placed on suitable, well-drained ground.[9] The freshly harvested roots are heaped in a conical pile on this straw bed. The pile of roots is then covered with a similar layer of straw and the entire clamp covered with soil to a thickness of 15 centimeters. In order to ensure that the internal clamp temperature does not exceed 40°C it is necessary that ventilators be constructed from locally available

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[7]Ibid., p. 10.

[8]Concepcion Magboo and Salvador Yabes, Pointers in Growing, Storing and Processing Cassava, Greenfields, 1979, Manila, Philippines, p. 22.

[9]R.H. Booth, Cassava Storage, Centro Internacional de Agricultura Tropical, Cali-Colombia (CIAT), Series EE-16. September, 1975.

materials, such as straw, hollow bamboo, drain pipes or timber. Precautions should be taken to prevent the entry of mice and rats.

Forms of Processing

Cassava chips represent the most common form in which dried cassava is produced and marketed by most of the producing and exporting countries. Chips are dried irregular slices of roots which vary in size but should not exceed 5 cm. in length. Others are in the form of broken roots similar to chips in appearance but generally thicker and longer. Pellets are obtained from dried and broken roots by grinding and hardening into cylindrical shape. These are about 2.3 cm. long and about 0.4-0.8 cm. in diameter and are uniform in appearance and texture. Pelletized chips are more popular as they meet ready demand in the EEC markets. There are advantages of pellets over chips: (a) quality is more uniform, (b) 25-30% less space required than for chips, thus reducing the cost of transport and storage, (c) handling charges for loading and unloading are cheaper, and (d) the product reaches the destination sound and undamaged, while a great part of a cargo of sliced chips is damaged in long-distance shipment because of sweating and heating.[10]

Appropriate Pelletizing Technology

It is a well-known fact that Thailand is the world's largest exporter of cassava pellets.[11] Because of similar conditions, the Thai

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[10] M.R. Grace, FAO Consultant, Cassava Processing (Food and Agriculture Organization of the United Nations, Rome, 1977).

[11] Donald D. Evans and Laurie Nogg Adler, Appropriate Technology for Development: A Discussion and Case Histories, Denver Research Institute, 1975.

technology for chipping and pelletizing seems appropriate for the Philippines even though it has not yet been adopted on a general scale.

A. Thai Processing of Cassava Into Pellets

From the field or storage, cassava tubers are taken to a chipping facility where they are sorted, trimmed, peeled and washed to produce chips of quality. After tubers have been chipped, chips are usually wheeled in wooden carts to an outdoor cement drying floor. Sun drying is most commonly practiced. Chips are spread on the floor by hand or by a tractor-like machine which is called payloader. These are turned during the day every two hours by rake and at the end of the day, they are heaped into piles under shelter. The drying process takes 2-4 days depending on the amount of sunlight and size of the chips. Minimum moisture content is 12-14%. After drying, chips are moved to the mill hopper by a payloader.

The next step is the production of pellets shown in Figure 2.[12] Heated pellets are formed and moved by a conveyor to a cooler where finished pellets emerge. After placing pellets in 50-kg. bags, they are ready for transport and delivery to the feed millers. Figure 3 shows the flow diagram of cassava processing steps.[13]

Use of Cassava as Animal Feed

Phillips[14] cited three methods by which cassava can be used as an animal feed in tropical countries.

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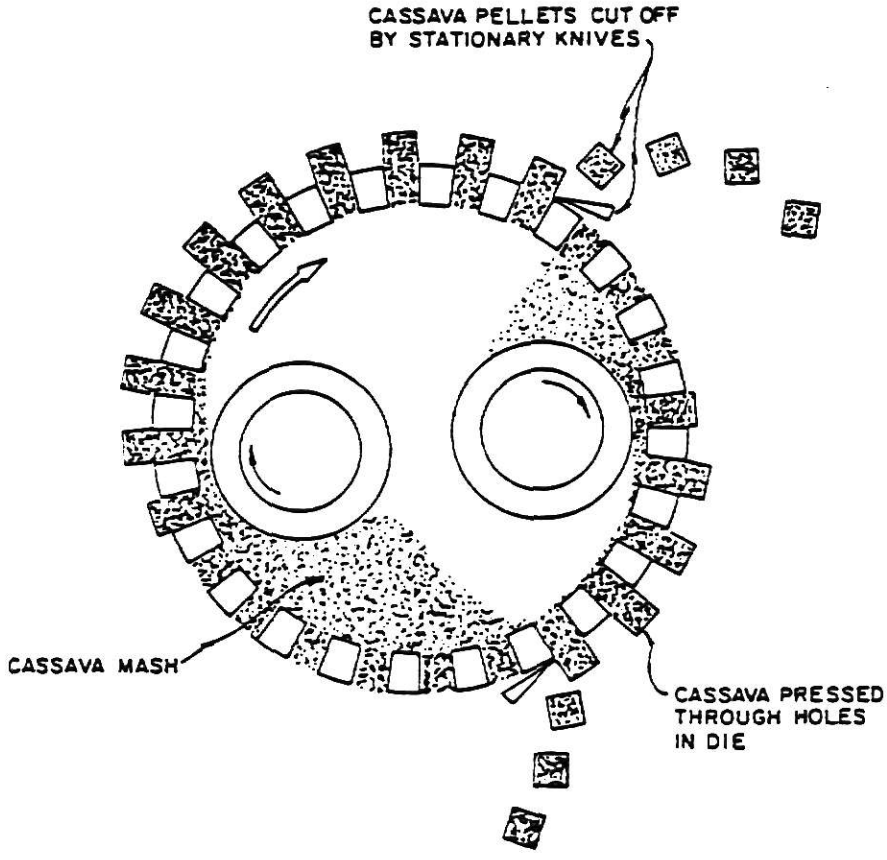
[12]Ibid., p. 102.

[13]Ibid., p. 98.

[14]T.P. Phillips, Prospects for Processing and Marketing Cassava Products as Animal Feed, School of Agricultural Economics and Extension Education, Guelph University, Ontario, Canada, World Animal Review, 1979, pp. 36-40.

FIGURE 2
CASSAVA-PRESSING MECHANISM



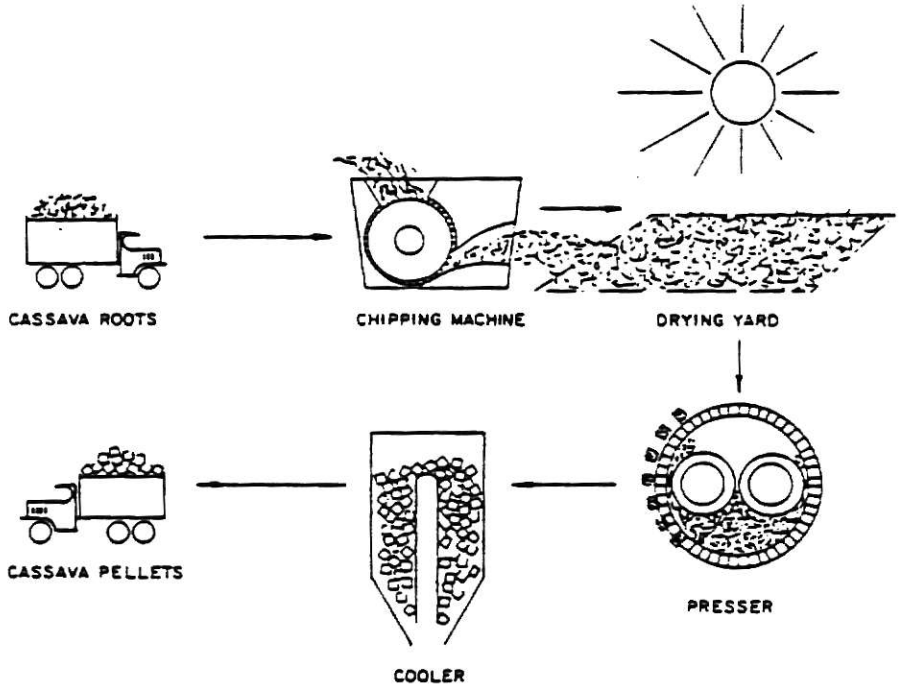
(1) Cassava mash

(2) Cassava pressed through holes in die

(3) Cassava pellets cut off by stationary knives

Source: N.C. Than, S. Muttamara, and B. N. Lahoni, "Technological Improvement of Thai Tapioca Pellets," Thai Journal of Agricultural Science II (April 1978), p. 21.

FIGURE 3
FLOW DIAGRAM OF CASSAVA PROCESSING STEPS



i) As an ingredient in compound feed manufacturing. Ingredients of compound feed are selected in such a manner as to minimize the total cost of the feed while meeting specified nutrients (protein, energy, calcium, etc.) and quality requirements. Linear programming is used to determine which ingredients to include in the ration and the competitiveness or complementarity of various crops. Phillips, in his analysis of the relationships between the potential percentage of cassava and other products in the rations found out that an increase of US $5 per ton in the EEC market would result in the removal of cassava from cattle rations and sharp decline in the proportion of cassava in pig rations. A decrease in price of cassava chips would lead to an increase in the use of cassava but because most feed millers place an upper limit on the amount of cassava in the ration, a price decrease implies a reduction in income to the sellers of cassava. It is therefore expected to find cassava priced at a level that provides the greatest returns to its sellers while still being competitive with other ingredients. Important ratios of the price of other feed ingredients to the price of cassava which might be applicable to any developing country are also listed by Phillips as reference:

Ingredient	Price Ratio
Sorghum	1.16:1
Barley or Maize	1.19:1
Wheat	1.22:1
Sunflower Meal	1.38:1
Soybean Meal	1.64:1

ii) As a substrate for single cell protein production. The work of Gregory et al. (1976) and Tan (1976) demonstrated that cassava can be used as a substrate for the production of single cell protein. This

experiment was installed at (CIAT) Centro Internacional de Agricultura Tropical where a 300 litre fermentor producing 28-38% protein biomass has been developed. Preliminary indications show that this process is capable of producing a nearly balanced pig feed directly from cassava. This means also that many more pigs can be supported per unit land area by the processed feed than by conventional feeding practices. While promising, this system so far has not yet been adopted in the developing countries of the world.

iii) As a feed extender during periods of feed shortage. Cassava will serve as a supplementary feed in places where there is a shortage of normal feed such as grazing. A feed extender is not primarily intended to be a balanced ration in itself but rather it should be used to maintain the weight gain achieved during the flush season. In the Philippines, cassava as feed extender is practiced. Duck raisers near Laguna de Bay (Philippines) use cassava as supplemental feed when traditional feeds like sea snails become scarce.[15]

Encouraging results were found by Gohl[16] (1975) by including cassava root meal up to 10% in rations for growing chicks and up to 20% in rations for layers. But when the meal was included in turkey rations, it seemed to cause health problems. Reasons for this are not known.

Nestel[17] (1974) in his review of the current trends in cassava research cited Muller et al. (1971) findings that cassava meal could be

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[15]PCARR, Philippine Recommends for Rootcrops, 1979.

[16]Bo Gohl, Tropical Feeds, Feeds Information Summaries and Nutritive Values (Unedited Version), FAO, Rome, 1975, p. 128.

[17]Barry L. Nestel, Current Trends in Cassava Research, IDRC, Ottawa, Canada, 1974, p. 12.

substituted to corn up to 60 percent level in broiler rations provided it is balanced with other supplements needed in the diet. It was also found that at higher levels of substitution, cassava should be pelletized. It was also pointed out that nutritional problems are likely to arise when the fiber content of cassava meal exceeds 3.5%.

Similarly, Gohl[18] (1975) indicated that cassava-based rations in mash-form are disliked by swine if not mixed with molasses or water. In contrast, pelleted rations have been found to be more acceptable than conventional rations based on corn. The following table gives the results of his findings from feeding experiments using cassava pellets in the rations:

	Level of cassava in ration (%)					
	26	49	69	22	41	58
Level of molasses (%)	-	-	-	10	10	10
Ave. daily gain (grams)	740	740	710	830	780	770
Ave. daily feed intake (kg.)	2.66	2.79	2.48	2.95	3.00	2.73
Kg. feed/kg. gain	3.57	3.76	3.49	3.56	3.85	3.54

All these studies lead to suggest that satisfactory results can be obtained with higher inclusions of cassava.

Tejada de Hernandez and Brambila[19] (1969) reported on using up to 50% cassava meal for young chicks which resulted in lower feed efficiency than chicks on corn starch. They also commented on a wide range of (HCN) Hydrocyanic Acid levels present in their rations and the uncertainty regarding its nutritional significance. In the same experiment, Jalaludin

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[18]Gohl, op. cit., p. 128.

[19]Op. cit., p. 12.

and Oh[20] (1972) found no toxic effects on feeding laying hens with very high levels of HCN.

In the Philippines, the failure to increase yellow-corn yields significantly and the good prospects of introducing high-yielding cassava varieties inspired Filipino researchers in determining the viability of using cassava as a corn substitute in compound feeds. Research results show that cassava in chips form can completely replace corn in poultry and livestock rations.

In a study of the acceptability and the economics of substitution to feed millers, Constantino[21] sought the opinion of the commercial feed millers and found out some reluctance to accept University of the Philippines at Los Baños replacement rate claim of cassava for corn in feed rations. It was indicated that the physical appearance and palatability of the feed mash will be adversely affected if more than 50% of the corn in feed ration is replaced with cassava. Therefore, complete replacement of corn with cassava would necessitate pelletizing or crumbling of the entire feed mash.

To determine whether cassava chips can be economically used in feed production, Constantino used a least cost formulation linear program to find the optimum price and quantity in feed formulation. Final results of the linear program for representative type of feeds are given by Tables 4 and 5. Table 4 shows that given the price of feed ingredients and a constant price of corn at ₱1.18 per kilo, cassava meal will not be used

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[20] Ibid., p. 13.

[21] Mina Constantino, Cassava Market and A General Strategy of Implementation for the Cassava Program, Asian Institute of Management (AIM), Manila, Philippines, 1979.

Table 4

LINEAR PROGRAM ON CASSAVA'S UTILIZATION IN REPRESENTATIVE TYPE OF POULTRY FEEDS (Least Cost Formulation)

	PER KILO PRICES	BROILER A (%)	STARTER B (%)	LAYER A (%)	MASH B (%)
Corn	₱ 1.18	36.00	22.70	39.30	26.30
Cassava Meal	-	0	15.00	0	15.00
Ipil-ipil Leaf Meal	0.73	4.00	4.00	5.00	5.00
Limestone Powder	0.10	0.20	0.10	5.90	5.80
Molasses	0.46	3.00	3.00	2.50	2.50
Copra Meal	0.86	8.00	7.00	10.00	10.00
Rice Bran	0.68	10.00	10.00	10.00	10.40
Fish and Bone Meal	2.70	6.00	6.00	6.00	6.00
Soybean Oil Meal	2.45	22.80	26.40	15.10	18.00
Bran and Pollard	0.80	9.00	4.80	5.20	0
Vitamin Premix	-	0.50	0.50	0.50	0.50
Mineral Premix	-	0.25	0.25	0.25	0.25
Methionine	26.00	0.07	0.08	0	0.02
Salt	0.30	0.25	0.25	0.25	0.25
TOTAL		100.07	100.08	100.00	100.02
Cassava price/kilo / Corn price/kilo		₱0.76 / ₱1.18	₱0.74 / ₱1.18	₱0.76 / ₱1.18	₱0.74 / ₱1.18

Source: Mina Constantino, Cassava Market and a General Strategy of Implementation for the Cassava Program (Unpublished Thesis) (AIM, Philippines, 1979), p. 148.

Table 5

LINEAR PROGRAM ON CASSAVA'S UTILIZATION IN REPRESENTATIVE TYPE OF HOG FEEDS (Least Cost Formulation)

	HOG STARTER		HOG FINISHER	
	A (%)	B (%)	A (%)	B (%)
Corn	₱ 37.50	23.90	28.30	15.80
Cassava Meal	0	15.00	0	15.00
Copra Meal	8.00	8.00	18.00	18.00
Ipil-ipil Leaf Meal	3.00	3.00	3.00	3.00
Limestone Powder	0.30	0.10	0.70	0.50
Molasses	4.00	4.00	5.00	5.00
Rice Bran	8.50	4.50	20.00	16.20
Fish and Bone Meal	4.90	5.30	3.00	3.40
Soybean Oil Meal	14.80	17.20	2.60	3.60
Bran and Pollard	18.00	18.00	18.40	18.50
Salt	0.25	0.25	0.25	0.25
Mineral Premix	0.25	0.25	0.25	0.25
Vitamin Premix	0.50	0.50	0.50	0.50
TOTAL	100.00	100.00	100.00	100.00
Cassava price/kilo	₱0.81	₱0.79	₱0.95	₱0.93
Corn price/kilo	₱1.18	₱1.18	₱1.18	₱1.18

Source: Mina Constantino, Cassava Market and a General Strategy of Implementation for the Cassava Program (Unpublished Thesis) (AIM, Philippines, 1979), p. 149.

in the least-cost formulation at ₱0.76 price level. Decreasing the meal price to ₱0.74 per kilo brings cassava into the least-cost formulation at a rate of 15% of the total broiler starter mash ration. The same findings apply for layer mash rations.

On the other hand, Table 5 reveals that given the prices of feed ingredients, and again with a constant price of ₱1.18 per kilo for corn, cassava meal will be used in the least-cost formulation of hog feeds at prices higher than ₱0.74 per kilo limit set in poultry feed production. Cassava meal can be used up to 15% of the total hog starter and finisher rations (representative hog feed rations) given a price of ₱0.79 and ₱0.93 per kilo, respectively.

Constantino noted that the acceptable cassava meal price selected by the least-cost formulations are totally dependent on the current price of other feed ingredients. Any price changes in other ingredients will affect the extent to which cassava can be economically used in various types of feed rations.

From the Bureau of Animal Industry report, the Philippines has about 73 registered commercial feed mills in operation. These operating feed mills are dominated by the Philippine Association of Feed Millers (PAFMI); non-PAFMI member firms exist but are not regularly registered under the bureau. Appendix A presents the different feed mills, their geographic location, and their rated capacities. On a regional basis, 80.8% are located in Luzon, 11% in Visayas, and 8.2% in Mindanao. Their rated capacities were calculated based on the average 8-hour per 26-day month operating year although a number of mills operate two or three 8-hour shifts.

CHAPTER 3

METHOD OF ANALYSIS AND ASSUMPTIONS

I. Methodology

An existing package program "Computerized System for Feasible Agribusiness Development"[22] developed by Dr. Richard Phillips et al. at Kansas State University was used to analyze both economic and financial aspects of the study.

This comprehensive feasibility analysis computerized program is used to measure the economic soundness of the project by computing the potential annual rate of return on investment based on the time flow of money into and out of the project. The desired rate of return is calculated by solving r in the formula:

$$I_0 + \frac{I_1}{1+r} + \frac{I_2}{(1+r)^2} + , \ldots , + \frac{I_n}{(1+r)^n} =$$

$$B_0 + \frac{B_1}{1+r} + \frac{B_2}{(1+r)^2} + , \ldots , + \frac{B_n}{(1+r)^n}$$

where:

I = Net Investment each period

B = Net Benefit each period

0, 1, 2, . . . n = represent the periods starting with the present as 0

r = annual rate of return on investment

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[22] R. Phillips et al., Kansas State University, Manhattan, Kansas, Vol. I.

The computer program is designed to compute and print out several kinds of return rates based on the above mentioned formula but with different measures of investment (I) and benefits (B). The return rate (r) is interpreted according to how (I) and (B) are defined. From the program, two types of return rates were calculated in this study:

(1) Internal Rate of Return (IRR) which is a measure of the annual earning power of the total capital investment; regardless of how the enterprise is financed and how the earnings are distributed.[23] It is also defined as that rate of discount which equates the present value of the stream of net receipts with the present value of the investment outlay schedule.[24]

(2) Financial Rate of Return (FRR) which is used to measure the earning power of equity capital in the enterprise after payment of all depreciation, interest and income tax expenses.[25]

II. Collection of Basic Data

The plan and technical specifications for the cassava processing plant were taken from a similar operation developed in Thailand. Thailand has specialized in utilizing cassava in animal-feed processing and has the expertise and equipment needed by the project. Technical requirements, labor requirements, cost and capacity of the recommended machinery and equipment to be used were all closely patterned after Thailand's cassava processing operation.

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[23] Phillips et al., op. cit., pp. 2-10.

[24] Ibid., pp. 2-11.

[25] Haim Levy and Marshall Sarnat, Capital Investment and Financial Decisions (Prentice Hall Int'l., 1978, London), p. 31.

Prices of raw materials (fresh cassava tubers) were obtained from the Philippines' Special Survey reports of the Ministry of Agriculture; prices of animal feed and feed ingredients were obtained from the Bureau of Animal Industry. Other Philippine sources were used for supplemental data needed for the analysis.

III. Development of Basic Schedules and Assumptions

Cash flow schedules of input data for computerized feasibility analysis were developed in the format needed for the computer program. Separate schedules of annual projections for a 20-year economic horizon were developed for capital outlay, working capital requirements, operating costs and operating revenues.

a) Projected Capital Outlay Schedule

A total list of equipment and facilities for the project based on the design and set-up of the plant was assembled together with unit prices, installation costs, delivery costs, customs taxes, duties, insurance cost and other charges. Price quotations for machines and equipment were based on the sample list of CCMW products and concomitant prices.[26] From such a list, combined cost estimates and capital outlay schedules were worked out for each functional unit, including appropriate allowances for replacement of equipment with useful life of less than 20 years. The list of equipment and facilities and estimated capital outlay is presented in Table 6; the breakdown of the cost of machinery and equipment for chipping and pelletizing is shown in Table 7. The estimated total capital outlay for

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[26]Evans and Adler, Appropriate Technology . . . Chonburi Casting and Machine Work Company, Ltd. (based on an interview with Pornsak Pusanguansit, 21 February 1979), p. 103.

Table 6

PROJECTED CAPITAL OUTLAY
(In Pesos)

ITEM	SPECIFICATIONS	LIFE (YRS)	AMOUNT (P)
Land	1 ha.	-	100,000
Land Improvements		-	50,000
Factory Building	1,300 sq. m.	30	70,000
Office Building	500 sq. m.	15	40,000
Storage Facilities		20	40,000
Transportation Facilities		5	125,000
Delivery trucks - 100,000			
Service jeep - 25,000			
Plant Machinery and Equipment		20	300,800
Office Equipment		10	5,960
Other Processing Facilities			20,000
Installation (20% of the cost of machinery and equipment)			81,216
Transportation			15,041
Customs duties and other handling charges			105,280
Contingency			46,014
TOTAL			P 999,310

Table 7

COST OF MACHINERY AND EQUIPMENT
(In Pesos)

ITEM	UNIT	AMOUNT (P)
Factory Machinery and Equipment:		
Chipper	1	6,656
Pressing machine and accessories	1	81,920
Motor, 160 h.p.	1	61,440
Motors for conveyor	5	23,040
Magnetic switch	1	35,840
Payloader	1	87,040
Scales	2	3,328
Carts	2	7,536
TOTAL		P 300,800

Source: Unpublished result from an ASRCT Economic Analysis Department Study (converted from baht to pesos), Evans and Adler, Appropriate Technology for Development: Discussion and Case Studies, Thailand: Cassava Pelletizing Technology, p. 101.

the project is ₱ 999,310 including ₱ 300,000 for land and buildings and ₱ 699,310 for equipment.

The projected annual capital outlay schedule is shown separately for facilities and for equipment in Table 11, the computer input table. The full capital outlay is entered in Period 0 with appropriate replacement values in Periods 5, 10 and 15 (see Table 6). The remaining depreciated values of facilities and equipment at the end of the economic horizon are entered as outlay credits in Period 20.

b) Projected Working Capital Requirements

In order to develop the projected schedule of working capital (current assets), the following period by period schedules were developed and used: a) raw materials inventory, b) supplies inventory, c) finished goods inventory, d) net accounts receivable, e) cash requirements and f) prepaid expenses. The summation of the above schedules gives the projected working capital requirements for the operation. These figures together with the number of days of operation maintained in each account are shown in Table 8. Estimated total working capital requirements is ₱ 669,333. This amount is entered to the projected annual cash flow table (Table 11) in period 1 when operations started, ₱ 270,000 as raw material working capital and ₱ 399,333 as other working capital. Because constant annual output is projected, no further working capital entries are made in the projected cash flow until Period 20 when credit is taken for the entire original entry.

c) Schedule of Labor Requirements and Costs

The schedule of labor requirements and costs by position was prepared by estimating the various categories of labor required period by period

Table 8

WORKING CAPITAL REQUIREMENTS
(In Pesos)

	NO. OF DAYS SUPPLY	FACTOR	AVERAGE YEARLY BALANCE (P)
Raw Materials Inventory	15	0.075	270,000
Supplies Inventory	30	0.15	6,192
Finished Goods Inventory	3	0.015	64,800
Working Cash	5	0.025	1,209.60
Prepaid Expenses	30	0.15	3,131.10
Net Accounts Receivable	15	0.075	324,000
TOTAL			P 669,332.7 ≃ 669,333

for operating the project based on the layout of the plant and operating schedule. Projected estimates are in terms of workers per year. Appropriate wages were applied to each category to obtain labor costs. The wages applied are the prevailing rates in the Philippines. The list of manpower requirements by category and wage rate is shown in Table 9. Projected annual labor cost is ₱ 181,584.

d) Projected Total Fixed and Variable Operating Expenses

Projected total annual fixed and variable operating expenses for the project are shown in Table 10. Variable expenses include production supplies, direct labor, repairs and maintenance, transportation costs, commissions, and fringe benefits for direct labor. Annual marketing expense was projected separately.

The fixed expenses include costs for administrative salaries, fringe benefits for administrators, insurance and contracts.

The annual operating expenses for the various categories are entered to the cash flow each year, beinning with Period 1 when operations are started and extending to Period 19 (Table 11). Total annual operating expenses, including the cost for raw materials is estimated at ₱ 4,024,037 (Tables 10 and 12).

e) Projected Raw Materials Expense

The projected annual expense for raw materials is based on estimated period by period volumes and cost of fresh cassava tubers to be supplied by the contract growers for processing into pellets. This was calculated based on recovery factor of 40%,[27] reflecting (a) tuber moisture content

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[27] M.R. Grace, Cassava Processing, FAO, Rome, 1975, p. 63.

Table 9

PROJECTED MANPOWER REQUIREMENTS
(In Pesos)

POSITION	NO.	SALARY/YEAR (P)
Supervisor	1	18,000
Quality Controller/ Switchboard Operator	1	12,000
Chipper Operator	1	12,000
Conveyor Operator	1	12,000
Purchasing Agent with technical knowledge	1	15,600
Drivers	2	19,200
Secretary/Typist	1	9,600
Salesman	1	13,200
Security Guard	1	9,600
Pit Person	1	7,200
Workers	14	48,384
TOTAL		181,584

Table 10

PROJECTED OPERATING EXPENSES
(In Pesos)

ITEM		AMOUNT (₱)
Raw Materials Expense		3,600,000
Variable Expenses:		
Direct Labor	110,784	
Production Supplies	41,940	
Marketing Expense	37,200	
Other Variable Expenses:		
Repairs and Maintenance	25,764	
Power, Fuel and Water	56,497	
Transport/Handling	48,000	
Fringe Benefits for Direct Labor	11,078	
Total Variable Expenses		331,263
Fixed Expenses:		
Indirect Labor	66,000	
Fringe Benefits for Indirect Labor	6,600	
Insurance	20,874	
Total Fixed Expenses		93,474
TOTAL OPERATING EXPENSES		4,024,037

of 70.25%,[28] (b) chip moisture content of 14%, (c) 2-3% loss of weight during the pelletizing process.[29]

The formula applied was:[30]

$$C = 1.0 + \left[\frac{M_1 - M_2}{1.0 - (M_1 - M_2)}\right], \text{ where}$$

C = metric tons of raw material per metric ton of product (pellets)

M_1 = Moisture content of tubers

M_2 = Moisture content of chips

$C = 1.0 + 1.28 = 2.28$ ~ no. of metric tons of tubers per metric ton of chips

For the additional shrinkage in pelletizing,

$2.28 + 0.22 = 2.5$ ~ metric tons of tubers per metric ton of pellets

Thus, it was assumed that 2.5 metric tons of tubers would be needed to produce one metric ton of cassava pellets. Based on this and the capacity of the pelletizing mill, and an assumed buying price for fresh tubers at ₱ 0.30 per kilo,[31] an estimated cost for raw materials at

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[28]Ibid., p. 13.

[29]Ibid., p. 65.

[30]Rice Mill Feasibility Analysis, Food and Feedgrain Institute, Kansas State University, Manhattan, Kansas, Manual No. 3.

[31]Prevailing buying price for fresh tubers in Bohol, Philippines, National Food and Agriculture Council, Pilot Cassava Feed Project, 1980.

₱ 3,600,000 was obtained by 4800 m.t. × 2.5 × ₱ 0.30 per kilo × 1000 kg./m.t. = ₱ 3,600,000.

f) Projection of Selling Price for Cassava Pellets

In the study, selling price for cassava pellets was estimated at a price competitive with yellow corn for finisher rations. At ₱ 0.90 per kilo the pellets would be preferred by the feed manufacturers over ₱ 1.30 per kilo price of yellow corn as carbohydrate ingredient. The ratio of the price of yellow corn feed ingredient to the price of cassava pellets is 1.30:0.90 or 1.44:1.00. With reference to the least cost formulation linear program determined by Constantino in Tables 4 and 5,[32] it is shown that there is no possibility for cassava pellets in poultry feeds at this price ratio. However, in hog feeds, cassava pellets can be substituted for corn in finisher rations.

Estimated revenue period by period based on the projected price and capacity of the mill is valued at ₱ 4,320,000 (4800 m.t. × ₱ 0.90/kg. × 1,000 kgs./m.t.). This annual operating revenue is entered to the projected cash flow each year from Period 1 through Period 19 (Table 11).

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[32]Mina Constantino, op. cit., see Tables 4 and 5.

CHAPTER 4

ECONOMIC ANALYSIS

As mentioned earlier, the computer package viz., "User's Guide to Computerized System for Feasible Agribusiness Development"[33] was used to measure the economic feasibility of the cassava processing project, using as input the projected cash flow schedule in Table 11.

IRR Analysis Results

As shown in Table 12, an Internal Rate of Return of 17.392 percent on total capital outlay was obtained for the basic alternative, indicating that the project is economically feasible at real opportunity cost of capital up to this annual earning rate.

At the rate represented by the solution IRR, the net present values of the total capital outlay schedule and the total net revenue schedule are identical at ₱ 1,620,877 (Table 12). At any annual discount rate representing the real opportunity cost of capital less than the solution IRR, the present value of the net revenue schedule is greater than that of the total capital outlay schedule, providing a benefit-cost ratio greater than 1.0:1.0 and a net present value (NPV) greater than zero. At a real opportunity cost of capital which is currently representative of the Philippines of 15 percent, the project shows a benefit-cost ratio of 1.28:1.00 and a net present value of ₱ 207,611 (Table 12).

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[33]Phillips et al., op. cit., pp. 2-10.

A LISTING OF THE DATA

2 2 1 6 1 1 0 2 0.0

TABLE 11

4800 MT CASSAVA PROCESSING OPERATION : A FEASIBILITY ANALYSIS

TOTAL OPERATION

PERIOD	FACILITY _INVESTM.	EQUIP _INVESTM.	RAW MAT. WORK_CAP	OTHER WORK_CAP	REVENUE _RECEIPTS	LABOR _EXPENSE	PRODN. SUPPLIES	RAW MAT. _COST_	FIXED EXPENSE_	VARIABLE _EXPENSE	MKTING. EXPENSE_	_____	_____
01982	300000.	699310.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11983	0.	0.	270000.	399333.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
21984	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
31985	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
41986	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
51987	0.	125000.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
61988	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
71989	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
81990	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
91991	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
101992	0.	130960.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
111993	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
121994	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
131995	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
141996	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
151997	40000.	125000.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
161998	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
171999	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
182000	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
192001	0.	0.	0.	0.	4320000.	110784.	41940.	3600000.	93474.	141339.	36500.	0.	0.
202002	-170000.	-294840.	-270000.	-399333.	0.	0.	0.	0.	0.	0.	0.	0.	0.

TABLE 12

INVESTMENT FEASIBILITY ANALYSIS

4800 MT CASSAVA PROCESSING OPERATION : A FEASIBILITY ANALYSIS
TOTAL OPERATION

INTERNAL RETURN ON TOTAL CAPITAL 17.392 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (PESOS) FACILITIES	INVESTMENT (PESOS) WORKING CAPITAL	INVESTMENT (PESOS) TOTAL	OPERATING (PESOS) TOTAL REVENUE	OPERATING (PESOS) OPERATING EXPENSES**	OPERATING (PESOS) NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE TOTAL INVESTMENT	PRESENT VALUE NET REVENUE
0	1982	999310.	0.	999310.	0.	0.	0.	1.0000	999310.	0.
1	1983	0.	669333.	669333.	4320000.	4024037.	295963.	0.8518	570171.	252116.
2	1984	0.	0.	0.	4320000.	4024037.	295963.	0.7256	0.	214764.
3	1985	0.	0.	0.	4320000.	4024037.	295963.	0.6181	0.	182947.
4	1986	0.	0.	0.	4320000.	4024037.	295963.	0.5266	0.	155843.
5	1987	125000.	0.	125000.	4320000.	4024037.	295963.	0.4486	56069.	132755.
6	1988	0.	0.	0.	4320000.	4024037.	295963.	0.3821	0.	113087.
7	1989	0.	0.	0.	4320000.	4024037.	295963.	0.3255	0.	96333.
8	1990	0.	0.	0.	4320000.	4024037.	295963.	0.2773	0.	82061.
9	1991	0.	0.	0.	4320000.	4024037.	295963.	0.2362	0.	69934.
10	1992	130960.	0.	130960.	4320000.	4024037.	295963.	0.2012	26349.	59547.
11	1993	0.	0.	0.	4320000.	4024037.	295963.	0.1714	0.	50725.
12	1994	0.	0.	0.	4320000.	4024037.	295963.	0.1460	0.	43210.
13	1995	0.	0.	0.	4320000.	4024037.	295963.	0.1244	0.	36809.
14	1996	0.	0.	0.	4320000.	4024037.	295963.	0.1059	0.	31355.
15	1997	165000.	0.	165000.	4320000.	4024037.	295963.	0.0902	14891.	26710.
16	1998	0.	0.	0.	4320000.	4024037.	295963.	0.0769	0.	22753.
17	1999	0.	0.	0.	4320000.	4024037.	295963.	0.0655	0.	19382.
18	2000	0.	0.	0.	4320000.	4024037.	295963.	0.0558	0.	16511.
19	2001	0.	0.	0.	4320000.	4024037.	295963.	0.0475	0.	14065.
20	2002	-464840.	-669333.	-1134173.	0.	0.	0.	0.0405	-45912.	0.
	TOTAL	955430.	0.	955430.	82080000.	76456703.	5623297.		1620877.	1620877.

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN PESOS REVENUE	OUTLAY	BALANCE
10.000	1.541	2475707.	1606813.	868894.
15.000	1.128	1834447.	1626836.	207611.
20.000	0.891	1433496.	1639599.	-176103.
25.000	0.737	1166791.	1582527.	-415737.
30.000	0.630	979795.	1554603.	-574808.
40.000	0.491	738669.	1504879.	-766210.

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
BASE CASE: 4800 MT CASSAVA PROCESSING OPERATION IN CENTRAL VISAYAS,PHILIPPINES

Reasons why depreciation, interest payments, and income taxes are excluded from operating costs for the calculation of Internal Rate of Return (IRR) are: (a) inclusion of depreciation would mean double counting, since the full capital outlay for depreciable facilities has been included in the capital investment schedule (see Table 11), (b) the inclusion of interest payments on borrowed capital would make it impossible to compare the resulting internal rate of return on total capital investment with the opportunity cost of capital, (c) the inclusion of income tax payments also would make such comparison invalid, because income tax represents a type of earnings distribution rather than a true operating cost.

Sensitivity Analysis of Alternatives

This method of analysis is a process by which modification of the key factors affecting capital investment, working capital, operating revenue or operating costs for the project are formulated and the consequences on project feasibility tested. Through the use of scalers that reflect changes in the projected schedule of variable and fixed costs, equipment costs, price of the product and/or inventories, etc., the sensitivity of the project's feasibility to each of the factors can be tested.

The summary of results for the cassava processing operation (Table 13) indicates that economic feasibility is relatively insensitive to changes in variable cost, labor cost, fixed cost, and facility investment, but very sensitive to changes in the price of pellets, raw materials cost and on working capital. The largest positive change in the IRR resulted from increasing the revenue by 15%, capital investment by 15% and variable cost by 15%, with an IRR of 58.068 percent. The second highest positive change in IRR resulted from increasing the price of cassava pellets by

₱ 0.05 per kilo over the base price of ₱ 0.90 per kilo with an IRR of 33.145 percent. A follow-up analysis involving a further increase in price of pellets from ₱ 0.90 per kilo to ₱ 1.00 per kilo combined with 5% increase in raw materials cost and change in inventory of raw materials to 30 days yielded an IRR of 31.064 percent. This change is shown in Alternative 25 in Table 13. Changes made in increasing the number of days for inventory of raw materials and simultaneously increasing the number of days for accounts receivable resulted in a marginally feasible internal rate of return at 12.644 percent.

If competent management can be obtained, such increases in working capital are not necessary, but can easily occur without careful managerial control. If so, resources that could be used more productively elsewhere may be needlessly tied up in inventory. For receivables, 15 days allowance (as in base case) is sufficient time for collection from feed manufacturers outlets in the Philippines. A significant change that resulted in IRR to -0.945 percent was the decrease in the price of cassava pellets by ₱ 0.05 per kilo. Another lower percentage in IRR resulted at 4.617 percent when raw materials cost was increased by 5%. These results indicate the sensitivity of project feasibility to product and raw material price changes, assuming no offsetting change in volume of operation, i.e., infinitely inelastic product demand and raw material supply faced by the cassava processing firms. Alternatives reflecting changes in product (or raw material) price with simultaneous opposite changes in volume of operation could be tested as well. However, the price of cassava tubers is bounded by farm production costs relative to those of alternative crops, while the price of chips is a function of the price of corn, as has been noted.

Table 13

SUMMARY OF RESULTS FOR IRR AND ITS SENSITIVITY ANALYSIS

SCALE FACTORS AND ITEMS ALTERED	BENEFIT/COST RATIO AT 15.00 PERCENT	PRESENT VALUE IN PESOS			RESULTING IRR (PERCENT)
		REVENUE	OUTLAY	BALANCE	
1) Price of pellets increased from ₱.90/kilo to ₱.92/kilo	1.457	2,369,974	1,626,836	743,138	23.615
2) Variable cost increased by 10% to reflect rising fuel prices	1.074	1,746,842	1,626,836	120,006	16.381
3) All capital outlays increased by 10%	1.025	1,834,447	1,789,520	44,927	15.470
4) Outlay for facility increased by 10%	1.108	1,834,477	1,656,289	178,158	17.012
5) Outlay for facility increased by 15%	1.098	1,834,447	1,671,016	163,431	16.827
6) Raw materials inventory decreased from 15 days to 10 days	1.237	1,834,447	1,482,768	351,679	19.474
7) Labor increased by 10%	1.085	1,765,781	1,626,836	138,944	16.600
8) Variable cost increased by 15% to reflect rising cost for repairs and maintenance	1.047	1,703,039	1,626,836	76,203	15.877
9) Production expense increased by 20%	1.096	1,782,456	1,626,836	155,620	16.792
10) Net A/R decreased from 15 days to 10 days	1.301	1,834,447	1,410,529	423,918	20.684

Table 13 (Continued)

SCALE FACTORS AND ITEMS ALTERED	BENEFIT/COST RATIO AT 15.00 PERCENT	PRESENT VALUE IN PESOS			RESULTING IRR (PERCENT)
		REVENUE	OUTLAY	BALANCE	
11) Raw materials inventory increased from 15 days to 20 days	1.091	1,834,447	1,681,408	153,039	16.701
12) Capital investment increased by 20%	1.057	1,834,447	1,735,063	99,384	16.067
13) Raw materials inventory increased from 15 days to 25 days	1.015	1,834,447	1,808,013	26,434	15.271
14) Net A/R increased from 15 days to 20 days	1.074	1,834,447	1,707,548	236,899	16.387
15) Variable cost increased by 14%	1.052	1,711,800	1,626,836	84,963	15.978
16) Price of pellets increased from ₱.90 to ₱.95/kg.	1.951	3,173,265	1,626,836	1,546,429	33.145
17) Capital investment increased by 10%	1.091	1,834,447	1,680,950	153,497	16.707
18) Outlay for equipment increased by 20%	1.028	1,834,447	1,785,071	49,376	15.522
19) Capital investment increased by 10%; Revenue increased by 10%; Raw material cost increased by 10%; Variable cost increased by 10.5%	1.302	2,188,734	1,680,950	507,785	20.672

Table 13 (Continued)

SCALE FACTORS AND ITEMS ALTERED	BENEFIT/COST RATIO AT 15.00 PERCENT	PRESENT VALUE IN PESOS			RESULTING IRR (PERCENT)
		REVENUE	OUTLAY	BALANCE	
20) Outlay for both facility and equipment increased by 15%; Revenue by 15%; Energy price increased by 15%	3.196	5,719,493	1,789,692	3,929,801	58.068
21) Raw materials cost increased by 5%	0.442	718,765	1,626,836	-908,071	4.617
22) Price of pellets decreased from ₱.90/kg. to ₱.85/kg.	0.140	227,866	1,626,836	-1,398,971	-0.945
23) Raw materials inventory increased to 30 days; Net A/R increased to 30 days	0.871	1,834,447	2,106,628	-272,181	12.644
24) Combination of alternatives 21, 16 and 13	1.138	2,057,583	1,808,013	249,570	17.571
25) Price of pellets increased from ₱.90/kg. to ₱1.00/kg.; Raw materials cost increased by 5%; Raw materials inventory increased to 30 days	1.841	3,396,401	1,845,122	1,551,279	31.064

Source: Computer print-out.

It is clear that careful planning and control of raw materials procurement and product marketing are a must for this project to be feasible. One way to do so would be by contracting with both cassava producers and feed manufacturers.

Given all these alternatives, the base case with an IRR of 17.392 percent is the most realistic, and the one chosen to carry forward in the financial analysis.

CHAPTER 5

FINANCIAL ANALYSIS

The same discounted cash-flow methodology was applied in financial analysis as in economic analysis. This analysis addresses income distribution, capital ownership, asset depreciation, etc. The structure of preparing this and the elements included in the cost and benefit streams are different from those in the economic analysis. The result is a measure of the return on equity capital invested after payment of interest and income taxes.

Pro Forma Financial Statements

Pro forma financial statements were drawn by computer program from the cash flow data in Table 11. Table 14 shows a listing of financial factors used in completing the pro forma financial statements. The income tax brackets and rates are stated for Philippine conditions, as are the interest rates and other conditions of long-term, intermediate and short-term loans. Level payment plans are used for amortizing both long-term and intermediate-term loans. Borrowing is limited to 80% of the total outlay for plant machinery and equipment and 70% of the total outlay for land and buildings. Short-term borrowing is limited to 50% of the current assets. One-half of annual net earnings after taxes is distributed as dividends to the owners, with 40% allocated to surplus and 10% to capital reserves. Under the structure chosen, total capital reserves are limited to 5% of total assets, and no addition to capital surplus is made after 1985, so that all after tax earnings are distributed from 1986

TABLE 14

A LISTING OF THE FINANCIAL FACTORS

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

SALES MARGINS:
- MAIN PRODUCTS 0.100
- BY-PRODUCTS 0.0

INCOME TAX RATE SIABILING YEAR 2:
- UP TO 0 0.250
- UP TO 100000 0.350
- OVER 200000 0.350

ANNUAL INTEREST RATES:
- SHORT TERM LOANS 0.180
- MEDIUM TERM LOANS 0.160
- LONG TERM LOANS 0.120
- BONDS & SECURITIES 0.0

ERACTION OF MEDIUM TERM LOAN REPAYMENTS BY PERIOD
- PERIOD 1 1.000

AVERAGE ACCOUNTS RECEIVABLE:
- MAIN PRODUCTS (X SALES) 0.075
- BY-PRODUCTS (X SALES) 0.0
- OTHER INCOME (X INCOME) 0.0

AVERAGE CASH BALANCE BY PERIOD:
- FRACTION OF LOSS 0.0
- FRACTION OF COSTS 0.025

AVERAGE ACCOUNTS PAYABLE:
- RAW PRODUCTS (X PURCHASES) 0.0
- SUPPLIES (X PURCHASES) 0.0

PREPAID EXPENSE:
- FRACTION OF CASH EXPENSE 0.150

GRACE PERIOD ON LOANS (YRS):
- MEDIUM TERM LOANS 0.0
- LONG TERM LOANS 0.0
- BONDS & SECURITIES 0.0

REPAYMENT PERIOD ON LOANS (YEARS):
- MEDIUM TERM LOANS 10.0
- LONG TERM LOANS 15.0
- BONDS & SECURITIES 0.0

AVERAGE INVENTORIES BY PERIOD:
- RAW MATERIALS (X PURCHASES) 0.075
- SUPPLIES (X PURCHASES) 0.150
- MAIN PRODUCTS (X SALES VOLUME) 0.015
- BY-PRODUCTS (X SALES VOLUME) 0.0

ERACTION OF LONG TERM LOAN REPAYMENTS BY PERIOD:
- PERIOD 1 1.000

ERACTION OF ASSET COST SUBSCRIBED:
- MACHINERY & EQUIPMENT 0.800
- LAND AND BUILDINGS 0.700
- BONDS / TOTAL FIXED ASSETS 0.0

ERACTIONAL ALLOCATION OF EARNINGS FOR THE PERIOD:
- TO CAPITAL RESERVES 0.100
- TO EQUITY IN SURPLUS 0.400

BALANCE SHEET RATIOS:
- CURRENT LIAB. / CURRENT ASSETS 0.500
- CAP. RESERVES / TOTAL ASSETS 0.050

PROJECTED RATE OF INFLATION IS 0.0 PERCENT PER PERIOD.

LEVEL INSTALLMENT PAYMENT PLANS:
- INTERMEDIATE TERM LOANS: 10 INSTALLMENTS, EACH REPRESENTING 0.20650119 OF THE ORIGINAL LOAN.
- LONG TERM LOANS: 15 INSTALLMENTS, EACH REPRESENTING 0.14682424 OF THE ORIGINAL LOAN.

onward. The basic pro forma financial statements are drawn in real terms (annual rate of inflation equal 0.0).

Buildings and equipment outlays for depreciation purposes were set up as indicated in Table 15. The years of useful life vary from 5 to 20 by type of asset, each asset being replaced as needed. Salvage values for depreciation purposes vary from 2 to 20 percent of original cost. The sum of the years' digit (SOYD)[34] method was used for the purpose of reducing income tax payments. With SOYD, relatively large depreciation expenses are taken (Table 16) in the early years of the life of the assets with smaller depreciation expense being taken in later years. This increases net returns after taxes in the early years of the cash flow. SOYD also reduces the risk that the investment cannot be recovered.

Summary depreciation schedules and annual depreciation expense for buildings and for equipment over the first 14 years are given by the computer output reproduced as Table 16. Total annual SOYD depreciation expense is summarized for buildings in column (5), for equipment in column (14), and for the combined assets in column (15). Note that total annual depreciation is highest in the early years of the cash flow, and thereafter declines until replacement equipment is acquired and the SOYD depreciation schedule started anew.

The projected operating statement for the first 14 years of the cassava processing project are presented in Table 17. The project has no other source of income, thus keeping a constant total annual revenue from sales of cassava pellets at ₱ 4,320,000 excepting for the second year (1984) where there is a positive change in inventory resulting in total

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[34]Moore/Saedicke, Managerial Accounting (Southwestern Publications, 4th Edition, 1976), p. 496.

TABLE 15

A_LISTING_OF_BUILDINGS_AND_EQUIPMENT_OUTLAY_BY_PERIOD

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

PERIOD	LAND-SITE	BLDG-30Y	BLDG-20Y	FACIL-15Y	FACIL-5Y	EQUIP-10Y	EQUIP-20Y	OTHER ASSETS
1	150000.	70000.	40000.	40000.	125000.	5960.	568350.	0.
2	0.	0.	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	125000.	0.	0.	0.
7	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	0.	125000.	5960.	0.	0.
12	0.	0.	0.	0.	0.	0.	0.	0.
13	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	40000.	0.	125000.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.
18	0.	0.	0.	0.	0.	0.	0.	0.
19	0.	0.	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.	0.	0.
ASSET LIFE		30	15	20	5	10	20	
PERCENT SALVAGE		5	5	5	20	2	4	
DEPRECIATION METHOD		2	2	2	2	2	2	
PERIODS DEPR DELAYED		1	1	1	1	1	1	

TABLE 16

DEPRECIATION SCHEDULES FOR BUILDINGS AND EQUIPMENT

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

DEPRECIATION BY PERIOD IN PESOS

FISCAL YEAR	PERIOD	BUILDINGS BY CLASS: 30 YRS 5 % CURRENT	IO_DATE	15 YRS 5 % CURRENT	IO_DATE	20 YRS 5 % CURRENT	IO_DATE	TOTAL CURRENT	EQUIPMENT BY CLASS: 5 YRS 20 % CURRENT	IO_DATE	10 YRS 2 % CURRENT	IO_DATE	20 YRS 4 % CURRENT	IO_DATE	TOTAL CURRENT	COMBINED CURRENT
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1983:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YEARLY TOTAL		0		0		0		0	0		0		0		0	0
1984:	1	4076	4076	4512	4512	3438	3438	12026	26667	26667	1041	1041	49885	49885	77593	89619
YEARLY TOTAL		4076		4512		3438		12026	26667		1041		49885		77593	89619
1985:	1	3940	8016	4212	8724	3266	6704	11418	21333	48000	937	1978	47351	97276	69661	81079
YEARLY TOTAL		3940		4212		3266		11418	21333		937		47351		69661	81079
1986:	1	3804	11820	3911	12635	3054	9798	10809	16000	64000	833	2811	44896	142172	61729	72538
YEARLY TOTAL		3804		3911		3054		10809	16000		833		44896		61729	72538
1987:	1	3668	15488	3610	16245	2922	12720	10200	10667	74667	729	3540	42402	184574	53798	63998
YEARLY TOTAL		3668		3610		2922		10200	10667		729		42402		53798	63998
1988:	1	3532	19020	3309	19554	2750	15470	9591	5333	80000	624	4164	39908	224482	45865	55456
YEARLY TOTAL		3532		3309		2750		9591	5333		624		39908		45865	55456
1989:	1	3397	22417	3008	22562	2579	18049	8984	26667	106667	520	4684	37414	261896	64601	73585
YEARLY TOTAL		3397		3008		2579		8984	26667		520		37414		64601	73585
1990:	1	3261	25678	2707	25269	2407	20456	8375	21333	128000	416	5100	34919	296815	56668	65043
YEARLY TOTAL		3261		2707		2407		8375	21333		416		34919		56668	65043
1991:	1	3125	28803	2407	27676	2235	22691	7767	16000	144000	312	5412	32425	329240	48737	56504
YEARLY TOTAL		3125		2407		2235		7767	16000		312		32425		48737	56504
1992:	1	2989	31792	2106	29782	2063	24754	7158	10667	154667	208	5620	29931	359171	40806	47964
YEARLY TOTAL		2989		2106		2063		7158	10667		208		29931		40806	47964
1993:	1	2853	34645	1805	31587	1891	26645	6549	5333	160000	104	5724	27437	386608	32874	39423
YEARLY TOTAL		2853		1805		1891		6549	5333		104		27437		32874	39423
1994:	1	2717	37362	1504	33091	1719	28364	5940	26667	186667	1041	6765	24942	411550	52650	58590
YEARLY TOTAL		2717		1504		1719		5940	26667		1041		24942		52650	58590
1995:	1	2581	39943	1203	34294	1547	29911	5331	21333	208000	937	7702	22448	433998	44718	50049
YEARLY TOTAL		2581		1203		1547		5331	21333		937		22448		44718	50049
1996:	1	2445	42388	902	35196	1375	31286	4722	16000	224000	833	8535	19954	453952	36787	41509
YEARLY TOTAL		2445		902		1375		4722	16000		833		19954		36787	41509

income being up to ₱ 4,654,611 by the accrual method of income accounting. Total annual operating expenses vary from year to year, as expected, due to variations in depreciation expense (columns 9 and 10), and interest payments (column 11). Declining annual depreciation expense results from the SOYD depreciation schedules as has been indicated. Declining annual interest expense results from the level-payment method chosen for amortizing the loans used to help finance the project. From 1985 forward, annual income tax liabilities for the project (column 14) increase with the decline in depreciation and interest expense. Likewise, the net income after taxes continues to increase (column 15 of Table 17).

Annual pro forma source and application of funds statements for the first 14 years of the cassava processing operation are given in Table 18. Total funds from all sources are listed in column (8) and total funds to all uses in column (15). Net income (column 5) increases everytime paid-in capital (column 1), added notes (column 3) and added loans (column 4) occur. Other sources of funds for the project are from sale of assets (6) according to the salvage values already indicated in the previous discussions and depreciation (7). These funds are applied in buying fixed assets (9), for allocating funds for working capital (11), for the payments due on loans outstanding (12), for dividends distribution to owners (13) and for additional cash needed for the operation.

Loan balance and repayment schedule for the operation is presented in Table 19. Reflected in this table are the 14 years beginning loan balances, current principal payments, and current interest payments. The amount borrowed under intermediate-term loans for equipment (2) is about ₱ 559,448 for the first years and decrease onward; land and buildings (1) for ₱ 210,000 and short-term loans for ₱ 404,398 (4). No loans are made

TABLE 17

PROJECTED OPERATING STATEMENT

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

INCOME AND EXPENSE BY PERIOD IN PESOS

FISCAL YEAR	PERIOD	SALES AND INCOME: PRODUCT SALES (1)	OTHER SALES (2)	CHANGE IN INVENTORY (3)	OTHER INCOME (4)	TOTAL INCOME (5)	OPERATING EXPENSE: DIRECT EXPENSE: PURCH. (6)	VARIABLE (7)	FIXED (8)	DEPRECIATION: BUILD. (9)	EQUIP. (10)	INTEREST PAYMENTS (11)	TOTAL EXPENSE (12)	OPERATING INCOME: NET B/F TAX (13)	INCOME TAX (14)	NET INCOME (15)
1983:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YEARLY TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984:	1	4320000	0	334611	0	4654611	3600000	330563	93474	12026	77593	114712	4228368	426242	139185	287058
YEARLY TOTAL		4320000	0	334611	0	4654611	3600000	330563	93474	12026	77593	114712	4228368	426242	139185	287058
1985:	1	4320000	0	0	0	4320000	3600000	330563	93474	11418	69661	182630	4287746	32254	8064	24190
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	11418	69661	182630	4287746	32254	8064	24190
1986:	1	4320000	0	0	0	4320000	3600000	330563	93474	10809	61729	177003	4273578	46422	11606	34816
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	10809	61729	177003	4273578	46422	11606	34816
1987:	1	4320000	0	0	0	4320000	3600000	330563	93474	10200	53758	170506	4258541	61459	15365	46094
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	10200	53758	170506	4258541	61459	15365	46094
1988:	1	4320000	0	0	0	4320000	3600000	330563	93474	9591	45865	163003	4242496	77504	19376	58128
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	9591	45865	163003	4242496	77504	19376	58128
1989:	1	4320000	0	0	0	4320000	3600000	330563	93474	8984	44601	167138	4264760	55240	13810	41430
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	8984	44601	167138	4264760	55240	13810	41430
1990:	1	4320000	0	0	0	4320000	3600000	330563	93474	8375	56668	156529	4245609	74391	18598	55793
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	8375	56668	156529	4245609	74391	18598	55793
1991:	1	4320000	0	0	0	4320000	3600000	330563	93474	7767	48737	144270	4224811	95189	23797	71392
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	7767	48737	144270	4224811	95189	23797	71392
1992:	1	4320000	0	0	0	4320000	3600000	330563	93474	7158	40806	130103	4202104	117896	31264	86632
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	7158	40806	130103	4202104	117896	31264	86632
1993:	1	4320000	0	0	0	4320000	3600000	330563	93474	6549	32874	113728	4177188	142812	39984	102828
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	6549	32874	113728	4177188	142812	39984	102828
1994:	1	4320000	0	0	0	4320000	3600000	330563	93474	5940	52650	108349	4190976	129024	35158	93866
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	5940	52650	108349	4190976	129024	35158	93866
1995:	1	4320000	0	0	0	4320000	3600000	330563	93474	5331	44718	104353	4178439	141561	39546	102015
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	5331	44718	104353	4178439	141561	39546	102015
1996:	1	4320000	0	0	0	4320000	3600000	330563	93474	4722	38787	99802	4165348	154652	44128	110524
YEARLY TOTAL		4320000	0	0	0	4320000	3600000	330563	93474	4722	38787	99802	4165348	154652	44128	110524

TABLE 18

PROFORMA SOURCE AND APPLICATION OF FUNDS STATEMENT

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

FLOWS BY SOURCE AND USE BY PERIOD IN PESOS

FISCAL YEAR	PERIOD	SOURCES OF FUNDS: PAID-IN CAPITAL (1)	ADDED EQUITY (2)	ADDED NOTES (3)	ADDED LOANS (4)	NET INCOME (5)	SALE OF ASSETS (6)	DEPRECIATION (7)	TOTAL FUNDS (8)	APPLICATIONS OF FUNDS: FIXED ASSETS (9)	WORKING CAPITAL (10)	LOWER EQUITY (11)	REPAYMENTS (12)	DIVIDENDS (13)	ADDED CASH (14)	TOTAL USES (15)
1983:	1	229862	0	0	769448	0	0	0	999310	999310	0	0	0	0	0	999310
YEARLY TOTAL		229862	0	0	769448	0	0	0	999310	999310	0	0	0	0	0	999310
1984:	1	203122	0	404398	0	287058	0	89619	984197	0	808796	0	31872	143529	0	984197
YEARLY TOTAL		203122	0	404398	0	287058	0	89619	984197	0	808796	0	31872	143529	0	984197
1985:	1	0	0	0	0	24190	0	81079	105269	0	0	0	36747	12095	56427	105269
YEARLY TOTAL		0	0	0	0	24190	0	81079	105269	0	0	0	36747	12095	56427	105269
1986:	1	0	0	0	0	34816	0	72538	107354	0	0	0	42373	31334	33647	107354
YEARLY TOTAL		0	0	0	0	34816	0	72538	107354	0	0	0	42373	31334	33647	107354
1987:	1	0	0	0	0	46094	0	63998	110092	0	0	0	48871	41485	19736	110092
YEARLY TOTAL		0	0	0	0	46094	0	63998	110092	0	0	0	48871	41485	19736	110092
1988:	1	0	0	0	80000	58128	25000	55456	218584	125000	0	0	56373	52315	-15104	218584
YEARLY TOTAL		0	0	0	80000	58128	25000	55456	218584	125000	0	0	56373	52315	-15104	218584
1989:	1	0	0	0	0	41430	0	73585	115015	0	0	0	68750	37287	-8938	115015
YEARLY TOTAL		0	0	0	0	41430	0	73585	115015	0	0	0	68750	37287	-8938	115015
1990:	1	0	0	0	0	55793	0	65043	120836	0	0	0	79400	50214	-8778	120836
YEARLY TOTAL		0	0	0	0	55793	0	65043	120836	0	0	0	79400	50214	-8778	120836
1991:	1	0	0	0	0	71352	0	56504	127896	0	0	0	91659	64253	-28016	127896
YEARLY TOTAL		0	0	0	0	71352	0	56504	127896	0	0	0	91659	64253	-28016	127896
1992:	1	0	0	0	0	86632	0	47964	134596	0	0	0	105826	86632	-57862	134596
YEARLY TOTAL		0	0	0	0	86632	0	47964	134596	0	0	0	105826	86632	-57862	134596
1993:	1	94957	0	0	84673	102828	25119	39423	347000	130960	0	0	122200	102828	-8988	347000
YEARLY TOTAL		94957	0	0	84673	102828	25119	39423	347000	130960	0	0	122200	102828	-8988	347000
1994:	1	0	0	0	0	93866	0	58590	152456	0	0	0	29348	93866	29242	152456
YEARLY TOTAL		0	0	0	0	93866	0	58590	152456	0	0	0	29348	93866	29242	152456
1995:	1	0	0	0	0	102015	0	50049	152064	0	0	0	33344	102015	16705	152064
YEARLY TOTAL		0	0	0	0	102015	0	50049	152064	0	0	0	33344	102015	16705	152064
1996:	1	0	0	0	0	110524	0	41509	152033	0	0	0	37855	110524	3614	152033
YEARLY TOTAL		0	0	0	0	110524	0	41509	152033	0	0	0	37855	110524	3614	152033

TABLE 19

LOAN BALANCE AND REPAYMENT SCHEDULE

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

BEGINNING BALANCES, PRINCIPAL PAYMENTS AND INTEREST CHARGES BY PERIOD IN PESOS

FISCAL YEAR PERIOD	BEGINNING LOAN BALANCES					CURRENT PRINCIPAL PAYMENTS					CURRENT INTEREST PAYMENTS				
	MORTGAGE LOANS	EQUIP. LOANS	BONDS & STOCKS	SHORT -TERM	TOTAL LOANS	MORTGAGE LOANS	EQUIP. LOANS	BONDS & STOCKS	SHORT -TERM	TOTAL LOANS	MORTGAGE LOANS	EQUIP. LOANS	BONDS & STOCKS	SHORT -TERM	TOTAL LOANS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1983: 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FOR YEAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984: 1	210000	559448	0	0	769448	-5633	-26239	0	-404398	-372526	-25200	-89512	0	0	-114712
FOR YEAR	210000	559448	0	0	769448	5633	26239	0	-404398	-372526	25200	89512	0	0	114712
1985: 1	204367	533209	0	404398	1141974	-6309	-30437	0	0	-36746	-24524	-85313	0	-72793	-182630
FOR YEAR	204367	533209	0	404398	1141974	6309	30437	0	0	36746	24524	85313	0	72793	182630
1986: 1	198058	502772	0	404398	1105228	-7066	-35307	0	0	-42373	-23767	-80444	0	-72752	-177003
FOR YEAR	198058	502772	0	404398	1105228	7066	35307	0	0	42373	23767	80444	0	72752	177003
1987: 1	190991	467465	0	404398	1062854	-7914	-40956	0	0	-48870	-22919	-74794	0	-72793	-170506
FOR YEAR	190991	467465	0	404398	1062854	7914	40956	0	0	48870	22919	74794	0	72793	170506
1988: 1	183077	426509	0	404398	1013984	-8864	-47509	0	0	-56373	-21965	-68242	0	-72752	-163003
FOR YEAR	183077	426509	0	404398	1013984	8864	47509	0	0	56373	21965	68242	0	72752	163003
1989: 1	174213	459000	0	404398	1037611	-9527	-58862	0	0	-68789	-20906	-73440	0	-72792	-167138
FOR YEAR	174213	459000	0	404398	1037611	9527	58862	0	0	68789	20906	73440	0	72752	167138
1990: 1	164286	400138	0	404398	968822	-11119	-68280	0	0	-79359	-19714	-64022	0	-72793	-156529
FOR YEAR	164286	400138	0	404398	968822	11119	68280	0	0	79359	19714	64022	0	72793	156529
1991: 1	153167	331858	0	404398	889423	-12453	-79205	0	0	-91658	-18380	-53097	0	-72753	-144270
FOR YEAR	153167	331858	0	404398	889423	12453	79205	0	0	91658	18380	53097	0	72753	144270
1992: 1	140714	252652	0	404398	797764	-13947	-91878	0	0	-105825	-16886	-40424	0	-72793	-130103
FOR YEAR	140714	252652	0	404398	797764	13947	91878	0	0	105825	16886	40424	0	72793	130103
1993: 1	126767	160774	0	404398	691939	-15621	-106579	0	0	-122200	-15212	-25724	0	-72752	-113728
FOR YEAR	126767	160774	0	404398	691939	15621	106579	0	0	122200	15212	25724	0	72792	113728
1994: 1	111146	138868	0	404398	654412	-17495	-11852	0	0	-29347	-13338	-22219	0	-72792	-108349
FOR YEAR	111146	138868	0	404398	654412	17495	11852	0	0	29347	13338	22219	0	72792	108349
1995: 1	93650	127016	0	404398	625064	-19595	-13748	0	0	-33343	-11238	-20323	0	-72792	-104353
FOR YEAR	93650	127016	0	404398	625064	19595	13748	0	0	33343	11238	20323	0	72792	104353
1996: 1	74055	113268	0	404398	591721	-21946	-15948	0	0	-37894	-8867	-18123	0	-72752	-99802
FOR YEAR	74055	113268	0	404398	591721	21946	15948	0	0	37894	8867	18123	0	72752	99802

for bonds and stocks. Corresponding total principal payments and total current interest payments are also shown in this table.

Calculated financial ratios (Table 20) show that the ratio of cost of goods sold to sales (1) represents the highest among the cost-structure ratios. Direct expense over sales (2) and ratio of depreciation expense to sales (3) represent insignificant elements of expense involved. Marginal percentages are also reflected for ratios (4) and (5). Debt ratio (also called degree of leverage ratio) (6) obviously indicates that the owners are highly leveraged in the early years but improve relative equity over time. In terms of the project's liquidity ratio which measures its ability to meet maturing obligations, current ratio of 2.00 is obtained (7). This provides for a shrinkage in the value of current assets by 50% before the firm is unable to meet its maturing short-term obligations. Relatively high ratios for current and deferred liabilities over total assets were obtained. Net worth represents only a small portion of the total assets (10) or an average of 16%.

Income to asset relationship ratios are reflected in columns 11 to 15. Total sales over total assets (11) exhibits a high ratio. This is an overall indicator of the efficiency of asset usage. For cash income to assets ratio (12), this measures the percentage of income in cash form over the project's assets. Net income to assets ratio (13) indicates the earning power of the operation. It measures the ability to use assets to generate profits. For columns (14) and (15), these ratios measure the percentage use for total depreciation and income taxes to assets respectively.

By using these ratios singly or in combination, one is able to develop an understanding of the strengths and weaknesses of the project

TABLE 20

FINANCIAL RATIOS

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

RATIOS BY PERIOD AND YEAR IN PROJECTED CASH FLOW

	SALES, INCOME AND EXPENSES					FINANCIAL STRUCTURE AND LEVERAGE					INCOME TO ASSET RELATIONSHIPS				
FISCAL YEAR PERIOD	COST OF GOODS/ SALES	DIRECT EXP./ SALES	DEPR. EXP./ SALES	INTEREST EXP./ SALES	NET PROFIT/ SALES	TOTAL ASSETS/	CURRENT ASSETS/	CURRENT LIAB./	DEFERED LIAB./	NET WORTH/	TOTAL SALES/ ASSETS	CASH INCOME/ ASSETS	NET INCOME/ ASSETS	TOTAL DEPR./ ASSETS	INCOME TAX/ ASSETS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1983: 1	-0.0	-0.0	-0.0	-0.0	-0.0	-1.299	-0.0	-0.000	-0.110	-0.0	-0.000	-0.0	-0.0	-0.0	-0.0
FOR YEAR	0.0	0.0	0.0	0.0	0.0						0.000	0.0	0.0	0.0	0.0
1984: 1	-0.865	-0.091	-0.019	-0.025	-0.062	-1.505	-2.000	-0.235	-0.423	-0.084	-2.705	-0.300	-0.248	-0.106	-0.081
FOR YEAR	0.865	0.091	0.019	0.025	0.062						2.705	0.300	0.248	0.106	0.081
1985: 1	-0.931	-0.098	-0.019	-0.042	-0.006	-1.533	-2.000	-0.239	-0.414	-0.125	-2.550	-0.067	-0.019	-0.201	-0.005
FOR YEAR	0.931	0.098	0.019	0.042	0.006						2.550	0.067	0.019	0.201	0.005
1986: 1	-0.931	-0.098	-0.017	-0.041	-0.008	-1.551	-2.000	-0.244	-0.398	-0.151	-2.610	-0.072	-0.028	-0.286	-0.007
FOR YEAR	0.931	0.098	0.017	0.041	0.008						2.610	0.072	0.028	0.286	0.007
1987: 1	-0.931	-0.098	-0.015	-0.039	-0.011	-1.588	-2.000	-0.251	-0.378	-0.170	-2.682	-0.078	-0.038	-0.362	-0.010
FOR YEAR	0.931	0.098	0.015	0.039	0.011						2.682	0.078	0.038	0.362	0.010
1988: 1	-0.931	-0.098	-0.013	-0.038	-0.013	-1.581	-2.000	-0.247	-0.386	-0.161	-2.634	-0.081	-0.047	-0.382	-0.012
FOR YEAR	0.931	0.098	0.013	0.038	0.013						2.634	0.081	0.047	0.382	0.012
1989: 1	-0.931	-0.098	-0.017	-0.039	-0.010	-1.626	-2.000	-0.257	-0.358	-0.176	-2.742	-0.082	-0.035	-0.460	-0.009
FOR YEAR	0.931	0.098	0.017	0.039	0.010						2.742	0.082	0.035	0.460	0.009
1990: 1	-0.931	-0.098	-0.015	-0.036	-0.013	-1.688	-2.000	-0.269	-0.323	-0.183	-2.877	-0.093	-0.050	-0.528	-0.012
FOR YEAR	0.931	0.098	0.015	0.036	0.013						2.877	0.093	0.050	0.528	0.012
1991: 1	-0.931	-0.098	-0.013	-0.033	-0.017	-1.776	-2.000	-0.285	-0.278	-0.179	-3.048	-0.107	-0.067	-0.588	-0.017
FOR YEAR	0.931	0.098	0.013	0.033	0.017						3.048	0.107	0.067	0.588	0.017
1992: 1	-0.931	-0.098	-0.011	-0.030	-0.020	-1.895	-2.000	-0.308	-0.219	-0.189	-3.254	-0.126	-0.090	-0.638	-0.024
FOR YEAR	0.931	0.098	0.011	0.030	0.020						3.254	0.126	0.090	0.638	0.024
1993: 1	-0.931	-0.098	-0.009	-0.026	-0.024	-2.092	-2.000	-0.295	-0.183	-0.136	-3.156	-0.133	-0.104	-0.611	-0.029
FOR YEAR	0.931	0.098	0.009	0.026	0.024						3.156	0.133	0.104	0.611	0.029
1994: 1	-0.931	-0.098	-0.014	-0.025	-0.022	-2.143	-2.000	-0.302	-0.165	-0.161	-3.225	-0.140	-0.096	-0.667	-0.026
FOR YEAR	0.931	0.098	0.014	0.025	0.022						3.225	0.140	0.096	0.667	0.026
1995: 1	-0.931	-0.098	-0.012	-0.024	-0.024	-2.207	-2.000	-0.310	-0.143	-0.178	-3.308	-0.147	-0.108	-0.714	-0.030
FOR YEAR	0.931	0.098	0.012	0.024	0.024						3.308	0.147	0.108	0.714	0.030
1996: 1	-0.931	-0.098	-0.010	-0.023	-0.026	-2.290	-2.000	-0.319	-0.118	-0.186	-3.401	-0.155	-0.122	-0.754	-0.035
FOR YEAR	0.931	0.098	0.010	0.023	0.026						3.401	0.155	0.122	0.754	0.035

F I N A N C I A L B A I L O S

TABLE 20- CONTINUED

480C MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

RATIOS BY PERIOD AND YEAR IN PROJECTED CASH FLOW

FISCAL YEAR PERIOD	SALES, INCOME AND EXPENSES: COST OF GOODS/ SALES	DIRECT EXP./ SALES	DEPR. EXP./ SALES	INTEREST EXP./ SALES	NET PROFIT/ SALES	FINANCIAL STRUCTURE AND LEVERAGE: TOTAL ASSETS/ NET WORTH	CURRENT ASSETS/ CURRENT LIAB.	CURRENT LIAB./ NET WORTH	DEFERED LIAB./ NET WORTH	NET WORTH/ TOTAL ASSETS	INCOME TO ASSET RELATIONSHIPS: TOTAL SALES/ ASSETS	CASH INCOME/ ASSETS	NET INCOME/ ASSETS	TOTAL DEPR./ ASSETS	INCOME TAX/ ASSETS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1997: 1	1.931	0.098	0.008	0.022	0.028	2.399	2.000	0.330	0.087	0.184	3.526	0.164	0.137	0.785	0.040
FOR YEAR	0.931	0.098	0.008	0.022	0.028						3.526	0.164	0.137	0.785	0.040
1998: 1	1.931	0.098	0.006	0.021	0.030	2.286	2.000	0.311	0.126	0.163	3.325	0.160	0.141	0.715	0.042
FOR YEAR	0.931	0.098	0.006	0.021	0.030						3.325	0.160	0.141	0.715	0.042
1999: 1	1.931	0.098	0.011	0.023	0.025	2.316	2.000	0.314	0.118	0.172	3.358	0.154	0.117	0.754	0.033
FOR YEAR	0.931	0.098	0.011	0.023	0.025						3.358	0.154	0.117	0.754	0.033
2000: 1	1.931	0.098	0.009	0.022	0.027	2.352	2.000	0.318	0.101	0.192	3.397	0.157	0.127	0.786	0.037
FOR YEAR	0.931	0.098	0.009	0.022	0.027						3.397	0.157	0.127	0.786	0.037
2001: 1	0.931	1.098	0.007	0.022	0.028	2.356	2.000	0.322	0.095	0.205	3.444	0.161	0.137	0.812	0.040
FOR YEAR	0.931	0.098	0.007	0.022	0.028						3.444	0.161	0.137	0.812	0.040
2002: 1	0.931	0.098	0.005	0.021	0.030	2.451	2.000	0.328	0.080	0.210	3.459	0.166	0.149	0.830	0.044
FOR YEAR	0.931	0.098	0.005	0.021	0.030						3.459	0.166	0.149	0.830	0.044

that are of particular interest to potential investors and development planners.

Cumulative record of all the anticipated transactions in the proposed processing operation are clearly presented in the pro forma balance sheet (Table 21). In developing pro forma balance sheet, the ratios were employed as standards or guides. Current assets accounts were calculated based on the financial factors given in Table 14 for each of the first nine items. Fixed assets with their corresponding depreciation expenses were obtained from (9) and (7) respectively of pro forma source and application of funds. Short-term loans under current liabilities account were taken from (4) of the loan balance and repayment schedule. The same schedule is the source of the deferred liabilities for intermediate and long-term loans (1) and (2). The statement of net worth for the project are shown as the results from (1) of source of funds reflected in Table 18. Capital reserves and surplus were calculated according to the financial factors allocated as shown in Table 14.

Financial Return on Equity Capital (FRR) Analysis

The financial rate of return is set up for computer in the same manner as in the internal rate of return run. All of the information for preparing input schedules were taken directly from the reconciled and balanced pro forma financial statements. The difference between FRR and IRR lies in the inclusion of new schedules as: paid-in equity, capital reserves and earned surplus in place of the capital investment. Other schedules included are depreciation expense, income tax, and interest expense under operating costs. The schedule of paid-in equity capital to the program by period are taken directly from equity investment. For the first period, paid-in equity capital is shown in the net worth section

TABLE 21

P_R_O_F_O_R_M_A__B_A_L_A_N_C_E__S_H_E_E_T

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

BALANCES BY PERIOD IN PESOS

LAST DAY OF EACH PERIOD FOR THE FOLLOWING YEARS IN THE PLANNING HORIZON:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CURRENT ASSETS:												
0. ACCUMULATED CASH	0	0	56427	90074	109810	94706	103644	94866	66850	8988	0	29242
1. WORKING CASH ACCOUNT	0	100601	100601	100601	100601	100601	100601	100601	100601	100601	100601	100601
2. RAW MATERIAL INVENTORY	0	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000	270000
3. FINISHED PRODUCTS INVENTORY	0	58320	58320	58320	58320	58320	58320	58320	58320	58320	58320	58320
4. BY-PRODUCTS INVENTORY	0	0	0	0	0	0	0	0	0	0	0	0
5. SUPPLIES INVENTORY	0	6291	6291	6291	6291	6291	6291	6291	6291	6291	6291	6291
6. ACCOUNTS RECEIVABLE, PRODUCTS	0	324000	324000	324000	324000	324000	324000	324000	324000	324000	324000	324000
7. ACCTS. RECEIVABLE, BY-PRODUCTS	0	0	0	0	0	0	0	0	0	0	0	0
8. ACCOUNTS RECEIVABLE, OTHER	0	0	0	0	0	0	0	0	0	0	0	0
9. PREPAID ACCOUNTS	0	49584	49584	49584	49584	49584	49584	49584	49584	49584	49584	49584
10. TOTAL CURRENT ASSETS	0	808796	865223	898870	918606	903502	912440	903662	875646	817784	808796	838038
FIXED ASSETS:												
11. LAND AND SITE	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000
12. BUILDINGS	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000
13. LESS DEPRECIATION	0	12226	23444	34253	44453	54044	63028	71403	79170	86328	92877	98817
14. NET BUILDINGS	150000	137974	126556	115747	105547	95956	86972	78597	70830	63672	57123	51183
15. EQUIPMENT	699310	699310	699310	699310	699310	799310	799310	799310	799310	799310	905151	905151
16. LESS DEPRECIATION	0	77593	147254	208983	262781	308646	373297	429915	478652	519458	552332	604582
17. NET EQUIPMENT	699310	621717	552056	490327	436529	490664	426062	369395	320658	279852	352819	300569
18. OTHER INVESTMENTS	0	0	0	0	0	0	0	0	0	0	0	0
19. TOTAL FIXED ASSETS	999310	909691	828612	756074	692076	736620	663035	597992	541488	493524	559942	501352
20. TOTAL ASSETS	999310	1718487	1693835	1654944	1610682	1640122	1575475	1501654	1417134	1311308	1368738	1339390
-0- -0- -0- -0- -0- -0- -0- -0- -0- -0-												
CURRENT LIABILITIES:												
21. ACCOUNTS PAYABLE,RAW MATERIAL	0	0	0	0	0	0	0	0	0	0	0	0
22. ACCOUNTS PAYABLE, SUPPLIES	0	0	0	0	0	0	0	0	0	0	0	0
23. NOTES PAYABLE, SHORT TERM	0	404398	404398	404398	404398	404398	404398	404398	404398	404398	404398	404398
24. TOTAL CURRENT LIABILITIES	0	404398	404398	404398	404398	404398	404398	404398	404398	404398	404398	404398
DEFERRED LIABILITIES:												
25. INTERMEDIATE TERM LOANS	559448	533209	502772	467465	426509	459000	400138	331858	252652	160774	138866	127016
26. LONG TERM LOANS	210000	204367	198058	190991	183077	174213	164286	153167	140714	126767	111146	93650
27. BONDS AND SECURITIES	0	0	0	0	0	0	0	0	0	0	0	0
28. TOTAL DEFERRED LIABILITIES	769448	737576	700830	658456	609586	633213	564424	485025	393366	287541	250014	220666
29. TOTAL LIABILITIES	769448	1141974	1105228	1062854	1013984	1037611	968822	889423	797764	691939	654412	625064
NET WORTH:												
30. PAID-IN CAPITAL	229862	432984	432984	432984	432984	432984	432984	432984	432984	432984	527941	527941
31. CAPITAL RESERVE	0	28706	31125	34606	39216	45029	49172	54751	61890	61890	61890	61890
32. EARNED SURPLUS	0	114823	124458	124503	124498	124498	124497	124456	124496	124495	124495	124495
33. TOTAL NET WORTH	229862	576513	588567	592090	596698	602511	606653	612231	619370	619369	714326	714326
34. TOTAL LIAB. AND NET WORTH	999310	1718487	1693835	1654944	1610682	1640122	1575475	1501654	1417134	1311308	1368738	1339390

P_R_O_J_E_C_T_E_D__B_A_L_A_N_C_E__S_H_E_E_T

TABLE 21 -- CONTINUED

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN REAL TERMS)

BALANCES BY PERIOD IN PESOS

LAST DAY OF EACH PERIOD FOR THE FOLLOWING YEARS IN THE PLANNING HORIZON:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CURRENT ASSETS:												
0. ACCUMULATED CASH	45947	49561	39452	0	34261	57961	70781	72345	0	0	0	0
1. WORKING CASH ACCOUNT	100601	100601	100601	100601	100601	100601	100601	100601	0	0	0	0
2. RAW MATERIAL INVENTORY	270000	270000	270000	270000	270000	270000	270000	270000	0	0	0	0
3. FINISHED PRODUCTS INVENTORY	58320	58320	58320	58320	58320	58320	58320	58320	0	0	0	0
4. BY-PRODUCTS INVENTORY	0	0	0	0	0	0	0	0	0	0	0	0
5. SUPPLIES INVENTORY	6291	6291	6291	6291	6291	6291	6291	6291	0	0	0	0
6. ACCOUNTS RECEIVABLE, PRODUCTS	324000	324000	324000	324000	324000	324000	324000	324000	0	0	0	0
7. ACCTS. RECEIVABLE, BY-PRODUCTS	0	0	0	0	0	0	0	0	0	0	0	0
8. ACCOUNTS RECEIVABLE, OTHER	0	0	0	0	0	0	0	0	0	0	0	0
9. PREPAID ACCOUNTS	49584	49584	49584	49584	49584	49584	49584	49584	0	0	0	0
10. TOTAL CURRENT ASSETS	854743	858357	848248	808796	843057	866757	879577	881145	0	0	0	0
FIXED ASSETS:												
11. LAND AND SITE	150000	150000	150000	150000	150000	150000	150000	150000	0	0	0	0
12. BUILDINGS	150000	150000	150000	188000	188000	188000	188000	188000	0	0	0	0
13. LESS DEPRECIATION	104148	108878	112985	116491	123921	130703	136896	142480	0	0	0	0
14. NET BUILDINGS	45852	41130	37015	71509	64079	57297	51104	45520	0	0	0	0
15. EQUIPMENT	905151	905151	905151	1005151	1005151	1005151	1005151	1005151	0	0	0	0
16. LESS DEPRECIATION	649700	686581	715343	736265	775923	807649	831444	847307	0	0	0	0
17. NET EQUIPMENT	255451	218664	189808	268886	229228	197502	173707	157844	0	0	0	0
18. OTHER INVESTMENTS	0	0	0	0	0	0	0	0	0	0	0	0
19. TOTAL FIXED ASSETS	451303	409794	376823	450395	443327	404799	374811	353364	0	0	0	0
20. TOTAL ASSETS	1306046	1268151	1225071	1299191	1286384	1271556	1254388	1234509	0	0	0	0
CURRENT LIABILITIES:												
21. ACCOUNTS PAYABLE,RAW MATERIAL	0	0	0	0	0	0	0	0	0	0	0	0
22. ACCOUNTS PAYABLE, SUPPLIES	0	0	0	0	0	0	0	0	0	0	0	0
23. NOTES PAYABLE, SHORT TERM	404398	404398	404398	404398	404398	404398	404398	404398	0	0	0	0
24. TOTAL CURRENT LIABILITIES	404398	404398	404398	404398	404398	404398	404398	404398	0	0	0	0
DEFERRED LIABILITIES:												
25. INTERMEDIATE TERM LOANS	113268	97320	78820	137361	125268	111240	94967	76091	0	0	0	0
26. LONG TERM LOANS	74055	52109	27529	26609	25886	25087	24192	23190	0	0	0	0
27. BONDS AND SECURITIES	0	0	0	0	0	0	0	0	0	0	0	0
28. TOTAL DEFERRED LIABILITIES	187323	149429	106349	163961	151154	136327	119159	99281	0	0	0	0
29. TOTAL LIABILITIES	591721	553827	510747	568359	555552	540725	523557	503679	0	0	0	0
NET WORTH:												
30. PAID-IN CAPITAL	527941	527941	527941	544451	544451	544451	544451	544451	0	0	0	0
31. CAPITAL RESERVE	61890	61890	61890	61890	61890	61890	61890	61890	0	0	0	0
32. EARNED SURPLUS	124494	124492	124493	124491	124491	124490	124490	124489	0	0	0	0
33. TOTAL NET WORTH	714325	714324	714324	730832	730832	730831	730831	730830	0	0	0	0
34. TOTAL LIAB. AND NET WORTH	1306046	1268151	1225071	1299191	1286384	1271556	1254388	1234509	0	0	0	0

of the balance sheet. Additional amounts of paid-in capital on other periods are taken from column 1 of the source and application of funds statement. In the schedule of retained earnings (capital reserves + earned surplus), are shown in the net worth section of the balance sheet. Figures are entered in the retained earnings schedule for a given period as defined by the amount shown in the balance sheet for the end of the previous period. The schedule of revenue by period is identical to that used in the determination of the internal rate of return for the project. Some adjustments may have occurred but accurate figures for this are taken from pro forma operating statement. The same holds true for the schedule of operating cost where income tax payments, interest payments and depreciation are also obtained from the pro forma operating statement.

These schedules used in the financial rate of return analysis provide an FRR of 16.939 percent. The effect that financial leverage has on the return to equity is shown by this result. From the chosen financial structure of the project, such result is attributable to the high interest rate on short-term loans. Note that the solution FRR is lower than the corresponding IRR for the operation (17.392%). Considering the assumed opportunity cost of capital at 15%, the operation is still feasible (Table 22).

Pro forma and FRR Results in Money Terms (Appendix B)

The earlier analysis of pro forma financial statements assumed a rate of inflation at zero percent. In order to test the soundness of the financial statements and FRR when inflation is taken into consideration, a projected annual rate of inflation at 12% was incorporated in the analysis. Results show a relatively higher FRR at 38.137 percent (Table 23). A new set of pro forma financial statements reflecting 12% inflation rate is exhibited in Appendix B.

TABLE 22

INVESTMENT FEASIBILITY ANALYSIS

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION (IN REAL TERMS)

FINANCIAL RETURN ON EQUITY CAPITAL 16.939 PERCENT

PERIOD NO.	IDENT.	EQUITY CAPITAL (PESOS) PAID IN	FROM EARNINGS	TOTAL	PROFIT AND LOSS (PESOS) TOTAL INCOME	OPERATING COST	NET PROFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL EQUITY	NET PROFIT
1		229862.	0.	229862.	0.	0.	0.	1.0000	229862.	0.
2		203122.	143529.	346651.	4654611.	4367553.	287058.	0.8551	296437.	245476.
3		0.	12094.	12094.	4320000.	4295810.	24190.	0.7313	8844.	17689.
4		0.	3483.	3483.	4320000.	4285184.	34816.	0.6253	2178.	21772.
5		0.	4608.	4608.	4320000.	4273906.	46094.	0.5348	2464.	24649.
6		0.	5813.	5813.	4320000.	4261872.	58128.	0.4573	2658.	26582.
7		0.	4142.	4142.	4320000.	4278570.	41430.	0.3911	1620.	16201.
8		0.	5578.	5578.	4320000.	4264207.	55793.	0.3344	1865.	18658.
9		0.	7139.	7139.	4320000.	4248608.	71392.	0.2860	2042.	20416.
10		0.	-1.	-1.	4320000.	4233368.	86632.	0.2445	-0.	21185.
11		94957.	0.	94957.	4320000.	4217172.	102828.	0.2051	19857.	21503.
12		0.	0.	0.	4320000.	4226134.	93866.	0.1768	0.	16786.
13		0.	-1.	-1.	4320000.	4217985.	102015.	0.1529	-0.	15601.
14		0.	-1.	-1.	4320000.	4209476.	110524.	0.1308	-0.	14454.
15		0.	0.	0.	4320000.	4200556.	119444.	0.1118	0.	13357.
16		16510.	-2.	16508.	4320000.	4191162.	128838.	0.0956	1579.	12321.
17		0.	0.	0.	4320000.	4211894.	108106.	0.0818	0.	8841.
18		0.	-1.	-1.	4320000.	4205030.	114970.	0.0659	-0.	8040.
19		0.	0.	0.	4320000.	4197957.	122043.	0.0598	0.	7298.
20		0.	-1.	-1.	4320000.	4190643.	129357.	0.0511	-0.	6615.
21		0.	0.	0.	0.	0.	0.	0.0437	0.	0.
	TOTAL	0.	0.	0.	82414611.	80577087.	1837524.		537445.	537445.

INTEREST PER CENT	PROFITABILITY RATIO	PRESENT VALUE IN PESOS NET PROFIT	EQUITY	BALANCE
10.000	1.556	785484.	504826.	280658.
15.000	1.101	589429.	535325.	54105.
20.000	0.883	472930.	535659.	-62729.
25.000	0.758	398719.	526302.	-127583.
30.000	0.677	348364.	514424.	-166060.
40.000	0.580	285047.	491268.	-206221.

ALTERNATIVE:
BASE CASE: 4800 MT CASSAVA PROCESSING OPERATION IN CENTRAL VISAYAS,PHILIPPINES
NO INFLATION

TABLE 23

INVESTMENT FEASIBILITY ANALYSIS

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION (IN MONEY TERMS)

FINANCIAL RETURN ON EQUITY CAPITAL 38.13% PERCENT

PERIOD NO.	IDENT.	EQUITY CAPITAL (PESOS) PAID IN	FROM EARNINGS	TOTAL	PROFIT AND LOSS (PESOS) TOTAL INCOME	OPERATING COST	NET PROFIT	PRESENT VALUE FACTOR	PRESENT VALUES TOTAL EQUITY	NET PROFIT
1		229862.	0.	229862.	0.	0.	0.	1.0000	229862.	0.
2		227057.	168121.	395178.	5213163.	4876921.	336242.	0.7229	286077.	243412.
3		0.	51728.	51728.	5463976.	5360517.	103459.	0.5241	27108.	54219.
4		0.	13879.	13879.	6119653.	5980878.	138775.	0.3794	5265.	52648.
5		10393.	17778.	28171.	6854014.	6676224.	177790.	0.2746	7737.	48828.
6		90426.	22096.	112522.	7676493.	7455527.	220966.	0.1988	22371.	43931.
7		63258.	-1.	63258.	8597673.	8374056.	223617.	0.1439	9104.	32184.
8		97196.	0.	97196.	9629392.	9349309.	280083.	0.1042	10127.	29182.
9		134086.	-1.	134085.	10784916.	10442317.	342599.	0.0754	10113.	25841.
10		174349.	-1.	174348.	12079097.	11667166.	411931.	0.0546	9520.	22492.
11		235312.	48893.	284205.	13528597.	13039650.	488947.	0.0395	11234.	19327.
12		77501.	1.	77502.	15152015.	14660680.	491335.	0.0286	2218.	14059.
13		121873.	-1.	121872.	16970251.	16389441.	580810.	0.0207	2525.	12031.
14		169340.	-1.	169339.	19006692.	18327109.	679583.	0.0150	2539.	10191.
15		220293.	0.	220293.	21287478.	20498702.	788776.	0.0109	2391.	8563.
16		356098.	90966.	447064.	23841978.	22932323.	909655.	0.0079	3513.	7149.
17		128324.	-1.	128323.	26703031.	25827209.	875822.	0.0057	730.	4983.
18		202059.	0.	202059.	29907369.	28876753.	1030616.	0.0041	832.	4244.
19		280869.	0.	280869.	33496270.	32254730.	1201540.	0.0030	837.	3582.
20		226346.	139053.	365399.	37515782.	36125247.	1390535.	0.0022	789.	3001.
21		-2664852.	-552510.	-3217362.	0.	0.	0.	0.0016	-5027.	0.
	TOTAL	379791.	-1.	379790.	*********	*********	10673081.		629866.	639866.

INTEREST PER CENT	PROFITABILITY RATIO	PRESENT VALUE IN PESOS NET PROFIT	EQUITY	BALANCE
10.000	3.226	3364640.	1043057.	2321582.
15.000	2.250	2157343.	958630.	1198713.
20.000	1.737	1496177.	861336.	634841.
25.000	1.424	1109833.	775159.	334674.
30.000	1.217	869929.	714837.	155092.
40.000	0.963	603650.	626537.	-22887.

ALTERNATIVE:
BASE CASE: 4800 MT CASSAVA PROCESSING OPERATION IN CENTRAL VISAYAS,PHILIPPINES
WITH 12% PROJECTED INFLATION RATE

Assuming that the adjusted market rate of interest is 15%, it is clear that the whole project is financially feasible. Even at a high interest rate of 30%, the profitability ratio is still more than one (1.217) and present values are positive.

SUMMARY AND CONCLUSIONS

This report appraises a project for processing cassava into pellets in Bohol, Central Visayas, Philippines. The processed cassava would be used as a carbohydrate ingredient in place of yellow corn in animal-feed rations. Appropriate technology and other requirements for the operation are closely patterned after a similar operation in Thailand.

This project would comprise processing 4,800 metric tons of cassava pellets annually in 200-day operation, eight hours per day. Cassava pellets would be sold to feed manufacturers at a price of ₱ 0.90 per kilo. Contract growing agreements with cassava growers in the area would be arranged to assure the continuous supply of raw materials and to permit undisrupted operation. A buying price of ₱ 0.30 per kilo for fresh cassava tubers is assumed for the project.

The project would involve an estimated cost of ₱ 5,024,337. It would be financed in proportion of 80% from intermediate-term loans, 70% from long-term borrowings and 50% from short-term loans for current assets. The prospective proceeds would be used for the procurement of raw materials, acquisition and installation of machinery and equipment, buying of land and for land improvements, construction of buildings and for storage facilities.

The study utilized the available program, Computerized Program for Feasible Agribusiness Development, in the analysis. The basic cash flow data was developed for computer input, and an annual Internal Rate of Return on Total Capital of 17.392 percent was obtained.

In order to test the sensitivity of economic feasibility of the project to certain key factors, 25 alternative cases were formulated and

tested. On basis of a series of tests through the use of different scalers for each alternative, the project was found to be sensitive to changes in the price of pellets, changes in working capital, and increases in raw material prices. The project was found to be insensitive to changes in variable and fixed operating expenses.

The base case with an IRR of 17.392 percent was considered to be the most realistic, and is the basis for financial analysis. Schedules of pro forma financial statements were developed through a financial structure set up for the project, as reflected in Table 14. The project was found to be financially able to meet all obligations. An FRR (Financial Return on Equity Capital) of 16.939 percent was obtained. With the assumed opportunity cost of capital at 15%, the project is considered profitable. Similar analysis was made with the incorporation of projected inflation with all prices affected equally, the financial rate of return to net worth capital was calculated from the inflated cash flow.

Certain management factors seem critical for the operation. They include (1) need for competent management in the procurement of raw materials, (2) careful pricing of cassava pellets, and (3) good credit management.

The feasibility analysis used in testing the economic viability of this project indicates that the project is feasible. However, before the findings can be applied for Bohol, Central Visayas, some essential adjustments are necessary in order to reflect the Bohol situation. Production targets for cassava pellets have to be adjusted to meet the needs of the region and other potential users. Market studies are needed to determine the accurate pricing of pellets and the demand estimates, taking into account the expected success of government policy encouraging feed

millers to use cassava. These factors are likely to affect the final IRR and FRR for the project.

The analysis has shown that when factors crucial to the feasibility of the project are varied, the project remains viable. The proposed project can be modified to suit a variety of situations without becoming infeasible. The analysis should serve as a useful guide for similar operations in the Philippines.

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APPENDICES

APPENDIX A

REGISTERED COMMERCIAL FEED MILLERS, GEOGRAPHIC LOCATIONS, AND RATED CAPACITIES, DEC. (1977)

		LOCATION	RATED CAPACITY* DAILY (50 KG. BAG)	RATED CAPACITY* YEARLY (50 KG. BAG)
I.	Phil. Association of Feedmillers (FAFMI)			
1.	Far East Agricultural Supply	Bulacan	1,000	312,000
2.	General Milling Corporation	Cebu	1,600	499,200
	General Milling Corporation	Metro Manila	3,200	998,400
3.	Liberty Flour Mill	Metro Manila	2,600	811,200
4.	Philippine Feed Milling	Metro Manila	800	249,600
5.	Republic Flour Mills	Metro Manila	3,000	936,000
6.	San Miguel Corporation	Metro Manila	15,000	4,680,000
7.	Virginia Inc.	Bulacan	1,780	555,360
8.	Vitarich Corporation	Bulacan	10,000	3,120,000
9.	Universal Robina Corporation	Metra Manila	4,000	1,248,000
	Robina Farms Cebu	Cebu	100	31,260
	TOTAL		43,080	13,440,960
II.	Central Luzon Feed Millers Ass'n Inc.			
1.	Batangas Feed Mills	Batangas	360	112,320
2.	Central Calumpit Feed Mill	Bulacan	300	93,600
3.	Grace Park Poultry Supply	Metro Manila	240	74,880
4.	Isma Agricultural Enterprise Inc.	Bulacan	160	49,920
5.	P. T. Leelin Enterprises	Camarines Sur	20	6,240
6.	Manlo Feeds Inc.	Metro Manila	360	112,320
7.	Naga Feed Mill	Camarines Sur	80	24,960
8.	N. Carlos Enterprises Inc.	Metro Manila	160	49,920
9.	Northern Animal Raisers Corp.	La Union	400	124,800
10.	Sta. Maria Feed Mill	Bulacan	1,280	399,360

APPENDIX A (continued)

		LOCATION	RATED CAPACITY DAILY (50 KG. BAG)	RATED CAPACITY YEARLY (50 KG. BAG)
11.	Sta. Maria Yellow Corn Center	Bulacan	1,200	374,400
12.	Tri-Sol Feeds	Bulacan	160	49,920
	TOTAL		4,720	1,472,640
III.	Metro Manila Feed Millers Ass'n Inc.			
1.	Anihan Enterprises Inc.	Metro Manila	1,400	436,800
2.	Feedrite Products Inc.	Metro Manila	400	124,800
3.	Hi-Level Feeds Company	Metro Manila	840	262,080
4.	La Fuerza Industry and Gen. Merchant	Metro Manila	1,200	374,400
5.	Masagana Meal Supply	Metro Manila	160	49,920
6.	Pacific Poultry Supply	Metro Manila	160	49,920
7.	Phil Superfeed Corporation	Metro Manila	200	62,400
8.	Reliance Feed Milling Co.	Metro Manila	768	239,616
9.	Royal Poultry Supply	Metro Manila	100	31,200
10.	United Poultry Supply	Metro Manila	640	199,680
11.	Vigo Feed Mill	Metro Manila	20	6,240
	TOTAL		5,888	1,837,056
IV.	Independent Feed Millers			
1.	Alco Feeds Manufacturer	Pampanga	400	124,800
2.	Alpha Feed Mill	Cebu	200	62,400
3.	Amis Enterprises	Bulacan	50	15,600
4.	Anbaco Enterprises	South Cotabato	80	24,960
5.	Bantan Trading	Metro Manila	100	31,200
6.	BRACOMA	Bulacan	240	74,880
7.	BULPRA	Bulacan	100	31,200
8.	Cagayan de Oro Consumers Coop. Society	Cagayan de Oro	20	6,240
9.	Cebu Agribusiness	Cebu	500	156,000
10.	Delta Feeds	Cebu	200	62,400
11.	Diamond Feeds	Nueva Ecija	600	187,200

APPENDIX A (continued)

		LOCATION	RATED CAPACITY DAILY (50 KG. BAG)	RATED CAPACITY YEARLY (50 KG. BAG)
12.	D'Pure Feeds	Bulacan	200	62,400
13.	Franz Feeds & Feeding Inc.	Bulacan	160	49,920
14.	Hi-Gro Feed Mill	Bulacan	200	62,400
15.	Island Feed Mill	Cebu	160	49,920
16.	Kwik Gro-Feeds	Metro Manila	200	62,400
17.	La Suerte Agro-Industrial Corp.	Metro Manila	40	12,480
18.	LIMCOMA	Batangas	600	187,200
19.	Marcin's Agro-Development Corp.	Cavite	800	249,600
20.	Massive Feed Mill	Bulacan	50	15,600
21.	Integrated Feed Mill	Metro Manila	96	29,952
22.	Monterey Farms Corporation	Batangas	600	187,200
23.	MECOM	Negros Occidental	500	156,000
24.	Pariñas Feed Mill	Albay	40	12,480
25.	People's Feed Mill	South Cotabato	160	49,920
26.	Pillsbury Mindanao Flour Milling Inc.	South Cotabato	2,400	748,800
27.	Raisers Products Inc.	Zambales	200	62,400
28.	Rapid Growth Feeds Inc.	Cebu	160	49,920
29.	Rose Industries, Inc.	Quezon	70	21,840
30.	Selecta Feeds	Metro Manila	320	99,840
31.	Sierra Madre Enterprises	Nueva Ecija	400	124,800
32.	Standard Feed Co.	Ilocos Norte	240	74,880
33.	Sta. Rita Poultry & Livestock Feeds	Pampanga	60	18,720
34.	Sulbad Agricultural Products, Inc.	North Cotabato	20	6,240
35.	Tarlac Agro-Industrial Corp.	Tarlac	200	62,400
36.	Ultra Agro-Industrial Corp.	Bulacan	400	124,800
37.	Unifeed Milling	Metro Manila	200	62,400
38.	Xavier University Agriculture Feed Mill	Cagayan de Oro	32	9,984
39.	Yangtze Trading	Bulacan	800	249,600
	TOTAL		11,798	3,680,976
	TOTAL RATED CAPACITY			20,431,632

*Capacity calculation based on 8 hour per 26 day month labor year.

APPENDIX B

PROJECTED OPERATING STATEMENT

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION (IN PESO TERMS)

INCOME AND EXPENSE BY PERIOD IN PESOS

FISCAL YEAR	PERIOD	SALES AND INCOME: PRODUCT SALES (1)	OTHER SALES (2)	CHANGE IN INVENTORY (3)	OTHER INCOME (4)	TOTAL INCOME (5)	OPERATING EXPENSE: DIRECT EXPENSE: PURCHA (6)	VARIABLE (7)	FIXED (8)	DEPRECIATION: BUILDI (9)	EQUIP (10)	INTEREST PAYMENTS (11)	TOTAL EXPENSE (12)	NET B/F TAX (13)	INCOME TAX (14)	NET INCOME (15)
1983:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YEARLY TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984:	1	4838399	0	374764	0	5213163	4031999	370230	104691	12026	77593	114712	4711251	501912	165669	336243
YEARLY TOTAL		4838399	0	374764	0	5213163	4031999	370230	104691	12026	77593	114712	4711251	501912	165669	336243
1985:	1	5419004	0	44972	0	5463976	4515837	414658	117254	11418	65661	191365	5320193	143783	40324	103459
YEARLY TOTAL		5419004	0	44972	0	5463976	4515837	414658	117254	11418	65661	191365	5320193	143783	40324	103459
1986:	1	6069285	0	50368	0	6119653	5057738	464417	131324	10809	61729	195521	5921538	198115	59340	138775
YEARLY TOTAL		6069285	0	50368	0	6119653	5057738	464417	131324	10809	61729	195521	5921538	198115	59340	138775
1987:	1	6797601	0	56413	0	6854014	5666667	520147	147083	10200	53758	199561	6595876	258138	80348	177790
YEARLY TOTAL		6797601	0	56413	0	6854014	5666667	520147	147083	10200	53758	199561	6595876	258138	80348	177790
1988:	1	7613311	0	63182	0	7676493	6344425	582564	164733	9591	45865	204751	7351929	324564	103597	220967
YEARLY TOTAL		7613311	0	63182	0	7676493	6344425	582564	164733	9591	45865	204751	7351929	324564	103597	220967
1989:	1	8526909	0	70764	0	8597673	7105757	652472	184501	8984	84930	232388	8269032	328641	105024	223617
YEARLY TOTAL		8526909	0	70764	0	8597673	7105757	652472	184501	8984	84930	232388	8269032	328641	105024	223617
1990:	1	9550137	0	79255	0	9629392	7958448	730769	206641	8375	72932	236715	9213880	415512	135429	280083
YEARLY TOTAL		9550137	0	79255	0	9629392	7958448	730769	206641	8375	72932	236715	9213880	415512	135429	280083
1991:	1	10696150	0	88766	0	10784916	8913458	818461	231438	7767	60934	241167	10273225	511691	169092	342599
YEARLY TOTAL		10696150	0	88766	0	10784916	8913458	818461	231438	7767	60934	241167	10273225	511691	169092	342599
1992:	1	11979680	0	99417	0	12079097	9983066	916676	259210	7158	48937	245654	11460741	618356	206425	411931
YEARLY TOTAL		11979680	0	99417	0	12079097	9983066	916676	259210	7158	48937	245654	11460741	618356	206425	411931
1993:	1	13417248	0	111349	0	13528597	11181040	1026677	290316	6549	36940	250223	12791755	736842	247895	488947
YEARLY TOTAL		13417248	0	111349	0	13528597	11181040	1026677	290316	6549	36940	250223	12791755	736842	247895	488947
1994:	1	15027306	0	124709	0	15152015	12522755	1149877	325153	5940	110996	296777	14411458	740517	249181	491336
YEARLY TOTAL		15027306	0	124709	0	15152015	12522755	1149877	325153	5940	110996	296777	14411458	740517	249181	491336
1995:	1	16830576	0	139675	0	16970251	14025489	1287862	364172	5331	51615	317611	16092060	878171	297360	580811
YEARLY TOTAL		16830576	0	139675	0	16970251	14025489	1287862	364172	5331	51615	317611	16092060	878171	297360	580811
1996:	1	18850256	0	156436	0	19006692	15708550	1442406	407873	4722	72233	340778	17576562	1030130	350546	679584
YEARLY TOTAL		18850256	0	156436	0	19006692	15708550	1442406	407873	4722	72233	340778	17576562	1030130	350546	679584

APPENDIX B1

PROBOBABILITY AND APPLICATION OF FUNDS STATEMENT

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN PESO TERMS)

FLOWS BY SOURCE AND USE BY PERIOD IN PESOS

FISCAL YEAR	PERIOD	SOURCES OF FUNDS: PAID-IN CAPITAL	ADDED -A/P-	ADDED -NOTES	ADDED -LOANS	NET INCOME	SALE OF ASSETS	DEPRECIATION	TOTAL FUNDS	APPLICATIONS OF FUNDS: FIXED ASSETS	WORKING CAPITAL	LESS -A/P-	REPAY-MENTS	DIVI-DENDS	ADDED -CASH	TOTAL USES
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1983:	1	229862	0	0	769448	0	0	0	999310	999310	0	0	0	0	0	999310
YEARLY TOTAL		229862	0	0	769448	0	0	0	999310	999310	0	0	0	0	0	999310
1984:	1	227057	0	452926	0	336243	0	-89619	1105845	0	905851	0	-31872	168122	0	1105845
YEARLY TOTAL		227057	0	452926	0	336243	0	89619	1105845	0	905851	0	31872	168122	0	1105845
1985:	1	0	0	-54351	0	103459	0	-81079	238889	0	106703	0	-36747	-51730	-41709	238889
YEARLY TOTAL		0	0	54351	0	103459	0	81079	238889	0	106703	0	36747	51730	41709	238889
1986:	1	0	0	-60813	0	138775	0	-72538	272186	0	121745	0	-42373	124897	-16829	272186
YEARLY TOTAL		0	0	60813	0	138775	0	72538	272186	0	121745	0	42373	124897	-16829	272186
1987:	1	-10353	0	-68178	0	177790	0	-63958	320359	0	136357	0	-48871	160011	-24880	320359
YEARLY TOTAL		10393	0	68178	0	177790	0	63958	320359	0	136357	0	48871	160011	-24880	320359
1988:	1	-90426	0	-76360	140987	220567	-44059	-55456	628255	220293	152719	0	-56373	198870	0	628255
YEARLY TOTAL		90426	0	76360	140987	220567	44059	55456	628255	220293	152719	0	56373	198870	0	628255
1989:	1	-63259	0	-85522	0	223617	0	-93914	466312	0	171044	0	-71651	223617	0	466312
YEARLY TOTAL		63259	0	85522	0	223617	0	93914	466312	0	171044	0	71651	223617	0	466312
1990:	1	-97196	0	-95785	0	280083	0	-81307	554371	0	191570	0	-82718	280083	0	554371
YEARLY TOTAL		97196	0	95785	0	280083	0	81307	554371	0	191570	0	82718	280083	0	554371
1991:	1	-134086	0	-107279	0	342595	0	-68701	652665	0	214558	0	-95508	342595	0	652665
YEARLY TOTAL		134086	0	107279	0	342595	0	68701	652665	0	214558	0	95508	342595	0	652665
1992:	1	-174349	0	-120152	0	411931	0	-56095	-762527	0	240305	0	-110251	411931	0	762527
YEARLY TOTAL		174349	0	120152	0	411931	0	56095	762527	0	240305	0	110251	411931	0	762527
1993:	1	-235312	0	-134572	-262980	-488547	-78016	-43489	-1243316	-406741	-269144	0	-127379	-440052	0	-1243316
YEARLY TOTAL		235312	0	134572	262980	488547	78016	43489	1243316	406741	269144	0	127379	440052	0	1243316
1994:	1	-77501	0	-150718	0	-491336	0	-116936	-836491	0	-301437	0	-43718	-491336	0	-836491
YEARLY TOTAL		77501	0	150718	0	491336	0	116936	836491	0	301437	0	43718	491336	0	836491
1995:	1	-121873	0	-168935	0	-580811	0	-96946	-968435	0	-337610	0	-50014	-580811	0	-968435
YEARLY TOTAL		121873	0	168935	0	580811	0	96946	968435	0	337610	0	50014	580811	0	968435
1996:	1	-169340	0	-189063	0	-679584	0	-76955	-1114942	0	-376126	0	-57232	-679584	0	-1114942
YEARLY TOTAL		169340	0	189063	0	679584	0	76955	1114942	0	376126	0	57232	679584	0	1114942

APPENDIX B2

L U A N B A L A N C E A N D R E P A Y M E N T S C H E D U L E

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN PESO TERMS)

BEGINNING BALANCES, PRINCIPAL PAYMENTS AND INTEREST CHARGES BY PERIOD IN PESOS

FISCAL YEAR PERIOD	BEGINNING LOAN BALANCES					CURRENT PRINCIPAL PAYMENTS					CURRENT INTEREST PAYMENTS				
	MORTGAGE LOANS	EQUIP. LOANS	BONDS & STOCKS	SHORT TERM	TOTAL LOANS	MORTGAGE LOANS	EQUIP. LOANS	BONDS & STOCKS	SHORT TERM	TOTAL LOANS	MORTGAGE LOANS	EQUIP. LOANS	BONDS & STOCKS	SHORT TERM	TOTAL LOANS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1983: 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FOR YEAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984: 1	210000	559448	0	0	769448	5633	26239	0	-452926	-421054	25200	89512	0	0	114712
FOR YEAR	210000	559448	0	0	769448	5633	26239	0	-452926	-421054	25200	89512	0	0	114712
1985: 1	204367	533209	0	452926	1190502	6309	30437	0	-54351	-17605	24524	85313	0	81528	191365
FOR YEAR	204367	533209	0	452926	1190502	6309	30437	0	-54351	-17605	24524	85313	0	81528	191365
1986: 1	198058	502772	0	507277	1208107	7066	35307	0	-60873	-18500	23767	80444	0	91310	195521
FOR YEAR	198058	502772	0	507277	1208107	7066	35307	0	-60873	-18500	23767	80444	0	91310	195521
1987: 1	190991	467465	0	568150	1226606	7914	40956	0	-68178	-19308	22919	74794	0	102268	199981
FOR YEAR	190991	467465	0	568150	1226606	7914	40956	0	-68178	-19308	22919	74794	0	102268	199981
1988: 1	183077	426509	0	636328	1245914	8864	47509	0	-76360	-19987	21965	68242	0	114540	204751
FOR YEAR	183077	426509	0	636328	1245914	8864	47509	0	-76360	-19987	21965	68242	0	114540	204751
1989: 1	174213	519988	0	712688	1406889	9927	61723	0	-85522	-13872	20906	83158	0	128264	232388
FOR YEAR	174213	519988	0	712688	1406889	9927	61723	0	-85522	-13872	20906	83158	0	128264	232388
1990: 1	164286	458265	0	798210	1420761	11119	71598	0	-95785	-13068	19714	73322	0	143679	236715
FOR YEAR	164286	458265	0	798210	1420761	11119	71598	0	-95785	-13068	19714	73322	0	143679	236715
1991: 1	153167	386666	0	893995	1433828	12453	83054	0	-107279	-11772	18380	61867	0	160920	241167
FOR YEAR	153167	386666	0	893995	1433828	12453	83054	0	-107279	-11772	18380	61867	0	160920	241167
1992: 1	140714	303612	0	1001274	1445600	13947	96343	0	-120152	-5862	16866	48578	0	180230	245694
FOR YEAR	140714	303612	0	1001274	1445600	13947	96343	0	-120152	-5862	16866	48578	0	180230	245694
1993: 1	126767	207269	0	1121426	1455462	15621	111758	0	-134572	-7153	15212	33163	0	201858	250233
FOR YEAR	126767	207269	0	1121426	1455462	15621	111758	0	-134572	-7153	15212	33163	0	201858	250233
1994: 1	111146	358492	0	1255998	1725636	17495	26222	0	-150718	-107001	13338	57359	0	226080	296777
FOR YEAR	111146	358492	0	1255998	1725636	17495	26222	0	-150718	-107001	13338	57359	0	226080	296777
1995: 1	93650	232269	0	1406716	1832635	19595	30418	0	-168805	-116792	11238	53163	0	253210	317611
FOR YEAR	93650	232269	0	1406716	1832635	19595	30418	0	-168805	-116792	11238	53163	0	253210	317611
1996: 1	74055	201851	0	1575521	1951427	21946	35285	0	-189063	-131832	8807	48296	0	283555	340778
FOR YEAR	74055	201851	0	1575521	1951427	21946	35285	0	-189063	-131832	8807	48296	0	283555	340778

APPENDIX B3

P.B.O. E.C.P.M.A. B.A.L.A.N.C.E. S.H.E.E.I

4800 MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN PESO TERMS)

BALANCES BY PERIOD IN PESOS

LAST DAY OF EACH PERIOD FOR THE FOLLOWING YEARS IN THE PLANNING HORIZON:

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CURRENT ASSETS:												
0. ACCUMULATED CASH	0	0	41709	24880	0	0	0	0	0	0	0	0
1. WORKING CASH ACCOUNT	0	112673	126194	141337	158297	177293	198568	222396	249084	278974	312451	349945
2. RAW MATERIAL INVENTORY	0	302400	338688	379330	424850	475832	532532	596884	668505	748730	838578	939206
3. FINISHED PRODUCTS INVENTORY	0	65318	73157	81935	91768	102780	115113	128927	144398	161726	181133	202869
4. BY-PRODUCTS INVENTORY	0	0	0	0	0	0	0	0	0	0	0	0
5. SUPPLIES INVENTORY	0	7046	7891	8838	9899	11087	12417	13907	15576	17445	19539	21884
6. ACCOUNTS RECEIVABLE, PRODUCTS	0	362880	406425	455196	509820	570998	639518	716260	802211	898476	1006293	1127047
7. ACCTS. RECEIVABLE, BY-PRODUCTS	0	0	0	0	0	0	0	0	0	0	0	0
8. ACCOUNTS RECEIVABLE, OTHER	0	0	0	0	0	0	0	0	0	0	0	0
9. PREPAID ACCOUNTS	0	55534	62199	69663	78022	87385	97871	109615	122769	137501	154002	172482
10. TOTAL CURRENT ASSETS	0	905851	1156263	1161179	1272656	1425375	1556419	1787985	2002547	2242852	2511996	2813433
FIXED ASSETS:												
11. LAND AND SITE	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000
12. BUILDINGS	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000
13. LESS DEPRECIATION	0	12026	23449	34253	44453	54044	63028	71403	79170	86328	92877	98817
14. NET BUILDINGS	150000	137974	126556	115747	105547	95956	86972	78597	70830	63672	57123	51183
15. EQUIPMENT	699310	699310	699310	699310	699310	875544	875544	875544	875544	875544	1204268	1204268
16. LESS DEPRECIATION	0	77593	147254	208983	262781	308646	353576	396508	439442	476379	613319	724315
17. NET EQUIPMENT	699310	621717	552056	490327	436529	566898	481968	409036	348102	299165	590949	479953
18. OTHER INVESTMENTS	0	0	0	0	0	0	0	0	0	0	0	0
19. TOTAL FIXED ASSETS	999310	909691	828612	756074	692076	812854	718940	637633	568932	512837	798072	681136
20. TOTAL ASSETS	999310	1815542	1984875	1917253	1964732	2238229	2315359	2425622	2571479	2755689	3310068	3494569
-0- -0- -0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-			
CURRENT LIABILITIES:												
21. ACCOUNTS PAYABLE,RAW MATERIAL	0	0	0	0	0	0	0	0	0	0	0	0
22. ACCOUNTS PAYABLE, SUPPLIES	0	0	0	0	0	0	0	0	0	0	0	0
23. NOTES PAYABLE, SHORT TERM	0	452926	507277	568150	636328	712688	798210	893955	1001274	1121426	1255998	1406716
24. TOTAL CURRENT LIABILITIES	0	452926	507277	568150	636328	712688	798210	893955	1001274	1121426	1255998	1406716
DEFERRED LIABILITIES:												
25. INTERMEDIATE TERM LOANS	559448	533209	502772	467465	426539	519988	458265	386666	303612	207269	358492	332269
26. LONG TERM LOANS	210000	204367	198058	190991	183077	174213	164286	153167	140714	126767	111146	93650
27. BONDS AND SECURITIES	0	0	0	0	0	0	0	0	0	0	0	0
28. TOTAL DEFERRED LIABILITIES	769448	737576	700830	658456	609586	694201	622551	539832	444326	334036	469638	425919
29. TOTAL LIABILITIES	769448	1190502	1208107	1226606	1245914	1406889	1420761	1433787	1445600	1455462	1725636	1832635
NET WORTH:												
30. PAID-IN CAPITAL	229862	456919	456919	456919	467312	557738	620597	718193	852279	1026628	1261940	1339441
31. CAPITAL RESERVE	0	33624	43970	57848	75627	97723	97723	97723	97723	97723	146618	146618
32. EARNED SURPLUS	0	134571	175879	175880	175879	175879	175878	175878	175877	175876	175875	175875
33. TOTAL NET WORTH	229862	625040	676768	690647	718818	831340	894598	991794	1125879	1300227	1584432	1661934
34. TOTAL LIAB. AND NET WORTH	999310	1815542	1884875	1917253	1964732	2238229	2315359	2425622	2571479	2755689	3310068	3494569

PROFORMA BALANCE SHEET — APPENDIX B3--CONTINUED

480C MT CASSAVA PROCESSING OPERATION
TOTAL OPERATION(IN PESO TERMS)

BALANCES BY PERIOD IN PESOS

LAST DAY OF EACH PERIOD FOR THE FOLLOWING YEARS IN THE PLANNING HORIZON:

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CURRENT ASSETS:												
0. ACCUMULATED CASH	0	0	0	0	0	0	0	0	0	0	0	0
1. WORKING CASH ACCOUNT	391938	438970	491646	550644	616722	690728	773616	866449	0	0	0	0
2. RAW MATERIAL INVENTORY	1051911	1178141	1319516	1477858	1655202	1853825	2076285	2325437	0	0	0	0
3. FINISHED PRODUCTS INVENTORY	227213	254478	285016	319218	357524	400426	448478	502295	0	0	0	0
4. BY-PRODUCTS INVENTORY	0	0	0	0	0	0	0	0	0	0	0	0
5. SUPPLIES INVENTORY	24510	27451	30745	34434	38566	43194	48377	54183	0	0	0	0
6. ACCOUNTS RECEIVABLE, PRODUCTS	1262292	1413768	1583420	1773430	1986243	2224590	2491542	2790525	0	0	0	0
7. ACCTS. RECEIVABLE, BY-PRODUCTS	0	0	0	0	0	0	0	0	0	0	0	0
8. ACCOUNTS RECEIVABLE, OTHER	0	0	0	0	0	0	0	0	0	0	0	0
9. PREPAID ACCOUNTS	193179	216361	242324	271403	303971	340448	381302	427059	-0	-0	-0	-0
10. TOTAL CURRENT ASSETS	3151043	3529169	3952667	4426987	4958228	5553211	6219600	6965946	0	0	0	0
FIXED ASSETS:												
11. LAND AND SITE	150000	150000	150000	150000	150000	150000	150000	150000	0	0	0	0
12. BUILDINGS	150000	150000	150000	357995	357995	357995	357995	357995	0	0	0	0
13. LESS DEPRECIATION	104148	108816	113585	118691	144088	164731	193419	215153	-0	-0	-0	-0
14. NET BUILDINGS	45852	41130	37015	241304	213907	188264	164576	142842	0	0	0	0
15. EQUIPMENT	1204268	1204268	1204268	1751623	1751623	1751623	1751623	1751623	0	0	0	0
16. LESS DEPRECIATION	815930	888163	941015	976883	1134531	1262570	1358800	1422615	-0	-0	-0	-0
17. NET EQUIPMENT	388338	316105	263252	774740	617092	489053	392823	329004	0	0	0	0
18. OTHER INVESTMENTS	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
19. TOTAL FIXED ASSETS	584190	507235	453268	1168644	989999	827317	707599	621846	0	0	0	0
20. TOTAL ASSETS	3735233	4036404	4405935	5555631	5939227	6380528	6927199	7587792	0	0	0	0
-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	
CURRENT LIABILITIES:												
21. ACCOUNTS PAYABLE,RAW MATERIAL	0	0	0	0	0	0	0	0	0	0	0	0
22. ACCOUNTS PAYABLE, SUPPLIES	0	0	0	0	0	0	0	0	0	0	0	0
23. NOTES PAYABLE, SHORT TERM	1575521	1764584	1976333	2213493	2479114	2776605	3109800	3482973	-0	-0	-0	-0
24. TOTAL CURRENT LIABILITIES	1575521	1764584	1976333	2213493	2479114	2776605	3109800	3482973	0	0	0	0
DEFERRED LIABILITIES:												
25. INTERMEDIATE TERM LOANS	301851	266566	225635	616040	569597	515723	453229	380737	0	0	0	0
26. LONG TERM LOANS	74055	52109	27529	145596	141691	137316	132417	126930	0	0	0	0
27. BONDS AND SECURITIES	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
28. TOTAL DEFERRED LIABILITIES	375906	318675	253164	761636	711288	653039	585646	507667	0	0	0	0
29. TOTAL LIABILITIES	1951427	2083259	2229497	2975129	3190402	3429644	3695446	3990640	0	0	0	0
NET WORTH:												
30. PAID-IN CAPITAL	1461314	1620654	1850947	2207045	2335369	2537428	2818297	3044643	0	0	0	0
31. CAPITAL RESERVE	146618	146618	146618	237583	237583	237583	237583	376637	0	0	0	0
32. EARNED SURPLUS	175819	175813	175813	175819	175813	175813	175813	175812	-0	-0	-0	-0
33. TOTAL NET WORTH	1783806	1953145	2173438	2620512	2748825	2950884	3231753	3597152	0	0	0	0
34. TOTAL LIAB. AND NET WORTH	3735233	4036404	4402935	5555631	5939227	6380528	6927199	7587792	0	0	0	0

CASSAVA PROCESSING OPERATION IN CENTRAL VISAYAS, PHILIPPINES: A FEASIBILITY ANALYSIS

by

ROSSENI M. MANALO

B.S.C., University of Santo Tomas, 1975

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Cassava has gained a place in Philippine agriculture as a component in animal feed rations. The importance is due to (1) the need to increase the availability of animal feed, (2) expected saving of foreign exchange, and (3) projected growth in livestock population. Considering these factors, it is pertinent to look into the viability of a proposed processing operation that converts cassava into pellets to be used as a carbohydrate feed ingredient to substitute for yellow corn in animal feeds.

This study evaluates the economic feasibility of a plant for chipping and pelletizing cassava for sale to feed manufacturers. The area under study is Bohol, Central Visayas, Philippines. Reliable data needed for the analysis are scarce from Philippine sources and had to be supplemented with data from Thailand and other sources.

The objectives of the study are (1) to estimate the cost and potential benefits associated with establishing facilities for processing cassava into pellets, (2) to determine the potential Internal Rate of Return (IRR) on total capital, (3) to work out a practical and sound financing plan for the proposed operation and (4) to determine the potential Financial Rate of Return (FRR) to equity capital.

An existing package program, "Computerized System for Feasible Agribusiness Development" developed by Dr. R. Phillips et al. at Kansas State University was used to analyze the feasibility of the project. The goals of the study warrant the use of IRR Feasibility Analysis Program, development of Pro Forma Financial Statements, and FRR Analysis Program. The IRR solution for the chosen configuration of 17.392 percent was obtained after comparing numerous alternatives using sensitivity analysis. The project was found to be sensitive to changes in the price of cassava pellets, raw materials cost, and changes in working capital. However, it

is insensitive to changes in capital investment, variable and fixed costs, and other operating costs. Pro forma financial statements were developed for the base case to evaluate the financing plan and indicate the outcome to potential lending institutions, to equity investors and to development planners. Schedules of depreciation of buildings and equipment, projected operating statements, source and application of funds, loan balances and repayments, financial ratios, and balance sheets for the project were all computed in the pro forma financial analysis. From the reconciled pro forma financial statements in real terms, an FRR of 16.939 percent was obtained for the project. The corresponding FRR based on an annual inflation rate of 12% was found to be 38.137 percent.

The analysis indicates that the cassava plant is feasible either as a private venture or as a government enterprise. Financial success for the project will depend upon careful management of working capital, pricing of cassava pellets, and scheduling of cassava production and harvesting.

The study findings are to be interpreted as promising for cassava processing in Bohol, Central Visayas, Philippines, but not definitive. Location specific analysis of markets and potential contract growers are needed before definite recommendations can be made. This analysis can serve as a guide to development planners and potential private investors in the Philippines as they move toward implementation of this kind of program.