

AN OVERVIEW OF
SMALL SCALE PROCESSED FOOD INDUSTRY IN THAILAND

Presented at IDRC Process Improvement Workshop
Vancouver, B.C., Canada
13 - 25 June 1983

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I. Status of the food industry in Thailand

1. Introduction

Thailand's economy is based on agro-industrial products. Major agricultural commodities are rice, sugar from sugar-cane, cassava pellets, and maize. Canned and frozen marine products, canned fruits and vegetables, and frozen chicken have noticeably increased. Therefore, agro-industrial development has been included in the government's fifth industrial development plan (1982 - 1986). The aim is to restructure industrial sectors to make them more suitable to economic conditions of Thailand. These policies are :

- (i) To promote manufactured export goods;
- (ii) To restructure the existing industries to be more efficient, and to promote efficiency in the new industries;
- (iii) To promote small-scale industries;
- (iv) To promote rural industries;
- (v) To set up a system for the development of basic industries;
- (vi) To encourage energy savings in industrial production;
- (vii) To promote industrial employment;
- (viii) to control quality standard and to prevent pollution of the environment;
- (ix) To set up a system to promote and monitor foreign investment.

Promotion of the food industries is to put effort on processing raw material into finished and semi-finished products especially for export purpose as well as expanding small-scale industries for both traditional processed food and domestic processed food products.

The development of infrastructure of processed food industries is very important role for the achievement of the fifth plan's goal. Thus, the development has to be started from cottage and small scale food industries where there are many problems including inadequate technologies low investment, unskilled workers, unhygienic, risk of safety and health hazard, etc. They also face many obstacles that need immediate assistance. Most of them are very closed and fearful of government officers, i.e. the enforcement and checking for bad products, for example. On the other hand, large scale food industries encounter problems such as inadequate raw material supply, lack of skilled man-power, low quality standard, low productivity, energy intensive, inexperienced marketing knowledge and inexperienced oversea trade channels.

In response to these problems, there are also a number of government institutions, government aids, foreign aids, associations, finance companies and bankers assisted in technical advices; services; research and development; compiling up-to-date technical information, statistics, and even data base; training program; funding; and financing these food industries. Therefore, institutions and organizations have to cooperate to achieve such goal. Apart from these, many large companies have gone into joint-ventured program with the foreign companies with or without the governmental assistance.

2. Classification of the food industry

Definition of small and medium size industries varies from country where their respective purposes, economic and social structure is concerned. In case of Thailand, the Small Industry Finance Office (SIFO) defines small industries according to their fixed assets which do not exceed two million baht (approximately \$US. 90,000). In the survey for research purpose, as defined by the size of employees for small-scale industries indicate the number between 10 to 49 persons whereas medium-size

industries employ between 50 to 199 persons.

Factories having more than seven employees or equipped with more than 2-horsepower machinery are required by law to register with the Factory Control Department, Ministry of Industry.

As indicated in Table 1, in Appendix I, the classification of overall number of registered manufacturing enterprises and workers by size of employment shows that major industrial enterprises and employees fall in the size ranged from 1 to 49 persons, which is accounted for 95 percent. It should be noted that there is also a large number of unregistered and/or illegal factories scattered wide over the country.

Processed food industry is ranked first among other manufactured products of four regions in Thailand as shown in Table 2. The total food industry accounted for about 65 percent of the overall manufacturing industries. There are approximately 30,000 factories where rice mills dominate in numberwise (Table 3) among other types of food processing factories. Of these factories, there is around 3 - 4 percent located in Bangkok area. Table 4 Shows number of fish processing and related factory.

A typical statistics of transparent noodle factories is given in Table 5 for their number of factories in two regions production capacity range, number of workers and capital investment.

2.1 Technological classification

Large industry is equipped with modern machinery which is mostly imported. It is capital and labor intensive. Manufactured products are mainly for export purpose. Overall, the processing line is a continuous or automatic operation type with sophisticated instrumental control system whereas some of them employs microprocessor based programmable controller or computerized controlling system. Most of the

technologies are imported solely or joint-ventured. Quality control is employed in the operation. Large industries are better in the management where educated employees such engineers, scientists, accountants, business administrator and technicians involve in the manufacturing processes.

Small-scale and medium-scale industries operate with simple or basic technology. The factory is equipped with semi-automatic and/or hand operated equipment which are applied and modified using locally made equipment and partly imported machinery. Most of the management is in family type where skills and experiences have been transferred to their children and relatives. Product quality and sanitary are being considered. Manufactured products are mainly for domestic consumption.

Village or cottage industry employs mainly traditional process with simple and appropriate technology. Labor employment, mostly unskilled are mainly members of family. The processing plant is usually part of their house. Products are unhygienic and low in quality. Production capacity is very low and sufficient for local consumption within limited area.

2.2 Commercial channel

Small-scale industries distribute their products through wholesalers and retailers. Some of them sell directly to their customers. Figure 1. illustrates a typical pattern of distributing channel. Small-scale factory may produce their own branded products and unbranded products which is repacked under wholesaler's label for distribution.

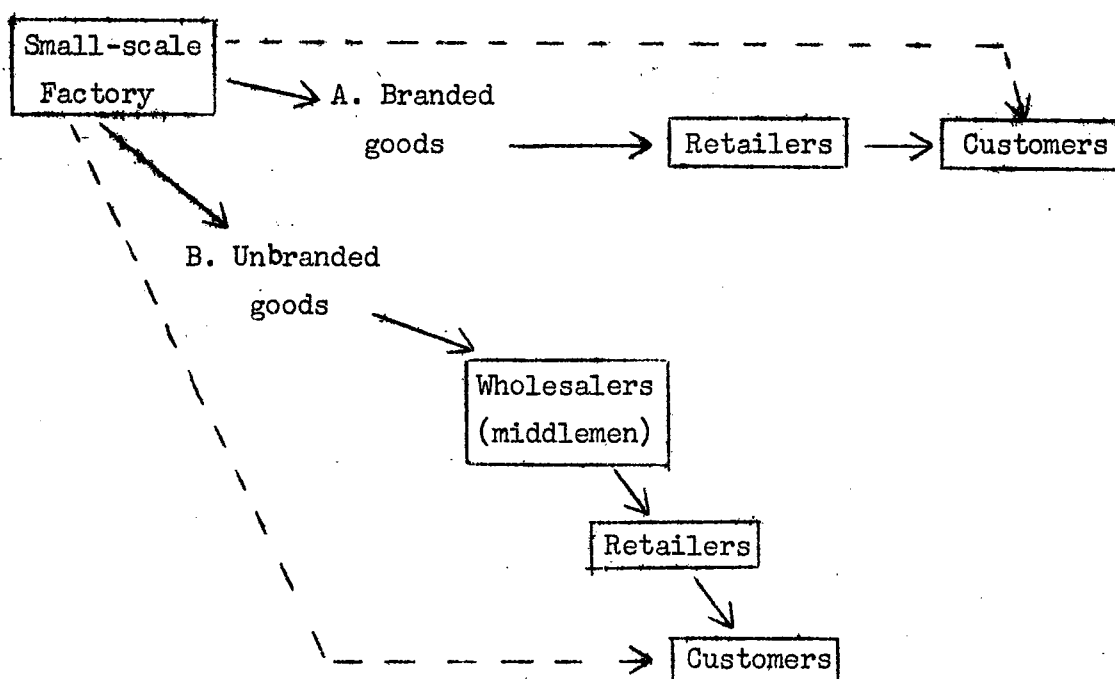


Figure 1 Distributing channels of small-scale food industry.

Location pattern of food industry is rather dispersed. Normally, they are located near the raw material supply where quick delivery could be made, for example, rice mills, sugar mills, pineapple and other fruit and vegetable canners, dairy plants, and seafood factories. Some of them are located near the market and river for water supply.

2.3 Management structure

Most of small-scale industries are operated by owners which is the family-type business. Even in large industries, management is mostly familyhood which is comprised of members of the family and

in-laws. However, there is also some management run by partnership which is jointly owned by closed friends.

Small-scale manufacturers have improper record on production and cost accounting to be used in the determination of actual net profit. They base on the working cash flow and the total sales each month.

Types of sales normally accepted by these small-scale manufacturers are credit sales and cash. Cheque system is also being accepted only from the acquainted wholesaler and/or retailers.

3. Major processed food products

Initially, processed food industry aimed at domestic consumption. The surplus was then exported. At present, trend is going towards exporting purpose. Processed foods account for about 50 percent of the total manufactured goods for export in Thailand. Food processing industries can be divided into 20 categories as follows:

1. Slaughtering
2. Canning and preserving of meat
3. Dairy processing
4. Canning and preserving of fruits and vegetables
5. Canning and preserving of fish and other seafoods.
6. Coconut and palm oil
7. Other vegetable and animal oil and fats
8. Rice milling
9. Tapioca milling
10. Drying and grinding of maize
11. Flour and other grain mills
12. Bakery products

13. Noodles and similar products
14. Sugar
15. Confectionary
16. Ice
17. Monosodium glutamate
18. Coffee and tea
19. Other food products
20. Animal feeds

3.1 Fishery products

Thailand is one of the leading countries in fish production and rank third among Asean countries. The annual catch is about 2 million tons in which marine catch is accounted for 90% and fresh water catch is about 10%. The disposition of the marine catch goes into local consumption and export (45%) in the form of fresh, chilled and frozen seafood; fish meal (22%) from trash fish; canned seafood (20%); dried, salted, and smoked fish products (8%); and fish sauce (5%). Shrimp, cuttle-fish and squid are the leading export products. Most of fresh water catch is for local consumption (70%); dried and salted fish (12%); fermented fish (10%); and boiled or smoked fish products (6%). At present, there are about 40 companies producing chilled and frozen products, 27 canneries and more than 200 in the production of dried and salted seafoods. The expansion of seafood industry in Thailand has been a phenomenon. Fishing which is usually done along coastal area has been expanded and developed into deep-sea fishing. Thailand has become the seventh largest fishing fleet in the Asia.

Frozen and canned seafood products have become a major processed food export valued at about 4,200 million baht, and 1,200 million baht, respectively in 1979. Most of the factories are medium scale and large

scale industries with labor intensive and high investment.

An the other hand, other seafood products such as dried and salted fish, fermented products, and smoked fish are produced mostly by small-scale factories and cottage industries.

3.2 Fruit and vegetable products

The most outstanding product in this group is canned pineapple. The industry has been set up mainly for export purpose. At present, there are 14 pineapple canning companies with capacity utilization of about 60% in 1980. The 1980 export value of canned pineapple products and juice is more than 1,500 million baht with the rate of 15% increased over the previous year. There are several factories which produce frozen, and dehydrated and glace' types of products.

Other tropical prints and temperate climate fruits are also processed by canning factories. Different styles of longans, rambutans, lychees in both heavy and light syrup are widely canned for local consumption and some for export.

Canned and frozen vegetable processing industries have been growing rapidly for export. Types of vegetables such as pear, baby corn, sweet corn and mushrooms are the main raw material.

Preserved fruit and vegetables are mostly produced by small and medium scale factory as well as cottage industry where ease of processing technique allows them to carry on. Preservation by sugar and/or salt and by drying are commonly done. The market is for local consumption. Typical customers are Thai women. It should be noted that they prefer two types of preserved fruits, namely sweet glacé type, and salty with tart-taste type. For preserved vegetables, pickleing is quite common. Vegetables such as lettuce, cucumber and tubers or roots are pickled first and then they are packed with brine in small cans.

3.3 Meat products

In the past slaughter house is operated and controlled only by the government organization for fear of hygiene problem such as foot and mouth disease. Recently the government has approved and granted private sectors to operate by their own. With certain regulations. Foot and mouth disease had been a problem in the past. At present, with the closed control of the southern part of Thailand, it is declared as disease free zone. This prospect enhances the production of meat products such as frozen products.

Red meat, white meat and games such as beef, buffalo meat, pork, chicken and duck meat are popular in Thailand.

Poultry processing has been growing tremendously in the past few years, especially frozen chicken for export. The 1980 statistics has shown that the frozen chicken products earned 520 million baht. The capacity utilization of chicken and ducks in 1981, was about 71 percent.

Cured pork products such as sausages, hams and bacon are produced for local consumption by small-scale factories but well equipped with machinery. The production capacity ranges from 100 to 1,000 Kg. of meat per day.

Other types of meat products are canned meat products, dried meat products, and traditional meat products.

Chinese sausages, dried and shredded pork products, meat ball, beef jerky and fermented sausages are produced in small-scale factories and cottage industries scattering around the country. Many of them do not register with the Ministry of Industry since they do not use machinery. Thus, the total number of local producers is hardly obtained.

3.4 Dairy products

Canned sweetened condensed milk and evaporated milk made from recombined milk powder are very popular wide over the country. Pasteurized milk is produced by few companies and is available only in big cities. Sterilized milk by ultra high temperature (UHT) process packed in rectangular packaging is growing rapidly in the local market. Butter, yokurt and cheese have very little impact in the market. These products are available mostly in Bangkok metropolitan area and some big provinces. This is mainly due to the nature of Thai food habits.

3.5 Starches, cereals, grains

Noodles, and similar products

Grain and cereals mill, especially rice is the back bone agro-industry of the country. It is the major export and staple food consumption.

Different types of starches from cassava, roots, rice, glutinous rice, wheat, etc. are produced by wet milling process. Tapioca flour is the main products for export and local consumption.

Different types of noodles are available based on different types of starches and ingredients. For examples, vermicelli, from rice, transparent noodle (bean thread) from mung bean starch, egg noodles from wheat flour, kanom cheen (fermented noodles), ramien, Kiem-e from rice starch are commonly consumed in Thailand. They are produced by cottage, small-scale factories.

3.6 Traditional food products

There is a large variety of traditional processed food products such as canned coconut cream, shrimp paste, fish sauce, fermented bean curd, fermented fish, dried meat and vegetables, fermented soy sauce,

tofu (bean curd), and pickles. They are produced domestically by cottage type factories and small scale factories which is based on their regional food habits. The production capacity is low and is based on available raw material. Some of them are prepared in their home by housewives.

II. Type of services, facilities and extension

1. Institutions

Five major universities, namely, Chulalongkorn, Kasetsart, Khon Kaen, Chiang Mai and Songklanakarin University, offer courses in Food Science and Technology including Food Engineering.

In some universities, the fourth year students (senior students) are required to visit industrial plant and research institutions for 2-months training before graduation. Universities also carry research programs in which graduate students and professors take part in the research activities.

The Institute of Food Research and Product Development (IFRPD) at Kasetsart University has developed a series of high nutrition low-cost foods from indigenous raw materials. The products have been tested for consumer acceptance and distributed to the "Day care children" centers in many provinces. The Institute is working in cooperation with the Ministry of Public Health. Among these products, Kaset baby food is most popular.

Besides, IFRPD has very good contacts with industry. Training in food processing has been arranged occasionally for small food producers. Technical assistance has also been provided to the industry to improve the productivity and product quality.

In 1974 ASEAN protein project which is a cooperative programme among the ASEAN countries has been set up with the financial support of the Australian-ASEAN Economic Co-operation Programme. With IFRPD as

coordination the project is a co-operative venture between many government institutes. Many kinds of nutritious low-cost foods have been developed. Some of those developed in one country are being tested for acceptability in the others. Recently a factory located in Chiang Mai to produce 100 tons of soybean flour a month has been completed. In 1982, ASEAN Food Technology Research and Development (FTRD) project has started for the R & D activities in processed food as a continuation of cooperative programme among ASEAN countries.

The Department of Science Service, Ministry of Science, Technology and Energy (formerly Department of Science, Ministry of Industry) provides services to the government, industry and the public on scientific and technical matters. The Department also carries out research on and development in the utilization of natural resources and industrial and agricultural wastes.

The Thailand Institute of Scientific and Technological Research (TISTR) formerly the Applied Scientific Research Corporation of Thailand is a non-profit making semi-autonomous, government research institute under the Ministry of Science, Technology and Energy. Its prime responsibility is to make full utilization of science and technology in the national socioeconomic development. Its major activities deal with research, on industrial, agricultural, environmental and building problems and related remedies. In addition, the Institute provides information service, standard testing and calibration services which are pre-requisites for technological development. Realizing the dependency of the national economy on agricultural sector TISTR determines to make full contribution to the rural development through appropriate application of science and technology.

Research and technical services as well as economic and market study are extended to private enterprises and government units.

There are other institutes working in specific products such as sugar, oil seed, fish, etc.

The Department of Industrial Promotion and the Thailand management Development and Productivity Centre, Ministry of Industry provide assistance in technical and management as well as pre feasibility and market study to small industries. Consultancy, seminar, demonstration or training, design of packaging etc. are also provided to producers.

The Thai Industrial Standard Institute (TISI) was established in 1968 to help improve the production standards of local by produced goods. Certificate guarantee of TISI will be given to the goods which meet a certain standard level of quality and safety. About 1,500 applicants for certification have been approved by TISI to use the standard guarantee mark.

2. Investment promotion

In 1977 the Board of Investment, BOI, opened an investment services centre in Bangkok to facilitate applications for investment projects. The investors are assisted in obtaining various government permits, licences and other authorization^{1/}. The BOI decides what type of industry are suitable for Thailand and what incentives and assistance should be offered to investors in the sectors.

The BOI also stipulates the minimum size of enterprises eligible for promotion which varies according to the type of industry. A capital investment of 1 million bath (excluding the value of land and working working capital) for livestock raising and processing is the levest minimum requirement.

^{1/}Board of Investment (1979) - Supplement in Bangkok Post July 1979.

In practice, promotional privileges granted by BOI have been largely reaped by larger industrial enterprises.

For the past several years one of the major activities at the BOI has been to direct investor interest towards suitable projects. This has been achieved by conducting either sector surveys or pre-feasibility studies.

"Suitable" from the Government's point of view would mean that a project meet one or more of three basic objectives. Those are: 1) that it is agro-industrial, 2) labour-intensive, and 3) export-oriented. A project that meets all three points will clearly be given the highest priority.

"Suitable" from an investor's point of view includes demand for the product, raw materials supply and prices, available infrastructure and technological considerations. A project can only be considered interesting if it appears to allow a reasonable return on investment.

In fact, the government interest in the role of small industries has dated back more than a decade as seen by the establishment of agencies directly responsible for small industry promotion such as Small Industry Finance Office (SIFO), Small Industry Service Institute (SISI).

SIFO is responsible for rendering financial support to small industries in Thailand. The objective is to extend loans at low cost to small entrepreneurs to set up new factories or expanding existing ones.

3. TISTR's role is food industry

Apart from mentioning in the institutional frame work, in 1978, TISTR carried out surveys of technology utilization in Thailand in the sectors concerning fish, fruit, soybean processing and animal

feed under UNIDO contract. The surveys covered the village and cottage level technologies, technology utilization by small and medium size industries. Technological and economic information data were collected and analyzed. The area of the possible technological improvement were also indentified.

Many constraints and problems have been found from the surveys both technologically and economically. Sanitation and safety of the products, the use of colouring agents and additiyes, are needed, to be seriously improved.

Example of fruit proceasing, varieties of Thai fruits are available all over the country, all year round, some of which are seasonally produced. Sun-dried, concentrated jam, brine pickled etc. are the most propular traditional processing for preservation used in small and cottage industry.

The products which are made from seasonal fruits will be kept for sale throughout the year. These processed fruits are available and popular in the domestic market. The product quality is not yet up to the standard for export because there are many problems involved, and this prevents the expansion of the products abroad.

Thus fruit processing requires a well-developed integrated technology system from planting, post-harvest handling, processing, packaging, to transport the products to the market in order to compete favourably is the international markets.

TISTR has been working in co-operation with two noodles factories to find the way in making pre-cooked noodles with the texture suited to Thai taste. Composite flour-wheat and tapioca starch are also used in making noodles to reduce the cost of material, since wheat flour is entirely imported.

Besides, research services such as suitable conditions of processing method, pre-feasibility and market studies etc. are also extended to many small concerns. One small factory produces coconut milk for commercialization with the use of TISTR's technical know how. The beverage powder prepared from soybean with chocolate powder as flavour is going to the prototype tested in the factory very soon. Tamarind pulp concentrate, tamarind extracted concentrate and concentrated syrup are being developed for a private firm. These products will be produced for export to the Middle East.

At present, TISTR has been working in process development for small-scale food industry in which transparent noodle industry is selected for the development. The activities involve with integrated TISTR team to brainstorm using operation research and system analysis techniques. The project is granted by International Development Research Center (IDRC) in 1981.

A cooperating project for technological transfer and joint-research between Korean Advanced Institute of Science and Technology (KAIST) and TISTR has initiated in 1982, on the low-cost extrusion cooking system for high nutrition low-cost food production. The project involves in using KAIST extruder to produce high nutrition low-cost food using indigenous raw material in Thailand.

III. Major constraints in small-scale food industry

Agro-industry is the backbone economic of Thailand. Rice milling has always been the biggest activity in the industry with an average export quantity of about 3 million tonnages per year followed by sugar, tapioca milling, animal feed, canned and preserved fruits and vegetables, vegetable oil and canned and preserved seafood products. The production exceeded domestic demand by almost 40 percent in 1978. Some of the surplus could be utilized in the form of processed foods which have more value added instead of exporting as bulk raw and/or semi-processed commodities.

Hence, the economic characteristics are:

- 1) Mostly relying on abundant local agricultural raw material inputs.
- 2) Relatively, labor intensive.
- 3) Well dispersed to rural areas due to the necessity for the plant to be located near the raw material supply.
4. Most of the industry produced for domestic consumption in which the surplus could go into export.

The overall promotion should be considered, starting from cottage, small-scale and medium scale industries to encourage the growing processed food production capabilities.

However, apparent problems and constraints exist within the country. Most of capacity utilization is still below the expected level. One of the problem is related to post-harvest losses due to handling, treatment, packaging, transportation, storage and disease, insect and animal infestation.

Small-scale industry encounters various problems as follows:

- 1) Use of poor quality of raw material input and inadequate or lack of quality control of processed food products
- 2) Lack of basic technological background such as processing techniques, food additives and preservatives, engineering and mechanic knowledge. Trial and-error is the main practice for solving problems.
- 3) Refuse to accept any change or modification from regular practice.
- 4) Low productivity or yield.
- 5) Lack of skilled personnels such as technicians, technologists, and engineers.
- 6) High competition in the market and overpowering by the large-scale industry.
- 7) Problem in financial status such as investment and loans with high interests.
- 8) Limited marketing channels through middle men or brokers.
- 9) Fluctuation of direct cost such as labor and raw material.
- 10) Over-enforcement by certain government institutions such as Food and Drug Administration. It makes them uncertain to cooperate with governmental organization for fear of prosecution.
- 11) Sanitation and hygienic problems including health and accidental hazards.
- 12) Pollution and disposal of solid and water waste material.

IV Summary

Food industry has an important role both directly and indirectly to the socio-economic and industrial development of the country. They account for at least 50 percent of the total manufacturing export with great potential for value added (30% of total manufacturing value added). Most of all, food industry contributes to the nutritional benefits for the local population. Thus, achievement towards the industrial growth could be met through cooperation among research and development institutions both private sectors and governmental organizations. Particular attention should be given as a major priority to the small-scale food industry where their constraints are greater than those of medium and large scale industry.

Active assistances should be provided for the small-scale industry in the area of technological training, extension programme, information, infra-structure facilities such as utilities, communication, transportation and services, workshop, a co-op system for small food processors, financial arrangements, etc.

APPENDICES

Appendix 1

Table 1 Number of manufacturing enterprises classified
by size of employment

Size of Employment (Person)	No. of Enterprises		No. of Workers	
	No.	%	No.	%
1 - 4	16,765	50.6	45,596	8.1
5 - 9	8,786	26.5	63,237	11.2
10 - 19	3,757	11.3	53,553	9.3
20 - 49	2,249	6.8	68,148	12.1
50 - 99	820	2.5	56,644	10.1
100 - 299	528	1.6	85,527	15.2
300 - 499	125	0.4	48,130	8.5
500 - 999	81	0.2	55,949	9.3
over 1,000	50	0.1	87,615	15.6
Total	33,160	100	563,401	100

Source : Department of Labor

Table 2 Classification and ranking by number of factories in Thailand

Region	1973		1979		Rank		
	No.	%	No.	%	1	2	3
Central (Bangkok)	14,854 (8,293)	41.2 (23.0)	27,718 (14,337)	40.9 (21.2)	Processed foods	Textiles	Chemical products and wood products
South	4,258	11.8	6,797	10	Wood products	Rubber and rubber products	processed foods
North	6,202	17.2	10,885	16.1	Tobacco	Pro-cessed	Wood products
North-east	10,743	29.9	22,336	33.0	Processed foods	Wood products	Textiles and non-metallic mineral products
Total	36,057	100	67,736	100	Processed foods	Wood products and textiles	Others

Source : National Economic and Social Development Board (NESDB), 1981

Table 3 Number of food processing factories classified by types of food

Item	No. of factories
	Total
1. Bakery products	126
2. Biscuits	37
3. Roasted coffee	79
4. Pastilles and other sugar confectionary	5
5. Dairies (milk and milk products)	16
6. Butter	7
7. Ice cream	118
8. Canned meat producte	44
9. Meat products	9
10. Grain mills	38
11. Tapioca pellets and chips	849
12. Tapioca mills	306
13. Canned fruits and vegetables	38
14. Preserved fruits and vegetables	33
15. Ground spices	78
16. Soft drink	41
17. Vegetable and animal oil and fats	213
18. Vinegar	6
19. Rice mills	27,231

Item	No. of factories
	Total
20. Starches	155
21. Mung bean transparent noodles	23
22. Flour	81
23. Animal feed	19
24. Frozen sea food	24
25. Canned seafood	17
Overall	29,593

Source : 1. Department of Agricultural Economics, Faculty of Economic and Business Administration, Kasatsart University (1975).

2. Industry Directory (1979 - 1980), Department of Industrial Economics, Ministry of Industry.

Table 4 Number of Fish Processing and Related Factories

Type of Products	Number of factories
Salted fish	141
Fish sauce	122
Fish meal	72
Dried shrimp	72
Shrimp paste	53
Steamed fish	46
Other fish sauce	38
Frozen seafood	25
Dried squid	8
Smoked fish	6
Canned seafood	17
Scale ice	3

Source : Dept. of Fisheries, 1974

Table 5 Typical statistics of transparent noodle factories in Thailand

Region	No. of Factories	Production Capacity (Ton/year)	No. of Workers	Capital Investment (1,000 Baht)
1. Central				
Bnagkok	2	86 - 195	22 - 350	100 - 2,400
Saraburi	6	12 - 43	3 - 49	10 - 600
Nakorn Pathom	3	30 - 50	11 - 80	1,100 - 1,500
Karnchanaburi	1	N/A	10	50
Patum thani	2	12 - 300	10 - 80	1,690 - 3,500
Chachoengsao	1	105	25	3,500
Samutsakorn	1	N/A	N/A	N/A
2. North				
Nakornsawan	2	36 - 218	up to 21	308 - 850
Kumpangetch	1	N/A	13	1,360
Sawankalok	1	12	N/A	186
Lampang	2	80 - 86	up to 50	250 - 2,200
Chiengmai	1	50	N/A	N/A
Total	23	12 - 300	3 - 350	10 - 3,500

Total production capacity = 1,100 ton/year
 Export = 180 ton/year
 Local consumption = 920 ton/year

Appendix II

Transparent noodle plant (Factory C)

Location : 78 Kilometres Southeast of Bangkok
Chachoengsao province

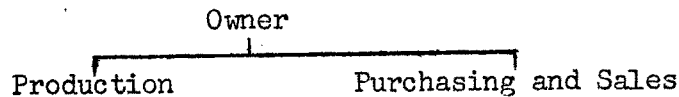
Product : Transparent noodle

Grade : Special - 100% (mung bean starch)
I - 80:10 (mung bean starch : other starches)
II - 50:20:20 (mung bean starch : potato starch:
tapioca starch or other bean
starches)
III - 30:10:50 (mung bean starch : potato starch:
tapioca starch or other bean
starches)

Average capital investment : 3.5 million baht

Raw material : mung bean grade 3, potato starch, tapioca starch and
other bean starches.

Management : Family type

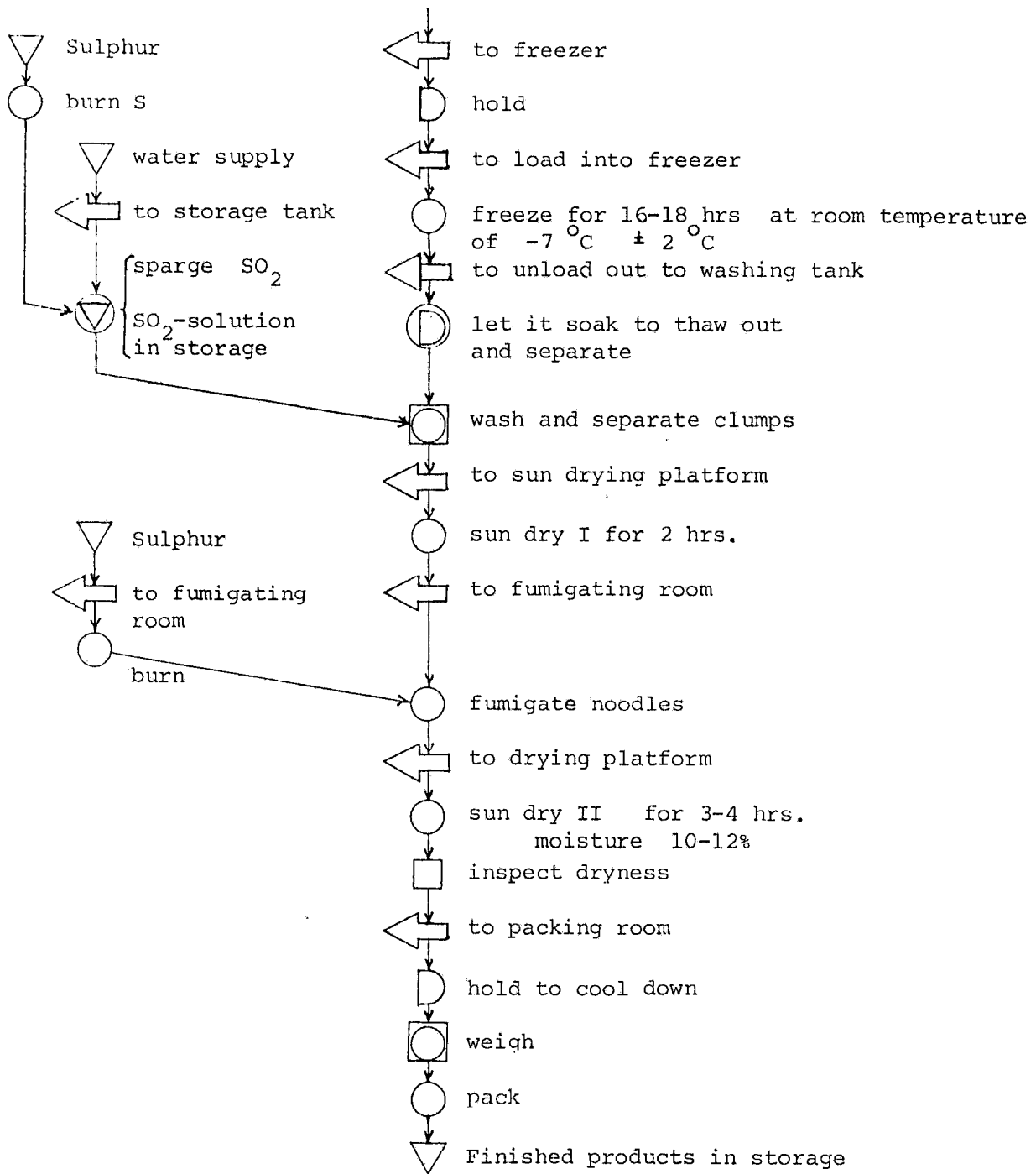


Workers : 20 Female
10 Male

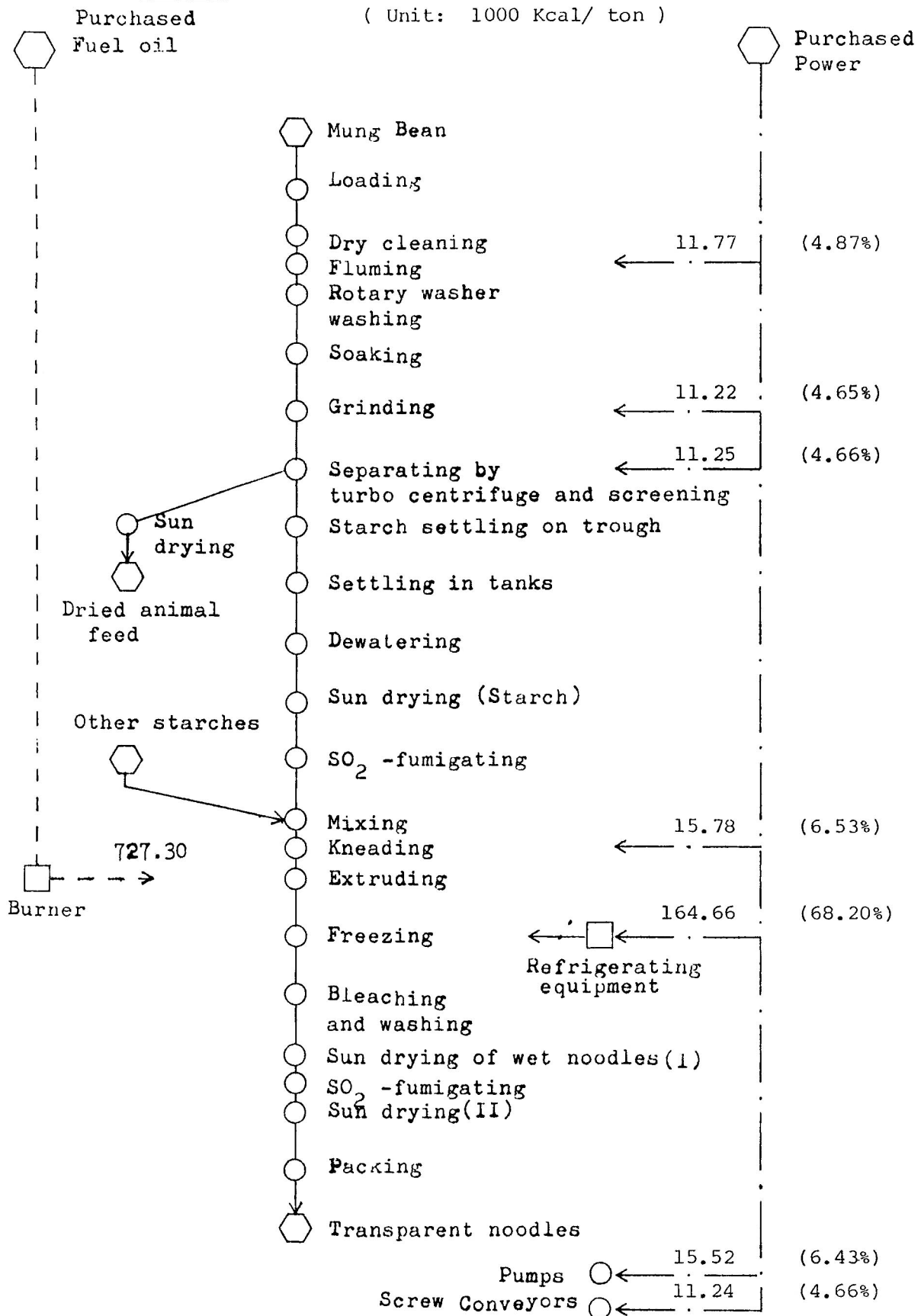
Capacity : 1.2 ton raw material input/day
0.4 ton transparent noodle output/day

Market : Mainly Chachoengsao province, and Chonburi

Price : Grade special : 50 Baht/kg
Grade I : 42 - 45 Baht/kg
Grade II : 33 - 34 Baht/kg
Grade III : 17 - 18 Baht/kg

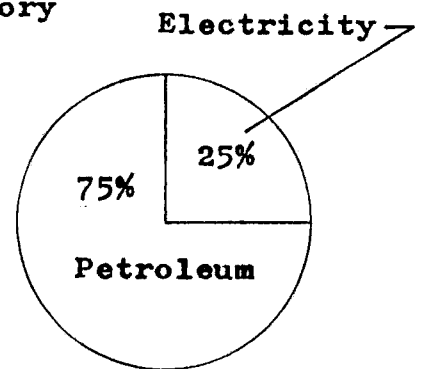


Energy utilization in transparent noodle factory



Estimated energy used in transparent noodle factory

Energy Source	Million Kcal/Year	Kcal/Kg
Electricity	86.96	241.56
Petroleum	261.83	727.30
Total	348.79	968.86



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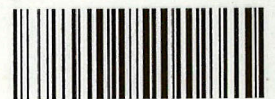
AN OVERVIEW OF SMALL SCALE PROCESSED
FOOD INDUSTRY IN THAILAND.

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An overview of small