FINAL REPORT

VOLUME III

PRIORITY LIST OF PRODUCTS

IN

CHEMICAL AND AGRO-BASED (FOOD) INDUSTRIES

SUBMITTED TO

THE OFFICE OF THE BOARD OF INVESTMENT

by

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

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Content

Pre-feasibility Study of Recommended Agro-based Product

Tropical Fruit Flavouring Bases

Introduction

This is a supplementary report of the Priority List of Chemical and Agro-based (Food) Industry. The study consists of a pre-feasibility study of the tropical fruits flavouring bases industry which has been selected from the high priority list of agro-based (food) industries.

The study brings together information about the general background of the industry, its market situation, the relevant technical knowledge, as well as an economic and financial analysis.

This pre-feasibility study is only intended to bring the opportunities that exist to the attention of potential investors. It is anticipated that the study will be used as a basis for a further more detailed feasibility study before making any decision to establish the products industry in Thailand.

1. Description of the products

Tropical fruit flavouring bases can be derived from natural fruit juice concentrates, or nectar, of puree and from synthesis or formulation of flavouring chemicals. In this study, flavouring bases from natural tropical fruits are being considered. The bases can be in liquid and/or powder form.

The liquid base is generally composed of fruit juice or puree or nectar in concentrated form. It is blended with sugar, or syrup, or high fructose syrup solids, or maltodextrin, fruit acids such as citric acid, or malic acid, stabilizer or thickening agent, preservatives, certified colouring matter or natural colour matter, essential oil, and emulsifier.

The powder base is normally made from blending spray dried fruit juice powder with sugar or dextrose, stabilizer, certified colour, fruit acids, ascorbic acid, tricalcium phosphate, sodium bicarbonate and anticaking agent. The dry-flavouring base can be manufactured in agglomerated form to permit rapid dispersion and ready-to-dissolve in water when reconstituted into liquid form.

The flavouring base may be diluted to give specific palatable and nutritious fruit beverages, nectar, corordial, squash or in the form of carbonated fruit drinks as main products. Other applications are ice-cream blending, ice-cream dressing, filling core of hard boiled candy, confectionery, fruit punch, gelatin desserts, and cake or pie fillings and to a lesser extent in syrup bases for pharmaceutical products.

The characteristics of the liquid bases are generally found to be at the concentration range of 40-65° Brix, pH 4 and viscous liquid. The bases can be preserved by adding preservatives, or by pasteurization, sterilization or freezing. They may be packed in glass bottles, cans, drums or barrels lined with polythene bag or internal coating using polymers or wax. In certain products, they may be packed in an inert atmosphere such as nitrogen gas or under vacuum.

Some of the information and data in this study are derived from certain factors, assumptions, and estimated figures which are subject to change. However, based on the available data, the production capacity at an economy of scale is estimated to be 1,000 tonnes per year. The analysis is mainly based on an all-year-round supply of raw material, i.e. tangerines and oranges with other seasonal fruits as a back-up line.

2. Marketing

2.1 Introduction

Before the project is formulated, the size and composition of the present effective demand should be determined in order to estimate the possible sales prices and volume. In this chapter, an attempt is made to gauge the present situation, future trends and prospects of the relevant parameters pertaining to the marketing of the flavouring base product. Because of the limitation in terms of time and budget, a more revealing and desirable line of enquiry could not be pursued in this study. As such, the analysis has necessarily been based almost entirely on data and information obtained from secondary sources. Therefore, in evaluating this analysis, a certain amount of reservation is adviseable.

2.2 The Product

Flavouring bases can be classified into two kinds, - natural flavour and synthetic flavour. Here, only the natural flavour is considered for determining the size of the market. This sector of the market, conceivably, stands in direct competition with the synthetic flavour sector. Basically, the flavouring bases are imported by the food and beverage manufacturers and sometimes by the cosmetics and pharmaceutical industries as an intermediate raw material. The natural flavours which could be produced in Thailand are tangerines, pineapple, grape, mango, banana, papaya, guava and jackfruit.

2.3 Domestic Demand

From the foreign trade statistics of Thailand for 1983, we can see that more than 2,000 tonnes of flavouring bases for beverages

were imported. As mentioned above, the food and beverage manufacturers are important importers. Of these the large beverage companies such as Coca-cola, Pepsi-Cola and Greenspot have to import the flavour from their mother companies. This kind of demand is therefore omitted from this study. The invoice of flavouring bases imports (Valuation Division, The Customs Department), indicates that around 1-6 percent of the annually imported quantity is natural flavour which amounts to approximately 160 tonnes per year. This percentage excludes the amount imported by those beverage companies that have been mentioned above. The quantity and value of imported flavouring bases is shown in Tables 2.1 and 2.2. The amount of 160 tonnes is very small compared to the economy of scale in producing bases (1,000 tonnes/year).

Because of insufficient data, the projection of domestic demand can not be analyzed. However, from Tables 2.1 and 2.2 we can see that the demand for flavouring bases for beverages fluctuates from year to year while the demand for natural flavour steadily increases. Considering the number and capital growth rate of food and beverage manufacturers (Appendix 1), it can be seen that their growth rates are very high compared to other manufacturers whose products are well established and who have been in the market for a long time. Expansion of thir demand is thus mainly tied to the growth of population. As the flavouring base is the intermediate raw material of these manufacturers and as the consumers prefer natural to artificial taste, then the domestic demand for natural flavour should increase.

Table 2.1

The quantity and value of flavouring base imported into Thailand

Unit : tonnes

: 1,000 baht

Item / Year	Powder flavouring base for beverage		Concertrated flavouring base	
	Quantity	Value	Quantity	Value
1978	267	8,160	2,017	179,762
1979	467	21,600	2,609	262,066
1980	455	17,090	2,127	235,096
1981	266	12,808	1,786	215,192
1982	353	13,578	3,068	201,188
1983	914	35,749	1,874	242,010
1984*	95	3,757	324	46,200

Source : The Customs Department, Foreign Trade Statistics of Thailand, Bangkok

Note : * only from January - February

Table 2.2

Imported quantity and value of natural flavouring base classified by kinds

Unit : tonnes (baht)

Year / Item	1981			1982			1983			1984 1/		
	Quantity	Value	C.I.F price (Baht/ tonne)	Quantity	Value	C.I.F price (Baht/ tonne)	Quantity	Value	C.I.F price (Baht/ tonne)	Quantity	Value	C.I.F price (Baht/ tonne)
Orange	19.780	436,243	22,055	117.620	4,832,631	1,087	167.480	5,989,076	35,760	115.840	4,108,749	35,469
Lime	0.267	39,954	149,640	0.765	83,266	108,844	1.030	67,518	65,516	0.544	6,706	12,327
Other 2/	1.276	93,352	73,160	2.056	107,637	52,352	0.100	10,942	109,416	0.497	8,454	17,011
Total 3/	21.320	569,549	81,699	120.440	5,023,534	67,428	168.610	6,067,535	70,231	116.880	4,123,909	21,602

Source : Valuation Division, The Customs Department, Bangkok.

Note : 1/ only January - March

2/ other = pineapple, banana and grape

3/ c.i.f price = average of c.i.f price of each product

2.4 Export Market

Unfortunately, the official trade statistics do not identify natural flavour as a distinct group. Therefore, it is difficult to establish the magnitude of foreign trade in this product. The market for this product is very much dependent on foreign demand because the domestic market is considered to be too small at present. However, trade sources believe that the export market is not as bright as it should be due to the strong competition from well established companies. But, the products of these foreign companies are made from sub-tropical and temperate zone fruits such as strawberries, peach, plum, grape, cranberry, raspberry and cherry. Thus, exotic tropical fruit flavouring bases may have the edge and can be introduced in to the European countries, North America and the United States as well as Asian countries with similar food habits. As seen from the list of manufacturers, especially those in the United States, it can be interpreted that there would be a potential for export.

The future expansion of export trade in natural flavour would very much depend on the ability of local producers to at least match the high degree of sophistication in natural flavour marketing overseas, especially in terms of product development and promotion. However, due to insufficient data and information, further market study from foreign sources is required to be conducted in order to assure the analysis.

2.5 Production

The production data of world flavouring bases can not be identified. However looking at their technology, we can deduce that many countries produce this product, especially in the most developed countries. The

largest producer in the world is the United States of America which produces both natural and synthetic flavours. With regard to the local situation in can generally be said that the food processing industry does not yet manufacture flavouring bases but there are trends in this direction. Two other firms produce an orange flavour concentrate which rather than being sold as an intermediate raw material to local food and beverage producers is sold directly for public consumption in the domestic market.

2.6 Channels of distribution

Since, the product can be imported and domestically produced then different marketing channels are used by different vendors.

2.6.1 Marketing channels of imported product.

Normally, the imported product is used as an intermediate raw material. Therefore, the users are also the importers but there are some agents that import the product and have direct contact with the users. This channel structure can be illustrated in Fig. 2.1.

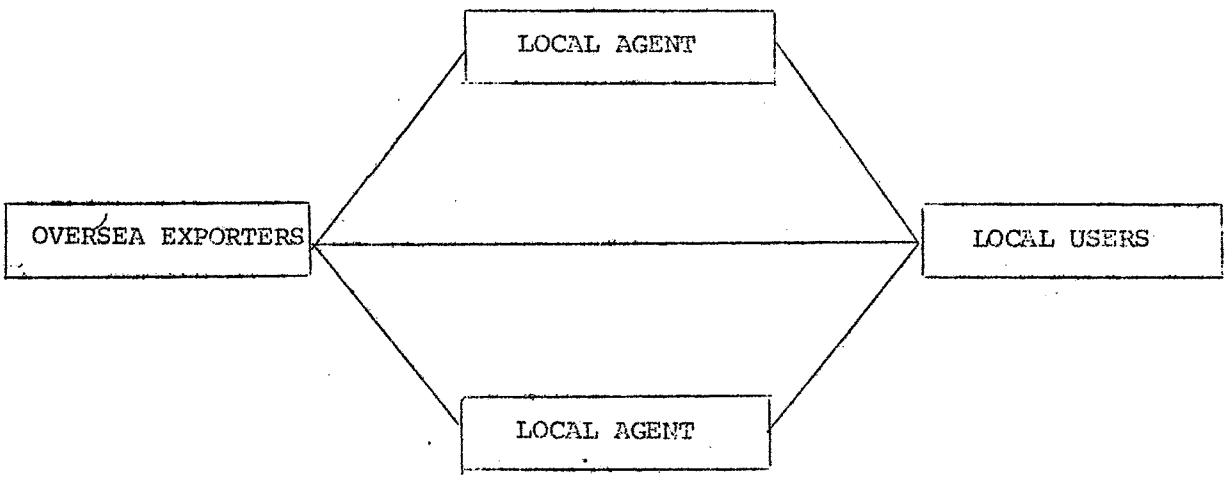


Fig. 2.1 Marketing channel of imported product

2.6.2 Marketing channels of local product

For the recently established local product, the marketing channels used by processors are simple and straightforward. Normally, processors contact agents who obtain their supplies from more than one source, i.e. from other processors, and sell it to supermarkets and grocery stores. This is represented in Fig. 2.2 as follows :

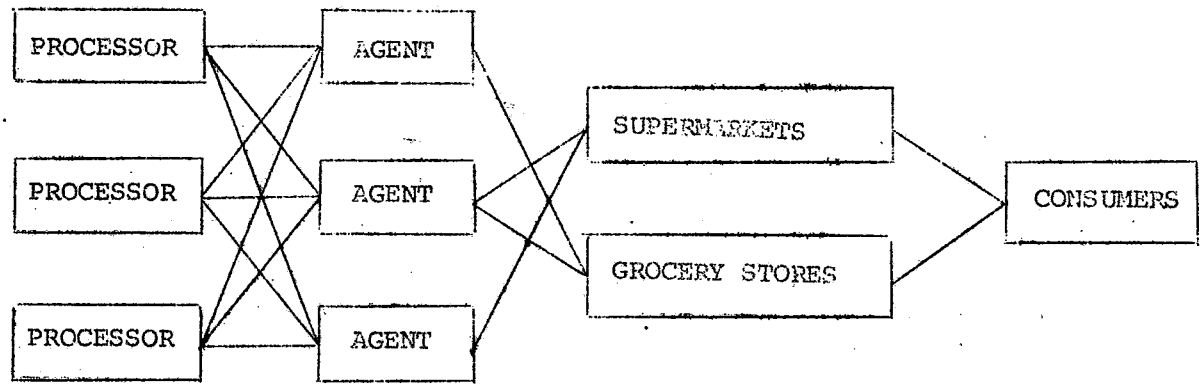


Fig. 2.2 Domestic marketing channel of local product.

2.6.3 Proposed marketing channels.

Since, the local food processing industry does not yet produce flavouring bases to any great extent then the distribution of the products could not be determined. In this study, the proposed marketing channels are only roughly determined and can be represented as shown in Fig. 2.3

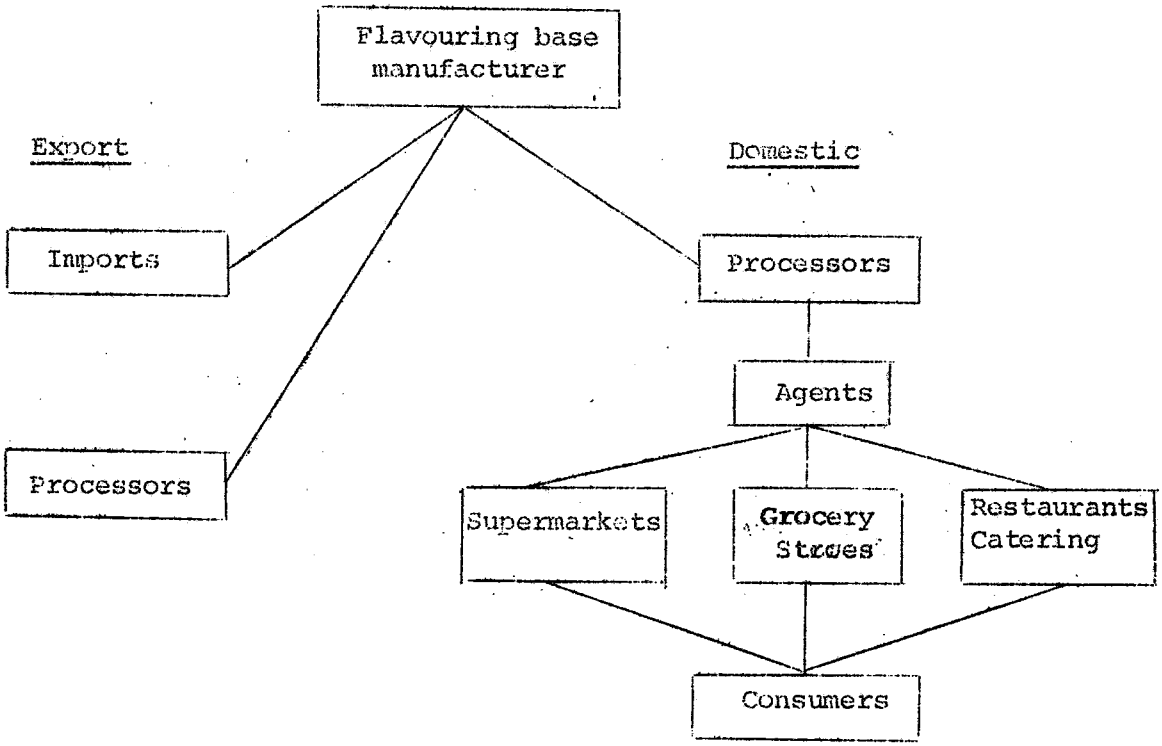


Fig. 2.3 Proposed marketing channels

2.7 Pricing

From the foreign trade statistics and interveiws with the distributors, it was found that the price of natural flavour is more expensive than that of synthetic flavour. The average imported price of natural flavour in 1982 and 1983 was about 67,000 baht per tonne, respectively while the average imported price of synthetic flavour in 1984 was about 30,000 baht per tonne.

The pricing decision for the product is very difficult because many kinds of product are sold at different prices. In the pricing decision, various methods can be employed depending on the objective of the firm. Two of the main methods commonly used are the mark-up or

cost-plus pricing and also competition oriented pricing. In the former method, a pre-determined percentage of profit margin is added to the production cost, thus ensuring that sales will be profitable. However, the disadvantage with this method is that the firm may be foreigoing the possibility of making a larger profit if the price is far below what the market can bear. As for the latter method, the determination of the price is based on the price which competitors are charging in the market. This requires constant monitoring of the market and could be disadvantageous if the firm's cost structure is higher than those of competitors.

For the purpose, of financial analysis the price of the product is determined by using a combination of methods. Here, the average prices of the different kinds of flavours and the average production costs are the factors determining the product price. This is equal to 54,000 baht/tonne (the average price of orange and other flavour is 70,231 baht/tonne while the production cost is approximately 46,621 baht/tonne).

2.8 Marketing Strategy

As mentioned above the market with the most potential is the overseas market, thus a more detailed analysis of this market should be undertaken. In planning the strategies to be adopted in the marketing of natural flavour for the domestic market, the following considerations may be worth taking into account.

2.8.1 Product

The flavouring base is normally used as an intermediate raw material for which its specific quality should be defined in order

to use in specific products. The food and beverage producers actually use the trademarks that have been used before and would never change it. With respect to this group, the best way for the producer to get the market share, is to communicate to them one by one and let them test the product so that they can be convinced of the quality.

2.8.2 Promotion

In a market where the competition comes from developed countries as in the case of flavouring bases, promotional efforts play a very important role especially in term of taxes and the marketing.

2.9 Tax Structure

At present Thailand has not yet produced natural flavouring bases extensively, and only a few manufacturers produce orange flavouring concentrate. The rate of tax imposed on this product is the same as that on other food and beverages. As regards the import of natural flavouring bases, the Customs Department has classified these products as miscellaneous consumable food items comprising food or drink concentrates and flavouring bases and fixed the rate of tax under the miscellaneous goods category of the customs tariff code no. 21.07 as follows :

Table 2.3

Rate of tax for miscellaneous goods category

Imported product	Duty rate C.I.F price (%)	Net profit (%)	Business tax (%)
Flavouring base used only for beverage industry	60	10.5	1.5
Others	60	10.5	7.0

Source : Department of Customs, Bangkok.

The following is the formula for calculating tax imposition on each product imported :

$$\text{Tax value to be collected by Customs Department irrespective of 2 \% discount} = \frac{(\text{C.I.F price} + \text{import duty}) \times (100 + \text{net profit}) \times \text{business tax}}{100 \times 100}$$

It should be noted that as a normal practice, a 2 % discount is granted for cash payment of import duty. And apart from the payment of business tax and import duty, the importer is also required to pay municipal tax at the rate of 10 %.

It can be seen from the above that the C.I.F duty rate is relatively high thus causing a rise in the local sale price, while the sale price of the locally-produced natural flavouring bases in this study was fixed lower than the average C.I.F price by 23 % in 1983. When including the import duty, the price of the imported natural flavouring bases is therefore much higher than the sale price which was estimated and fixed by the working team for the local producers. Consequently, the high tax collection imposed on this kind of product has already played a part in helping to prop up the local industry of natural flavouring bases production.

2.10 Conclusion of market for flavouring bases

The study shows that the domestic market is very small but there is a potential demand in the future due to the expansion of food and beverage manufacturing which uses the flavouring base as an intermediate raw material. The market depends very much on foreign countries, sophisticated promotional strategies should be used.

3. Raw Materials and Supplies

3.1 General background

Thailand is one of the tropical fruits producers which has a potential for export in the world market. However, these fruits are mostly used for fresh consumption, rather than processing which would increase their value added. The flavouring bases industry can process to create value added for the fruits and for import substitution. Examples of the fruits used in flavouring bases processing are presented in the next section.

3.2 Production and exportation

3.2.1 Oranges

There are many kinds of oranges that can be grown in most areas of Thailand. Four major varieties of orange are cultivated in Thailand (tangerine, sweet orange, acidless sweet orange and neck orange). The peak season for oranges is during October to December.

Table 3.1

The cultivated area and its production classified by variety

Unit : Rai

Unit : Tonnes

Name	1981		1982*	
	Cultivated Area	Production	Cultivated Area	Production
Tangerine	227,813	370,158	300,000	900,000
Sweet Orange	22,932	15,310	20,000	40,000
Acidless Sweet Orange	14,350	13,483	20,000	40,000
Neck Orange	4,923	3,212	4,000	2,000

* Estimated

Source : Department of Agricultural Extension, Bangkok.

From the Table 3.1, it can not be concluded that the supply of these raw materials is sufficient for this industry, since most of these supplies are consumed fresh or are exported. Hence, the exporting record of this raw material is shown in the following Table 3.2.

Table 3.2

The exported quality, value and average f.o.b. price

(1978-82)

Year	Oranges		Average Price B : T	Tangerines		Average f.o.b Price ฿ : T
	Quantity (Tonne)	Value (฿ 1,000)		Quantity (Tonne)	Value (฿ 1,000)	
1978	4,495	16,343	3,636	76	466	6,132
1979	1,432	8,368	5,844	58	480	8,276
1980	1,408	11,971	8,502	285	2,764	9,664
1981	1,226	9,957	8,122	563	4,039	7,174
1982	4,276	32,992	7,716	790	3,899	4,935

Source : Department of Customs, Bangkok

Table 3.2 shows the value and quantity of export to be unstable. In particular, the average f.o.b price of tangerines has been decreasing from 9,664 ฿/Tonne to 7,174 ฿/Tonne and to 4,935 ฿/Tonne in 1980, 1981 and 1982, respectively. Thus, the consumption of this raw material in the flavour bases industry is one of the remedies to stabilize the price level of oranges, in Thailand.

3.1.2 Bananas

In the cropping year 1981/1982, the cultivated area of

bananas was approximately 194,846 rais and its total product was about 117,212 tonnes. In the last five year, (Table 3.3) the trend of the banana export price has been increasing, therefore, it can be stated that its production will increase as a consequence of his.

Table 3.3

The exported quantity, value and average f.o.b price or bananas (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	19,170	30,084	1,569
1979	19,201	31,939	1,663
1980	12,724	28,923	2,273
1981	16,196	43,470	2,684
1982	18,388	51,079	2,778
1983	9,655	25,069	2,596

Source : Department of Customs, Bangkok.

3.2.3 Mango

The peak season for mangoes is from March to May. Some varieties are for export. The total cultivated area and production in 1981/82 was 1,021,785 rais and 426,573 tonnes, respectively. The quantities exported from 1978 to 1983 are shown in Table 3.4

Table 3.4

The exported quantity, value and average f.o.b price of Mangoes (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	3,171	13,807	4,354
1979	3,266	19,388	5,936
1980	3,275	19,444	5,937
1981	3,068	21,155	6,907
1982	566	5,425	9,585
1983	2,520	20,876	8,225

Source : Department of Customs, Bangkok

From the Table 3.4 the quantities exported are rather stable because the overseas markets for Thai mangoes are mostly limited to ASEAN countries. Other markets, such as Japan and Europe are dominated by Philippino mangoes which are cheaper. Furthermore, the quality of Philippino mangoes is better than Thai mangoes. As Mangoes are oversupplied for local consumption. It would be better to convert into processed products aiming for export to compete in the world market and to have higher value added.

3.2.4 Coconut

Coconut is an all year round fruit in Thailand which is also exported as copra. Although, Thailand is usually one of the copra exporting countries if there is a shortage of coconut, in some years

copra will be imported for industrial use. The total cultivated area in 1980/81 was 2,908,545 rais and the total production was 1,615,608 tonnes. The value and quantity of coconut copra exported 1978-1983 are shown in Table 3.5.

Table 3.5

The exported quantity, value and average f.o.b price of coconut (1978-1983)

Year	Quantity (100 units)	Value (฿ 1,000)	Average f.o.b Price (฿/tonne)
1978	15,898	4,592,107	288.85
1979	14,641	4,030,068	275.26
1980	17,943	1,532,583	85.41
1981	29,704	3,901,709	131.35
1982	63,812	5,686,270	89.11
1983	14,176	6,032,186	567.8

Source : Department of Customs, Bangkok

3.2.5 Tamarind

The peak season for tamarind is during January and February. The total cultivated area and its production in 1980/81 was 70,561 rais and 62,272 tonnes respectively. At present, tamarind is used for direct consumption and is cooked for a daily meal. The product is only for local consumption, hence, it is considered to be a raw material for the flavouring bases industry. Since this product is surplus it could be utilized as

preserved fruit. If the flavouring bases industry can increase demand for tamarind, the farmer will get more benefit from higher price due to elimination of the over supply.

3.2.6 Papaya

Papaya is an all year round fruit which can be grown in every part of Thailand. The data on cultivated area has not yet been collected and compiled. The quantity and value of exports are shown in Table 3.6.

Table 3.6

The exported quantity, value and average f.o.b price of papaya (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	4,511	10,669	2,365
1979	6,038	15,351	2,542
1980	5,322	15,762	2,962
1981	9,575	35,161	3,672
1982	12,441	68,499	5,506
1983	16,393	82,456	5,029

Source : Department of Customs, Bangkok

From the Table 3.6, the trends of exported quantity and price are increasing, so it may be concluded that the production will be increased to meet the export demand.

3.2.7 Lime

The peak season for lime is during July and November. The cultivated area and total production in 1980/81 were 176,948 rais and 44,874 tonnes, respectively. The quantity and value of export are shown in Table 3.7.

Table 3.7

The exported quantity, value and the average f.o.b price of limes (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	49	669	13,653
1979	173	1,558	9,006
1980	41	492	12,000
1981	196	1,774	9,051
1982	333	2,359	7,084
1983	188	2,202	11,713

Source : Department of Customs, Bangkok

3.2.8 Guava

Guava is an all year round fruit. In the cropping year 1980/81, the total production and cultivated area were 72,558 tonnes and 145,408 rais, respectively. The quantity and value of export are presented in Table 3.8.

Table 3.8

The exported quantity, value and the average f.o.b price for guava (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	293	1,952	6,662
1979	180	1,380	7,667
1980	150	1,457	9,713
1981	589	6,152	10,445
1982	566	5,425	9,585
1983	412	2,943	7,143

Source : Department of Customs, Bangkok

Note : This quantity and value of exports included mangosteen.

3.2.9 Grape

Grape is an all year round fruit and its peak period is during January and February. The total product and cultivated are in the cropping year 1980/81 were 41,460 tonnes and 26,545 rais, respectively. The quantity and value of export are shown in Table 3.9.

Table 3.9

The exported quantity, value and the average f.o.b price of grape (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	1,911	20,122	10,530
1979	2,089	23,895	11,438
1980	1,561	18,078	11,581
1981	1,368	27,027	19,756
1982	1,994	37,747	18,930
1983	1,440	28,800	20,000

Source : Department of Customs, Bangkok

The trend of export quantity is not stable but the trend of f.o.b price has been increasing by about 10 % per year.

3.2.10 Longan

Longan can be grown in the North of Thailand, especially in Chiangmai, Lampang and Lamphun. Its harvesting period is during July and September. At present, the export market of longan is for Hongkong, Singapore and Malaysia. The trend of export quantity and price are increasing at an average of 54 % and 14 % per year, respectively. The value and quantity of logan exported from 1978 to 1983 are shown in Table 3.10.

Table 3.10

The exported quantity, value and the average f.o.b price of longan (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	1,971	34,891	17,702
1979	3,286	55,767	16,971
1980	3,684	92,186	25,023
1981	5,517	154,284	27,965
1982	10,316	296,518	28,743
1983	7,320	207,154	28,300

Source : Department of Customs, Bangkok

At present, there are some problems concerning the export market, i.e., the foreign markets consist only of neighbouring some countries; primary packaging needs to be improved in order to reduce the muchanical damage during transportation; and the is a lack of trade information which results in low bargaining power of the farmers. Thus, the flavour bases industry is one of the solutions to be promoted to overcome these problems.

3.2.11 Lychee

The harvesting period of lychee is during May and June. The Northern part of Thailand is the most suitable area for cultivation, especially in Chiangmai and Chiangrai. In the cropping year of 1980/81, the total cultivated area and production were about 25,644 rais and

6,128 tonnes, respectively. At present, there is still no export potential because of insufficient supply. However, some of them are processed and packed in syrup for the canned fruit industry, but in terms of export value it is insignificant.

3.2.12 Rambutan

Rambutan is one of the fruits that contributes a large amount of foreign exchange earnings to the country. The South and the North continue to be the dominant suppliers. The harvesting period is not less than 3 months, i.e. May, June and July. In the cropping year of 1980/81 the total cultivated area and production were 374,165 rais and 392,200 tonnes, respectively. The produce is consumed directly and processed for the canned fruits industry. The exported quantity and price have fluctuated from year to year as shown in Table 3.11

Table 3.11

The exported quantity, value and average f.o.b price of rambutan (1978-1983)

Year	Quantity (Tonne)	Value (฿ 1,000)	Average f.o.b Price (฿/Tonne)
1978	304	1,761	5,793
1979	233	1,760	7,554
1980	116	1,259	10,853
1981	413	3,746	9,070
1982	523	3,950	7,552
1983	273	3,554	13,018

Source : Department of Customs, Bangkok

3.2.13 Jackfruit

Jackfruit is another of the commercial fruits grown in Thailand. In the cropping year of 1980/81, the cultivated area of jackfruit was about 81,025 rais and the total production was approximately 22,011 tonnes. The harvesting period of jackfruit is during March to August. The total production is domestically consumed. The price of jackfruit varies with its seasonal period.

3.3 Source of raw materials and seasons

Considering the source of raw materials for flavouring bases industry, it is dependent on the plantation areas of those tropical fruits in Thailand. Figure 3.1 shows types of tropical fruits and the location of plantation areas in Thailand. However, to set up a flavouring bases factory, one has to consider the cost of the transportation of the final product and raw material, pollution control, water resource, labour cost and land cost. A detailed survey of the areas should be conducted for the determination of a specific plant site.

Many fruits vary in availability according to season. These are Figure 3.2. However some fruits are available throughout the year, e.g., tangerines, banana, coconut, guava, papaya and grapes.

3.4 Cost of raw materials

The prices of fruits in Thailand have fluctuated from season to season. In general, the domestic prices of those fruits varied during 1983-1984 as indicated in Table 3.12.

Table 3.12

Average price index in seasons

	1983			1984		
	Winter	Summer	Rainy season	Winter	Summer	Rainy season
Tangerine ฿/kg.	6.37	7.50	7.88	7.50	7.50	-
Banana ฿/100 Units	55.00	52.50	52.50	76.67	101.25	105
Mango ฿/kg.	-	2.75	-	-	4.12	-
Coconut ฿/100 Units	495.00	-	522	727	637	-
Papaya ฿/kg.	2.94	2.75	2.75	-	4.12	-
Lime ฿/Units	.44	.62	.38	.87	1.38	.51
Guava ฿/kg.	7.10	7.10	7.10	7.59	-	-
Grape ฿/kg.	16.0	16.0	16.0	20.19	-	-
Longan ฿/kg.	23.26	-	-	26.45	-	-
Lychee ฿/kg.	-	-	38.33	-	-	32.07
Rambutan ฿/kg.	-	-	12.07	-	-	-

Source : Department of Internal Trade, Bangkok

Apart from the fruits a number of raw materials must be imported as ingredients and food additives. These are shown in Table 3.13.

Table 3.13

Various ingredients used in the flavouring bases industry

Name	Price (฿/Kg.)
Enzyme Pectinase (for lime, mango, guava and papaya)	2,300
Preservatives	
- Sodium : Benzoate or benzoic acid	30
- Potassium Sorbate	30
- Sodium Metabisulphite	145
Certified Food Color (such as Ponceau 4 R, Azorubine Tartrazine or sunset yellow FCF, Fast green FCF, Indigo carmine)	450
Acidulant (commercial grade)	
- Citric Acid	60
- Malic Acid	60
Sugar (local)	12.50
Container (local)	
- Glass bottle with cap (750 g/bot.)	5 ฿/bot.
- Tin can with lid	
- No.2 (450 g/can)	2.05 /bot.
- No. $2\frac{1}{2}$ (580 g/can)	2.65 /bot.
- No. 10 (3,000 g/can)	10 /bot.
Thickening agent	1,200 ฿/kg.
Tricalcium phosphate	50
Sodium bicarbonate	12
Dextrose or Maltodextrin	35

Source : Compiled by The Study Team from a variety of literature on the subject.

4. Choices of Technology, Process Machinery, Equipments and Location

4.1 Overview of the process

A general process outline of tropical fruit flavouring bases is described in a number a major steps as follows :

4.1.1 Ripening

Fruits are transported to the processing plant according to the production schedule. The fully ripe fruits should be processed without delay. However, some varieties of fruits are harvested when they are still green, e.g. banana, guava, papaya, mango, etc. Therefore, they have to be stored to control the level of ripening prior to processing. The controlling factors for fruits ripening are generally recognized to be temperature, humidity and ventilation as well as utilization of ripening gas if necessary. The optimum conditions of the storage room are around 14-18°C, 90 % - 95 % R.H. and good air ventilation (Nelson and Tressler, 1980). The storage room should be protected from any infestation of insects, pests and rodents and contamination of mold, and bacteria. Good sanitation practice is necessary to clean the room and packaging with sanitizing chemicals will eliminate unwanted odour.

4.1.2 Inspection, sorting and washing

When ripe fruits are ready for processing, they are dumped out on an inspection belt. Here, the diseased fruit, green fruit and damaged fruit are removed after inspection. Some fruits with small defects may be trimmed to make them acceptable for processing.

From the inspection belt the good fruits drop into a washing tank or onto a washing belt passing through a stream of jet-water.

Mechanical or manual agitation and the addition of a detergent (surface active agent) help to remove dirt, debris and dried flower parts. An elevator belt conveys fruits from the washing tank for clear water spraying as well as for the rinsing of the detergent from the peel.

4.1.3 Peeling and blanching

Fruits are graded into 3 sizes; large, medium and small. Then, they are transferred to an atmospheric steam chamber for about $2\frac{1}{2}$ minutes for blanching and are there cooked in a water bath. Thinner peels are easily slip-peeled. Fruit peeling can also be achieved by mechanical means and/or chemical treatment such as lye peeling using aqueous solutions of caustic soda. However, lye peeling may alter the taste and colour whereas mechanical peeling contributes to low yields of peeled fruit.

For banana, the fruit is peeled to remove peel rag and rot, then, it is blanched in steam or boiling water (or a combination of both) until a centre temperature of 88°C is reached. A medium size peeled banana requires about 6-8 min. (Guyer and Erikson, 1954).

4.1.4 Juice extraction

After peeling, the peel is sent to the hopper by the conveyor. The peeled fruit is charged into the chopper or slicer and then crushed before feeding into the pulper/finisher, which consists of a cylindrical screen with 1.5 mm. perforations and three paddles rotating inside. The unifrom rate of feed is imported because the rate of feed, as well as the speed and the adjustment of the paddles, controls the amount of waste being discharged from the machine. Non-uniform movement of the material through the pulper may cause discolouration of the puree.

In the pulper, the peeled fruit is crushed with centrifugal force. Fruit juice or puree passes through a screen whereas pulp seeds and fiber, are separated out. The fruit juice is sent to the finisher, and coarse pulp, fiber and seeds are removed by a 0.5-0.8 mm. screen to produce clear fruit juice.

4.1.5 Deaeration

After pulping and finishing, the puree is pumped through a dearator to remove entrapped air. The air and gas mixed in the fruit juice are eliminated by spraying it in a vacuum chamber of the deaerator. The objective is to remove oxygen which lessens the possible deterioration caused by this gas during prolonged storage. Oxidation is one of the main problems which causes loss in colour, breakdown of vitamins, loss of flavour and production of off-flavours. The removal of air also makes products more uniform and smoother and the method is for improvement of colour. Another advantage is the prevention of foaming caused by entrapped air, thus allowing correct and uniform filling in containers in the processing line.

4.1.6 Enzyme treatment

The utilization of enzymes by either partial or complete hydrolysis of the suspended starches, proteins and pectins is important for certain kinds of fruit puree, for instance guava, papaya and mango. It is used to reduce viscosity, to improve filtration efficiency, and to clarify fruit juices. A number of commercial enzymes are available for uses which differ in terms of type and activity. So too are, other kinds of enzyme-mixture and the type of carriers of dilutents with which they are mixed for standardization of enzyme activity. The quantity of

enzyme preparation to be used for a particular fruit juice is normally given in directions supplied by the distributors.

4.1.7 Filtration

After enzymatic treatment, the fruit juice or puree is easily filtered through various filter media by gravity, pressure or vacuum. Continuous of intermittent filtration may be used and the filtration may be rough or close. The filter media may be finely woven cloth, either canvas or metal, fiber or asbestos pads, cotton pulp or discs. During filtration the juice must be protected from aeration and from contamination with metallic impurities from the filter lines and the filter medium.

The commonly used filters in a fruit juice factory are plate and frame presses. They consist of solid vertical plates and hollow frame cast with side lugs so that they may be mounted on two parallel horizontal bars and clamped together. A filter cloth is laid over each plate to cover both faces and a frame is set on each side so that by alternating plates and frames a series of filter cells is formed. A hole in each plate and frame serves as a feed channel, an opening from this channel admits feed into each frame and at the botton of each plate there is an outlet for the filtrate. Many different designs of this filter press assembly are available, varying in type and design of plates and frames, in location of feed, and of discharge and in method of operation to suit the particular fruit juices or puree to be filtered. Therefore, the fruit juice may be fillered afted preliminary treatment by settling, straining, fining or heating.

4.1.8 Pasteurization

Plate pasteurizers, similar to those used in the dairy industry, are now customary in fruit juice processing. These consist of embossed metal plates pressed together to form alternating channels for the flow of juice or puree and the heating (or cooling) medium. The heating medium may be steam or pressurized hot water. Times and temperatures used in the pasteurizing process depend upon the method employed and the product treated. The high temperature-short-time method employs a comparatively high temperature for a short time. Some examples of pasteurizing treatments for fruit juices or puree follow : for guava puree the recommended time-temperature relationship will be 60 sec. at 90.6°C, for the mango puree, the temperature is raised to 90.6°-93.3°C, held at that temperature for 2 min, then rapidly cooled to 32.2°-37.8°C but a heat treatment of 30 seconds at 87°C is sufficient for orange juice and slightly milder sufficent for lemon juice.

In the pasteurization process, the pathogen is killed and viable microbes are reduced and at the same time, pectin decomposing enzyme and vitamin C oxidizing enzyme are inactivated to prevent deterioration of the fruit juice quality.

Fruit juice is normally pasteurized before evaporation. Since the final concentrate must be pasteurized, one may question the need for this first heat-treatment. Indeed, the first pasteurization may be omitted if the temperature in the evaporator is low or the retention time is short. However, in small-scale operations a double pasteurization is preferable for safety and better flexibility.

4.1.9 Concentration

Fruit juices naturally contain 80-90 per cent water and their bulk can be reduced greatly by the removal of most of it using vacuum evaporator and/or freezer. The advantages of concentration from the points of view of packaging, transportation and storage cost are evident. This also helps to preserve the juice because, as its concentration increases, fewer micro-organisms remain capable of multiplying in it.

Virtually all bacteria, and most moulds and yeasts are incapable of growing in a juice which has been concentrated to 50 per-cent solids (w/w) or more and only a few osmophillic yeasts and moulds are still able to grow at up to 70-80 per cent solids. The growth of these is further limited by the high acidity of concentrated fruit juices.

Modern fruit juice concentration equipment is based on either of the two possible approaches to the problem of minimizing heat damage : low temperature or short contact time.

As with any other liquid, the boiling point of fruit juice or puree may be lowered by reducing the pressure. Many industrial fruit juice concentrators operate with very low pressures, corresponding to boiling points (based on water) of 18°C or below, thus obviously eliminating the danger of cooling. However, this method has serious limitations. Operation at high vacuum entails an increased initial cost of equipment as well as operating expenses. Ordinary cooling water is not sufficiently cold for the condensation of the vapours at such pressures, so chilled water, regrigerated brine or direct expansion refngerant systems must be used. The viscosity of the concentrate is much higher

at low temperature. As a result, heat transfer is bound to be slow, and retention time is long. There seems to be no appreciable advantage from the viewpoint of retention of volatile substances.

Nowadays, emphasis has been put on shorter contact time rather than on low temperature. Pressure is reduced only sufficiently to obtain boiling at 45-55°C. However, the concentrate remains in contact with the heating surface for only a few seconds. Rapid evaporation is secured by an improved rate of heat transfer. Most of the modern evaporators are termed "film evaporators", since the concentrate is heated in the form of a thin film moving over the heat transfer surface. There are several different techniques for forming and moving this film eg. plate evaporators, falling-and/or climbing-film evaporators, swept-surface evaporators, rotating-surface evaporatos.

In all evaporation processes, steam economy is a matter of considerable economic importance. There are several methods of increasing the amount of water removed per ton of steam used and since all of these methods represent an increase in capital investment, their economic merits should be analysed in close relation to the conditions that prevail in any place where such an installation is planned. However most evaporators can be equipped with some kind of steam-saving system.

There is another type of evaporator called TASTE (temperature accelerated short time evaporator). A typical TASTE has 6 stages and 4 effects plus a flash cooler. Fruit juice passes through each stage only once, so the time that the fruit juice is in the evaporator is in the order of minutes instead of 1 or 2 hours as is the case for a low temperature unit. One or more stages in the TASTE might operate as high

as 93°C to 100°C and would simultaneously pasteurize, enzyme-stabilize and evaporate the fruit juice. Other stages and effects range down to about 15°C. These have several advantages : (a) low product residence time minimizes caramelization, oxidized flavours and colour changes; (b) fruit juice leaving the evaporator is almost free from microorganisms; (c) units have a low initial cost and (d) units are easily cleaned. However, they also have disadvantages : (a) they are relatively inflexible because the product goes through each stage only once, and changes in concentration of feed are reflected in a change in pumpout concentration; (b) it is not convenient to blend "add back" with the feed juice and send it through the evaporator as this action would increase the concentration of the pumpout ; and (c) high temperatures cause more rapid fouling of the heat exchanger tubes and necessitate more frequent cleaning. (Nelson and Tressler, 1980).

There are alternative methods of concentration due to the disadvantages of evaporation such as losses of volatile substances, heat damage, cost of equipment and steam. The most studied processes in this field is freeze concentration or freeze drying. Several processes, differing mainly in the method of freezing and separating the ice from the concentrate, have been proposed. None has yet found appreciable commercial application for fruit juice concentrates.

Most fruit juice factories use the rotating-surface evaporator known as the Centri-Therm machine. The heat transfer surface is an inverted cone that rapidly rotates about its axis. Steam is applied to one side of the cone while fruit juice flows very rapidly in a thin film on the other surface. Retention time is extremely short, and remarkably high concentration ratios can be obtained in a single

pass. This evaporator is much more compact than most other machines of comparable capacity. Then, the evaporator may be connected directly to the heat treatment unit so that the hot fruit juice is immediatly flashed into the vacuum chamber. Alternatively, the fruit juice may be cooled and stored in a balance tank, from which it is fed into the evaporator. The former method represents better steam economy, but its applicability depends on the construction and operation principle of the evaporator.

4.1.10 Preparing bases for industrial use

Pure, natural juices have some serious marketing limitations; for example, they are relatively expensive and do not posses the thirst-quenching power of more watery drinks. However, citrus flavours (traditionally orange and lime) are established favourites in the field of carbonated and non-carbonated soft drinks. In many cases, this flavour is imparted by essential oils or imitation essences. But, the public seems to prefer cloudy beverages with a more fruity character. These contain varying amounts of citrus components such as juice, concentrate, pulp and zest. They are generally supplied to the bottler in the form of ready-to-use "bases" that are tailored to his needs. These bases are complex, concentrated mixtures to which only water, CO_2, sugar or other sweeteners need be added to obtain the final beverage.

The raw materials that make up these bases are fruit juices and their concentrates, pulp, peel, essential oils and natural essences. Food acids, stabilizers, certified colours, chemical preservations may be added if necessary.

The different components are blended in tanks with agitators. Some ingredients eg. essential oils are first emulsified in a small amount

of concentrate, juice or sugar syrup, using emulsifiers and stabilizers. It is very important to avoid as much as possible the inclusion of air in the process of mixing, since high viscosity of the material renders deaeration difficult. Daeration is carried out by spraying the mixture into a vacuum chamber or by spreading it in the form of a thin film on rotating conical surfaces and applying a vacuum. Intimate mixing of all ingredients and a certain degree of further size reduction may be achieved by means of homogenization.

There is another kind of bases called "Ade" bases. They are concentrated products that contain a considerable amount of sugar. They are intended for direct consumer use. When mixed with the proper amount of water, they yield a beverage containing 10 per cent or more of fruit.

4.1.11 Homogenization

Homogenization is the operation in which the desired reduction in the size of the droplets of the internal phase is brought about by forcing the crude emulsion through a narrow opening at high velocity. This operation is used to retard or prevent settling and separation of fruit juice or puree as much as possible.

Most of the juice or puree is sometimes homogenised or viscosised in similar machines of the type used for milk and other dairy products. It is called a presure homogenizer which consists of a homogenizing value and a high pressure pump. The fruit juice or puree will be forced through narrow orifices at a pressure of 1,000 to 1,400 lbs. per sq. in., thus finely breaking up the suspended solids. The

viscosity of the fruit juice or puree will be increased and it is given a smoother consistency, sometimes characterized as "oily".

4.1.12 Preservation and packaging

Preservation against spoilage may be accomplished by freezing or heat treatment or by addition of chemical preservatives. If the base contains a high level of sugar, it will have a greater resistance to spoilage by most microorganisms. Fruit beverage bases containing 65 per cent soluble solids (65° Brix) as measured by refractometer and at pH 4.0 or lower (as measured by pH meter) can be preserved by relatively mild heat treatment. The product is pumped through a plate pasteurizer where it is rapidly heated to 88°C (Breake, 1973). Sanitized cans (commonly No. 10 or larger) are filled, sealed, inverted for 3 to 4 minutes to sterilize the lid, then cooled in a water bath as quickly as possible.

The 65° Brix bases have also been preserved without heat by the addition of 500 ppm sodium benzoate and 500 ppm potassium sorbate together. The beverages made from these bases will contain about 105 ppm of each preservative. They are filled in steel barrel lined with a suitable plastic or filled into wooden barrels which must be in good condition and freshly coated with paraffin wax. However, since sodium benzoate has no retarding effect on browning, the product must be kept in cold storage or an other preservative is used, i.e. sulphur dioxide (2,000 to 3,000 parts per million) is added directly to the barrels.

Generally, most of the filling systems used for fruit flavouring bases are as follows :

(a) Hot fill systems

Hot fill systems have been used in the production for many years. Where the product is blended, using a pre-sterilized concentrate, treated water and other ingredients. The flavouring base is heated in a Paraflow plate pasteurizer to 85-95°C, held in external holding tubes and cooled to filling temperature by regeneration with the cold product or chilled water. The filling temperature should be not less than 65°C , necessary to ensure kill of spores and molds in the container, and limited at the top end by the container material. For plastic containers, a temperature in the range of 68°-75°C is normally used. The product is fed to the filler which may be in a controlled atmospheric room to avoid recontamination, then the filled containers are sealed. Containers are then conveyed through a conventional progressive holding/spray cooling tunnel using chilled water to temperature. The containers are held at a dwelling time of around 10 minutes depending on filling temperature. The hot fill system meets market demand for large containers such as no. 10 can and drum.

(b) Aseptic filling systems

When considering this system, it is suitable for bag-in-box or large cans or small containers. However the processing parameters are based on HTST (high temperature short time) treatment at 90-95°C within 15-30 seconds holding, followed by regenerative and secondary cooling to a filling temperature into the presterilized or aseptic package at around 20-25°C. The system is a closed system and the importance of deareration or treatment with ascorbic acid is singnificant for the prevention of oxidation effects in the container. This may cause

browning reaction during storage. The complexity of the plant, energy consumption and capital cost should be considered for such a system. For multi-product systems, such as flavouring bases products processed from different varieties and formulaes, the aseptic tank system (ATS) may facilitate the production scheduling by making the sterilized plant independent of the fillers. Production can terminate, then followed by plant clean-up while filling proceeds.

CIP system (Clean-in-place) is recommended for sterilization of the equipment as well as ATS system for the multi-product process. They are not inexpensive means, but in many cases, can be justified on economic grounds.

4.1.13 Dehydration

The conversion of fruit juice to powder form by removal of almost all of its water has obvious economic advantages in packaging, storing and distributing. Unfortunately, the technological difficulties encountered are tremendous due to problems in reconstitution, caking and off-flavour development.

Most of the early processes were based on vacuum drying, and extrapolation of vacuum concentration. However, the final stages of drying are extremely slow and products melt into a sticky mass that must be solidified by chilling and then ground.

At present, there is substantial effort devoted to the production of satisfactory powder from the fruit juice by spray drying. Limited quantities of these are available commercially. In general, high temperatures are employed in spray drying but drying times are so short under ideal conditions that they can be dried to reasonably low moisture levels without excessive heat damage.

The spray drying is the transformation of a pumpable fluid feed (solution, slurry, or paste) into a particulate dried product in a single drying process. The drying operation consists of three stages :

a) Atomization of the feed liquid into a spray by the use of a vaned wheel rotating at high speed.

b) The contacting of the spray with hot air to promote evaporation. The hot air enters the chamber around the atomizer vaned wheel.

c) The separation of dried product from the air in a cyclone.

The basic principles involved concern the atomization of the feed liquid into a spray of very small droplets. These droplets have a very large surface area and evaporation is completed rapidly. The necessary small droplet sizes are produced by rotating the vaned wheel at high speeds. The resulting evaporation rates are high enough to enable completion of moisture removal from the droplets even though the small chamber volume gives short droplet residence times in the dryer. During the evaporation stage, there is an accompanying cooling effect on the droplets, and with the product residence time in the chamber of short duration, heat damage of the product is prevented.

Normally the counter current spray drying is used for products which are not heat sensitive but require a degree of heat treatment to obtain a special characteristic, i.e. porosity of bulk density. In this case the final powder temperature is higher than the

outlet drying air temperature, therefore, this method is unworkable and impractical for many foodstuffs with heat sensitiveness, especially the fruit flavouring bases. However, for reasons of equipment efficiency as well as for economic reasons, temperatures ranging from 100° to 160°C must be employed and, therefore, it is quite obvious that any incoming air at this temperature will destroy or completely burn the product very quickly. Even when the drying air is fed at 50°C the air damages the dry powder since in all known countercurrent drying processes the dispersed droplets explode when contacting the low saturated drying gas. They then shrink into a flattened skin which later on, during the course of the dehydration, agglomerates into the conventional type of particle having an exterior crust of skin and inner cavities close to the exterior.

P. Hussmann (U.S. Patent 3,415,665; Dec. 10, 1968) discovered that in order to obtain the desired structure in the dehydrated product it is necessary that the treatment of the material during the first part of the dehydration be extended or continued beyond the time necessary for dehydrating the product to the desired degree of water content. That is until a corn or grain is formed from the dispersed droplets. It is an important aspect of the process that the residence time of the material to be dehydrated in the drying zone exceeds the time necessary for obtaining a product of the desired residual humidity. Thus the contact time of the material to be dehydrated with the specified conditions exceeds that required for the degree of dehumidification.

Moreover, in accordance with the process, it is necessary that in the first zone of the dehydration, there be maintained an atmosphere

of such high humidity that the dispersed droplets do not, as it is customary, explode during the dehydration and then shrink into a flattened skin which later on, during the course of the dehydration, agglomerates into the conventional type of particle having an exterior crust of skin and inner cavities close to the exterior. Therefore, it is assumed that the product temperature will remain close to wet bulb temperature of the surrounding air until most of the moisture has been removed because of the rapid evaporation of water. At that point the surface of the powder particles is no longer saturated with moisture because of the decreased rate of water migration from the interior of the particles. The period of rising product temperatures is so short, however, that there is little opportunity for heat damage unless passage through the drier system is interrupted.

Nowadays spray drying of most fruit juices still presents problems owing to the low melting or softening points and the hydroscopic nature of their pure powders that result in stickiness. The hygroscopic property is critically important as it may determine the moisture level of the powder in a given situation. Thus hygroscopicity and low softening point are indirectly interactive since the sticky point temperature of the powder depends in part on its moisture content as well as on its composition. Within limits, the drier the powder the higher is its sticky-point-temperature. On the other hand, the moisture content of the powder will depend on the aqueous vapour pressure, or relative humidity of the surrounding air. It is obvious, therefore, that both dry bulb temperature and relative humidity of exhaust air are critically important in the successful spray drying of fruit juices.

There is also the use of drying aids including sucrose, corn syrup solids, lactose, gums (e.g. arabic, tragacanth), agar-agar, alginates, pectic substances, milk solids, starch, sodium carboxymethyl cellulose, methyl cellulose and glyceryl monosterate. Some drying aids are added in large amounts; for example, in a commercial process, corn syrup solids of low dextrose equivalent are added to lemon juice at the rate of 50 per cent or higher on a dry basis. (Tressler and Joslyn, 1961). However, they are presumbly effective only to the extent that they favourably affect the hygroscopic and the sticky-point temperature of the product.

There is a new process for drying liquid from high sugar foods called foam-mat drying, which was developed at the U.S.D.A. Eastern and Western Research Laboratories (U.S. Patent 2,967,109; Jan. 3, 1961). This process appears ideally suitable for citrus juice powder production. Researchers at the USDA Citrus and Subtropical Products Laboratory, Winter Haven, Florida, have developed a similar technique for drying citrus juices under normal (atmospheric) pressure instead of under vacuum. The dehydrated products of the process are in a porous condition and are easily rehydratable.

The essential steps in the process are :

(a) A liquid concentrate of the juice is converted into a stable foam by incorporating a minor proportion of an edible surface active agent and a subtantial quantity of air or other nontoxic gas.

(b) The foarm in the form of a relatively thin layer is exposed to a current of hot air until it is dehydrated.

In modern technology, fixation technology has been introduced to encapsulate fruit flavour extracted from the process. The so-called microencapsulation technique using the matrix-modified starch derivatives or modified micro-crystalline cellulose mixture blended with fruit juice concentrate prior to spray drying is generally used in the commercial production. This technique provides a pronounced flavour after rehydration due to the flavour encapsulated within the matrix structure and the flavour being protected from any possible loss.

After dehydration, the fruit base powder will be mixed with sugar, fruit acids, thickening agent or stabilizer, flavour and certified colour. In practice the best mix attainable is that in which there is a random distribution of the ingredients. The methods of controlling the mixing operation usually involves sampling of the batch, analysis of the samples and statistical treatment of the results.

4.2 Choice of the process

Fruits may be divided into 2 major groups i.e. citrus fruits or acid-based fruits such as tangerines, sweet oranges, limes, grapes and pineapple; and puree-based fruits such as banana, guava, mango, papaya and jackfruits. The production schedule is set mainly for tangerines with other seasonal fruits as a sideline to fill up the plant production capacity. The technology for fully developed production of tropical fruit flavouring bases can be described in the overall process flow chart as illustrated in Fig. 4.1.

For this study, two types of process were considered. Fig 4.2 (Plant 1) illustrates the type for the production of pasteurized and

un-pastuerized flavouring bases and Fig. 4.3 (Plant 2) illustrates the type for similar production as in plant 1 but with an additional line of production for flavouring bases powder or beverage powder base.

The process for plant 2 is selected for an economic and financial analysis.

4.2.1 Process flow chart description (Plant 2, Fig. 4.3)

Fruits are delivered to processing plant and held in a storage area or they are immediately processed. They are inspected and sorted to remove culls and defects such as rotten, infested fruits, and bruises along the conveyor belt.

In case of citrus fruits or acid-based fruits, fruits are washed and graded according to size to fit the extractor adjustment whereas puree-based fruits are peeled and blanched for better yield.

Fruit juice is extracted, collected and passed through pulper/finisher or filter. Juice is deaerated and preheated before concentration by vacuum evaporator (e.g. Centritherm unit) to the desired degree of brix (65°B). Thus, the concentrate is mixed with thickening agent, sugar (or dextrose,high-fructose-solids) and other adjusting ingredients and additives, such as colour, clouding agent, synthetic flavour to enhance the natural flavour and aesthetic appearance before the homogenizing step.

The unpasteurized flavouring base is obtained by the addition of preservatives such as sodium bisulphite or sodium metabisuphfite or benzoic acid or its salt, and/or potassium sorbate at the approprate or authorised concentration level. The flavouring base is then filled

FIG 4.1

EXPANSION PLANT

PROCESS FLOW CHART OF TROPICAL FRUIT FLAVOURING BASES)

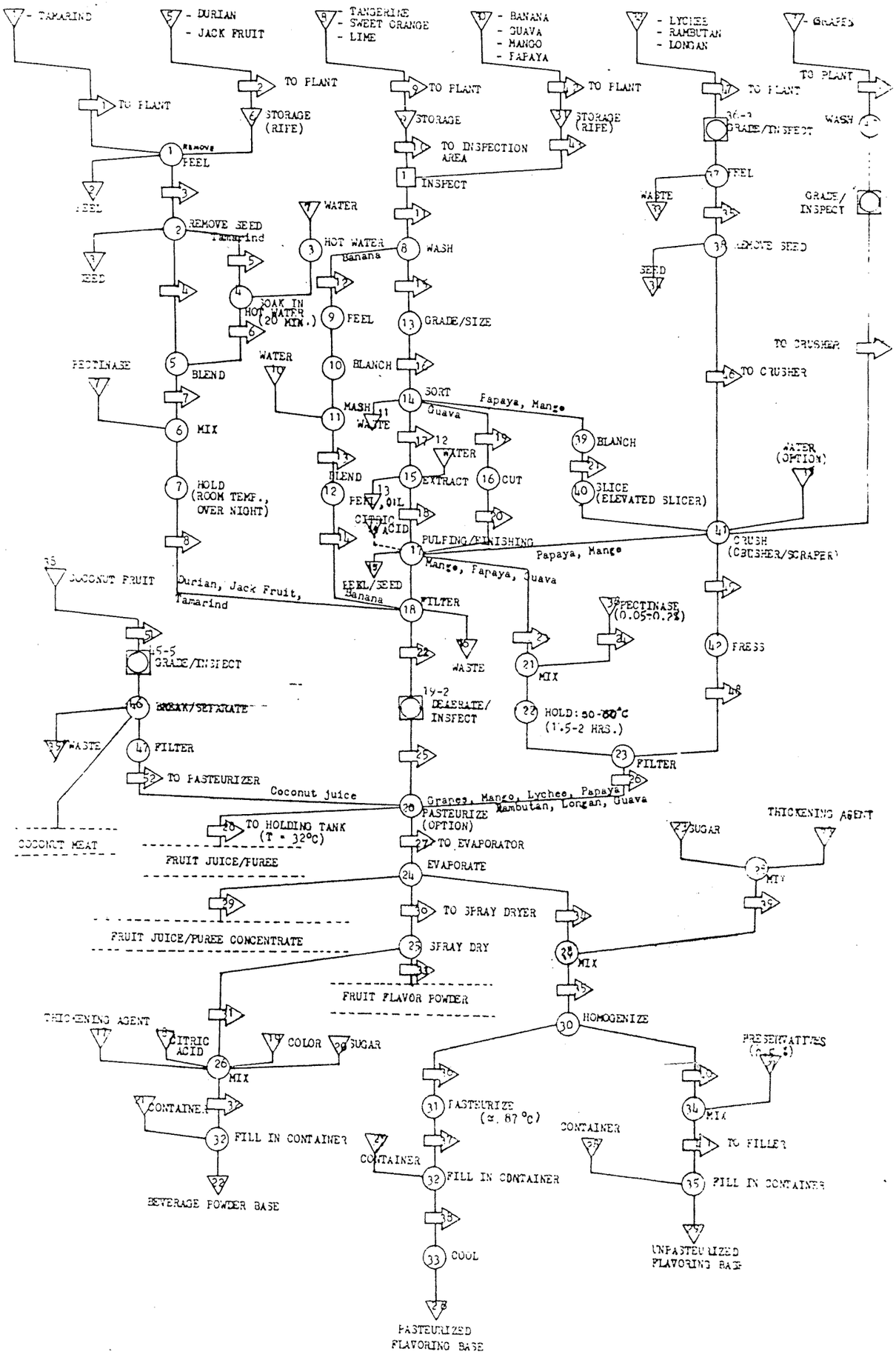


FIG 4.2

PROCESS FLOW CHART FOR FLAVORING BASES

PLANT 1

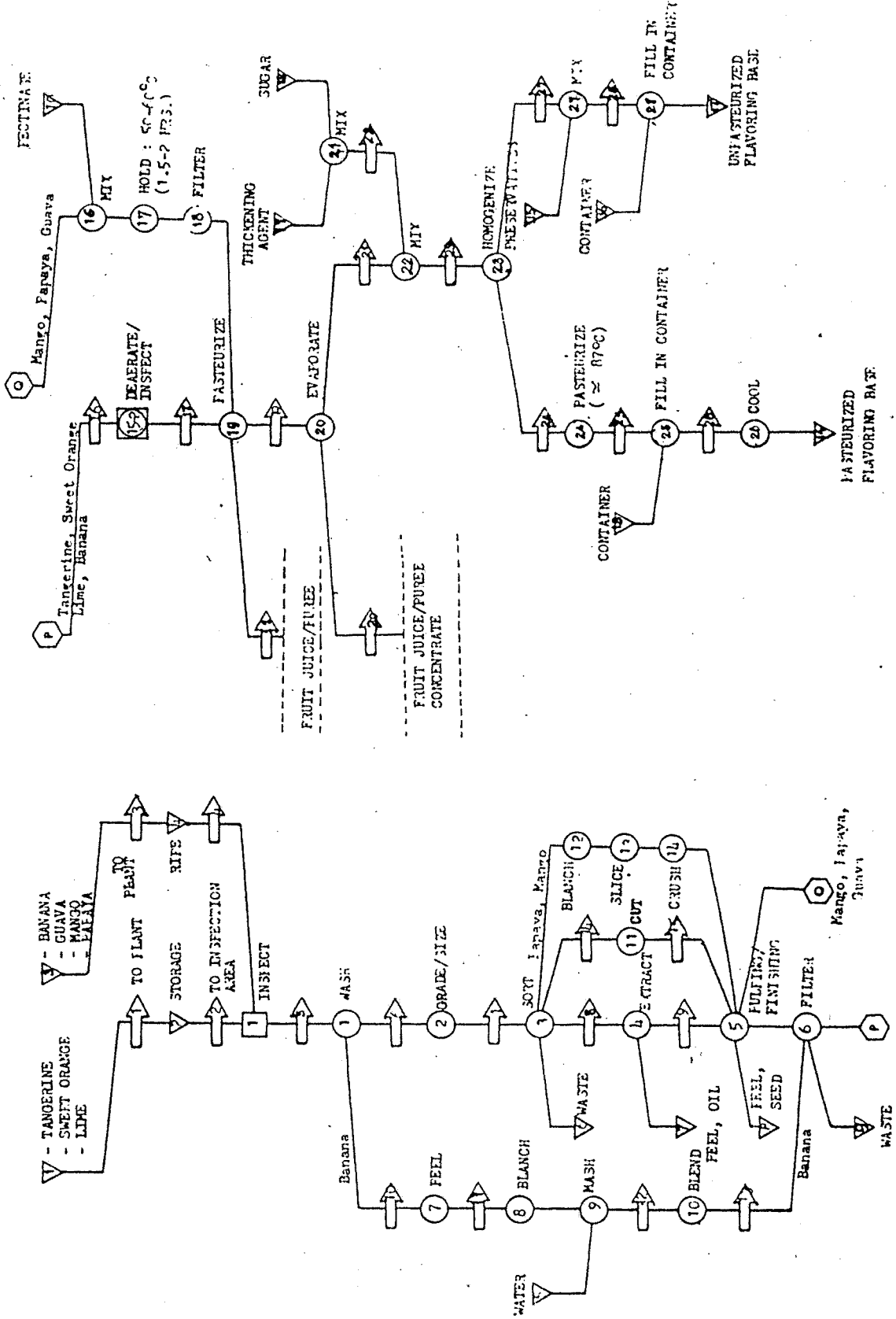
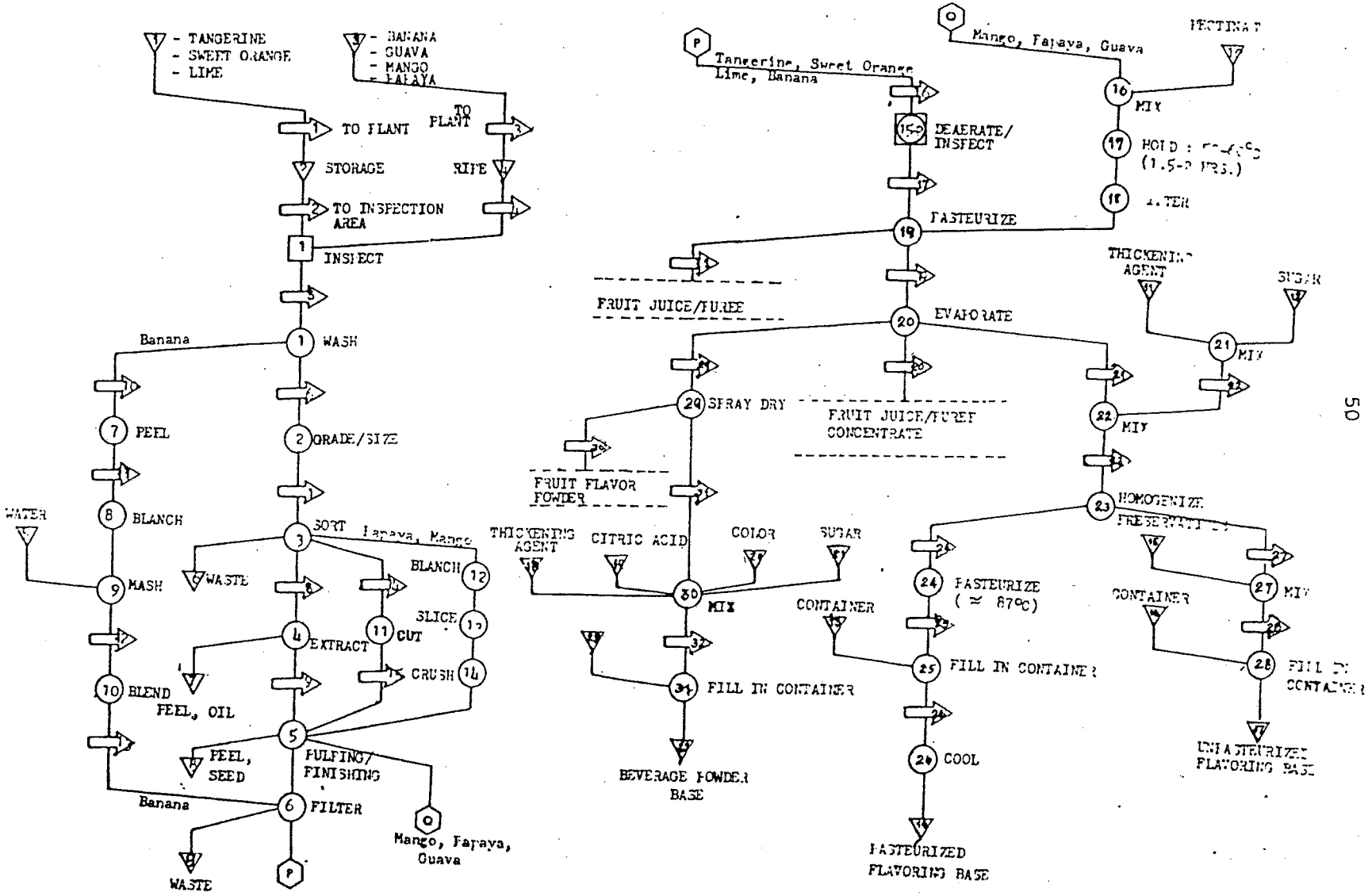


FIG 4.3

PROCESS FLOW CHART FOR FLAVORING BASES

PLANT 2



and sealed in containers such as cans and drums lined with a polyethylene bag.

The pasteurized flavouring base is obtained by pumping the homogenized concentrates through a pasteurizer which heats it to the pasteurizing temperature. The pasteurized base is then hot-filled and sealed in containers and cooled immediately before storing in the refrigerated room.

Beverage powder base is produced by spray drying the fruit juice concentrate. The dry powder is blended with other flavouring substances, thickening agent, fruit acids, ascorbic acid and other additives such as certified food grade colouring matter, tricalcium phosphate, sodium bicarbonate and anticaking agent to the desired formulation. The product is then packed in the container and kept in the dry storage warehouse.

Puree-based fruits are processed in the same processing line but use additional equipment such as blancher, slicer, crusher, pulper/finisher and filter according to each type of fruit in season. The puree may be treated with pectinase enzyme and filtered for clear base or without treatment of enzyme (this is aimed for ice-cream dressing or cake/pie fillings) followed by the concentration step through an evaporator and other processing steps as described in the flow chart.

4.3 Plant Layout, machinery and equipment

4.3.1 Plant layout

The procesing plant for tropical fruit flavouring bases requires an area of approximately 1 Rai (1,600 sq.m.) with the proposed layout illustrated in Fig. 4.4.

The processing area is estimated to be 300 sq.m. and raw material and finished product storage require around 300 sq.m. whereas the area for office and laboratory is approximately 60 sq.m.

In the area no. 40, an oxidation pond (17 x 8 sq.m.) is provided for waste water treatment at initial state. Under full capacity production, it may require additional systems such as aeration tank, settling tank and drying beds with control panel. However, the additional system will be decided based on the B.O.D. load after the full operation. Thus, the cost of additional system is not included in the economic analysis in this study.

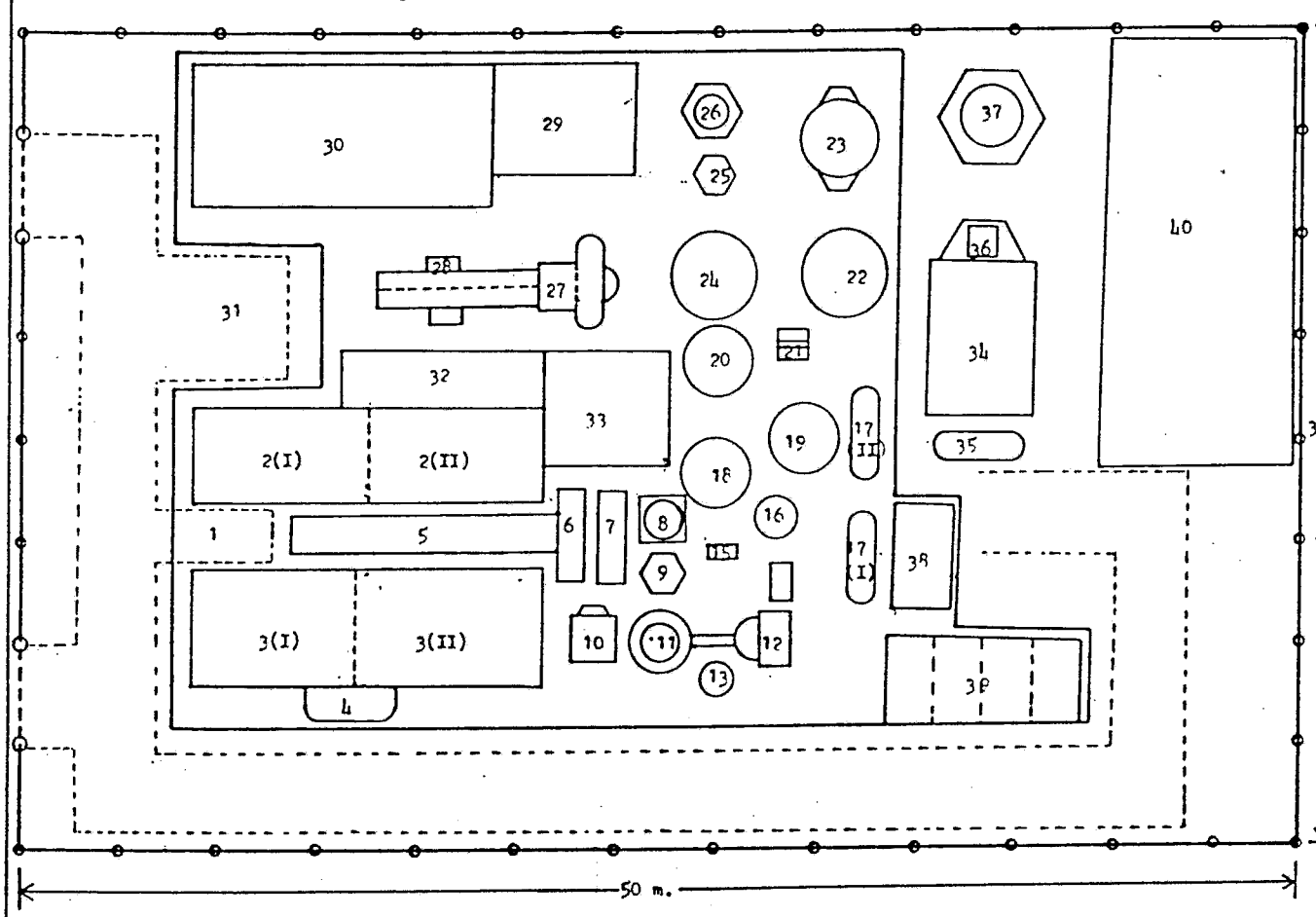
The production capacity for economy of scale is 24 tonnes of raw material per day. The total number of workers is estimated to be 30 persons.

4.3.2 Machinery and equipment

A list of machinery and equipment for plant 1 and 2 is shown in Table 4.1 and includes their estimated costs (price estimated from United Nations, 1969). Basic equipment is the same for plant 1 and plant 2 except three additional equipment, i.e. spray dryer, dry mixer, and filling, sealing and labelling unit for powder are required for plant 2.

FIG 4.4
PLANT LAYOUT

OF TROPICAL FRUIT FLAVORING BASE PLANT



DESCRIPTION :

1. UNLOADING PLATFORM
2. STORAGE ROOM I, II
3. COLD ROOM I, II
4. AIR COMPRESSOR
5. INSPECTION LINE
6. WASHER
7. GRADER
8. BLANCHER
9. JUICE EXTRACTOR
10. SLICER
11. CRUSHER OR BLENDER
12. PULPER/FINISHER
13. OIL EXTRACTOR
14. FILTER PRESS
15. CONTROL PANEL
16. DEAERATOR
17. PLATE HEAT EXCHANGER I,II
18. HOLDING TANK
19. BALANCE TANK
20. PREMIX TANK
21. CONTROL BOARD
22. EVAPORATOR
23. SPRAY DRYER
24. MIXING TANK
25. HOMOGENIZER
26. MIXER
27. FILLING/SEALING MACHINE
28. LABELLER
29. CONTAINER STORAGE
30. WAREHOUSE
31. LOADING PLATFORM
32. INGREDIENT STORAGE
33. LABORATORY ROOM
34. BOILER PLANT
35. FUEL TANK
36. STAND-BY POWER GENERATOR
37. WATER SUPPLY & TANK
38. WORKSHOP
39. TOILET
40. WASTE WATER TREATMENT

Table 4.1

List of machinery and equipment for tropical fruit flavouring base plant

Item No.	Description	Estimated cost (x 1,000 ₿)	
		Plant 1	Plant 2
1	Receiving line and bins	450	450
2	Conveyor, washer, grader	350	350
3	Juice extractor	1,200	1,200
4	Pulper/finisher	400	400
5	Filter press unit	100	100
6	Blender	100	100
7	Elevated slicer	50	50
8	Crusher/scraper	50	50
9	Blancher	50	50
10	Deaerator and vacuum pump	200	200
11	Plate type pasteurizer unit and control system (1 tonne/hr)	1,400	1,400
12	Liquid mixer	50	50
13	Evaporator unit	1,600	1,600
14	Spray dryer (1 tonne/hr)	-	6,000
15	Dry mixer (100 Kg./batch)	-	50
16	Filler, sealer and labeller for liquid	200	200
17	Homogenizer (1 tonne/hr)	800	800
18	Filler, sealer and labeller for powder	-	200
19	Pasteurizing unit for concentrates	1,000	1,000

(cont.)

Item No.	Description	Estimated cost (x 1,000 ₱)	
		Plant 1	Plant 2
20	Refrigeration unit	250	250
21	Boiler plant	900	900
22	Air compressor unit	50	50
23	Laboratory equipment & instruments	300	300
24	Centrifugal separator	400	400
25	Miscellaneous items such as piping, pumps, vessels, tanks and conveyors	800	800
		10,700	16,950

4.4 Quality Control Program

Quality control is one of the keys to quality flavouring based products and better process control. It starts from the control of purchased fruits. Here, the brix-to-acid ratio and solids content is determined prior to process. This step is necessary for the adjustment of the process to control the product according to the spefification.

Degree of ripeness, and physiological defects are inspected.

Colour measurement by means of colourimeter, or Munsell disk colour comparator, or colour standard models such as standard tiles, tubes, plastic models is done from lot-to-lot.

Viscosity measurement is checked for extracted juice at the concentration step and final products by means of a viscometer such as

the Brookfield synchroelectric viscometer.

There are other analysis programs for controlling other charateristics of the product including on-line measurement in the unit operation. The list of instruments is shown in Table 4.2. There are three types of analysis, namely physical, chemical and microbiological tests.

4.4.1 Physical test

Examples of analysis are : apparent viscosity, brix or soluble solids, colour measurement, screened pulp, suspended solids, total solids, stability test such as abuse test, gel test, accelerated cloud stability test, and clarification test.

Table 4.2

List of basic instruments and apparatus in the QC laboratory

Item No.	Instruments
1	Refractometer
2	pH meter
3	Brookfied viscometer
4	Hydrometer
5	Colorimeter
6	Spectrophotometer, visible and UV range
7	Laboratory centrifuge
8	Infra-red moisture tester
9	Scientific glass apparatus

(cont.)

Item No.	Instruments
10	Refrigerator
11	Incubator
12	Sterilizing oven
13	Autoclave
14	Colony counter
15	Microscope
16	Blender
17	Balance $\pm$ 0.001 and Scale $\pm$ 0.1

4.4.2 Chemical test

Examples of chemical analysis are Davis value test (for bitterness), total titratable acidity, defects examination, pectinesterase (PEU), recoverable oil such as bromide-bromate titration, modified Clavenger method, and ascorbic acid.

4.4.3 Microbiological test

Several analysis such as diacetyl value (for off-flavour test), plate count for bacteria, yeast and mold, direct microscopic count, filth, insect fragments, and fly eggs and larvae.

These analysis have to be modified for quickness and case of use in the processing plant. The analysis will assist in lerms of better process control to protect against undesirable off-flavour, discolouration and loss of flavour.

A recording and reporting system have to be set up to be used as a batch-to-batch control and for data base information.

In modern flavour production, the factory will require sophisticated analytical instruments such as gas chromatography (GC) mass spectrophotometry, x-ray diffraction, and high pressure liquid chromatography (HPLC) to identify flavour components, structure and characteristics of the products. At this stage, the plant will be developed in terms of high technology using flavour chemistry and other techniques so as to compete with other well-established foreign companies as well as to expand into synthetic products to meet the market demand.

4.5 Plant location

The processing plant would need to be located in the Central Region near fruit growing areas so as to provide an assured and adequate supply of raw material as well as access to public utilities and telecommunications.

According to the location of raw material supply in 6 regions as shown in Table 4.3, most of the fruit-growing areas are not far from Bangkok except those growing seville orange, longans and lychees which are in the Northern Region of Thailand. Therefore, the appropriate plant location should be within or nearby Bangkok. Another important factor is an efficient and adequate provision of public facilities, such as, water supply, electricity, waste-waster treatment, transportation and telecommunications, i.e. telex and telephone.

Therefore, providing the above conditions are adhered to the location for the plant could be any available industrial estate area

(see details in Appendix 14) which provides substantial privileges. The following estates are worth considering :

(a) Lard Krabang industrial estate and export processing zone with an area of about 1,323 rais.

(b) Bang Poo industrial estate on Sukhumvit Road, Samut Prakarn with an area of about 3,733 rais.

(c) Laem Chang industrial estate project close to the Eastern Sea board Project area (Laem Chabang), with an area of about 2,688 rais. This will be operational from 1988.

Table 4.3

Raw Material Sources

Fruits	Region						Location
	Central	North	South	East	West	North-East	
Tangerine	x						Bangkok (Amphur Rungsit), Phatum thani
Banana			x			x	Narathiwat, Nakhonsri-thamarat, Surat thani, Udon thani, Srisaket
Guava		x				x	Petchabun, Sukhothai, Udon thani, Nakhon-ratchasima
Papaya		x			x	x	Ratchaburi, Nakhonphatom Petchabun Nakhonratchasima
Mango		x				x	Srisaket, Surin, Nakhon-ratchasima, Burirum, Nakhonsawan
Lime			x		x		Nakhonsrithamarat, Petchaburi
Sweet orange (Seville orange)		x					Lampang, Phrae
Grapes					x		Ratchaburi, Nakhonphatom, Samutsakorn
Coconut					x		Nakhonphatom
Tamarind						x	Nakhonratchasima, Udon thani, Burirum
Durian				x			Chantha buri
Jack fruit		x				x	Sukhothai, Uttaradit, Udon thani
Rambutan				x			Chantha buri
Longan		x					Chiangmai, Lamphun
Lychee		x					Chiangrai, Chiangmai

Source : Fruit Plant Statistics of Thailand, Crop Year 1980/81

5. Economic and Financial Analysis

A pre-feasibility study is a tool that helps the project promoter to take a decision on the investment. To facilitate this decision, both investment and production costs have to be estimated, and the computation of the investment criteria has to be done. In terms of the contribution of the project to the national economy, value added, employment effect and foreign exchange earnings or savings have to be considered. So also does the project exchange rate and the effective rate of production. The first indicates how many units of local resources are required in order for the project to save one unit of foreign exchange while the second shows a ratio of the excess value-added obtainable due to the imposition of tariffs to value-added obtainable in free-trade conditions and is an indication of the international competitiveness of the project.

In this study, the project exchange rate and the effective rate of production can not be computed because of insufficient information on foreign exchange and local costs.

5.1 Investment costs

The information on investment and production costs is based on the citrus juices processing plant then adding the cost of required equipment such as blender mixer and spray dryer for the powdered project. Since the available data is for 1969, the estimation of the price in 1984 is done by multiplying the known price with the increasing rate of wholesale equipment and machinery price index in Thailand based on the available data. The investment costs (Table 5.4) are defined as the sum of fixed capital and net working capital. The details are shown in the following section.

5.1.1 Fixed capital [1/]

The plant has an input capacity of 4 tonnes of fruit per hour. Assuming 250 days of steady operation per year (1 shift per day), this capacity corresponds to approximately 8,000 tonnes of fruit per year.

- Machinery and equipment cost The cost of machinery and equipment which can produce fruit juice concentrates is estimated about 10,050,000 baht. This amount includes the insurance, freight and import taxes. To produce the flavouring bases the following equipments are also required :

Table 5.1

Additional equipment for fruit juice concentrate plant in order to produce the flavouring bases.

Equipment	Capacity	Price(baht)
Blender	500 kg./batch	50,000
Homogenizer	1 tonne/hour	800,000
Mixer	100 kg./batch	50,000
Spray dryer (only for the powdered product)	1 tonne/hour	6,000,000

It is unnecessary for the plant to buy the spray dryer if the powdered flavouring base are not produced. Then the total cost of machinery and equipment is approximately estimated as 16,950,000 baht.

1/ United Nations; Industrial Process of Citrus Fruit, Food Industry Studies No. 2, New York 1969.

- Land and development cost The land requirement of this factory is about 1 rai which costs approximately 100,000 baht and the cost cost of land development is about 50,000 baht, so the cost of land and development is approximately 150,000 baht.

- Building The following cost factors are assumed in Table 5.2

Table 5.2

The building cost of the plant

Building	Area (m^2)	Cost/m^2 (baht)	Total cost (baht)
Production	300	3,000	900,000
Storage	300	2,500	750,000
Office and laboratory	60	4,500	270,000

- Installation The installation cost is assumed as 20 percent of equipment cost which is about 3,390,000 baht.

- Contingencies This item is normally assumed as 10 percent of the total cost of all items mentioned above which is computed as 2,241,000 baht.

5,1,2 Working capital

Since most of the operating expenses are cash items that must be paid during a short period, while the returns from sales are expected to come in later, ample working capital is necessary. An amount equal to the approximate variable costs of production for 3 months was assumed

which is about 11,575,750 baht at full capacity. Normally, the amount of working capital required can be computed by adding up the amount of cash in hand, stock of raw materials, receivables, stock of finished goods and so on. These items should be assemed by the investor or anyone who studies the pre-feasibility study

Here, if the amount of variable costs of production paid for 3 months is assumed as the annual working capital requirement then the amount of required working capital in each year is related to the volume of the product. The details are presented in Table 5.3

Table 5.3

working capital in each year

	Volume of product (tonne)	Total working capital (1,000 baht)	Working capital requirements (1,000 baht)
year 1	750	8,818.31	8,818.31
year 2	900	10,581.98	1,763.67
year 3	1,000	11,757.75	1,195.77
year 4	1,000	11,757.75	0
and subsequent years			

Table 5.4

Initial investment costs

Item	Investment category	Cost (thousand baht)
1	Plant machinery and equipment	16,950
2	Land and development	150
3	Buildings	1,920
4	Installation	3,390
5	Contingencies	2,241
6	Total fixed capital	24,651
7	Working capital	11,758
8	Total investment cost	36,409

5.2 Project financing

Assuming that the total investment costs can not be borne by the proprieter, a bank loan is required to finance the project. The ratio for loan and equity determined for the bank is 70 : 30 and the interest rate is 14 percent per annum, while the repayment period is 10 years. (Table 5.5) The details of repayment on loan are shown in Appendix 3.

Table 5.5

Sources of total investment cost

Finance	Percent	Amount(1,000 baht)	Interest (1,000 baht)
Bank loan	70	25,480	3,567
Equity	30	10,929	-
Total	100	36,309	3,567

5.3 Production cost

Manufacturing costs consist of basically two major classifications: variable costs and fixed costs. Variable costs can be defined as those that vary in accordance with the level of production. This classification usually consists of the materials directly consumed in the production of the flavour base product, such as fruits, chemical, sugar, power, cans and cases. Fixed costs can be defined as those that remain constant and are not influenced by the level of production under normal operating conditions. This classification includes administrative salaries, maintenance, insurance and miscellaneous expenses such as telephone and telex, office supplies and stationery supply.

5.3.1 Variable costs

- Direct raw material Raw material consists of tropical fruits, enzyme pectinase, preservatives, thickening agent , sugar and so on.

From market analysis , It is indicated that the main fruit used in the process should be tangerines but because the peak season of the fruit does not extend throughout the year, thus coconut, mangoes, durians, papaya and guava should be produced to fill up the capacity and machine utilization. The cost of fruit is based on the price of tangerines and the average price of those fruits mentioned above. The output of the plant varies with the kinds of fruits used in the process, so the average yield of all kinds of fruits is use which approximately equals 0.125 per tonnes fruit.

- Labour We shall assume that the plant is idle during the off-season. Most of the labour requirement will be temporary workers, to whom salaries will be paid for actual working days only. Only four skilled

workers (including management) will be employed throughout the year. The details of labour cost which is sometimes defined as fixed cost, are presented in Table 5.6.

Table 5.6

The details of labour cost

Number	Cost per unit (baht)	Payroll/year (1,000 baht)
Unskilled (temporary) 20	64/day	320
Skilled (temporary) 5	80/day	100
Skilled (permament) 4	5,000/month	240
Total		660

The total variable cost is computed on the basis of one tonne of the product. The details of this are shown in Table 5.7

Table 5.7

Price and amount of raw material and labour used

Item	Amount used	Price/Unit (baht)	Total cost (baht)
Fruit	8 tonne	3,000	24,000
Enzyme pectinase	0.18 kg.	2,300	414
Sodium benzoate	5 kg.	30	150
Potassium sorbate	5 kg.	30	150
Thickening agent	2.5 kg.	1,200	3,000
Sugar	1 tonne	1,250	1,250
Food Color	0.07 kg.	450	31.5
Acidulant	10 kg.	60	600
No. 2 cans	2,222 unit	2.05	4,555
Cases	93 unit	24	2,232
Utilities and power	-	-	2,150
Labour	-	-	660
Total variable cost			39,192.50

5.3.2 Fixed costs

- Maintenance and supplies Provision must be made to supply necessary replacement of parts, repair and adjustment supplies, and other maintenance materials. Estimated annual cost is about 5 percent of total equipment cost which equals 847,500 baht.

- Miscellaneous For administrative purposes some expenses such as office supplies, laboratory supplies, telephone and telegraph, dues

and subscriptions, lights, water, and sewage may occur from time to time. These expenses are estimated at 10 percent of permament labour costs which equals 24,000 baht per annum.

- Sales and distribution costs The estimated cost of sales and distribution is about 1 % of sale revenue which equals 540,000 baht per annum.

- Interest As mentioned above, the capital requirement will be supplied from two sources, i.e. equity capital and bank loan. Interest rate has been worked out on a 10-year basis at 14 percent per annum on borrowed capital which is about 3,567,200 baht.

- Depreciation It is important for entrepreneurs to set aside a sufficient fund for the cost of depreciation. However, no one can predict accurately the useful life of a machine. In this study, a 10-year straight-line depreciation method is used. The calculations are given below :

Fixed investment less land	24,501,000 baht
Annual 10-year straight-line depreciation	2,450,100 baht

5.3.3 Unit cost and factory cost

For purpose of cash-flow analysis it is sufficient to calculate total costs. However, an attempt should also be made to calculate unit costs in consideration of the variable unit costs which is then deducted with expected profit from the anticipated unit sales price. The residual unit income is then multiplied by the output. The resulting figure should be checked to see if it is sufficient to accomodate total fixed (overhead) costs.

Normally, the start-up of production would not reach full capacity of the plant. Because of the lack of production skills the potential degree of market penetration will not be reached so it is assumed that during the first year only 75 % of the full capacity can be produced and for the second year the production is assumed at 90 % of the full capacity as a running-in period. Third and subsequent years the factory will produce at full capacity. The production cost is presented in Table 5.8.

Table 5.8

Unit Production-Cost Estimate

Year / Production Programme	Start-up		Full Capacity	
	1 (75 %)	2 (90 %)	3 (100 %)	4 (100 %)
Direct raw material	36,382.50	36,382.50	36,382.50	36,382.50
Direct labour	880	733	660	660
Utilities and power	2,150	2,150	2,150	2,150
Factory costs	39,412.50	39,265.50	39,192.50	39,192.50
Fixed (overhead) costs	1,162	968	871.50	871.50
Sales and distribution costs	540	540	540	540
Operating cost	41,145.50	40,773.50	40,604	40,604
Financial costs (interests)	4,756	3,964	3,567	3,567
Depreciation	3,267	2,722	2,450	2,450
Total production or manufacturing costs	49,168.50	47,459.50	46,621	46,621

5.4 Income of the project

5.4.1 Sale revenue

The output of the plant is only the flavouring bases. Even though there are by-products they are insignificant in the early stage because their value is not sufficient to change the criteria on which the decision to invest is made. Moreover, to produce by-products such as essential oil, additional costs of processing equipment have to be taken into account.

There are many kinds of fruits that can be used in producing flavouring bases. Hence, the price of each product varies with different types of fruits. For the purpose of financial analysis, an average price of all kind of flavouring base is considered and with the assumption that the ex-factory price is less than the average c.i.f price which approximately equals 43,000 baht per tonne. Then, the sales revenue can be computed by multiplying the amount produced with the sale price per tonne.

5.4.2 Profit and loss statement

This catagory shows the amount of projected profit and cost of the manufacturing year by year. The criteria of investment can be determined from this information. The details on profit and loss statement are presented in Appendix 4.

5.4.3 Cash flow

The cash inflow and outflow of the producer are shown in the cash flow analysis which consists of financial resource, equipment cost, operating cost, repayment on loan, corporate taxes, sales revenue and any item that is paid in cash. The cash flow of the plant with a

capacity of 4 tonnes of fruit per hour is shown in Appendix 5 and, from this Table the investment criteria such as break-even point, the pay-back period and the internal rate of return (IRR) can be computed.

5.4.4 Break-even point

Break-even point is the point at which sales revenues equal production costs. When expressing the break-even point in physical units produced, the basic assumption can be put into the following equations (annual data) :-

Sales value = production costs

Sales value = (sales volume) x (unit sales price)

Production costs = (fixed costs) + (variable unit costs) x (sales volume)

Thus, $px = vx + f$

where p = unit sales price, baht

x = production volume at break-even point, tonne

v = variable unit costs, baht

f = annual fixed costs, baht

then the break-even point volume is calculated as follow :

$$x = \frac{f}{p - v}$$

$$= \frac{7,548,800}{(54,000 - 38,532.50)} = 488$$

The quantity that the producers need to produce to recover the annual fixed cost equals 488 tonnes which accounts for 50 percent of the full capacity of the plant.

5.4.5 Pay-back period

The pay-back period is defined as the period required to recuperate the original investment from the profits earned by the project. Profit is defined as net profit after tax, including financial cost and depreciation. The profit calculation is shown in Table 5.9 as follows :

Table 5.9

Profit calculation

(thousand baht)

Item \ Year	1	2	3	4
Net profit	2,350.94	3,943.51	5,208.60	5,386.24
Interests	3,567.20	3,382.75	3,172.42	2,932.6
Depreciation	2,450.10	2,450.10	2,450.10	1,450.10
Profit	8,368.24	9,776.36	10,831.12	10,768.94

When calculating the pay-back period, the computation usually starts with the construction period during which the initial investments will be made. There two ways of calculating the pay-back period. First the cost of land and the working capital are included in the total investment cost. In the second method, the value of land and working capital are deducted from the total investment costs on the assumption that these values can be fully regained at the end of the project. The calculations of the pay-back period are shown in Table 5.10 the results of the second method are shown in the [illegible] packets.

Table 5.10

Pay-back period calculation

Period	Amount paid back (profit) (1,000 baht)	Balance of end of year (Investment-Profit) (1,000 baht)
Year 0 (construction period)	-	36,409 (24,551)
Year 1	8,368.24	28,040.76 (16,182.76)
Year 2	9,776.36	18,264.40 (6,406.40)
Year 3	10,831.12	7,433.28
Year 4	10,768.94	

The calcualtions indicate that the original investment costs will be recovered after 3.6 years. If the values of land working capital are deducted, the recovery will be 2.6 year.

5.4.6 Net present value

Based on a 14 % discount rate, the net present value is calculated to be 7,433,769 baht. This shows that the profitability of investment is above the cut-off discount rate thus the project can be considered acceptable.

5.4.7 Internal rate of reutrn

The internal rate of return (IRR) is the discount rate at which the percent value of cash inflows is equal to the present value of cash outflows, or it is the rate at which the present value of the receipts from the project is equal to the present value of the investment

assuming the net present value is zero.

The calculation is made by using the data from the cash-flow table. An estimated discount rate is then used to discount the net cash flow to the present value and the IRR is computed by the formula shown below.

$$i_r = i_1 + \frac{PV\ (i_2 - i_1)}{PV + NV}$$

where i_r = IRR, %

i_1 and i_2 = assumed low and high interest rate, respectively

PV = the net present value (positive) at the low discount rate of i_1 , baht.

NV = net present value at the high discount rate of i_2 , baht.

then the IRR of the project is

$$i_r = 21 + \frac{45.86\ (22-21)}{45.86 + 754.41} = 21.06\ \%$$

The details of computation are shown in Appendix 6

Normally, the IRR is used to determine the conditions of loan financing since it indicates the maximum interest rate that could be paid without creating any losses for the project proposal. If several alternatives are being compared, the project with the highest IRR should be selected assuming that IRR is greater than the interest rate of loan that the enterpreneur could get from the bank. Here, the computed IRR is equal to 21.06 percent which is greater than the interest rate (14 %). It indicates that the return on investment is greater than the cost of financing so this project is acceptable.

5.5 Sensitivity analysis

There are three main factors which might affect the profitability of the project :

(a) the sale price

(b) the price of raw material

(c) fixed capital

These are dealt with in the following sections.

5.5.1 The sale price decrease

For the purpose of revealing the sensitiveness of the prefitibility, it was assumed that the sale price decreases around 10 %.

5.5.2 The price of main raw material increase

Since, the main raw material of the project is fruit whose price fluctuates according to season as well as type, this study, assumes a 10 % increase in the price rate of fruit.

5.5.3 The increase in fixed capital

The estimation of fixed capital was made on the basis of data (in 1968) which requires adjusting. Thus, 10 % increase in investment cost is assumed.

Table 5.11

Sensitivity Analysis

(baht)

Variable	Based value (baht)	Increasing or decreasing	Results in criteria (NPV)	Percentage change
Sales price	54,000	48,600	- 9,689.67	- 30
Raw material cost	3,000	3,300	6,866.76	8
Fixed cost	16,950,000	18,645,000	6,355.88	14

The calculations for these changes are shown in Appendix 7-13

Table 5.11 shows the effect on the investment decision criteria by the 10 % change in the variables. With equal percentage change in the variables, investment criteria is most sensitive to change in sales price, followed by changes in fixed cost and then raw material cost.

5.6 Overall economic benefit

The contribution of this project to the national economy is now considered. Normally, the method of cost-benefit analysis is used for such a purpose but the criterion considered in this study the magnitude of value added to the product. This criterion for appraising the main impact of the project on the economy and a set of additional indices is used to measure certain implications of the investment, such as the effects on employment, foreign-exchange earnings, project exchange rate and the effective rate of protection. Other implications such as the implication for infrastructure, technical know-how and the environment

which cannot easily be measured in quantitative terms, should also be are not included here.

5.6.1 Net value added

Net value added generated by the project equals the value of output minus the value of current material inputs and services purchased from outside the project, and total investment outlays. Thus the net value added for a single year can be calculated from the following equation :

$$NVA = O - (MI + D)$$

where :

NVA = expected net value added generated by the project ;

O = expected value of output of the project which is usually the sales revenue

MI = expected value of current material inputs and services purchased from outside the project which is required to obtain the above output

D = annual depreciation value

Each year of net value added in this project is as follows :

Net value added for 1st year = 40,500 - (30,430.87 + 2,450.1)

= 7,619.03 thousand baht

Net value added for 2nd year = 9,453.15 thousand baht

Net value added for 3nd year = 10,945.9 thousand baht and subsequent years

However, the net value added for the project's whole economic life can be computed by adding up all the single years of net

value added which approximately equals 104,534,380 baht.

5.6.3 Employment effect

When evaluating an investment project from an employment point of view, its impact on both unskilled and skilled labour should be taken into account. Not only direct employment, but also indirect employment should be considered. Here, only direct employment is considered because the production volume of a plant (1,000 tonne of product per year) is not adequate for substituting all the imports and the required raw material is not substantial enough to increase the cultivated area of the fruits. Thus employment related to linkage activities are unlikely to increase. But when the plant is expanded and production is sufficient to increase indirect employment, the impact on indirect employment should then be considered.

As mentioned before, the manpower requirement of a plant for flavouring bases with a capacity of 1,000 tonnes of flavouring bases per year is approximately 20 unskilled workers and 9 skilled workers. The indicator of employment effect of the project may be computed as follows :

$$Z = \frac{Jo}{I}$$

where :

Z = total employment effect (for skilled and unskilled labour) per unit of investment

Jo = the total number of new job opportunities (excluding the foreign personnel)

I - total investment

Then, the total employment effect per unit of investment is equal to

$$Z = \frac{29}{36,409,000} = 0.0000008$$

Hence, 10,000,000 baht of total investment creates 8 new job opportunities. However, if indirect employment effect could be calculated, the number of new job opportunities should increase.

5.6.3 Foreign-exchange effect

Even although, import substitution is assumed for the project there are still import requirements of raw materials, machinery, purchase of know-how, royalty payment and so on to be taken into account. Therefore the net foreign-exchange saving should be considered by determining the net foreign-exchange flows of the project.

Assuming that only the machinery and some raw material are imported and the saving of foreign exchange is computed by multiplying the volume of production with the average c.i.f price of 58,145 baht/tonne, then, the net foreign-exchange flows for each year could be computed by the formula :

$$Fe = XP - (C_F + D_F)$$

where :

Fe = expected annual net foreign-exchange flows

X = volume of production per annum

P = Average c.i.f price

C_F = Annual cost of imported materials

D_F = Annual depreciation of imported machinery and equipment

Then, the annual year of foreign exchange flows is equal to

Year 1 = 750 x 58,145 - (4,065,375 + 1,695,000)

= 37,848,375 baht

Year 2 = 900 x 58,145 - (4,878,450 + 1,695,000)

= 45,757,050 baht

Year 3 = 1,000 x 58,145 - (5,420,500 + 1,695,000)

and subsequent years

= 51,029,500 baht

The annual foreign-exchange saving depends on the volume of production and the overall foreign-exchange position of the country for the life span of the project. This is computed by summing up each year of foreign-exchange saving and is approximately equal to 49 million bahts.

However, the foreign-exchange effect considered here is based on the assumption that the total volume of production is sold to the domestic market and only the machinery, equipment and some raw materials are imported. But in practice the product may be exported and some material for buildings and laboratory may be imported so the amount of 49 million bahts of foreign-exchange saving is rather high. The constraint of this study is that all of the cost and sales revenus are estimated values and the details of their composition is scarce. Thus, the detail of forign exchange or local currency can not be computed. The outcome of the result is rather a rough estimation and this should be borne in mind.

5.7 Conclusion and recommendations

The project can be considered acceptable if the sale price per tonne equals 54,000 baht and the sale volume equals the production volume with the amount of total investment cost equalling 36,409,000 baht.

The profitability of the project will be different if the sale price, raw material cost and fixed cost are changed. With 10 % change in these variables the investment criteria is most sensitive to changes in sale price. The result is that when the sale price equals to 48,600 baht per tonne, the project should not be accepted. On the other hand , a 10 % change in raw material cost and fixed cost would not alter the investment criteria. It means that even although there is a 10 % increase both in fixed cost and the main raw material price, the project is still sound and acceptable.

6. Conclusion and Recommendations

6.1 Conclusion

Tropical fruit flavouring based products have been selected for prefeasibility study with the agreement of BOI committee.and TISTR Working Research Team. The process and product line may be considered economically feasible if manufacturing costs are within a reasonable range and product quality is up to the standard level. The study could only be defined in relative terms since there was serious limitations in terms of time and budget. Thus, the analysis, especially the market study has been entirely based on secondary sources of information and data. The enquiry could not be readily pursued in this study within the time and budget frame. Economic and financial analysis are mainly based on the citrus juice processing plant in which the cost data is obtained from the 1969 average cost multiplied by certain factors to convert it into the present value. Some analysis is also based on the available present data.

Since certain data and information from secondary sources are not absolute and instead rather dependent upon various influencing factors, they therefore are subject to change. Thus, certain assumptions and estimates have been made to assist the analysis.

In this study, an economic-engineering model approach is used under the following criterion :

a) Seasonal effect, production per area and price of the raw material.

b) Market study based on secondary data from the customs department with hidden factors considering import substitution and potential for export. Define possible market channels and pricing.

c) Define level of possible technology and the ratio of imported machinery to total machinery cost.

d) Assume plant capacity related to raw material and the economy-of-scale considering one selected technology only. But liquid based production line alone is compared to the liquid base and additional powder base production line.

e) Estimate the physical inputs of labour, equipment, land, building and utilities for the production requirement as well as waste water treatment facilities.

f) Define minimum investment needed for equipment and plant. Specify rates of depreciation, interest , maintenance, taxes, and insurance. Arrange the possible plant layout. Assume a reasonable and logical location for the plant including laboratory's minimum requirement for quality control program.

g) Specify operating conditions of the plant, labour shifts and the length of operating seasons.

h) Determine investment cost, profit, financing aspects, production cost, profit/loss statement and sensitivity effect.

The study may be concluded in the following outlines :

Production description - The tropical fruit flavouring base is derived from natural tropical fruit juice or puree or nectar into concentrated base both in liquid and powder forms by blending with

certain food additives and preservatives to meet the specified requirement of the customs. They may be packed in bulk containers such as drums, barrels and large cans or small containers. The base can be supplied to beverage producers for making aseptically packaged beverages, flavoured fruit drinks, UHT fruit juice product, ice-cream manufacturers, true fruit WONFR, etc.

Plant capacity - The study indicates around 8,000 to 10,000 tonnes of fruits per year which could be processed into liquid base of around 800 to 1,000 tonnes per year based on individual type and variety of fruits.

Marketing - Natural flavouring bases are generally imported by the food and beverage manufacturers as raw material. This amounts to about 100 tonnes per year. The well established joint-ventured or sub-licensed beverage producers import mostly from their mother companies and strictly control programs under their brand names. However, the growth rate of domestic demand is increasing in Thailand. And, these manufacturers could initiate new carbonated tropical fruit beverages with the possible permission of their mother companies providing that it will not be the same type as is already appearing in the product under licence. Therefore, it is envisaged that there may be a potential demand in the near future for tropical flavouring bases. Although export market may not be as bright as it should be due to strong competition from well-established and large foreign firms with regard to quality and cost, nevertheless, most of the world-wide brand named products are not made from tropical fruits. In this case, exotic tropical fruits flavouring bases may have an edge to be counter introduced into European countries,

Japan and probably in U.S.A. as well as Asian countries where food habits are quite similar.

As shown in the list of manufacturers (Appendix 2) especially those in the United States, it may be interpreted that there would be a potential for export. From the information obtained Food Materials Corporation in U.S.A. has just started to launch their new natural tropical fruit flavour product while other giant flavour manufacturers, such as Firmenich Inc., Fries and Fries, Fritzche Dodge and Olcott Inc., Givaudan, Globe Extracts Inc., Naarden International and Internal Flavours and Fragrances Inc., are geared to produce natural flavours (anon. 1984). However, due to insufficient data and information, a further market study from foreign information sources would be necessary in order to assure the potential.

Raw materials and supplies - Fruits are abundant in Thailand. Certain types of fruits such as tangerines and rambutans are surplus in their peak season. There are also many varieties which are under-utilized. It would be of great benefit to the country to process these into more value-added products.

The production plan should be based on fruits which are available all-year-round such as tangerines, papaya and guava with side-line production plan for in-coming seasonal fruits to fill in the plant's capacity.

Most of the fruits are found within the Central Region, especially near-by Bangkok but some fruits are from the North.

The trend in price-increase per year has been steady. Nonetheless, it is considered to have minimal effect. However, there

are some constraints, namely poor post-harvesting handling and transportation which affect the product quality, and price fluctuation during the season. With regard to the second constraint, purchasing under contract can not be made due to the nature of the local trade channel. A fruit flavouring bases plant would have to establish the best method to obtain a fruit supply at the least fluctuating price.

Technology, processing machinery, equipment and instruments

Technology level - Technology described in this study is defined as medium level. However, it can spin off to a higher level of technology to produce more value added products, and perhaps heat stable flavour, synthetic flavour and microencapsulated flavour to meet any demand.

Process - Processing steps are mainly the same except enzyme treatment which is used with certain fruits such as mangoes, papaya and guava. The process of plant 2 producing liquid base and powder base is compared against the process of plant 1 where only pasteurized and unpasteurized liquid bases are produced.

Plant layout - The required area is approximately 1 rai (1,600 square meter) in total of which about 300 sq.m. is for processing area, another 300 sq.m. is for storage facilities and ca. 60 sq.m. is for laboratory and office. The area of an oxidation pond is at least 140 sq.m.

Machinery and equipment - The main processing machinery is similar to fruit juice production line with some additional equipment. The estimated machinery investment for plant 1 is about 10,700,000 Baht

and plant 2 is about 16,950,000 Baht. Imported machinery is around 35-40 percent of total machinery.

Quality control - The QC program consists of 3 major analyses, namely physical test, chemical test and microbiological test. Modified official methods are normally used for rapid testing in the unit operations.

Location - The plant would need to be located in the Central Region, especially near tangerine growing areas, to obtain an assured and adequate supply as well as public utilities and telecommunications. The suggested locations are industrial estate areas. (e.g. at Lard Krabang, Bang Poo, and Laem Chabang)

Economic and Financial Analysis

The study has been determined and based on assumptions and available data as follows :

- plant input capacity = 4 tonnes of fruits per hour or

  annual input capacity = 8,000 tonnes of fruits/year.
- 250 working days per year
- 1 shift/day operation
- 30 workers
- output capacity at 1,000 tonnes of products/year

Investment parameters - Investment includes machinery and equipment, land development, buildings, installation, etc. for fixed capital cost of 24,651,000 Baht and working capital is estimated to be 11,758,000 Baht. Thus, the total capital investment required is 36,409,000 Baht.

Project financing - 70 % from bank loan and 30 % equity, assumed 14 % per annum for interest rate and with repayment period of 10 years.

However, the project may be applied for B.O.I promotion privilege and financing from IFCT (Industrial Finance Corporation of Thailand) with fixed asset, such as land properties for the guarantee. The loan may have a good grace period including other privileges and benefits.

Production - The assumed production program runs at 75 %, 90 % and 100 % full capacity from the first year and projection is up to 10 years.

A profit and loss statement and cash flow analysis have been made.

Break even point is calculated at the production capacity required to recover the annual fixed cost which is equal to 488 tonnes or approximately 50 % of full capacity of the plant.

The internal rate of return (IRR) for the project is at 21 % which is considered to be acceptable. However, due to the previously, mentioned constraints it could not be concluded that this project is better than other projects without comparing the IRR's of those projects.

Sensitivity analysis indicates that 10 % change in the variables would affect investment criteria.

Net value added - the project's net value added for its whole economic life is approximately 104,000,000 Baht.

The project will be acceptable if the sale price of the product is 54,000 Baht/tonne with the sale volume equal to production

volume. This is for the total investment cost which equals 36,409,000 Baht. If the sale price drops to 48,600 Baht/tonne, the project should be held or dropped since the sensitivity change has been determined at 10 %.

From the marketing study it has been found that the local market is somewhat limited, accounting for only about 1 % - 6 % of the appropriate production capacity. The business activity is therefore centered on the foreign market where the competition is high particularly with respect to quality. It is admitted that at the available technological level in Thailand the production standard is not up to that of some foreign countries. But with regard to price competition, there should be no doubt that Thailand could manufacture the product at a cost lower than the C.I.F price.

The quality of raw materials would play an important role in determining the quality of the product and ought to be taken into account.

As, the trade is centered on the foreign market, marketing unstability is forseen, especially for new producers who may find it hard to enter the market. And at the some time, they need the full support from the government.

With regard to the domestic market, the beverage industry is normally a major purchaser of the product, but with ties and limitations; that is to say, most beverage companies using foreign trade brands have to buy the flavouring bases from their originating companies. If diversification could be made for these firms to use the locally-produced natural flavouring bases, the local demand for the product would increase.

There is price competition with the synthetic flavouring bases. From the research study, it has been discovered that though high import duty is imposed on the synthetic flavouring bases, their local sale price is still less than that of the natural flavouring bases by almost 100 %. Users therefore prefer the synthetic flavour to to the natural one.

6.2 Recommendations

Having set out the conclusions, including a consideration of the aforementioned problems, the Working Team hereby wishes to propose the following remedies and recommendations :

1. In respect of the product quality, the entry into the overseas market should be canned out in the form of a joint venture with major producing countries such as the U.S.A and Australia. This would enable the Thais to learn about their advanced technology so that a product of high quality can be produced to compete with other foreign countries.

It is noteworthy that the joint venture should focus on the production of tropical fruit flavouring bases as those major manufacturers lack the tropical fruit sources. This is a good way to attract the joint investment.

2. For the raw materials, producers ought to buy them directly from farms, so that the raw material control and supervision could be made from the start of the harvest, particulary with regard to the maturity and ripeness of fruits which play a main factor in determining the quality of the product.

3. With reference to marketing abroad, the government should help by negotiating with foreign countries on external trade policy in favour of Thailand, revising export duty imposition purposely for price competition with other countries, and providing marketing information on this industry to the producers. Apart from this, a joint-venture operation could also help reduce many marketing problems.

4. With respect to the home market, consideration should be given to persuading producers of food and beverages and of products using flavouring bases as raw material to switch to or expand their use of the locally-made product. With regard to the companies using foreign trade brands, they should be encouraged as well as motivated to produce various products other than those required to use the brands as such, for example, they could use other trade marks while resorting to the available production technology and using the locally-produced flavouring bases as raw material. This way would partly help increase demand for the product.

5. Concerning price competition with the synthetic flavouring bases, manufacturers of the natural flavouring bases might make a good use of media and advertisment and at the some time reduce their production cost. The government should also help by presinbing promotion measures for instance by tax, and eg. either income or business tax, on producers using the natural flavouring bases as raw material only.

6. With respect to the flavouring bases industry, rights and privileges for investment granted by government agencies, such as the Board of Investment and the Industrial Finance Corporation of Thailand (IFCT), should cover the importation of machinery and scientific apparatus. They should also cover tax payment rates and loans with low interest together with a longer period of grace for investment.

Appendix 1

Capital of Newly Registered Companies and Partnerships Classified by Types of Business in Thailand

(thousands of baht)

Line	Item	1981							1982						
		Limited Companies			Ltd. Partnerships		Reg. Ord. Partnerships		Limited Companies			Ltd. Partnerships		Reg. Ord. Partnerships	
		Number	Authorized capital	Paid-up capital	Number	Capital	Number	Capital	Number	Authorized capital	Paid-up capital	Number	Paid-up capital	Number	capital
1	Textiles	28	88,050	35,788	24	39,805	-	-	52	132,600	84,750	30	15,270	-	-
2	Wearing apparel	45	67,814	35,489	41	10,700	1	1,000	58	114,490	54,898	66	21,240	-	-
3	Leather & leather products	8	47,700	13,450	5	2,650	-	-	18	36,900	20,250	12	6,850	1	200
4	Wood & wood products	36	104,200	40,050	38	14,710	-	-	52	116,600	91,075	59	58,300	-	-
5	Paper & paper products	5	6,000	1,500	8	2,000	-	-	14	39,100	28,700	11	5,860	-	-
6	Printing & Publishing	51	47,160	17,567	64	15,770	1	30	52	101,350	72,775	76	39,520	1	11,710
7	Chemical	21	130,900	33,825	7	1,860	-	-	28	165,100	101,050	12	9,780	-	-
8	Chemical products	49	106,305	38,995	30	4,610	1	137	37	118,990	54,372	23	7,200	-	-
9	Rubber & rubber products	14	55,010	40,578	11	3,645	-	-	14	41,000	28,450	10	5,150	-	-
10	Plastic products	26	58,900	23,025	28	15,600	-	-	38	72,250	53,450	24	21,050	-	-
11	Non-metallic mineral products	18	66,500	24,980	24	11,813	-	-	24	75,100	43,975	33	37,890	-	-
12	Basic metal industries	10	33,500	17,375	18	5,130	-	-	16	23,400	15,138	36	14,150	1	1,200
13	Fabricate metal products	28	135,400	59,617	38	12,240	-	-	52	163,718	95,941	55	31,220	-	-
14	Machinery & equipment	25	42,400	14,175	19	6,710	-	-	24	53,900	28,550	19	15,270	-	-
15	Electrical machinery	30	73,100	25,225	31	10,873	-	-	51	171,400	106,525	28	14,750	-	-
16	Vehicles & transport equipment	23	84,500	26,975	22	5,175	1	30	44	106,850	80,500	24	14,701	-	-
17	Other manufacturing	25	52,000	20,700	21	8,080	-	-	42	115,818	72,592	23	19,180	-	-

Source : Department of Commercial Registration

Appendix 2

List of manufacturers and users

2.a List of importers in Thailand

- Chaichana Marketing Ltd., Part.

  447/449 Chawkambop Road, Bangkok

- Choice Food (Thailand) Ltd.

  Soi Kluey Nam Tai, Rama IV Road, Bangkok

- Continental Food Co., Ltd.

  414 Sukumvit 63 Rd., Klong-ton, Prakhanon, Bangkok

- Daily Foods Co., Ltd.

  769 Sukumvit Rd., Bangkok

- Dejo Grocery Ltd., Part

  2453 New Petchaburi Rd., Bangkok

- Dumex Limited

  829/1 Jareonnakorn Rd., Klongtuonsai, Klongsarn,Bangkok

- Eng Seng Kee Co., Ltd.

  501/10 Maiterchit Road, Bangkok

- Eng Thai Bottling Limited Partnership

  113/1 Sukumvit 55 Rd., Prakanong, Bangkok

- Five Store Ltd., Partnership

  1333 Opp. Bangsue Police Station, Phahonyothin Road,

  Bangkok

- Foremost Dairies Co., Ltd.

  99/30 Chaeng Wattana Road, Bangkhen, P.O. Box 1066,

  Bangkok

- G.M.C. World Perfumery Ltd.

  17/5-8 Arunamarin Road, Bangkoknoi, Bangkok

- Hang Huat Company

  41-45 Chakrawad Road, Wat Tuke, Bangkok

- Hengnam Trading Ltd., Part;

  62-64 Siphya Road, Bangkok

- International Cosmetic Co.

  757/10 Soi Pradoo, Sathupradit Rd., Yanawa, Bangkok

- Kiang Hua Limited Partnership

  411/8-9 Rama IV Rd., Bangkok

- Phamachem Co., Ltd.

  98 Yotha Road, Taladnoi, Bangkok

- Rama Food Products Co., Ltd.

  59 Sukumvit 42 Rd., Soi Saengchan, Prakanong, Bangkok

- Siam Agro-industry (Pineapple) Co.,

  10th Flr; Boonmitr Bldg., 138 Silom Road, Bangkok

- Siam Multra L.P.

  76/6 Linchi Road, Bangkok

- The Thai Dairy Industry Co., Ltd.

  197/1 Silom Road, Bangrak, Bangkok

- Thai Jsekyo Co., Ltd.

  690 Chokchai Bldg, Sukumvit Rd., Bangkok

- Thai President Foods Co., Ltd.

  2154/1 TF Bldg., New Petchaburi Rd., Bangkok

- United Dairy Foods Co., Ltd.

  3059/1-3 Sukumvit Road, Prakanong, Bangkok

2.b List of Producers or Exporters Agents

- Acmal Trading Limited

  Acmal House, 566 ST Kilda Rd., Melbourne, Australia

- Barnett & Foster Limited Deming Estate

  Wellingborough, Northants NN 82, U.K.

- Bell Flavour & Fragrances Inc.

  500 Academy Dr., Northbrook, IL 60062, U.S.A.

- Borden Inc., Industrial Food Products

  180 E. Broad St., Suite 1701, Columbus, OH 43215, U.S.A.

- Bowley/Krin-Ko Div., Blanke Baer

  1572 Labin Williams Rd., Fenton, MU 63026, U.S.A.

- Bush Boalue Allen

  7 Mercedes Dr., Montvale, NJ 07645, U.S.A.

- Carmi Flavour & Fragances

  613 S. Imperial St., Los Angeles, CA 90021

- China National Native Product & Animal By-products

  Import & Export Corporation

- Citrosuco Paulista S.A.

  Rua Joao Pessao, 305 P.O. Box 1 15990-Matao

  Saopaulo, Brazil

- Continental Flavours

  2951 E. Enterprise St., Brea, CA 92621, U.S.A.

- Co-Ro Food A/S

  P.O. Box 31, 1 Ellekaer OK., 3600 Frederikssund, Denmark

- Cosco International Inc.

  540 Frontage Rd., Northfield, Illinois 60093, U.S.A.

- Dominion Products Inc.

  882 Third Avenue, Brooklyn, N.Y 11232, U.S.A.

- Firmenich & Co.

  Hayes Rd., Southall, Middx UB 2 5NN, U.K.

- Flavour Resources, Div. of Biddle Sawyer Corp

  2 Penn Plaza, New York, NY 10121, U.S.A.

- Florasynth, Inc.

  410 E 62 nd St, New York, NY 10021, U.S.A.

- Fontarome S.A.

  P.O. Box 104-1217, Meyrin2, Geneve, Switzerland

- Fontarome Zone Industriaelle de Meyrin-lase Postale

  P.O. Box 104-1217, Meyrin 2, Geneve, Switzerland

- Food Materials Corp

  2711 W. Irving Park Rd., Chicago, IL 60618, U.S.A.

- Fook On Tai

  12 Ko Shing Street, Hong Kong

- Foote & Jenlus

  1420 Crestmont Ave, Camden, NJ. 08103, U.S.A.

- Fraser & Neave (S) PTE Ltd.

  475 River Valley Rd., Singapore 1024

- Fries & Fries

  Div. of Mallinekrodt, Inc., 110 E. 70th St., Cincinnati OH 45216, U.S.A.

- Fritzche, Dodge & Olcott, Inc.

  76 Ninth Ave, New York, NY 10011, U.S.A.

- General Foods Philippines, Inc., Severina Industrial

  Subo KM 16 South Super Highway, West Paranaque, Metro Manila Philippines

- Givaudan Corp.

  Flavour Div., 100 Delawanna Ave., Clifton, NJ 07014, U.S.A.

- Globe Extracts, Company

  10 Davids Dr., Hauppauge, NY 11787, U.S.A.

- Haarmann & Reimer Corp.

  Box 175, Springfield, NJ 07081, U.S.A.

- Henry Broch & Co.

  9933 Lawler Ave., Skokie, IL 60077, U.S.A.

- Hercules Incorporated, PFW Div.

  33 Sprague Ave., Middletown, NY 10940, U.S.A.

- H. Kohnstanun & Co. Inc., Flavour Div.

  161 Avenue of the Americas, New York, NY 10013, U.S.A.

- Ingredient Technology Corp., Flavour & Fragrance Div.

  7501 E. Mc. Nichole, Detroit, MI 48234, U.S.A.

- International Dairy Engineering Co. of ASIA Inc.

  Commercial Invoice & Packing List

- International Flavour & Fragrances, Flavour Div.

  521 West 57th St., New York, NY 10019, U.S.A.

- International Multifoods Corporation

  P.O. Box 2942, Minneapolis, Minnesota 55402, U.S.A.

- Isekyu Co., Ltd.

  Nagoya, Japan

- Jay Food Processing, Inc.

  640 Montrose Ave., South Plainfield, NJ 07080, U.S.A.

- K.K. Typhone

  RM 604 Takeda Bldg. No. 11-6, 2-Chome, Ginza, Chuo-ku, Tokyo, Japan

- Lawrence Flavours & Fragrances

  P.O. Box 4308 Melbourne 3001, Victoria, Australia

- Lidano

  P.O. Box 59, DK-4400 Kalumdsory, Denmark

- Mauri Foods, Flavours Group

  Columbia Lane, Homlbush 2140 (02), Australia

- McCormick Company Incorporated

  Baltimore, MD. 21202, U.S.A.

- Naardern Int'l

  10 Painters Mill Rd., Owings Mells, MD 21117, U.S.A.

- Nat'l Starch & Chemical Ccrp.

  Ingredients Group, 1090 Pratt, Elk Grove Village, IL 60007, U.S.A.

- Ong Boon Seng (PTE) Ltd.

  P.O. Box 1994, Singapore

- Otten Flavours

  1234 Hamilton St., Philadelphia, PA 19123, U.S.A.

- Penta Mfg. Corp.

  P.O.B. 1452, West Caldwell, NJ 07007, U.S.A.

- P.J. Rhodes & Co.

  Export-import World Trade Center San-Francisco, California 94111, U.S.A.

- Stange Co., International Division

  342 North Western Avenue, Chicago, Illinois 60612, U.S.A.

- Sunburst Foods

  P.O. Box 13, Smithfield, NSW 2164, Australia

- Suncrest Company of Canada

  37 Enterprise Rd., Ressdale 603, Ontario, Canada

- Takasago Perfumery Co., Ltd. 19-22

  3-Chome Takanawa, Minato-ku, Tokyo, Japan

- The Illes Co.

  ~~Box 35412, Dallas, TX 75235, U.S.A.~~

- The R.T. French Company

  P.O. Box 23450 Rochester, New York, NX 14692, U.S.A.

- Ungerer & Co.

  4 Bridge water Ln., Box U, Lincoln Park, NJ 07035, U.S.A.

- Universal Flavours

  5600 W. Raymond St., Indianapolis, IN 46241, U.S.A.

- Virginia Dare Extract Co., Inc.

  882 Third Avenue, Brooklyn, N.Y 11232, U.S.A.

- Vitex R & H Div., Carlin Foods Corp.

  1850 Craig Park Ct., St. Louis, MO 63141, U.S.A.

- Wimco Ltd., Indian Mercantile Chambers

  R. Kamani Marg., Ballard Estate, Bombay 400 038, India

2.c List of manufacturers in Thailand

- Continental Food Co., Ltd.

- SRV Manufacturing Co., Ltd.

  Sukumvit 36 Road, Prakanong, Bangkok

- United Daily Foods

  958/14 Bangna-Trad Highway

2.d List of Trade Associations related to flavouring base products

- California Fruit Exchange

  1400 10th, Street, Sacramento 14, California, U.S.A.

- Carbonated Beverage Institute

  230 Park Ave. Suite 1600 New York, NY 1016, U.S.A.

  Tel. 212/968-0280 Elaine Welsh

- Flavour & Extract Mfrs. Assn.

  900 17th. St., NW. Washington, DC. 20006, U.S.A.

  Tel. 202/293-5800 Daniel Thompson

- National Assn. of Fruits, Flavours - Syrups, Inc.

  3000 Marcus Ave. P.O. Box 337, Lake Success, NY 11042,

  U.S.A. Tel. 516/328-3120 Walter B. Jacofsen

- National Soft Drink Assn.

  1101 16th. St., NW Washington, D.C. 20036, U.S.A.

  Tel. 202/463-6732 Dwight C. Reed

- Society of Soft Drink Technologists

  1101 16th. St., NW Washington, D.C. 20036, U.S.A.

  Tel. 202/463-6756 Harry Korab

- Sugar Users Group

  888 16th. St., NW Washington, D.C. 20006, U.S.A.

  Tel. 202/223-3225

- Citrus & Allied Essence, Ltd.

  65 S. Tyson Ave., Floral Posk, NY 11001, U.S.A.

  Tel. 212/343-0031

Appendix 3

Loan repayment schedule

Unit : Baht

Year	Principal outstanding (Begining of year) (1)	Annual Repayment (2)	Interest 14 % (3)	Principal repayment (4) = (2) - (3)	Principal balance (End of year) (5) = (1) - (4)
1	25,480,000	4,884,872.70	3,567,200.00	1,317,672.70	24,162,327.30
2	24,162,327.30	4,884,872.70	3,382,725.82	1,502,146.85	22,660,180.42
3	22,660,180.42	4,884,872.70	3,172,425.26	1,712,447.44	20,947,732.98
4	20,947,732.98	4,884,872.70	2,932,682.62	1,952,190.08	18,995,542.29
5	18,995,542.29	4,884,872.70	2,659,376.01	2,225,496.69	16,770,045.60
6	16,770,045.60	4,884,872.70	2,347,806.38	2,537,066.32	14,232,979.28
7	14,232,979.28	4,884,872.70	1,992,617.10	2,892,255.60	11,340,723.68
8	11,340,723.68	4,884,872.70	1,587,701.31	3,297,701.38	8,043,552.29
9	8,043,552.29	4,884,872.70	1,126,097.32	3,758,775.38	4,284,776.91
10	4,284,776.91	4,884,872.70	599,868.77	4,285,003.93	- 227.02

Appendix 4

Projected Profit and Loss Statement

(thousand baht)

Item \ Year	1	2	3	4	5	6	7	8	9	10
Production in tonne	750	900	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Gross sales (54,000 baht/tonne)	40,500	48,600	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
Sales distribution costs (1 % of gross sales)	405	486	540	540	540	540	540	540	540	540
Net sales	40,095	48,114	53,460	53,460	53,460	53,460	53,460	53,460	53,460	53,460
Manufacturing cost										
Variable cost at 38,532.50 baht/tonne	28,899.37	34,679.25	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5
Fixed costs (including labour cost)	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5
Operating profits	9,664.13	11,903.25	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00
Less										
Interest	3,567.20	3,382.75	3,172.42	2,932.68	2,659.38	2,347.81	1,992.62	1,587.70	1,126.10	599.87
Depreciation	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1
Net profit before taxes	3,616.83	6,066.93	7,773.48	8,013.22	8,286.52	8,598.09	8,953.28	9,358.20	9,819.80	10,346.03
Taxes (35 % of profit)	1,265.89	2,123.42	2,720.71	2,804.62	2,900.28	3,009.33	3,133.64	3,275.37	3,436.93	3,621.11
Net profit after taxes	2,350.94	3,943.51	5,052.77	5,208.60	5,386.24	5,588.76	5,819.64	6,082.83	6,382.87	6,724.92

Appendix 5

Cash-flow of project

thousand baht

Item \ Year	0	1	2	3	4	5	6	7	8	9	10
A. Cash inflow											
1. Loan	25,480	-	-	-	-	-	-	-	-	-	-
2. Operating profit	-	9,664.13	11,903.25	13,396	13,396	13,396	13,396	13,396	13,396	13,396	13,396
3. Resale value of land 1/	-	-	-	-	-	-	-	-	-	-	120
4. Liquidation value of working capital	-	-	-	-	-	-	-	-	-	-	11,757.75
B. Cash outflow											
1. Total investment outlay	(36,409)	-	-	-	-	-	-	-	-	-	-
2. Working capital 2/	(8,818.31)	(1,763.67)	(1,175.77)	-	-	-	-	-	-	-	-
3. Repayment on loan	-	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)
4. Corporate taxes	-	(1,265.89)	(2,123.42)	(2,720.71)	(2,804.62)	(2,900.28)	(3,009.33)	(3,133.64)	(3,275.37)	(3,436.93)	(3,621.11)
C. Net cash flow (A-B)	(19,747.31)	1,749.7	3,719.19	5,790.42	5,706.51	5,610.85	5,501.8	5,377.49	5,235.76	5,074.2	16,767.77

1/ Assumming the resales value of land is equal to 120 percent of purchased price of land

Appendix 6

The net present value at difference discount rates

Unit : thousand baht

Year	Net flow	Discount rate (DC) 14 %	Present value at DC = 14 %	Discount rate (DC) 22 %	Present value at DC = 22 %	Discount rate 21 %	Present value at DC. = 21 %
0	- 19,747.31	-	- 19,747.31	-	- 19,747.31	-	- 19,747.31
1	1,749.70	0.877	1,534.49	0.820	1,434.75	0.826	1,445.25
2	3,719.19	0.769	2,860.06	0.672	2,499.30	0.683	2,540.20
3	5,790.42	0.675	3,908.53	0.551	3,190.52	0.564	3,265.79
4	5,706.51	0.592	3,378.25	0.451	2,573.63	0.466	2,659.23
5	5,610.85	0.519	2,912.03	0.370	2,076.01	0.385	2,160.17
6	5,501.80	0.456	2,508.82	0.303	1,667.04	0.319	1,755.07
7	5,377.49	0.400	2,150.99	0.249	1,338.99	0.263	1,414.28
8	5,235.76	0.351	1,837.75	0.204	1,068.09	0.218	1,141.39
9	5,074.20	0.308	1,562.85	0.167	847.39	0.180	913.35
10	16,767.77	0.270	4,527.30	0.137	2,297.18	0.149	2,498.39
Net present value			7,433.76		- 754.41		45.86

Appendix 7

Projected profit and loss statement when the sale price decrease

thousand baht

Item \ Year	1	2	3	4	5	6	7	8	9	10
Production in tonne	750	900	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Gross sales (48,000 baht/tonne)	36,450	43,740	48,600	48,600	48,600	48,600	48,600	48,600	48,600	48,600
Sales distribution costs	365	437	486	486	486	486	486	486	486	486
Net sales	36,085	43,303	48,114	48,114	48,114	48,114	48,114	48,114	48,114	48,114
Manufacturing cost										
- Variable cost	28,899.37	34,679.25	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5
- Fixed costs	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5
Operating profit	5,654.13	7,092.25	8,050	8,050	8,050	8,050	8,050	8,050	8,050	8,050
Less										
Interest	3,567.20	3,382.75	3,172.42	2,932.68	2,659.38	2,347.81	1,992.62	1,587.70	1,126.10	599.87
Depreciation	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1
Net profit before taxes	- 363.17	1,259.4	2,427.48	2,667.22	2,940.52	3,252.09	3,607.28	4,012.20	4,473.80	5,000.03
Taxes (35 % of profit)		313.68*	849.62	933.53	1,029.18	1,138.23	1,262.55	1,404.27	1,565.83	1,750.01
Net profit after taxes	- 363.17	945.72	1,577.86	1,733.69	1,911.34	2,113.86	2,344.73	2,607.93	2,907.97	3,250.02

*Less the loss in year 1 and taxes from the result.

Appendix 8

Cash-flow of project when the sale price decrease

thousand baht

Item \ Year	0	1	2	3	4	5	6	7	8	9	10
A. Cash inflow											
1. Loan	25,480	-	-	-	-	-	-	-	-	-	-
2. Operating profit	-	5,654.13	7,092.25	8,050	8,050	8,050	8,050	8,050	8,050	8,050	8,050
3. Resale value of land	-	-	-	-	-	-	-	-	-	-	120
4. Liquidation value of working capital	-	-	-	-	-	-	-	-	-	-	11,757.75
B. Cash outflow											
1. Total investment outlay	(36,409)	-	-	-	-	-	-	-	-	-	-
2. Working capital	(8,818.31)	(1,763.67)	(1,175.77)	-	-	-	-	-	-	-	-
3. Repayment on loan	-	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)
4. Corporate taxes	-	-	(313.68)	(849.62)	(933.53)	(1,029.18)	(1,138.23)	(1,262.55)	(1,404.27	(1,565.83)	(1,750.01)
C. Net cash-flow (A - B)	(19,747.31)	(994.41)	717.93	2,315.51	2,231.60	2,135.95	2,026.90	1,902.58	1,760.86	1,599.30	13,292.87
Discount rate 14 %	-	0.877	0.769	0.675	0.592	0.519	0.456	0.400	0.351	0.308	0.270
Net Present value at DC 14 %	(19,747.31)	(872.10)	552.09	1,562.97	1,321.11	1,108.56	924.27	761.03	618.06	492.58	3,589.07

Net PV = - 9,689.67

Appendix 9

Projected profit and loss statement when the cost of raw material increase

thousand baht

Item \ Year	1	2	3	4	5	6	7	8	9	10
Production in tonne	750	900	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Gross sales (54,000 baht/tonne)	40,500	48,600	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
Sales distribution costs	405	486	540	540	540	540	540	540	540	540
Net sales	40,095	48,114	53,460	53,460	53,460	53,460	53,460	53,460	53,460	53,460
Manufacturing cost										
- Variable cost (40,932.50 baht/tonne)	30,699.37	36,839.25	40,932.5	40,932.5	40,932.5	40,932.5	40,932.5	40,932.5	40,932.5	40,932.5
- Fix costs	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5	1,531.5
Operating profit	7,864.13	9,743.25	14,059	14,059	14,059	14,059	14,059	14,059	14,059	14,059
Less										
Interest	3,567.20	3,382.75	3,172.42	2,932.68	2,659.38	2,347.81	1,992.62	1,587.70	1,126.10	599.87
Depreciation	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1	2,450.1
Net profit before taxes	1,846.83	3,910.40	8,436.48	8,676.22	8,949.52	9,261.09	9,616.28	10.021.20	10.482.80	11,009.03
Taxes (35 % of profit)	646.39	1,368.64	2,952.77	3,036.68	3,132.33	3,241.38	3,365.70	3,507.42	3,668.98	3,853.16
Net profit after taxes	1,200.44	2,541.76	5,483.71	5,639.54	5,817.19	6,019.71	6,250.58	6,513.78	6,813.82	7,155.87

Appendix 10

Cash-flow of project when the cost of raw material increase

thousand baht

Item \ Year	0	1	2	3	4	5	6	7	8	9	10
A. Cash inflow											
1. Loan	25,480	-	-	-	-	-	-	-	-	-	-
2. Operating profit	-	7,864.13	9,743.25	14,059	14,059	14,059	14,059	14,059	14,059	14,059	14,059
3. Resales value of land	-	-	-	-	-	-	-	-	-	-	120
4. Liquidation value of working capital	-	-	-	-	-	-	-	-	-	-	11,757.75
B. Cash outflow											
1. Total investment outlay	(36,409)	-	-	-	-	-	-	-	-	-	-
2. Working capital	(8,818.31)	(1,763.67)	(1,175.77)	-	-	-	-	-	-	-	-
3. Repayment on loan	-	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)	(4,884.87)
4. Corporate taxes	-	(646.39)	(1,368.64)	(2,952.77)	(3,036.68)	(3,132.33)	(3,241.38)	(3,365.70)	(3,507.42)	(3,668.98)	(3,853.16)
C. Net cash-flow (A-B)	(19,747.31)	569.2	2,313.97	6,221.36	6,137.45	6,041.80	5,932.75	5,808.43	5,666.71	5,505.15	17,198.72
Discount rate 14 %	-	0.877	0.769	0.675	0.592	0.519	0.456	0.400	0.351	0.308	0.270
Net present value at DC. 14 %	(19,747.31)	499.19	1,779.44	4,199.42	3,633.37	3,135.37	2,705.33	2,323.37	1,989.02	1,695.59	4,643.65

Appendix 11

Loan repayment schedule when the investment cost changes

thousand baht

Year	Principal outstanding	Annual repayment	Interest 14 %	Principal Repayment	Principal balance
1	27,000	5,176.28	3,780	1,396.28	25,603.72
2	25,603.72	5,176.28	3,584.52	1,591.76	24,011.96
3	24,011.96	5,176.28	3,361.67	1,814.61	22,197.35
4	22,197.35	5,176.28	3,107.63	2,068.65	20,128.70
5	20,128.70	5,176.28	2,818.02	2,358.26	17,770.44
6	17,770.41	5,176.28	2,487.86	2,688.42	15,082.02
7	15,082.02	5,176.28	2,111.48	3,064.80	12,017.22
8	12,017.22	5,176.28	1,682.41	3,493.87	8,523.36
9	8,523.36	5,176.28	1,193.27	3,983.01	4,540.35
10	4,540.35	5,176.28	635.65	4,540.63	- 0.28

Appendix 12

Projected profit and loss statement when investment cost change

thousand baht

Item \ Year	1	2	3	4	5	6	7	8	9	10
Production in tonne	750	900	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Gross sales (54,000 baht/tonne)	40,500	48,600	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
Sales distribution costs	405	486	540	540	540	540	540	540	540	540
Net sales	40,095	48,114	53,460	53,460	53,460	53,460	53,460	53,460	53,460	53,460
Manufacturing cost										
- Variable cost	28,899.37	34,679.25	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5	38,532.5
- Fixed costs	1,531.5	1,531.5	1,531.5	1,531.5	1.531.5	1.531.5	1.531.5	1,531.5	1,531.5	1,531.5
Operating profit	9,664.13	11,903.25	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00	13,396.00
Less										
Interest	3,780	3,584.52	3,361.67	3,107.63	2,818.02	2,487.86	2,111.48	1,682.41	1,193.27	635.65
Depreciation	2,634.6	2,634.6	2,634.6	2,634.6	2,634.6	2,634.6	2,634.6	2,634.6	2,634.6	2,634.6
Net profit before taxes	3,249.53	5,684.13	7,399.73	7,653.77	7,943.38	8,273.54	8,649.92	9,078.99	9,568.13	10,125.75
Taxes (35 % of profit)	1,137.34	1,989.45	2,589.91	2,678.82	2,780.18	2,895.74	3,027.47	3,177.65	3,348.85	3,544.01
Net profit after taxes	2,112,19	3,694.68	4,809.82	4,974.95	5,163.20	5,377.80	5,622.45	5,901.35	6,219.28	6,581.74

Appendix 13

Cash-flow of project when the investment cost change

thousand baht

Item \ Year	0	1	2	3	4	5	6	7	8	9	10
A. Cash inflow											
1. Loan	27,000	-	-	-	-	-	-	-	-	-	-
2. Operating profit	-	9,664.13	11,903.25	13,396	13,396	13,396	13,396	13,396	13,396	13,396	13,396
3. Resale value of land	-	-	-	-	-	-	-	-	-	-	120
4. Liquidation value of working capital	-	-	-	-	-	-	-	-	-	-	11,757.75
B. Cash outflow											
1. Total investment outlay	(38,104)	-	-	-	-	-	-	-	-	-	-
2. Working capital	(8,818.31)	(1,763.67)	(1,175.77)	-	-	-	-	-	-	-	-
3. Repayment on loan	-	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)	(5,176.28)
4. Corporate taxes	-	(1,137.34)	(1,989.45)	(2,589.91)	(2,678.82)	(2,780.18)	(2,895.74)	(3,027.47)	(3,177.65)	(3,348.85)	(3,544.01)
C. Net cash-flow (A-B)	(19,922.31)	1,586.84	3,561.75	5,629.81	5,540.90	5,439.54	5,323.98	5,192.25	5,042.07	4,870.87	16,553.46
Discount rate 14 %	-	0.877	0.769	0.675	0.592	0.519	0.456	0.400	0.351	0.308	0.270
Net present value at 14 %	(19,922.31)	1,391.66	2,738.99	3,800.12	3,280.21	2,823.12	2,427.74	2,076.9	1,769.77	1,500.23	4,469.43

NPV = 6,355.86

Appendix 14

Locations

The location of the Tropical Fruit Flavouring Base plant should be in an industrial estate provided by the Industrial Estate Authority of Thailand (IEAT). Its aims are to provide an industrial estate which offers adequate community utilities and other public facilities for sale, lease and purchase; to encourage the setting up of all types of industries as well as to offer special privelages and profits as incentives for investment programmes; to establish an attractive investment atmosphere for investors in line with the goal of the National Economic and Social Development Plan; to ease present and future urban planning; and to share industrialists' financial burden in setting up industries. This latter aim will be taken care of by means of financial institutions which can assist and promote the projects of those who are interested in operating their business in the estate.

At present, there are five industrial estates as follows ;

1. Bang-Chan Industrial Estate

This is located between Kan-Nah-Yao Subdistrict, Bangkhapi District and Bang-Chan Sub-district, Minburi District, Bangkok with a target area of 683 rais.

2. Lard-Krabang Industrial Estate and Export Industrial Zone

This is on Chalong-Krung Road, Lum-Pra-Tiew Sub-district, Lard-Krabang District, Bangkok, with an area about 1,323 rais.of which 173 rais is for export processing zone. It located about 4 kilometres from the King Rama IV-Institute of Technology, Lard Krabang.

3. Bang-Poo Industrial Estate

The site is located about 34 kilometres to the southeast of Bangkok on the north side of Sukhumvit Highway (the old road to Pattaya). It is only five kilometres from the provincial town of Samut Prakarn near the mouth of the Chao Phya River. It lies just beyond the Ancient City. The target area is about 3,733 rais, between Bangpoo-Mai Sub-district and Prack-Sa Sub-district, Muang District, Samut Prakarn Province.

4. Bang Phli-Bang Po Industrial Estate

This is located between Theparak Road and Bangna-Trad Road, Bang-Sao-Thong Sub-district, Bang-Pl District, Samut Prakarn Province with an area about 455 rais. However, in this area, there are problems of ground subsidence of more than 10 centimetres per year and no flood protection.

5. Northern Region Industrial Estate : Lamphun Province

The area is about 1,760 rais, located on the Asian Highway (between Chiangmai Province and Lamphun Province), Ma-Khue-Chae Sub-district, and Ban-Klang Sud-district, Muang District, Lamphun Province.

There are also five new industrial estates existing as follows :

1. Laem-Chabang Industrial Estate

The industrial estate including residential area is about 2,688 rais, located close to the Eastern Seaboard Project area (called Laem Cha-Bang), on the west side of the estate. Therefore, the eastern railway can reach the estate. This estate will be in operation in 1988.

2. Marp-Taput Industrial Estate (The Eastern Seaboard Heavy Industries Estate)

This area is located in Pla Sub-district, Ban-Chang District, and Huay-Pong Sub-district and Marp-Taput Sub-district, Muang District, Rayong Province with the area about 20,000 rais. It will also be in operation in 1985 and completed in 1988.

3. Southern Region Industrial Estate : Songkhla Province

The estate is in Songkhla-Hat Yai area with an area about 800 rais in conjunction with the Songkhla deep-water port.

4. Nakorn-Ratchasima Province Small Industries and Services Estate

This is located at 4-7 kilometres of Nakornratchasima-Choke Chai highway with an area about 200 rais.

5. Samutsakorn Pollutive Industries Estate

This estate is in the area of Om-Noi District, Samutsakorn Province with an area about 2,080 rais. IEAT is also purchasing all of the area to bring pollutive industries into one place together.

Every project of IEAT is developed and operated to serve industries. The area a each estate is divided up into individual sites ranging in size from five to seven rai or a larger size in according with the original industrial zoning. In addition, some estates, e.g. Bangpoo Industrial Estate have been declared as a Board of Investment Industrial Promotion zone. This means that investors who plan to run operate their factory within the industrial estate areas may be eligible for special privileges.

- Under the provisions of the Investment Promotion Act. B.E. 2520 (1977) an investor in plant situated in an industrial estate receives the following special incentives which are in addition to the general incentives granted to all investors :-

I. For enterprises in the Investment Promotion Zones.

- Maximum reduction of 50 per cent of business tax on the sales of products for a period up to five years (Section 35 (1)).

- Reduction of 50 per cent of corporate income tax for five years after the termination of a normal income tax holiday or from the date of income earning. (Section 35 (2)).

- Permission to double the cost of transportation, electricity and water supply for deduction from taxable corporate income. (Section 35 (3))

- Permission to deduct from the taxable corporate income up to 25 per cent of the investment in the costs of installing infrastructural facilities for 10 years from the date of income earning. (Section 35 (4))

II. For export enterprises.

- Exemption of import duty and business taxes on imported raw materials and components. (Section 36 (1))

- Exemption of import duty and business taxes on re-export items. (Section 36 (2))

- Exemption of export duty and business taxes. (Section 36 (3))

- Permission to deduct from the taxable corporate income an amount equivalent to 5 per cent or an increase in income derived from

export over the previous years, excluding costs of insurance and transportation. (Section 36 (4)

At present, from the data of IEAT, some industrial estates have been fully operational, for example, Bang-Chan Industrial Estate and Nakor-Ratchasima Province Industrial Estate. But there is also problems of ground subsidence and flooding in Bang-Plee Industrial Estate. Furthermore, Southern and Northern Region Industrial Estates are quite far from most raw material sources. As a result, there are only a few areas left for the Fruit Flavouring Base Plant. However, the area should not be far from Bangkok due to the reasons mentioned easlier.