ESEARCH CORPORATION OF THAILAND

APPRAISAL REPORT NO. 13

A DESCRIPTION OF THE INDUSTRIAL SECTOR IN THAILAND

BY

NIPON KAMOLRATANAGUL

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ECONOMIC EVALUATION GROUP

ASRCT, BANGKOK 1968

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F O R E W O R D

The primary purpose of this document, "A description of the industrial sector in Thailand," is to provide the Board and management of ASRCT with a synoptic view of manufacturing activity in the Kingdom, as a background for formulating the research policies and programmes of ASRCT.

Some excellent accounts have, of course, already been written of individual industries in Thailand but nowhere does there appear to be any attempt, at least any recent attempt, to review the manufacturing economy as a whole, other than in fiscal terms. Such a review is essential, and indeed urgent, if the scarce research resources of the country are to be allocated to best advantage.

The document has been prepared from data already existing within ASRCT and no special recourse has been had to industry to obtain information. This limitation has been imposed because a prime desideratum of such a description as this, is that it should be available relatively quickly: it is better to have a document incomplete in some details than no document at all.

Inadequacies and inaccuracies which now exist in the document will be progressively remedied. It is planned to carry out successively a series of Brief Reviews of industrial sectors. All such Reviews will follow a similar pattern and as each is completed, it will replace the corresponding section of the present document.

Moreover, the Economic Evaluation Group holds a continuous watching brief for all new industrial developments as reported in the Press and elsewhere, and when an industry is known to have undergone some radical changes, the description of it will be re-written.

LIMITATIONS

The major limitation of this document is, of course, that it has been prepared without special recourse to industry, as explained above.

A second limitation is the paucity of production statistics in Thailand. essential if a quantitative description of industry is to be gained. Within its files, ASRCT has certain data on the production and operations of individual firms but, except where such data has already been published elsewhere,

the information has been regarded as confidential.

There is, of course, a scarcity of information generally on Thai industries, only those with "investment potential" having been at all well documented. But the very fact that an industry has investment potential virtually ensures its expansion so that what has been published about it, is soon out of date.

The document is generally limited to a description and does not, for the most part attempt to analyse, discuss or project the various aspects of the manufacturing sector. The document is merely a "working manual" and its very deficiencies will, it is hoped, act as stimuli for further enquiry.

ACKNOWLEDGEMENTS

The document has drawn heavily upon previous accounts of individual industries, notably those by USOM personnel, such as Marsden (1966) and by Artamonoff (1965) whose contributions are formally acknowledged in the list of references, along with notations of other sources.

In the text itself, the sources of the various tables of statistics are given and there are occasional footnotes which are in the nature of references.

By and large, however, it is impossible to acknowledge every source since such a work as this must draw upon fragments from the daily press, company brochures and the like, together too numerous to mention.

The authors would like to thank, in particular, Mr. Eugene F. Sullivan of USOM and Mr. Jaral Intarangsi of the Ministry of Industry for their very helpful comments on an earlier draft of the document. Thanks are also due to Mr. Frank G. Nicholls, Chief Adviser of ASRCT, for his help and encouragement during the preparation of the "Description", the idea of which he originally conceived.

The document draws heavily upon statistics published by The Department of Customs and by the National Statistics Office. It also uses extensively data provided by the Board of Investment especially that published in the Board's "Investment newsletters" and more recently in its journal, "The Investor." A debt of gratitude is acknowledged to all those sources.

In addition, the authors wish to express their gratitude to Dr. C.L. Wrenshall, Research Director-General of the Technological Research Institute within ASRCT, and his colleagues for their patient reading of drafts and helpful comments thereon.

The authors would be most appreciative if readers generally would bring to their notice errors, omissions and particularly sources of further relevant information.

A DESCRIPTION OF THE INDUSTRIAL SECTOR IN THAILAND

By Nipon Kamolratanagul,* Sachee Piyapongse,* Sainarong Rasananda,* Chirtsukdi Sornchai,* Suvanna Vibhatakarasa,* Norman L. Wake,* and Rachnekorn Vanotayarote.*

THE INDUSTRIAL SECTOR

(a) General

Thailand is still overwhelmingly an agricultural country with more than 80 per cent of its economically active population engaged in agriculture, forestry, and fishing, and only 4 per cent in manufacturing industry. Moreover, Thailand probably still has a much smaller fraction of its labour force engaged in the industrial sector than other countries in Asia, as Muscat (1966) previously showed.

Manufacturing is limited mainly to the processing of rice and other foodstuffs, certain mineral and forest products as well as to producing consumer goods for internal consumption.

Thailand's dependence on rice and rubber for over half its foreign exchange earnings makes the economy extremely vulnerable to fluctuations in world demand and prices. Because of this and because the work-force is expected to increase from 15,000,000 now to 23,800,000 in 1981 (i.e. an increase of 60 %) stringent efforts are being taken by the Thai Government to expand the country's economic base through a strengthening of the infrastructure and product diversification.

The growth of the manufacturing sector

Prior to the 1930's, the manufacturing sector of the Thai economy was virtually non-existent apart from rice-milling and saw-milling.

Following the 1926 revisions of some old treaties which had prevented the Thai government from raising the level of import tariffs, a number of revenue-raising duties was imposed which gave incidental protection to the establishment of manufacture of sugar, matches, liquor, cigarettes, soap, etc.

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* Economic Evaluation Group, ASRCT.

Curtailment of imports during World War II provided additional protection and stimulated the growth of such items as textiles and shoes.

But another development was meanwhile occurring. During the 1930's, the Thai government initiated a policy of direct government investment in, and management of, new industrial enterprises. Starting with textiles, paper, and sugar manufacture all of which were begun before World War II, the list of government-owned industries expanded rapidly in the 1940's and early 1950's, but seemed to have stabilized at around 120 by 1958.

Despite the fact that employment in the government enterprises is only some 5 per cent of total manufacturing employment, this large-scale entry of government into the industrial sector, undoubtedly acted as a disincentive to foreign direct investment in manufacturing. In the period 1951-54, for example, 90 per cent of new direct foreign investment in Thailand went into wholesale trading and mining, and only 7 per cent into manufacturing (Muscat, 1966).

Since promulgation of investment promotion legislation in 1959 which, inter alia, guaranteed that the Government would not engage in additional competitive industry, there has been a significant increase in foreign capital inflow, and, largely as a result, manufacturing industry has grown at an average rate of 12 per cent annually and its share of national income has increased from 11 to 14 per cent. Although small in comparative terms, the changing composition of output is of considerable significance, betokening both a broadening and deepening of the industrial sector which was scarcely evident before.

Prior to 1960, Thailand had been entirely dependent on imports of capital goods and quality consumer goods, but consumer good's share of total imports has now fallen from 40 per cent to 29 per cent and there has also been a considerable diversification in production of producer goods. Products which existed in the previous decade such as sugar, cement, cotton textiles, glass, and tobacco, are now being produced more efficiently and in greater quantities. To their volume has been added a spate of new goods such as automobiles, tyres, batteries, springs, pharmaceuticals, electrical goods, petroleum products, and a wide range of metal products.

But for all these encouraging signs and tokens, there still remains the fact that of the total number of 51,000 registered factories, over half are

rice mills and only four per cent of all factories have more than 50 employees.

The composition of the industrial sector

Figure 1 shows the contribution of the Manufacturing Sector to Thailand's Gross Domestic Product from 1962 to 1967. The figure, however, does not fully reflect the growth-rate of the sector itself which grew 10.5 per cent in 1964 and increased its growth each year up to 18.7 per cent in 1967. Much of this expansion has been, as mentioned earlier, a result of the Industrial Promotion Act which has, for example, caused a trebling of invested capital between 1966 and 1967, with the establishment of 91 new factories and the expansion of 12 existing industries.

Nevertheless, despite the plethora of new factories which has arisen in the vicinity of Bangkok, only 4 per cent of the population is engaged in manufacturing industry, the contribution of which to GDP has risen only from 11 to 13 per cent in the past ten years. In fact, the proportion reached 12 per cent in 1956 and again in 1958 and then receded.

Figure 2 shows the contributions to GDP by industry and ownership. It is apparent that at least one half of the total contribution arises from industries supplying goods for direct personal consumption.

Table 1 gives a more detailed breakdown of the contribution and rate of growth of individual industries.

It is illustrative to place in juxtaposition with these intra-sectoral growth rates, the changes which have taken place in the corresponding imports and exports (Table 2). It will be noted that, while all industries have shown some increase in the value of output - many of the order of 50 per cent or more for the period, imports have, except in one case, also shown marked increases, especially in items for personal consumption. Some of this increase is probably due to imports made through military aid and only more recent statistics will indicate the extent of this.*

Exports show some encouraging gains in those industries in which there has been recent investment involving foreign expertise.

It is the purpose of the remainder of this document to examine in closer

* As from August, 1967 import and export statistics exclude figures for military aid.

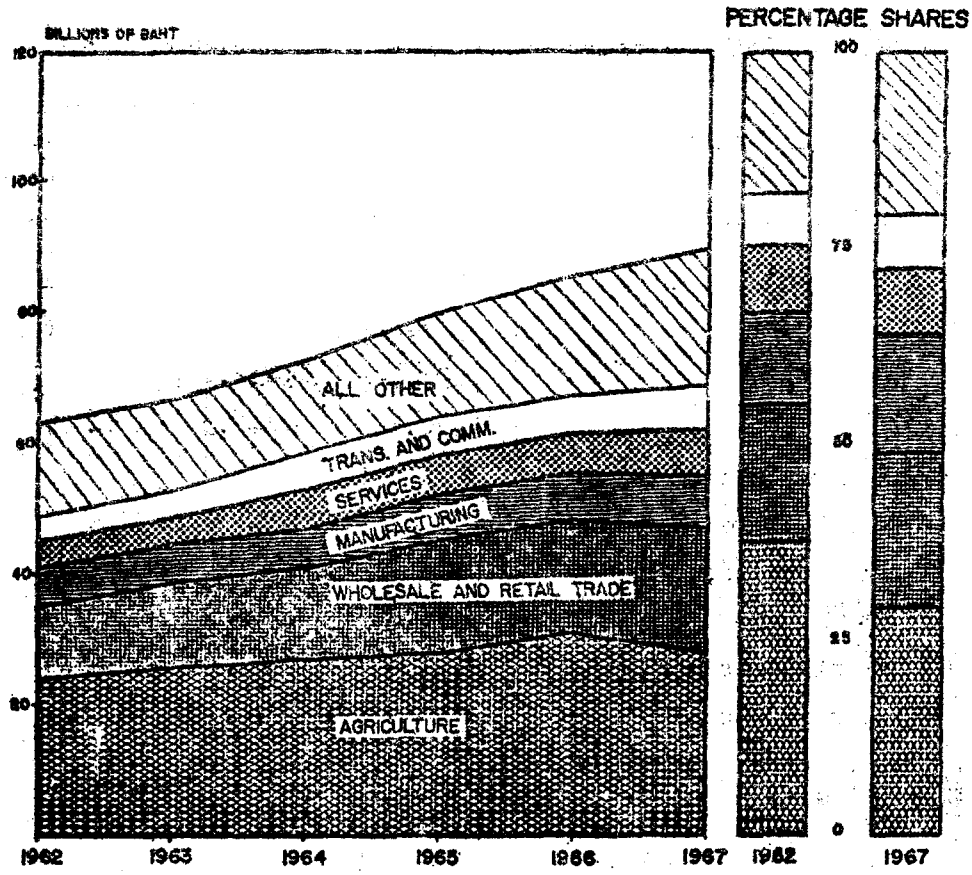

Figure 1.— GDP originating by sector at 1962 prices.

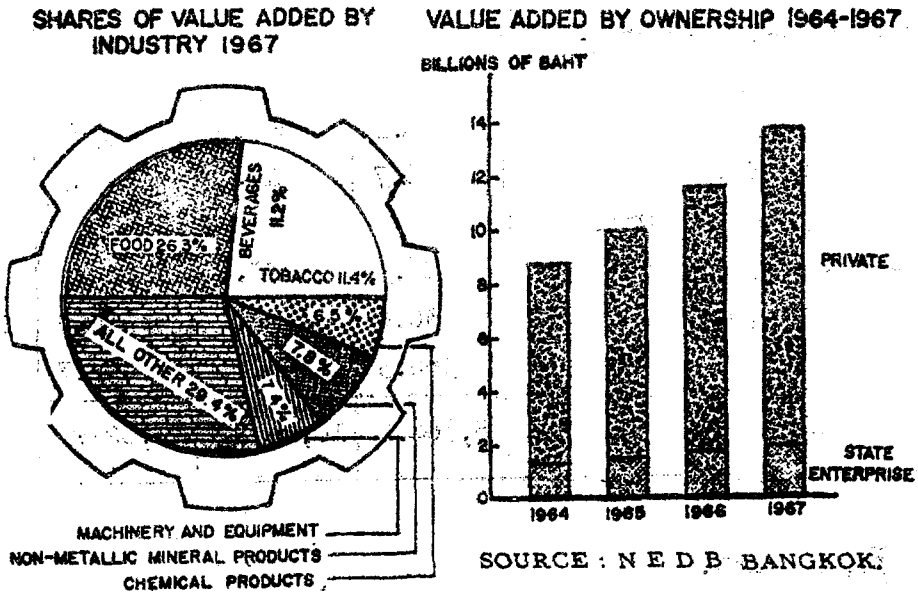

Figure 2.— GDP originating from manufacturing by industry and ownership.

TABLE 1

GROSS DOMESTIC PRODUCT ORIGINATING FROM MANUFACTURING

(Millions of baht)

	1964	1965	1966	1967
Food	2,402.6	2,464.8	2,768.1	3,635.5
Beverages	927.3	1,007.3	1,318.6	1,541.4
Tobacco	1,031.3	1,232.6	1,403.7	1,566.4
Textiles	372.5	446.5	483.5	561.4
Footwear, other wearing apparel and made-up textile goods	306.9	317.2	327.9	338.9
Wood and cork products, except furniture	558.9	655.9	692.1	759.9
Furniture and fixtures	104.9	112.4	144.9	164.6
Paper and paper products	44.9	59.8	59.8	69.9
Printing, publishing and allied industries	213.7	235.8	226.0	246.6
Leather and leather products, except footwear	131.4	137.5	138.4	142.1
Rubber products	216.2	290.1	304.9	319.4
Chemicals and chemical products	621.9	705.9	765.1	901.5
Petroleum refining	166.5	637.4	722.0	842.9
Non-metallic mineral products, except products of petroleum and coal	579.8	720.9	885.4	1,080.6
Basic metal industries	8.7	13.0	12.3	11.9
Electrical machinery, apparatus, appliances and supplies	26.3	32.5	32.5	36.0
Machinery and equipment	630.0	686.1	894.9	1,018.1
All other	360.5	289.7	448.7	562.5
Total value added	8,704.2	10,045.7	11,628.8	13,799.8

Source: NEDB, Bangkok.

TABLE 2

COMPARISON OF LOCAL MANUFACTURES WITH CORRESPONDING IMPORTS AND EXPORTS

Description	SITC Code	ISIC Code	GDP contribution (Millions of baht)			Import value (Millions of baht)			Export value (Millions of baht)		
			1964	1967	Increase (%)	1964	1966	Increase(+) Decrease(-) (%)	1964	1965	Increase(+) Decrease(-) (%)
Food	0	20	2,402.6	3,635.5	51.3	876.0	2,172.7	+ 148.0	7,152.6	7,115.4	- 0.5
Beverages	11	21	927.3	1,541.4	66.2	17.8	527.0	+ 2,860.7	0.004	5.2	*
Tobacco	12	22	1,031.3	1,566.4	51.8	165.4	332.4	+ 100.9	81.7	116.0	+ 41.9
Textiles	65	23	372.5	561.4	50.8	171.7	1,726.1	+ 905.3	37.6	110.9	+ 194.9
Footwear, other wearing apparel and made-up textile goods	85	24	306.9	338.9	10.4	15.8	12.0	- 24.0	0.3	0.07	- 75.3
Wood and cork products except furniture	63	25	558.9	759.9	35.9	9.3	86.8	+ 833.3	8.4	5.4	- 35.7
Furniture and fixtures	82	26	104.9	164.6	56.8	17.7	48.0	+ 171.1	0.5	0.6	+ 20.0
Paper and paper products	64	27	44.9	69.9	55.6	337.1	566.6	+ 68.0	3.6	0.3	- 91.4
Printing, publishing and allied industries	892	28	213.7	246.6	15.4	93.9	179.1	+ 90.7	0.6	0.3	- 50.0
Leather and leather products except footwear	61	29	131.4	142.1	8.1	5.3	8.9	+ 67.8	4.0	3.8	- 5.0
Rubber products	62	30	216.2	319.4	47.7	308.9	331.9	+ 7.5	1.3	1.7	+ 30.7
Chemicals and chemical products	5	31	621.9	901.5	44.9	1,485.6	3,446.7	+ 132.1	15.2	11.4	- 25.0
Petroleum refining	313	32	166.5	842.9	406.2	1,224.0	1,570.4	+ 28.3	6.4	49.3	+ 679.6
Non-metallic mineral products except products of petroleum and coal	66	33	579.8	1,080.6	86.3	185.2	403.6	+ 117.9	45.6	23.2	- 49.1
Basic metal industries	68+69	34	8.7	11.9	36.7	1,747.1	3,159.1	+ 80.8	17.6	1,302.5	+7,300.5
Electrical machinery, apparatus, appliances and supplies	721	37	26.3	36.0	36.8	767.7	1,028.8	+ 34.0	5.4	12.0	+ 122.2
Machinery and transports equipment (non-elec)	7+721	38	630.0	1,018.1	61.6	3,752.5	5,881.1	+ 56.7	1.4	3.3	+ 135.7

Note: SITC and ISIC do not, of course, correspond in all respects; The comparison is however sufficiently close to illustrate the observations in the text.

Source: GDP contribution: NEDB, Bangkok., import & export data: Department of Customs, Bangkok. (1967 annual import & export statistics are not yet available.)

detail what has been happening in each industrial segment. The breakdown adopted is that of the International Standard Industrial Classification.

(b) Major group 20: Food manufacturing industries (Except beverage industries)

Thai people, in common with many other Asian peoples, have a preference for freshly prepared foods and this has constrained the pattern of development of the industry compared with its counterpart in Western countries. Canning, for example, tends to be a relatively minor activity and preservation by drying or salting is comparatively important. ECAFE* (1965), considered that, a large part of the surplus foods especially vegetable and fish is being wasted.

Although Thais are not yet consumers of fresh milk to any extent, in 1966, imports of condensed and evaporated milk were valued at 300 million baht and milk powders 100 million baht. Scope for development of a dairy industry is therefore apparent.

The growth in consumption and production of food in Thailand, as in other countries, is related to growth in population and per capita income. According to the National Economic Development Board, population is forecast to grow at the rate of 3.2 per cent per year through 1971; and per capita income growth is forecast at 3.5 per cent per year through 1966 and at the rate of 3.8 per cent per year thereafter through 1971. With that rapid growth will come not only an increase in the volume of demand for food but in the composition of demand also.

Thailand's food processing industry is not well developed, with two recent exceptions — pineapple canning and frozen shrimp processing for export.

(i) Group 201: Slaughtering, preparation preserving of meat

Meat slaughtering, preparation and preservation other than canning is dominated by municipally-owned plants. A sizable volume of unrecorded slaughter also occurs.

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* "Sectoral study, food processing industries." Prepared for Asian conference on industrialization, 6-20 December 1965, Manila.

In 1963, there were 291 plants listed as being engaged in meat slaughtering and 33 plants engaged primarily in the preparation and preservation of meat and meat products.

There are about 11 manufacturers of sausages with a total output of under 300 tonnes. Chinese sausages are made by many very small operators.

Three canners dominate production in that field, the products being principally meat curries and items fitting Thai rather than Western-type cuisine. The major part of production is consumed by the military. Average can-size is 180 grammes.

The following are the names of major factories and their products:-

1. Bangkok Slaughterhouse. It is the only large modern plant. It started operation in 1961. "Presently, it is slaughtering at the rate of about 100,000 head of cattle and buffaloes, 150,000 pigs and 6 million head of poultry annually.

2. Two meat canning establishments owned by the Department of Defence, one of which is the Preserved Food Organization. Both have their own slaughter-houses.

Presently, idle capacity in the PFO canning plant more than exceeds forecast canned goods production. It is considered unlikely that additional investment in existing canneries will be other than for replacement parts. Because of its importance, the following are some details of the Preserved Food Organization's activities.

Preserved Food Organization

Production net weight in kg

Year	Ban Pong Factory	Bangk Khen Factory	Total
1963		28,876.890	28,876.890
1964	83,714.60	82,591.320	166,305.920
1965	46,877.50	65,370.198	112,047.698

Sales statistics October 1965-August 1966.

Type of food	Sales in baht
Meat	664,243.50
Pork (canned)	159,315.00
Chicken	84,173.00
Fish	5,219.00
Dressing or sauce	77,973.25
Salted Foods	4,018.50
Pickles	9,538.50
Curry stock	46,845.25
Sweets and dessert	9,454.50
Fruit	190,051.75
Total	1,250,832.25

(ii) Group 202: Manufacture of dairy products

Production of milk products in Thailand is mainly from imported milk powder and butter-fat: the dairy industry, while supported by first-rate technological know-how from abroad in several centres throughout the country, is nevertheless not much beyond the experimental stage, although bottled milk is displayed in most shops catering for 'farangs.'

The original operator in this field was Foremost Dairies (Bangkok) Ltd. which bases its manufacture largely on reconstituted milk of which its capacity could handle 150,000 gallons per month. It produces ice-cream up to 30,000 gallons per month, as well as buttermilk, yoghurt, cottage cheese, and water ices.

The local production of condensed milk has attracted a good deal of interest, there being three producers at present with two further producers soon to commence operations.

In the field of fresh-milk production, a Danish-Thai venture and Kasetsart University, the latter producing 4,000 pint bottles per day, are the chief operators.

(iii) Group 203: Canning and preserving fruit and vegetables

This part of the food-processing industry is defined for purposes of

this report as including firms producing pickles, dried, smoked and stewed fruits and vegetables, but excluding products packed in airtight containers which are covered under food canning. The industry is made up of many small firms and time limitations have not permitted an extensive survey of producers.

Estimated 1964 consumption and production of preserved fruits and vegetables excluding products packed in airtight containers:-

	Thousands of tonnes
Consumption	88.7
Imports	1.5
Exports	1.7
Production	88.9

Source: Marsden, 1966, brief analyses of selected industries in Thailand, page 126.

Six varieties of fruit are canned; pineapple is reported to represent a major share of the total volume. The typical pack is a 800 grammes can. Other kinds of fruits are longan, litchi, rambutan and chestnut.

The Thai-Pineapple Industrial Corp. has recently received promotion privileges for the canning of fruit. Capacity is reportedly planned at 1490 tonnes per year with investment in land, equipment and buildings of approximately ฿ 8.0 million if the proposed plant goes into operation. A plant located in Bangkok to pack 500 tonnes per year of dried fruit in airtight plastic bags has received promotion. Investment in land, plant, and equipment is estimated at ฿ 850,000.

Garlic pickles are also packed in glass jars by one manufacturer. Estimated output is about 80 tonnes per year.

Soy sauce. Consumption of soy sauce is estimated at ฿ 1.15 per capita per year at the wholesale price level. The import of soy sauce was only 7,257 kg. valued at about 57,000 baht, in 1966, suggesting that much of the presumably large consumption arises as mother liquor from local gourmet powder production. The total import of unidentified sauces and the like in 1964 was ฿ 1.5 million at c.i.f. prices.

(iv) Group 204: Canning, preserving of fish and other seafoods

Canning of fish and other seafood

Five of the leading canners dominate domestic production. Production estimates are based on the equivalent of 4 months peak operation. Canned fish are produced in 3 quality grades and value estimates are based on the following relationships in grade and price. Average can-size is 180 grammes.

Estimated 1964 consumption and production of canned fish and seafood in Thailand

(tonnes)

Consumption	Imports*	Exports*	Production+
1979	856	13	1,136

* 1964 - Department of Customs Thailand - Values c.i.f.

+ Based on survey - values - exfactory price; value added calculated at average of 30 %.

Preserved fish and seafood (other than canned)

Consumption and production of commercially dried, salted, smoked and boiled fish and seafood based on Department of Fisheries' information is:-

Estimated production of commercially dried, salted, smoked, and boiled fish and seafood in 1963

(*thousand of tonnes*)

	Dried & salted	Boiled & smoked	Total
Fish and seafood utilized*			
Marine	44.0	4.0	48.0
Fresh water	4.8	4.8	9.6
Total	48.8	8.8	57.6

Source: * Department of Fisheries.

	Dried & salted	Boiled & smoked	Total
Preserved fish production			
Marine	25.0	2.6	27.6
Fresh water	3.2	3.2	6.4
Total	28.2	5.8	34.0

The companies freezing and exporting shrimp and lobster tails have a combined capacity of over 765 tonnes per year. While Thailand is an exporter of salted, dried, and smoked fish and seafood, the average value per tonne of imported fish and seafood is considerably higher than that of domestic exports. Therefore, the total value of imports of these items is considerably higher than exports. However, unidentified exports of frozen shrimp and lobster tails, included in production estimates in the following table, tend to balance the difference between value of imports and exports.

Estimated trend of consumption and production of commercially dried, salted, smoked and boiled fish and seafood

(thousands of tonnes)

	Imports*	Exports*	Raw fish used for production+	Production+	Apparent consumption
1960	1.6	4.0	20.4	12.3	9.9
1961	2.3	3.4	36.3	21.6	20.5
1962	1.4	1.8	47.1	28.0	27.6
1963	1.3	1.5	57.6	34.0	33.8
1964	1.3	1.8	69.0	41.1	40.6
1965	1.2	2.3	‡	‡	‡
1966	1.0	2.3	‡	‡	‡
1967	0.8	1.3	‡	‡	‡

Sources: * Department of Customs, Bangkok.

\+ Department of Fisheries, Bangkok.

‡ no later data available.

Value of imports, exports, and production of preserved fish and seafood in 1964

	Million baht
Imports	20.0
Exports	4.7
Domestic production	546.2
Value added in production	163.9

Fish, salted. Millions of fishes are hatched and caught every year in the gulf of Thailand. Pla-tu is the most important among salted fish exported from Thailand. Saltfish is exported mainly to Indonesia and Singapore.

Export statistics	Quantity (tonnes)	Value (million baht)
1962	62	0.2
1963	28	0.07
1964	38	0.07
1965	2137	6.3
1966	2425	7.4
1967	12	0.05

Dried mussels. Dried mussels are second only to fish in importance and abundance. The mussels are gathered in large quantities, the meat is taken out of the shell, boiled, and then sun-dried. Mussels are exported only in the dried form, mainly to Singapore and Hong Kong. They are popularly used for human consumption.

Export statistics	Quantity (tonnes)	Value (million baht)
1962	153	1.0
1963	75	0.6
1964	118	0.8
1965	172	1.0
1966	87	0.6
1967	166	1.1

Shrimp paste ("kapi"). Production has grown gradually in recent years, averaging overall (in terms of shrimp and prawn utilized) about 25 per cent of the catch. It has been unable to fill consumption requirements, however,

due to the limited availability of shrimp and prawn for this industry. A sizable expansion in the shrimp and prawn catch took place in 1963 due to development of export sales of shrimp. While the percentage of the catch utilized for paste is expected to decline, production of paste is forecast to continue to grow at a rate of 10 per cent per year.

Fish sauce. Since no imports are recorded, Thailand is apparently self-sufficient in fish-sauce, an extremely popular condiment which, incidentally, replaces table salt.

Estimates of production of fish sauce for 1964 suggest that some 40 million litres were made, using about 20,000 tonnes of fish, or roughly 2 litres of sauce per kilogramme of fish. The sauce is produced in six grades of quality and first grade, which requires about 5 years to mature, accounts for approximately 25 per cent of sales and retails at ฿ 6.50 per 750 cc bottle. Maturation time for the poorest grade is only a few months and it retails at ฿ 1.00 per bottle.

The major producers are Thai Preeda Industry Co., Ltd., Songwat, and Phairoj Co., Chon Buri.

Investment in fixed assets in the fish sauce industry can be expected to increase with increased production and is estimated to approach ฿ 40 million in total by 1971.

(v) Group 205: Manufacture of grain-mill products

Rice-milling. Rice milling is the nation's principal industry. The production is for local consumption and also for export. There are about 15,000 mechanized rice-mills: over half the total number of registered factories. Paddy processed is of the order of 11 million tonnes annually valued at over 17,000 million baht.

There is considerable over-capacity in the Thai rice-milling industry, only some of which will be utilized by the production target of 13.7 million tonnes by 1971. There are moves to re-organize the industry.

The following are the major rice-millers in Bangkok:-

1. Bang Bua Tong Rice Mill Ltd., Partnership,
   1-5 Lamphun Chai Road, Bangkok. Tel. 27355. Rice Miller, Exporters and Importers.

2. Chin Seng Rice Mill Co., Ltd.,
412 Surawong Road, Bangkok. Tel. 30402. Rice Mills and Exporters.

3 Soon Chieng Lee Rice Mill Co., Ltd.,
497-498 Chong Nonsi Road, Bangkok.

4. Soon Heng Lee Rice Mill Co., Ltd.,
18-20 Bush Lane, Bangkok. Tel. 30744. Rice Miller, Exporters.

5. Tep Nang Rong Co., Ltd.,
532-534 Songwat Road, Bangkok. Tel. 20694.

6. Thai Long Rice Trading Co., Ltd.,
260 Talat Noang Lane, Bangkok. Tel. 30151, 32922.

7. United Agricultural Co., Ltd.,
256 Sano Lei, Bang Bua Thong, Nonthaburi. Tel. 22936.

8. Thai Rice Co., Ltd.
691 Pak Khlong Sathon, Bangkok. Tel. 31289, 32322.
Rice Millers, dealing in rice, Industry of Porcelain Wares and Welded Metal Wares.

Processing of maize (corn). Thailand's third biggest industry is maize processing, and about 1.4 million baht worth of milled grain is produced annually and is attracting some very large American investment such as Calabrian Co. Inc, (multi-million dollar). Most shelling of maize is done either by farmers or by contract shellers in farm areas, but there are three Bangkok operators with large drying capacities:-

(1)	Bangkok drying and silos	1,200	tonnes/day.
(2)	Siam drying and silos	3,000	tonnes/day.
(3)	United silo (RH Ho)		

Calabrian (Thailand) Co., Ltd., has started drying and storing corn for eventual marketing on a world wide basis. The company's facilities have been designed to accommodate an annual capacity of 600,000 tonnes.

Other exporters are:-

1. Bangkok Perdpone Limited, Perdpone Limited Partnership.
2-4 Rama 4 Road, Khlong Toei, Bangkok. Tel. 36532.

2. Farm Kirikarn Co., Ltd.,
160 Chareon Krung Road, Bangkok. Tel. 20344.

3. Great Eastern Shipping and Trading Corp. Ltd., Partnership.
1148 Songwat Road, Bangkok. Tel. 28570.

4. New Thai Product Limited Partnership.
   1068 Songwat Road, Bangkok. Tel. 20887, 21409, 22587, 28640.
5. Nomura Trading Co., Ltd., (Bangkok Branch).
   129-135 Ratchawong Road, Bangkok. Tel. 23089.
6. Sanyaluk B.F. Co., Ltd.,
   1157 Charoen Krung Road. Bangkok. Tel. 30860.
7. Seng Thai Products Co., Ltd.,
   147-151 Suapa Road, Bangkok. Tel. 28332.
8. Shinto Trading (Thailand) Co., Ltd.,
   115/1 Surawong Road, Bangkok. Tel. 30875, 38165.
9. Soon Heng Lee Produce Co., Ltd.,
   18-20 Bush Lane, Bangkok. Tel. 30744.
10. Tep Panich Co., Ltd.,
    532-534 Songwat Road, Bangkok. Tel. 25134, 20694, 26460.

Generally speaking, the Thai maize trade is progressive and orderly. That this is so largely due to the adoption of a new system of transacting business with Japan, and to the favourable disposition of overseas buyers.

The milling of wheat flour is undertaken by one company, United Flour Mill Co., Ltd., which is a joint venture of Thai, Chinese, and Argentinian capital. It received promotional privileges in June 1961 with a total investment of 25 million baht and a registered capital of 10 million baht. It is connected through its managing director, Mr. R.H. Ho, with Thai Wah Co., Ltd., a major operator in the tapioca products field.

Situated on the Chao Phraya River below Bangkok, the mill was expected to reach an output of 40,000 tonnes of flour p.a. by the end of 1968, thus supplying about 80 per cent of Thailand's total consumption of 50,000 tonnes p.a. of which noodles account for about 60 per cent. Total capacity is 54,000 tonnes p.a. and demand is said to be rising at the rate of 10 per cent annually.

Wheat flour consumption in Thailand is comparatively low - 1.4 kg per capita compared with 19 in Malaysia, 22 in Korea, 27 in India, and 38 in Japan. The position in Thailand is partly governed by its pre-eminence as a rice producer, partly by tax structures on both rice and wheat: an excellent discussion of the position is given in "The Investor," December, 1968.

Noodles. Although noodles appear to be a popular item of Thai diet, expenditure on noodles was only 0.6 per cent of total expenditure on food and beverages in 1962.

Noodles consumed are mainly of rice and there is a substantial export over 9 million baht's worth in 1966.

Wheat noodles appear to be largely imported and are a relatively small item, the 1966 import being some 65,000 baht in value.

Noodles are also made from the carbohydrate moiety of mung bean, the valuable protein portion being run to waste except in one or two cases.

Mung noodle factories

1. Walun Company Ltd.,
   49 Sunpawut road,
   Tambol Bang Na, Bangkok.
2. Bangkok Mung Noodles Factory,
   5/9 First Bangkok road,
   Tambol Bang Fo, Bangkok.
3. Thai-Heng
   47 Kor. Tambol Nongkhae,
   Saraburi.
4. Chiang Mai Wun Sen Industry Co., Ltd.,
   Moo 3, Tambol Nong Hoi,
   Chiang Mai.
5. Thai Poon-Pol Factory Company Ltd.,
   Tambol Damnoen Saduag,
   Samut Sakhon.

(vi) Group 206: Manufacture of bakery products

Bakery products are chiefly consumed by foreigners in Thailand but Thai people themselves are fairly rapidly acquiring a liking for the taste and convenience of leavened bakery products. Traditional Thai tastes are for the sweeter cakes and to some extent for biscuits.

The following table shows how imports of wheat and flour have moved in recent years (local flour-milling capacity has been increasing).

Year	Wheat*	Wheat flour*
1960	24,000	23,000
1961	26,000	25,000
1962	27,000	26,000
1963	30,000	29,000
1964	34,000	24,000
1965	30,000	17,000
1966	55,000	14,000

* in tonnes, rounded.

The larger bakeries are situated in the Bangkok area and include the following: Seiler's Bakery, United Flour Mill Bakery. Major biscuit makers are Khong Guan Biscuit Factory "Thailand" Co., Ltd., and Hodson Biscuit Confectionery Co., Ltd.

(vii) Group 207: Sugar factories and refineries

Although some sugar consumed in Thailand is produced from certain palm and coconut trees, the great bulk of production is from sugar-cane.

Cane-sugar production and export varies widely:-

Year	Production (tonnes)	Export (tonnes)	Wholesale* price (baht/kg)
1964	167,973	48,908	5.14
1965	319,976	83,834	2.54
1966	269,168	54,855	3.05
1967	232,412	16,800+	3.48

* Refined sugar.
+ preliminary, up to August.

Source: The Sugar Institute; Department of Customs.

The current season's crop (1968) of cane appears to be likely to yield 2.19 million tonnes of cane as against 2.53 million tonnes in the previous season, due partly to drought, partly to the price disincentive which arose out of the surpluses in recent years. With an estimated production of 200,000 tonnes and no current export surplus, Thailand is now faced with the prospect

either of foregoing the 15,000 tonne quota allotted by the U.S., or fulfilling the quota and relaxing import restrictions on raw sugar in order to make good the resulting deficiency in the local market. The ensuing price rise will presumably tend to recreate surplus conditions next season but discontinuance of the government export subsidy of 2 baht per kg to the industry will mitigate the tendency. Establishment of condensed milk factories in the country in recent years has no doubt increased consumption of local sugar.

Thailand currently has 32 cane sugar mills of which four were government-owned, namely:-

Chon Buri Sugar Industry Co.,
Suphan Buri Sugar Factory
Thai Sugar Organization (Lampang Mill)
" " (Uttaradit Mill)

Artamonoff (1965) noted that the latter two were about to be sold and he also recommended the immediate sale of the Chon Buri and Suphan Buri enterprises because of their inefficiency, the number of tonnes of cane used to produce a tonne of sugar being 12.

From statistics published in the FAO Production Year book, however, Thailand would appear to be a relatively efficient producer of sugar, overall (see table). The sugar is not a fully refined grade but is mainly "plantation white."

In addition to sugar, the industry also produces molasses, bagasse, and filter-cake. Data obtained from a private sugar producer showed the ratio of production (per tonne of cane) as:-

95 kg sugar (99.83 % sucrose)
76 " molasses
250 " bagasse
30-40 " filter-cake (48 % moisture).

No attempt seems to have been made to extract the Carnauba-like wax from the filter cake, although Thailand's lower labour costs may make this feasible, despite its commercial failure elsewhere.

No present use is made of bagasse other than as an under-boiler fuel. Generally, the cost of conversion of boilers to oil-fuel, the cost of the oil-fuel itself coupled with the cost of transport and storage of bagasse,

all tend to militate against its use, as a raw material for say, wall-boards. In 1966, for example, it would appear that there were 600,000 tonnes of bagasse arising in Thailand, and one group of 7 sugar mills within a radius of some 5 kilometres near Ban Pong were then producing 200,000 tonnes of bagasse p.a. It is in this area that the Siam Kraft Paper Company has established and plans to utilize "limited quantities" of bagasse as a pulp-stock.

It would also appear from the figures above that Thailand produced about 216,000 tonnes of molasses in 1966, of which 118,000 tonnes (55 per cent) were exported.

In 1967, Thailand became, virtually for the first time, an importer as well as an exporter of molasses as the following data show:-

Molasses, 1967

	Quantity	Value	Unit value
Export	64,500,000	39,889,928	0.62 baht/kg
Import	34,666,918	35,606,023	1.03 "

This, of course, is tantamount to Thailand re-importing about half her molasses exports at 66 per cent increase in price. The basic reason is that the export market is the more lucrative and exporters make firm contracts with overseas buyers at the expense of local needs. The practice has also grown up of sugar-mills requiring a 50 per cent deposit prior to harvest, against molasses orders by local distillers. Some local distilleries are understood to have made representations to the government, requesting a control of molasses export.

Selected countries: Production of sugar cane sugar 1965/66 (1000 tonnes)

Country	Sugar cane	Centrifugal sugar	Nontrifugal sugar	Total sugar	Cane per tonne of sugar
Australia	14,388	1,984	-	1,984	7.25
Brazil	75,853	4,852	270	5,122	14.8
Hawaii	10,518	1,129	-	1,129	9.31
Thailand	3,500	265	150	415	8.45
U.S.A.	10,929	1,002	-	1,002	10.90

Source: FAO Production Year book 1966.

(viii) Group 208: Manufacture of cocoa, chocolate,and confectionary

Non-chocolate confectionary

Thai people have a large range of traditional sweets, usually home-made or the products of cottage industries. Nevertheless, 1966 imports of 53,950 kg show that a considerable market exists for Western-type sweets. By far the most popular type is Hall's "Mentholyptus", imported from England, but copied here by at least thirty producers.

Chocolate confectionary

Chocolate products are popular among Thai children. No chocolate manufacture exists in Thailand, and supplies are imported from England and Japan.

1966 imports of		chocolate bonbons and chocolate candies	20,441	kg
"	"	chocolate, tablets, slabs, bars,and similar forms	97,339	kg
"	"	chocolate and chocolate preparations	17,148	kg

(ix) Group 209: Miscellaneous food preparations

Vinegar. At present there are 40 factories registered as vinegar producers with the Ministry of Public Health. Of these, 32 are engaged in production of imitation vinegar, 5 of distilled vinegar, and only 3 of fermented vinegar in the true sense.

Two fairly large plants producing distilled vinegar are being built and are being registered, one in Nonthaburi Province (1 million baht capital investment) and the other in Minburi District of Bangkok. According to the Thai Food Law, imitation vinegar is prepared by diluting acetic acid with water,and contains not less than 4 grammes and not more than 7 grammes of acetic acid in 100 millilitres.

Distilled vinegar includes products obtained by acetic fermentation of diluted spirit or of diluted alcohol or by further distilling the fermented product, and should contain not less than 4 grammes of acetic acid in 100 millilitres.

Fermented vinegar is the product obtained by alcoholic and subsequent acetic fermentation of vegetables, fruits, or sugar, and should not contain less than 4 grammes of acetic acid.

Of the five factories that produce distilled vinegar, that of the Preserved Food Organization uses diluted alcohol from the Government's Distillery at Ayutthaya as the raw material, and submerged culture type of acetator (Heinrich Fringe). The production capacity of this plant is about 750 litres per day.

Another factory at Suphan Buri will ferment its own alcohol from rice, sugar cane juice, pineapples, or corn, and distil it. Acetic fermentation from the dilute alcohol will be carried out by submerged culture type of acetator also, and the production capacity will be about the same as the one at the Preserved Food Organization.

Three other factories under this category, as well as the two under construction, ferment their own alcohol and distil it. Acetic fermentation is of the slow or Orleans process, employing home-made bran or old vinegar stock as the fermenting agent. The fermentation takes about 4-5 months in wooden tanks with occasional stirring.

At present vinegar production is a cottage industry, and even the most modern plant producing distilled vinegar cannot compete with imitation vinegar, because of the very low retail price of the latter.

Monosodium glutamate is produced by fermentation of glucose or sucrose in the presence of adequate quantities of urea. Molasses and tapioca are the preferred raw materials. It is marketed in a very pure form. This commodity, more informally described as "gourmet powder", is produced by three different companies, producing 4,000 tonnes. These companies planned to make their own hydrochloric acid and caustic soda.

All three companies have been accorded Promotion Certificates which specify that the capacity of the electrolysis unit is fixed at a minimum size of 1,825 tonnes per annum; this is larger than their own consumption and it is obvious that these companies will try to bring their surplus quantities of hydrochloric acid and caustic soda on the market. A survey of the present situation is needed.

The firms are:-

1. Ajinomoto Co., (Thailand) Ltd. produce 180 tonnes/month
   212-14 Ratchawong Road. Tel. 24490, 28892.
2. Thai Churos Factory. Produce 80 tonnes/month.
3. Hasa Provision Industries Co., Ltd. produce 100 tonnes/month.
   Tel. 28204.

Soy sauce (see Group 203 "Canning and preserving of vegetable products")

Chilli sauce. Dried chilli, as an export commodity, earns normally more than 27 million baht a year for Thailand. Chilli is grown all over the country, the principal area being Ratchaburi province. The only firm to produce chilli sauce is at Si Racha, Chon Buri province. There is no production of tomato sauce commercially.

There is a production of garlic powder, pepper powder, and fish-paste but only as a home industry, not in registered factories.

Animal feeds industry in Thailand

The commercial production of prepared animal and poultry feeds is still in its infancy in Thailand and demand itself is relatively low.

Development of the animal feeds industry, together with related industries such as livestock breeding and raising, and meat preparation and preservation is important to Thailand. These industries are based primarily on domestic raw materials and sizable production potentials for both domestic and export outlets exist. Development of these industries can have a favourable effect on economically depressed agricultural areas of Thailand, such as the north-east.

Production (1964)

1. Feed concentrates 25,000 metric tonnes.
2. Fish meal production has grown from 3,000 to 9,000 tonnes in the period 1960-1964. The trend is expected to continue.
3. Feed grains and similar raw materials.

Export 1964-1701 million tonnes, f.o.b. value ฿ 1,794 million.

According to leading manufacturers, about 70-80 per cent of the industry's concentrate sales are to poultry farmers for chicken egg production, and from

20 to 30 per cent are to swine raisers. Less than 5 per cent of volume is to duck and broiler raisers and horse breeders. Broiler production is said to be largely still experimental. Duck farms are principally small "backyard" establishments. Ducks are primarily raised for egg production. Ingredients used by duck raisers are reported to be mainly small whole fish, known as duckfish, molluscs, fish meal, and cereal bran.

Consumption of commercially prepared feeds by cattle and buffaloes in Thailand is negligible.

Thailand's production of feed materials is still principally represented by raw materials for export such as feed grains, cassava meal, chip and waste, and oil cake. The bulk of maize exports are to Japan, while West Germany has been the largest customer for cassava products. Exports of oil seed cakes have grown in recent years to about 153 metric tonnes in 1966. In that year, exports of edible oil seeds were approximately 90,800 tonnes. Export of feed ingredients such as oil-cake meals, vegetable oil residues, and fish meal have been growing but are still at a relatively low level amounting to approximately 7,573 tonnes in 1966. Exports of food wastes and prepared animal feed has also grown, reaching 4,753 tonnes in 1966. These products are principally exported to neighbouring countries.

An estimate of total consumption of feedstuffs is:-

Overall consumption of feed ingredients

Item	Per cent of mixed feed	Metric tonnes
Concentrates	30	25,000
Rice bran	50	41,700
Broken rice	10	8,300
Total	100	83,300

There are no state enterprises engaged in this industry. The Poultry Cooperative, which is an ordinary partnership formed under the Thai Government Agricultural Product Marketing Co-op Division, owns a relatively modern animal feed concentrate plant in Bangkok. The plant is leased to the major private manufacturer of feed concentrates in Thailand, The Charoen Pokphand (Bangkok) Co., Ltd.

The structure of the industry is that there are 5 manufacturers - one dominates in feed concentrates, ingredients and finished feed and 4 small-scale firms produce ingredients and finished feed. Six small plants are engaged in production of fish meal and 125-140 firms handle maize and sorghum, chiefly for export. Major operators are:-

1. The Charoen Pokphand (Bangkok) Co., Ltd.
   Tel. 31865.
2. Peter Claimer Co., Ltd.
   52, 52/17 Ratchaprarop Road. Tel. 75703.
   Tapioca flour.
3. Thai Wah Trading Co., Ltd. Tapioca products
   21 Sathorn Tai Road. Tel. 32100.

In an effort to step up animal feed production in Thailand and particularly to lower the cost of pork, the Board of Investment has recently promoted 11 animal feed firms with a total proposed capacity of some 900,000 tonnes, of which pig feed will account for about one third. Presently, pig-breeders either make their own feed or buy a low-grade ready-mixed food made in small factories. Demand projection for pig-feed is as follows:-

Year	Pig population	Feed demand (tonnes)
1968	522,840	209,136
1969	717,300	286,920
1970	946,800	378,720
1971	1,215,000	485,940
1972	1,527,000	610,848

Source: "The Investor," December 1968.

Tea and coffee

Tea. Supplies of tea for Thailand are largely obtained by import but there is some local production also.

In 1966, some 800 tonnes of tea leaves and 700 tonnes of tea dust were imported. In 1964, the latest data available, 106 tonnes of tea-leaves and 132 tonnes of tea-dust were produced mainly in northern Thailand - Changwat Chiang Mai being the centre of the tea-growing industry.

By law, importers of tea must buy from local producers, 15 per cent of the quantity of tea they import. Locally-grown tea is "black" tea: all supplies of "green" tea ("Chinese" tea) must be imported.

The major tea processor in Thailand is Thai Tea Co., Ltd. of Chiang Rai, which also has an office at 1065 Songwat Road, Bangkok. Output of tea is said to be 3 tonnes per day, but this may be "in the season" only.

Coffee. Supplies of coffee are obtained both by import and by local production. In 1966, some 6,000 tonnes of "Coffee, not roasted" and 120 tonnes of "Instant coffee" were imported.

The Ministry of the Interior has been fostering coffee production by the hill tribes of northern Thailand, annual production targets for 1964-66 being 5,000 tonnes p.a., rising to 5,400 tonnes in 1971.

Almost all the coffee grown in Thailand is of Robusta type, supplies of the finer-flavoured Arabica being obtained by import.

Maltose syrup (Ba-sao) is made by about five companies in Bangkok and is used as a sweetening, flavouring, and to some extent a conditioning agent in local confectionery, bakery products, and ice-cream. There is also a sizable export market, over 500 tonnes having been exported from the Port of Bangkok in 1967 with a value of 1.4 million baht, major destinations being Hong Kong, Malaya, and Japan.

It is made either from tapioca flour or from glutinous rice, by acid hydrolysis or enzymically. Amongst producers are Seng Heng Co., Ltd.

(c) Major group 21: Beverage industries

(i) Group 211: Distilling, rectifying and blending of spirits

There are now 38 registered establishments in Thailand which distil alcoholic liquor, the majority being in the provinces. Originally, they were all government-owned and operated but in recent years, all have been leased to private operators except the Ayutthaya Alcoholic Spirits Distillery.

Whilst all the establishments, including the Ayutthaya Distillery, produce potable spirits, industrial alcohol for outside sale is made only at Ayutthaya, although some, at least, of the potable spirit distilleries have a pot-still with which to produce a rectified spirit for adjusting their

"whiskies" to the required strength.

Total production of all spirits in the 1966 fiscal year was some 137 million litres, generally within the range 30-35 degrees Gay-Lussac. Most of the production is called "whisky" or "rice-whisky" but is, in effect, a white rum since molasses is the major substrate.

The largest of the potable alcohol distilleries is the Bang-yee-khan Distillery at Thon Buri, operated by the Maha Khun Co., Ltd. This establishment makes 3 brands of blended "whiskies" - "Mekhong", "Kwang Thong", and "Marshal" (a matured "whisky"); a range of liqueurs, vermouth; and glutinous rice spirits.

The process for making Mekhong-type "whiskies" is to mix, for example, 2.5 tonnes of glutinous rice (previously saccharified with Rhizopus mould) with 25 to 30 tonnes of molasses and make up to 100 tonnes with water, ferment with yeast, then distil.

The Bang-yee-khan distillery claims to make 10 million (750 cc) bottles of Mekhong per year and claims also that Mekhong contains only 0.01 per cent fusel oil compared with 0.08 per cent in Scotch whisky. The Distillery also makes a spirit, "Pae-Pow", wholly from glutinous rice and this spirit is particularly popular amongst the Chinese.

A description of the operations of the Ayutthaya distillery appears under "Ethyl Alcohol" in Group 311.

Outside Bangkok, there is generally a distillery in the larger provinces and this services also the smaller adjacent province (or provinces). Nam Seng Thye Co., Ltd., Bangkok, for example, leased the government distilleries in Ratchaburi, Suphan Buri Chiang Mai, and Nakhon Sawan and is also allowed to supply the province of Samut Songkhram (from Ratchaburi) and Lamphun (from Chiang Mai).

As previously stated, molasses is the major raw-material used in Thailand for making potable spirits (apart from Pae-Pow which is based wholly on rice): glutinous rice, which is a more costly substrate, is normally a minor ingredient used to impart flavour to mekhong-type whiskies.

One plant early in 1967, was paying the following prices for raw materials:-

Molasses (usually 50 % sugar)	:	80 baht per 100 kg

Cassava starch	:	50 baht per 100 kg
Glutinous rice	:	130 to 150 baht per 100 kg
Sorghum	:	100 baht per 100 kg

In an endeavour to overcome problems of molasses supply and price, this company had two experts investigating the possibilities of further using cheaper alternatives for molasses.

The price of molasses is said to have increased about three-fold over the past four to five years.

So far as is known, no distillery in Thailand attempts to make use either of its CO_2 off-gas or its fermenter wastes. In the case of the Ayutthaya distillery, fermenter-wastes (containing much yeast) are run into the near-by river at the rate of 200 tonnes per day. On a pro rata basis, then, the total distilling industry in Thailand may be discarding some 500,000 tonnes of yeast-containing fermenter wasted annually. (See also Group 213, breweries). Some distilleries now have plans to recover their fermenter wastes.

(ii) Group 212: Wine industries

There are rumours of impending local wine production but no official confirmation. Grape production is rapidly increasing and a wine industry would help to absorb the surplus grapes.

(iii) Group 213: Breweries and the manufacture of malt

Beer production in Thailand in 1967 was 26,502,259 litres, an increase of 5 million litres over the previous year. Import of "beer and other fermented cereal beverages" into the Port of Bangkok in 1967 was 3,555,005 litres valued at 33,213,701.

Thailand has two breweries, both in Bangkok. The larger, operated by the Boon Rawd Brewery Co., Ltd., produces bottled beer under the name of "Singha." In February, 1967, this brewery announced that it intended to expand production to 50 million litres p.a. by 1969 and to 100 million litres by 1970.

The smaller of the two breweries, Thai Amarit Brewery Ltd. makes a bottled "draft" beer under the brand "Krathing Thong." This beer relies on microfiltration rather than pasteurization for its sterility.

In 1967, 4,710 tonnes of malt valued at 19.6 million baht and 89 tonnes of hops valued at 6.1 million baht were imported through the Port of Bangkok. Neither material is produced in Thailand.

Thai Amarit Brewery Ltd. uses its CO_2 off-gas to make soda-water while Boon Rawd, the major producer of soda-water, allows its fermenter gas to escape, drawing its CO_2 from combustion of fuel oil.

From the breweries arise spent yeast, spent malted grain, and spent hops. Only the spent malted grain is known to be used as animal (or fish) fodder, the other two by-products being run to waste, although plans are in hand to recover the yeast for animal feed.

(iv) Group 214: Soft drinks and carbonated water industries

In the fiscal year, 1965-66, almost 600 million bottles of soft-drink- most of it carbonated - were produced in Thailand.

From 70 per cent to 75 per cent of the soft-drink market is supplied by three companies, namely:-

Thai Pure Drink Co. (bottlers of "Coca Cola," "Fanta" and "Sprite")
Sern Suk Co., Ltd. (bottlers of "Pepsi Cola")
Seven-Up Bottling Co., Ltd. (bottlers of "Crown Cola")

Fraser and Neave (Thailand) Ltd., who dominate the markets in Malaya, Singapore, and Hong Kong are quite small in Thailand. A large number of other smaller companies share the remainder of the Thai market - those include Bireley, Union Soda, Mambo Co., Green Spot, Pure Co., and King Huat. Two of these companies - Bireley and Green Spot - do not carbonate their soft drinks.

Some 98 per cent of the soda-water bottled in Thailand is made by the Boon Rawd Brewery Co., Ltd. using combustion of fuel oil as a source of CO_2.

Green Spot (Thailand) Co., Ltd., in addition, bottles "Vitamilk," a milk substitute based on the emulsification of soya-bean press-cake. A similar product, "Polak" is also on the market.

The industry considers its market to be comprised of three segments - the "rainbow" segment (i.e. coloured drinks), the "lime" segment (lemonade, etc.), and the "Cola" segment. In Thailand the "Cola" segment accounts for 50 per cent of the market as against 70 per cent in the U.S.A.

The raw materials as well as bottles are generally made in Thailand - the major exception being, flavouring essences and closures. Importation of "natural fruit flavours" into Thailand in 1967 was valued at 6.6 million baht of which 6.2 million baht in value came from U.S.A. No flavouring essences for commercial drinks are said to be made in Thailand.

A feature of the industry is its undecentralized nature - apart from Chiang Mai, there appear to be no provincial bottling plants, at least, of any size. The centralization of glass-bottle manufacture and CO_2 production in Bangkok may account for this, but it is in distinct contrast to the production of liquor (see Group 211) which is highly decentralized.

(d) Major group 22: Tobacco manufactures

(i) Group 220: Tobacco manufactures

The tobacco industry in Thailand was fully monopolized in 1941 as a result of the Tobacco Act of that year, and placed under the control and management of the newly created Thailand Tobacco Monopoly. This state enterprise is under the jurisdiction of the Ministry of Finance, and its functions are to raise the agricultural standards of Thai tobaccos; to undertake the sound and efficient production of high quality Virginia, Burley, and Oriental types of tobaccos; the manufacture and sale of cigarettes, and tobacco products and the import and export of leaf tobaccos.

So vast and profitable is the monopoly operation that its yearly profits far exceed that of any other state enterprise, and its contribution amounts to over 10 per cent of the Gross National Product.

At the present time, the Thailand Tobacco Monopoly markets 11 brands of cigarettes, 2 brands of cigars - and a pipe tobacco. In 1966, the sales of cigarettes totalled over 11.1 billion units - (Cigarettes 544,228,654 packets of 20, cigars 61,040 packages of 20, other tobacco rolled for smoking 77,209 tins) an increase of approximately 8 per cent over sales in 1965.

A very large percentage of domestically grown Thai Virginia, Burley, and Oriental tobaccos is used in the blends of the various brands of cigarettes manufactured by the Thailand Tobacco Monopoly but the largest used is Virginia, 92 per cent. One predominating factor in favour of Virginia tobacco cultivation in Thailand appears to be the propriety of soil and climatic

conditions prevailing in the tobacco growing regions. Light loamy soil, with adequate, but not over-rich, plant food may be found throughout these regions. As the main growing season falls early in October just after the rainy season and extends into the middle of the cool season, the air temperature is sufficiently cool to permit gradual ripening of the leaves.

The main Virginia tobacco growing regions are in the north and northeast.

Both Burley and Oriental tobaccos are grown on a comparatively small scale at present, but production of both these types is being stepped up to meet the increasing domestic consumption and export demands.

The Thailand Tobacco Monopoly staff a large and active Research Department which consists of two divisions; field research and factory research. In the field, experiments are conducted at the Tobacco Experimental Station at Mae Jo, Chiang Mai, in agronomy, plant breeding, soils and fertilizers, entomology, plant pathology, and general agricultural engineering with special application to improved tobacco production methods.

The scientific work on factory research is conducted at the central laboratory in Bangkok. Its activities include the analysis and testing of tobacco leaf and other materials used in the tobacco industry; the control of quality; the development of new blends; the studies of the physical and chemical characteristics of Thai tobacco; the relation between chemical composition and quality of leaf; the chemical components of tobacco as affected by fertilization and cultivating conditions; the studies of the chemical constituents of cigarette smoke and the investigation of the production of materials used in the manufacture of cigarettes.

In order further to increase exports of Thai Virginia flue-cured leaf tobacco, certain sections of the Tobacco Act have been revised by the Government to make it more flexible and in step with present day conditions. In pursuance of this policy, there is now a limited number of private tobacco dealers licensed to purchase Virginia tobacco from the curers and to process this tobacco for export.

The overall production of tobacco, though greatly enhanced in the last few years, still leaves a great deal to be desired. Of several hundred thousand acres of potential tobacco land available, only about 40,000 acres are presently being utilized for tobacco growing. However, with more modern

techniques and mechanization, the Thailand Tobacco Monopoly hopes to put more arable lands under tobacco in the near future.

The overall production of tobacco in 1964 totalled 62.8 thousand tonnes, an increase of about 16.2 thousand tonnes over 1963. Export of manufactured and unmanufactured tobacco has also increased appreciably from 3,963 tonnes in 1963 to 6,380 tonnes in 1964, 6,109 tonnes in 1965, 7,938 tonnes in 1966, earning more than 81 million baht. Tobacco is exported mainly to Europe.

Tobacco production and export statistics

Year	Production ('000 tonnes)	Export of leaf or unmanufactured ('000 tonnes)	Export value (million ฿)	Export of chewing tobacco manufactured (tonnes)	Export of chewing tobacco value (million ฿)
1959	67.1	1.2	15.7	231.9	4.4
1960	74.1	1.7	20.6	244.4	3.4
1961	48.4	1.1	12.4	275.0	3.5
1962	47.9	2.6	30.5	355.0	4.0
1963	46.6	3.7	41.3	181.0	2.6
1964	62.8	6.1	78.6	233.0	3.1
1965	75.5	6.0	88.5	62.9	1.2
1966	-	7.9	114.9	57.8	1.0

Source: Department of Agriculture, Bangkok (Production data)
Department of Customs, Bangkok (Export data)

In addition to the Thailand Tobacco Monopoly there are some 80 cigarette factories. They are mainly small and unmechanized with 2 or 3 female workers only. They produce Thai-style cigars and cigarettes in which banana leaves instead of paper are used to contain the tobacco.

There is also a number of tobacco-curing factories in northern Thailand especially around Chiang Mai, in which the investment is quite high but precise details are not available.

Another item of tobacco with an export value in excess of one million baht in 1966 is chewing tobacco, export of which fell from 3.1 million ฿ in 1960 to just over one million in 1965. Chewing tobacco is manufactured from a special kind of tobacco leaf and is then mixed with spices. It is preferred by the working class, especially the harbour coolies. The exports go mostly to Singapore and Malaysia. This type of tobacco is processed in a large number of very small factories.

(e) Major group 23: Manufacture of textiles

(i) Group 231: Spinning, weaving and finishing textiles

This industry became more active after the end of the Second World War spurred on by the great shortage of textile products during the war. However, during the first decade after the war the local textile industry was very much hampered by imported products. The Ministry of Industry, realizing the importance of the textile industry to the economy of the country, made great efforts to assist the industry in all possible ways during those trying years. From 1959 onwards, the industry has made considerable progress resulting in great savings of foreign exchange which would otherwise have been used for imports.

During the war the number of spindles in the country totalled only some 10,000. By the end of 1965 the number of spindles had reached 227,796 and the cotton yarn produced during the year was estimated to be 29,303 metric tonnes. During 1966, 64,800 more spindles came into operation and in the next two years 30,400 more will be added making a total of 322,996 spindles by the end of 1968. For synthetic fibre yarn, there were altogether 9,600 spindles in operation at the end of 1965.

"The Investor" (December, 1968), quoting the Textile Manufacturing

Association of Thailand states that there are now 13 spinning mills in operation, including two State enterprises, with a combined total of 319,124 spindles. These companies are authorized for 452,484 spindles and the six newcomers for 114,860 but not all of that total will enter production until after 1971.

All but three of the 13 spinners also weave. Of these, eight spin, weave, and sell the gray goods to the bleachers and dyers; the other two manage their own bleaching and dyeing. In 1966 the integrated mills reportedly accounted for about 5,410 of the country's 13,270 looms. There were 7,807 looms in independent weaving mills (which tend to be small and susceptible to failures) and 53 in prisons. Clearly the weaving mills of the integrated companies are the country's larger weaving operations, with the biggest factory. Thai Durable, running over 1,000 looms.

Synthetics ahead. Certainly there is scope for expansion. Demand for textiles is rising by six to seven per cent yearly. In the future, too, it is projected that the consumption of synthetics will outpace that for cotton textiles, but there are sizable supply-demand gaps in both categories. Last year Thailand's production of cotton products fell 100 million yd^2 below demand (377 million) and synthetics fell 88 million.

If 1971 demand targets are to be satisfied domestically, the nation will have to produce an additional 150 million yd^2 of cotton textiles — one-quarter of its requirement - and 20 million yd^2 of synthetics. In any case, some 40 million yd^2 of special kinds of synthetics will need to be imported.

Thailand spends 400-500 million baht annually on imported cotton cloth. Tariffs on cloth and yarn were raised early this year to help protect local manufacturers.

Demand has shown differential changes — for example, a greatly increased demand for low-count cotton yarns and fabrics in the rural areas, and great upsurge in requirements of synthetics and cotton-synthetic blends in the higher income urban areas.

Details of individual mills

The Ministry of Defense (Thai Textile Organization) presently owns and operates two cotton spinning and weaving mills. Primary production is for military consumption. The mill in Bangkok is 30 years old having 10,000

spindles and 400 power looms. The mill at Phitsanulok started operations in 1965. It has 21,600 spindles, 400 power looms, and reportedly has modern finishing equipment although not the sanforizing process. Another mill in the Bangkok area owned by the Ministry of Defense is leased to a private concern, the Thai Cotton Mills Co., Ltd. That mill formerly had 72,000 spindles but operations have been discontinued since February 1964 as the result of a fire. The company has a 15 year lease and reportedly plans installation of 20,000 spindles to produce 20-count yarn in 1966. Financing is said to be provided in part by insurance funds.

The Thailand Department of Correction (penitentiary) has two cotton weaving mills reportedly containing 33 power looms and 100 hand looms. The Toray Textile mill was started with 10,000 spindles, 220 high-speed automatic looms and equipment to dye and finish 400,000 yd^2 of cotton, synthetic and blended cloth per month. This plant is now tripling its entire output capacity with an additional US $1.5 million investment.

Teijin Ltd. has set up a 10 tonne per day polyester fibre plant as an addition to its joint weaving and dyeing plant to facilitate integrated operations.

Toyo Rayon is planning to construct a polymerization plant to produce nylon chips from caprolactam. This plant would be an addition to its existing 3 tonne per day nylon yarn plant.

In addition, the Marubeni-Iida Company and Dureha Spinning Company of Japan have put up a 14,000 spindle mill to produce poplin yarn for shirt and blouse making. The Thai Synthetic Textile Co. (a 50-50 Thai-Japanese venture) is building a US $ 12.6 million, 44,000 spindle plant, to produce 10 million yd^2 of synthetic and cotton blended shirting per year.

Cotton spinning and weaving was restored to the list of promotable industries on 1st November, 1968, after an absence of 4 years. By the end of November, 10 firms had made application proposing a total of 275,000 additional spindles and approximately 3 500 looms. Spindle capacity would thus rise by about 70 per cent if all plans were put into effect. The Board of Investment, however, is said to have in mind an expansion of 200,000 spindles.

One of the applicant companies, a joint venture between Plains Cotton Cooperative Association, U.S.A., and Thai interests, envisages approximately 68,000 spindles and a 1,000 looms giving employment to some 4,500 Thai workers.

This venture would be considerably larger than Thailand's present largest cotton spinner, Thai Blanket Industry, with 52,000 spindles. Thai Blanket Industry and Thai Durable both have expansion programmes under way, and six other enterprises are set to launch into production next year. Amongst these, U.S. Summit will have 41,600 spindles and Teijin 10,000.

These new investments in textile processing will result in increasing per capita consumption of textile fabrics from 14 yds in 1966 to 18 yds in 1970 with a corresponding saving in foreign exchange of about US $ 30 to 40 million per year in total imports of textiles.

Thai silk

For centuries, sericulture and the art of weaving were confined to the north-eastern provinces of Thailand. The silk was raised not for commercial use, but generally as a hobby. Fabric was woven and kept by the farmers in order to give it away as part of a dowry or as a gift on special occasions.

There are two kinds of indigenous looms, both of which are made of wood: the old style loom and fly-shuttle loom. The latter works much faster than the old style throwing loom. The handicap in the fly-shuttle loom is that it weave only plain fabric of single colour or checkered patterns. Fabrics of elaborate designs, such as gold or silver brocades, have to be woven on old-style throwing looms. In some elaborate designs, it would require the work of one skilled weaver and two assistants three months to produce the fabric sufficient for making a lady's evening dress.

Woven Thai silk usually comprises two types of thread: a warp of imported thread, mainly from Japan, of 3 to 12 plies, and a weft of Thai thread, which is superior in appearance, though weaker than the imported thread. In 1966, 134 tonnes of silk yarn, valued at 44 million baht was imported, about 75 per cent of it from Japan.

Total output of woven Thai silk is not known for certain because much of total production takes place in unregistered establishments. About 130 firms are said to be employing thousands of people for the weaving of Thai silk while some 24,000 families are engaged in the production of raw silk.

Year	Value of export (million baht)
1960	17
1961	22
1962	27
1963	33
1964	33
1965	32
1966	37

The more or less stationary nature of the present industry is attributed both to the difficulty of increasing production and to rising domestic demand for the product.

Quite recently, further attempts have been made to ameliorate the industry. Changwat authorities in Surin, for example, are undertaking the first large-scale plantations of mulberry trees and organizing villagers into co-operatives for the purpose of increasing output and up-grading the quality of raw silk. It is hoped that within three years the crop will be doubled from the present 200,000 kg.

In July, 1968, a Japanese mission visited Thailand to discuss establishment of a research and training centre in Khorat to disseminate technical know-how for the development of the Thai Silk industry.

"Chiang Mai cotton": since ancient times it has been common practice in Thailand for households to weave cotton for their own use, and this has developed into an industry some of the products of which are exported. The fabrics of exotic colour and design are generally known as "Chiang Mai cotton" although similar fabrics in wider variety are produced at Hua Hin as well as in Chiang Mai.

Kenaf-mill industry

This industry commenced in 1951 and now comprises 10 mills of which 4 are government-owned and 6 privately-owned. Major product of the industry is gunny-sacks made wholly from Thai kenaf. Minor quantities of other sacks, hessian and twine are also made.

Production of gunny-sacks in 1967 was almost 50 million of which about 14 per cent were exported as empty sacks and probably over 40 per cent as filled sacks; thus, more than half the sacks produced are eventually sent abroad.

Capacity of the industry is about 73 million gunny-sacks i.e. about 80 per cent is in use. If, however, all mills worked to a 6-day week, 3 shifts-a-day schedule, output could be raised about 40 per cent.

Because of recent severe competition between the ten mills, the Ministry of Industry has issued an order forbidding establishment of additional mills or expansion of existing mills. The mills themselves have, in fact, formed a joint company, the Siam Gunny-Sack Company, which will both set prices for local sales of gunny-sacks as well as act as export agent for all mills.

The industry provides a stable, "door-step" market for some 100,000 tonnes of Thai kenaf, gives direct employment to almost 12,000 people, and both earns foreign exchange through export of sacks as well as saving exchange to the tune of about 400 million baht which would otherwise need to be expended for purchase of sacks from abroad. The industry is, moreover, heavily decentralized, the mills extending from Bangkok to the far north-east of Thailand.

The mills operating are as follows:-

Name of bag factory	Location	Calculated capacity (No. of bags/year)
Government		
1. Thai Jute M.U. Co., Ltd. (W.V.O.)	Saraburi	4,900,000
2. Northeast Jute Mill Co., Ltd.	Khorat	10,000,000
3. Nonthaburi Jute Mill Co., Ltd.	Nonthaburi	7,700,000
4. Bangkok Jute Mill Co., Ltd.	Pathum Thani	9,800,000
Private		
5. Khon Kaen Jute Mill Co., Ltd. (ADAMJEE)	Khon Kaen	4,300,000
6. Sikhiu Jute Mill Co., Ltd.	Khorat (Sikhiu)	8,600,000
7. Laem-Thong Industry Co., Ltd.	Khorat (Sung Noen)	8,100,000
8. Industrial Development Co., Ltd.	Khorat (Pak Chong)	8,200,000
9. Jute Industries (1961) Co., Ltd.	Ayutthaya	3,000,000
10. Jute & Kapok Industry Co., Ltd.	Udon Thani	4,300,000
		69,100,000

The following table gives details of supply and availability.

TABLE 3

GUNNY-SACKS; SUPPLY AND AVAILABILITY

Year	Production	Import	Total supply	Export	Export, full sacks (containing principle crops)	Apparent domestic consumption
	(1) '000 units	(2) '000 units	(3)=(2)+(1) '000 units	(4) '000 units	(5) '000 units	(6) '000 units
1958	4,553.3	17,677.9	22,231.2	109.3	14,057.5	8,064.4
1959	5,060.0	19,722.3	24,782.3	28.4	15,007.7	9,746.3
1960	6,877.8	21,145.0	28,022.8	0.8	19,721.6	8,300.4
1961	8,842.1	25,258.9	34,101.0	95.4	26,089.5	7,916.1
1962	10,815.9	30,826.9	41,642.8	54.0	24,105.0	17,483.8
1963	23,129.0	0.3	23,129.0	134.9	28,837.0	-5,843.4
1964	33,511.2	12,354.3	45,866.0	34.4	41,453.4	4,378.2
1965	40,022.5	641.0	40,663.5	154.5	38,648.5	1,860.5
1966	45,297.2	2.7	45,299.9	5,972.0	40,018.4	-690.6
1967	54,661.0	1.3	54,662.3	6,449.0		

Source: Production from Economic Divisions, National Economic Development Board
Import and Export from Department of Customs, Bangkok.

Carpets. Import of carpets into Thailand in 1964 was 30,000 yd^2 valued at over 10 million baht. In 1967, import had increased to 86,000 yd^2 with a value of 30 million baht (Port of Bangkok only), i.e. a three-fold increase.

In February, 1968, one of Thailand's two carpet factories, Thailand Carpet Co., Ltd., near Don Muang, began operations. The company is at present producing almost 10,000 m^2 of carpet per month on a two shift basis and expects to increase output to over 15,000 m^2 per month by 1970. Present employment of 250 is expected to rise to 350 by 1970.

The company is a joint venture between Philippines Carpet Manufacturing Co., Ltd. Hong Kong Carpet Manufacturers Co., Ltd. and Thai interests. The product, sold under the brand-name, "Tai Ping," is made of New Zealand wool but also contains some local animal hair and locally-formulated latex adhesive.

Present investment is 11 million baht to which an additional 10 million baht will be added to enable the planned expansion.

A second company, also promoted by the Board of Investment, is Universal Carpet Manufacturer Ltd. in Samut Sakhon Province which began production early in 1968 also, monthly production being 5,000 square yards per month. In October, 1968, the company plans to install a set of Belgian-made Wilton carpet-weaving machines and, initially, Hong Kong experts will supervise production. Production will be stepped up to 7,500 square yards monthly.

Customs tariff on imported carpets is 40 per cent ad valorem.

(ii) Group 232: Knitting mills

Imports of knitted wear for 1966 and 1967 are shown in the attached table which indicates a very large expansion in the field of knitted or crochetted outerwear:-

	1966	1967
Knitted socks and stockings	22,150,000	27,223,000
Knitted or crochetted, underwear	8,200,000	9,288,000
Knitted or crochetted, outerwear	39,682,000	61,357,000

Source: Department of Custom, Bangkok.

Most recent statistics for the industry are for 1963 which show:-

Knitting mills in 1963

	No. of factories reported	No.of workers	Fixed assets (baht)	Cost of production (baht)	Total value (baht)
10 or more employees	8	1077	10,156,000	23,138,000	32,000,000
1-50 employees	4	23		297,000	430,000

Source: National Statistical Office

The identity of the 12 larger mills which obviously then dominated the industry is not known. In 1964, the Bangkok Nylon Co., was established with a capital of 6 million baht and claimed that it could supply the entire Thai demand for nylon sox. It is supplied with yarn by a sister company, Thai Toray Co., which also supplies yarn for weaving to a third member of the group, Thai Toray Textile Mill.

All three companies are joint Thai-Japanese ventures. Thai Toray Co., began operations in 1967, with a registered capital of 32 million baht and a capacity of 3 tonnes of yarn daily.

(iii) Group 233: Manufacture of cordage, rope, and twine

Imports in 1966 were:-

	(tonnes)	Million (baht)
Twine, cordage, ropes, and cables of cotton	24	0.5
" " " " " jute	294	2.0
" " " " " hemp	63	0.5
" " " " " manila	205	13.7
" " " " " coir	9	0.06
Total	595	16.76

Exports were only 9 tonnes, valued at 63,000 baht.

There is no recorded trade in synthetic ropes.

Manufacture of such fastenings must obviously have been a feature of Thai life from earliest times but historical references are not accessible. NSO records show that in 1963 there were 23 "factories" with 2 or more employees in Thailand which were classed as "rope-making institutions." Half of these made rope and twine from coir, etc; the other half used "other fibres." The position is complicated by the fact that, at present, all ten kenaf mills make a twine from kenaf-all for their own use and some for sale as well. Average kenaf mill employment averages 1,200, only a few of whom are, of course, engaged in making twine.

Manufacture of cordage. rope, and twine has been accorded Promotion Privileges and two companies have been granted certificates. A condition of the privilege is that production capacity per factory must exceed 150 tonnes per year. In addition, there appears to be a number of "mechanized rope factories" which have not received Promotion Privileges, presumably because they are too small.

Import of "Sisal and other fibres of the agave family" in 1966 was only 13 tonnes worth 65,000 baht. There was no recorded import of hemp fibre.

The statistical picture seems to suggest that Thailand makes ropes of coir and kenaf self-sufficiently, but imports virtually all her requirement of ropes made from other fibres.

Thailand has a fishing-net industry which has suffered in recent years through foreign import competition, and the fact that the import duty on synthetic threads is much higher than on imported nets. In August, 1968, the Board of Investment accepted a request for protective measures, the industry promising that its production would meet total demand in 2 years' time.

(iv) Group 239: Manufacture of textiles not elsewhere classified

Production of mats from straw is a traditional Thai industry; mats, in fact occupy an important place in the typical Thai household.

There is a negligible import and export trade in mats, although recent imports show a steep upward trend:-

	1965 (baht)	1966 (baht)	1967 (baht)
Mats of straw and other vegetable material	973	15,661	81,148

Source: Department of Customs, Bangkok.

Manufacture is largely on a cottage industry basis although the 1963 Industrial Census showed that there were 12 factories with over 10 employees and 8 smaller factories, total receipts being 935,000 baht p.a. Materials used are rice straw, banana straw, and sisal.

(f) Major group 24 Manufacture of footwear, other wearing apparel and made-up textile goods

(i) Group 241: Manufacture of footwear

Import of footwear in 1966 was almost 12 million baht in value and this had risen to over 16 million baht in 1967.

The number of mechanized leather shoe factories in Thailand (and in Bangkok-Thon Buri) in 1967 was 72. No data were available for production, but in 1963 the "institutions making footwear apparels," according to NSO were 270 of which 96 per cent had under 10 employees, but accounted for over 80 per cent of the total value of output.

The industry is not a promoted one. Major firms in the industry are Bata Shoe Co. of Thailand, Ltd., a member of the world-wide Bata chain. Bata is undoubtedly the largest manufacturer in Thailand making leather, rubber, and rubber-canvas footwear. It suffers a good deal of plagiarism at the hands of smaller shoe-makers who use similar brands.

Bata began manufacture of footwear in Thailand in 1959 and advertises that it "is producing well over 50,000 pairs of shoes weekly, giving employment to 600 employees.

Nanyang Mfg. (Thailand) Co., Ltd. as the largest manufacturer of rubber footwear. Other companies are:-

Wathanakit Rubber Industry LP
Hong Kong Rubber Works

The industry used to sell its scrap leather to Australia for grinding and compounding into a leather composition. At the last contact, such export had ceased.

The industry complains that Thai leather is water-proofed, so that no claims can be made that leather shoes "breathe," and are therefore preferable to shoes of plastic or rubber.

(ii) Group 242: Repair of footwear

In most countries, this service is mainly carried out by small independent cobbling shops some of which also make surgical footwear. The position in Thailand is similar, many repairers merely operating on the footpath or in alcoves.

No statistics are available on the industry as most cobblers do not use any machinery.

(iii) Group 243: Manufacture of wearing apparel except footwear

This group includes manufacture not only of clothing and hats, but various accessory items of dress such as gloves, umbrellas, belts, and handkerchiefs. It covers apparel made "by cutting and sewing fabrics," and thus does not include knitted goods. (Group 23).

It is traditional in Thailand to have clothing custom-made or made at home rather than to buy it ready made. The industry therefore comprises a large number of small bespoke tailors and dress-makers' shops and only recently has the mass-production of garments arisen.

There is, however, a rapidly growing demand for "high fashion" wearing apparel most of which is satisfied by import. Imports in 1966 were valued at 117 million baht and these had risen in 1967 to 154 million baht. Exports though comparatively much smaller, are not inconsiderable — 23 million in 1966 and 20 million baht in 1967.

Latest published statistics on the industry are for 1963:-

Institutions making wearing apparel (1963)

	No. of factories reported	No. of workers	Annual wage (baht)	Cost of production (baht)	Total receipts (baht)
Manufacture outerwear and underwear 10 or more workers	38	726	2,853,000	3,022,000	6,367,000
1-10 workers	2,737	8,812	20,861,000	53,896,000	117,146,000

Institutions making wearing apparel (1963) (continued)

	No. of factories reported	No. of workers	Annual wage (baht)	Cost of production (baht)	Total receipts (baht)
Manufacture hats 10 or more workers	2				
1-10 workers	32	144	219,000	561,000	1,194,000
Manufacture umbrellas (1-10 workers)	6	28	65,000	124,000	264,000

Source: National Statistics Office.

The dominance of the small shops is clearly shown and even so, the figure is probably too low because of failure of in-the-home workers to register.

Data from NEDB suggest that the growth of the industry is not keeping pace with the general rate of growth of the economy.

	1957	1962	1963	1964	1965
Annual production of wearing apparel (including footwear) (million baht)	238	287	297	308	321
GDP originating from manufacturing(million baht)	5,510	7,437	7,874	8,570	9,684

Source: Office of NEDB.

(iv) Group 244: Manufacture of made-up textile goods, except wearing apparel

This group covers mainly household furnishings curtains, sheets, tablecloths, etc. as well as canvas products e.g. tents. It does not, however, include manufacturers who themselves weave the base cloth.

It is therefore a minor group partly because one of the major items, blankets, are almost wholly produced by the weavers (Thai Blanket Industry Co., Ltd., and Peone Blanket Industrial Co., Ltd.), and therefore fall into Group 231. Partly, also, it is a minor group because the items comprising the group are not generally traditional parts of Thai household furnishings.

Imports in recent years are shown as follows:-

	1965		1966		1967	
	(kg)	(baht)	(kg)	(baht)	(kg)	(baht)
Blanket wool and cotton	1,713,464	30,262,209	2,098,977	37,003,274	1,743,521	34,326,603
Bed linen	130,732	7,043,993	159,523	8,927,401	209,580	10,986,198
Table linen	12,621	816,248	11,239	1,245,645	15,164	1,127,757
Towels	364,354	13,469,655	312,683	12,864,174	337,741	13,107,887
Kitchen linen	1,583	33,850	2,464	200,275	2,335	169,769
Curtains and other furnishing articles	479	33,920	7,284	622,546	437	104,680
Mattresses, quilts, eiderdowns, cushions, pouffes, pillows, and similar articles	25,524	810,082	130,424	3,032,081	596,568	9,575,980
Mosquito nets	875	62,349	206	7,294	504	22,672
Made up articles of textile material n.e.s.	15,023	862,103	34,066	1,517,176	57,353	2,555,444
Total	2,264,655	53,394,409	2,756,866	65,419,866	2,963,203	71,976,990

According to the Industrial Census, 1963, there were some 74 small factories producing made-up textile goods in Thailand. Their total receipts were 6.6 million baht.

(g) Major group 25: Manufactures of wood and cork, except manufacture of furniture

(i) Group 251: Sawmills, planing and other wood-mills

Some 40 per cent of the saw-mills in Thailand are situated in the Bangkok-Thon Buri area, according to 1966 statistics, but they accounted forby for the greatest part of the sawn-timber produced in the Kingdom. Thailand's river system favours this situation since it is cheaper to transport timber as logs by river than to carry sawn-timber by road or rail. Most of the timber, particularly that of higher class, arises in forests in the north of Thailand. About 50 per cent of the entire country is under forest.

Teak is the most important of Thai timbers and strenuous government efforts in recent years have been made to conserve existing stands and to replant. Export is carefully controlled, a fact attested by the following export statistics.

Teak export statistics

Year	Quantity (m^3)	Value (million ฿)
1959	73,253	244.0
1960	100,925	356.1
1961	64,528	252.2
1962	39,753	170.1
1963	32,215	136.7
1964	40,490	178.8
1965	26,399	112.1
1966	31,261	148.9

Source: Department of Customs.

Between 1961 and 1965, production of timber in Thailand increased by 60 per cent but demand has tended to outstrip production; exports of timber, other than teak, have shown a steady, if not a declining, tendency.

Export of milled timbers (except teak)

Year	Quantity (m^3)	Value (million ฿)
1956	86,550	76.9
1957	90,604	85.4
1958	90,333	68.3
1959	63,205	51.1
1960	112,572	95.3
1961	66,425	65.8
1962	59,344	57.1
1963	68,515	67.9
1964	79,026	77.9
1965	63,908	64.1
1966	20,652	56.3

Source: Department of Customs.

The cutting of firewood and the making of charcoal have been important industries but a progressive dieselization of the Thai railways and the increasing use of fuel oil and LP gas otherwise are tending to reduce this dependency. The government, moreover, is keen to check the illicit felling of trees, expecially for charcoal production.

The following table tends to show a steady tendency in both fire-wood and charcoal production.

The production of firewood and charcoal in Thailand

Year	Firewood (m^3)	Charcoal (m^3)
1962	1,446,005	664,512
1963	1,479,706	655,061
1964	1,336,367	677,891

Source: Annual Report, Royal Forestry Department, 1965.

Manufacture of wooden doors and windows

These are normally made to order in carpenters' shops, but substantial economies could doubtless be achieved by adopting standard, if possible modular, sizes, and by reducing the number of types.

Only one factory, Thai Plywood Co., Ltd. is producing flush doors in a mechanized plant and in large numbers. In the period 1959-1966, the value of the company's production of doors increased almost 12 times and the number of doors by eight times.

Plywood

Plywood is the most important wood-based panel at present made in Thailand. Two manufacturing plants are operating at present, one in Bang Na and one at Phra Pradaeng.

The larger of the two is Thai Plywood Co., Ltd., owned by the Thai Government Forest Industry Organization. The Company was until recently the sole producer and an exclusive supplier of plywood products to the Thai market. The company started working in 1957 and the production has increased steadily. The plant includes four production units: 2 plywood mills, 2 veneer mills, a flush door mill and a saw-mill for boards, and miscellaneous saw-mill products. Plywood is by far the most important product. In 1966, the total value of Thai Plywood Co. sales amounted to 155 million ฿ out of which plywood sales contributed 122 million.

The Table below gives production and sales figures of plywood manufactured during the period 1957-1966. In two shifts the capacity is at present about 5,000 sheets per day. An extension of the capacity is underway which will raise the output to 10,000 plywood sheets/day., i.e. about 3 million sheets/year. Total capital investment in the Thai Plywood plants amounts to approximately 100 million ฿, or 5 million U.S. dollars (80 million ฿ in 1957). The total number of employees is 1,370 including clerical personnel.

Thailand: Plywood Manufacture (1957-1966)*

Year	Production			Sales	
	Number	m^2	m^3	m^3	Value (thousands of ฿)
1957	123,309	343,298	1,881	84,643	5,139.1
1958	289,096	797,345	3,862	289,346	14,790.4
1959	591,724	1,634,583	8,084	467,223	29,819.3
1960	830,243	2,287,316	10,469	662,414	42,858.8
1961	901,242	2,515,946	12,422	1,000,509	45,146.1
1962	1,519,756	3,206,246	15,815	1,280,288	61,575.1
1963	1,361,133	3,795,270	18,385	1,285,768	73,587.1
1964	1,707,017	4,807,933	23,828	1,605,542	98,730.9
1965	1,743,569	4,916,262	25,653	1,806,868	103,175.0
1966	1,780,926	5,082,837	26,849	1,659,885	122,609.7

Source: Thai Plywood Co., Ltd.

Of the raw material, 39 per cent is obtained from the mill's own concessional area in the Uthai Thani Forest, about 350 km from the factory; 20 per cent from the Forest Industry Organization, and 41 per cent from independent dealers+. Main transport is floating by raft along the Chao Phraya river. Logs from the other areas are mostly brought by truck. Teak from the north is sometimes transported by rail.

A second sizable plywood plant, the Bangkok Plywood Factory was established in 1966. The reported capacity is 7-8,000 sheets of 4 ft x 8 ft. plywood per 8 hour day, but present output is about 2,000 sheets per day. Most of plywood manufactured in this factory is from hardwood of Shorea species.

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* Based on 4 ft x 8 ft sheets, average thickness 4.3 mm.

+ Tressel, M. Premrasmi, Thanom, and Indegrand, P. (1965). Plywood and board products in Thailand. In "Plywood and wood-based panels." Vol. II. FAO/PPP CONS/PAPER 3.5 p. 2 (Food and Agriculture Organization of the United Nations : Rome).

Both plywood factories face difficulties in the full utilization of their capacities as a result of raw material supply. An estimated 60 to 70 per cent of plywood is sold in Bangkok. The main use is for house-building, for ceilings, side walls, and furniture.

Plywood not absorbed in local consumption is exported, the quantities involved being shown in the following table.

Plywood

Year	(tonnes)	(1,000 ฿)
1959	175	988
1960	83	344
1961	64	256
1962	263	971
1963	148	591
1964	131	581
1965	127	619
1966	38	135

Source: Department of Customs, Bangkok.

Particle board

The particle board factory under the name "Sri Maharaja" Board Co., Ltd." is a sister company of the Sri Maharaja Co., Ltd., which is in turn, a subsidiary company of Crown Property and runs one of the largest saw mills in the Far East. Sri Maharaja Co. has its own forest with a total area of approximately 400 km^2. Monthly output of the saw mill is about 2,000 tonnes of planks and boards, mainly yang and takhian, 50 per cent of which is provided for export. Huge quantities of residues as waste wood (about 200 m^3/day) are available daily for the production of particle board.

The particle board industry was started in 1958. Total capital investment amounts to 30 million ฿. The daily output of the plant is 22 tonnes of finished boards. "Teak boards" are produced in the standard size 4 x 8, 8 and 19 mm thick and their daily output is 350 boards in one shift. Production also includes parallel-grooved acoustic board and plyboards as well as rubberized coconut mattresses.

Sri Maharaja Shaving Board factory was one of the first particle board factories put up in a tropical country and one of the major problems encountered in starting the plant was the wood composition. High moisture content and relatively short storage life of soft wood required special attention. The surface of particle boards is at present mainly composed of yang and softwood, and the core of takhian and softwood or tabaek and softwood depending on thickness. Each year, the factory consumes imported components of the glue used, to the value of some 200,000 dollars.

The Board of Investment has recently granted promotional privileges in Group C to a new chipboard factory which was expected to start production in April 1968. The capacity based on 2 cm thick board will amount to approximately one million square metres per year. The factory will use the QRAL extrusion process and utilize wood waste as raw material. The boards will be used for furniture manufacture, partitioning and lining, and measures have also been taken to work out standard housing designs which would utilize this board on a large scale for low-cost housing.

Fibre board

In order to reduce the shortage of building materials for linings and introduce a replacement for lumber which was until recently extensively used for construction work, decisive measures have been taken for starting a fibre board industry.

Two fibre board factories are planned to begin manufacture in the near future. The first of them, a project of the Sri Maharaja Co., Ltd., is already under construction in Si Racha and was expected to be in full production by July 1968. The total investment in the factory will be about 45 million ฿. The guaranteed capacity is 65 tonnes/day. Dry methods of production will be used, with an adhesive additive of 2 per cent giving a hardboard of a density 1.0-1.1. It is expected that the hardboard will take over a part of the thinner shaving board market (5-6 and 8 mm).

The second fibre board factory, financed by the Thai Plywood Company (Ministry of Agriculture) is expected to begin operation in 1959. The minimum capacity of the plant will be 90 tonnes of hardboards per day, based on 125 cm by 490 cm, and a thickness of 3.5 mm. The total capital investment needed is estimated at 74 million ฿. Wet process will be used. The fibre

board plant will be located in Bang Na and use the existing facilities of the plywood plants. Raw material will be log core waste and veneer waste of the plywood plant, and the quality of the product will conform to requirements for medium hardboard specified by British standards.

If the construction of both fibre-board factories is carried out as planned, the board market will have by 1971, when full capacities are expected to be utilized, an additional 150 tonnes of fibre boards per day, or an equivalent of about 8 million square metres of lining and partitioning sheets per year.

Wood-wool board

There is only one factory producing wood-wool boards in Thailand under the trade name "cellocrete". The plant was established in 1956 with a capital of 2.7 million ฿ and is located in Bangkok.

Until now the only raw material used has been somphong. Experiments are made in order to replace somphong with rubber-wood (Hevea brasiliensis) or cheap and easily available khi-nun. Timber is supplied mainly from the central region, 100-200 km from Bangkok. Main problem is lack of raw material because of transport difficulties.

There are altogether 78 employees, working one shift. Maximum daily capacity is 300 boards.

Cellocrete boards are used as partitions, linings, insulating structural roof decks and pitched roofs as well as insulating shuttering. As a lining or partition material cellocrete comes between the light concrete blocks and slabs and the boards and panels such as asbestos cements, fibre board, and shaving board. It is primarily a partition material and has the fire-resistant qualities of most cement products.

Manufacture of wood-wool board (cellocrete) in Thailand

Year	Value of production (baht)	Quantity* (m^2)
1962	1,512,894	52,200
1963	1,389,440	47,800
1964	1 617,966	55,600
1965	1,816,370	62,500
1966	2,260,813	78,000

* Based on 1.00 x 2.00 x 0.025 m boards.

Source: Cellocrete manufacturers.

A factory to produce the building board known throughout the world as "Stramit" has been built south of Bangkok. The board is made of compressed straw, and is 50 mm thick. Capacity of the plant is said to be 400,000 m^2 annually.

(ii) Group 252: Wooden and cane containers and cane small-ware

Production of wooden crates and boxes is a comparatively small industry in Thailand despite the relative cheapness of timber: in the first place, Thailand does not yet produce to any extent the range of commodities which require crating, e.g. canned goods, machinery; and secondly, there is a tendency to transport goods in baskets or in sacks rather than in boxes.

Manufacture of sacks has been dealt with in Group 231. The manufacture of wickerwork is carried out in nearly every village throughout Thailand because of the ready access to raw-material. The materials most commonly used are: bamboo, palm leaf, rushes, sisal, jute (as well as kenaf), and even banana-straw.

(iii) Group 259: Manufacture of cork and wood products not elsewhere classified

Cork

All cork and cork products are imported into Thailand, total value in 1966 being of the order of 3 million baht (see the following Table).

Wood carving

Wood carving is a home industry and no information exists as to its exact size and nature or the value of its production.

Thai wood-carvings have achieved an increasing international popularity over the years. Most of the production is in northern Thailand with teak as the favourite medium. The industry is largely a cottage industry with an estimated 6,000 to 7 000 families wholly or partly engaged. However, three Chiang Mai firms each with over 50 employees, are also included in the industry. Total output and size of export is unknown but about 40 per cent of production is believed to be sent abroad.

Other items in this miscellaneous group include wooden ladders, blocks, handles, yokes, picture and mirror frames, and coffins. Production of all

Import of cork to Thailand

Year	Agglomerated cork in block, slabs, sheets, rods, and tubes		Cork gaskets		Cork stoppers		Cork lifebelts		Articles of natural cork		Articles of agglomerated cork	
	Quantity (kg)	C.I.F. value (฿)	Quantity (kg)	C.I.F. value (฿)	Quantity (kg)	C.I.F value (฿)	Quantity (kg)	C.I.F. value (฿)	Quantity (kg)	C.I.F. value (฿)	Quantity (kg)	C.I.F. value (฿)
1960	157,134	1,432,806	449	12,964	90,961	2,081,441	353	16,870	1,062	59,159	13,862	309,810
1961	74,316	883,010	1,904	32,480	89,013	2,160,272	248	9,308	7,340	302,149	23,294	393,038
1962	108,365	1,196,147	-	-	67,392	1,770,696	10	897	1,438	77,701	11,011	193,407
1963	53,425	851,356	-	-	51,762	1,312,902	61	13,799	11,485	488,365	3,949	168,716
1964	51,460	848,878	-	-	45,316	1,238,784	74	4,540	8,830	409,176	4,821	103,072
1965	56,807	877,218	1,930	104,059	48,852	1,309,694	24	895	18,793	849,127	824	51,519
1966	53,281	1,169,444	4,460	140,080	35,426	980,151	-	-	16,343	652,659	16,078	314,294

Source: Department of Customs, Bangkok.

these are carried out by numerous small workshops spread throughout the country. Nothing is known of cork-goods manufacture.

(h) Major group 26: Manufacture of furniture and fixtures

(i) Group 260: Furniture and fixtures

In 1965, there were 593 "mechanized wood articles factories" registered in Thailand while the Industrial Census showed that there were only 43 "furniture and fixtures" factories with 10 or more employees for that year. Despite some lack of coincidence between the two sets of data, there is, nevertheless, quite some probability that the industry was, and still is, mainly composed of a large number of very small units.

The furniture industry in all countries has a high degree of natural protection from import competition because of the bulky nature of the product. The industry in Thailand has the added advantage of relatively cheap and plentiful supplies of timber. It is therefore not surprising to find that imports of furniture and fixtures tend to be of a specialized kind, the major items of value in 1966 being metal furniture and parts (34 million baht), mattresses (8 million baht), metal filing cabinets (4 million baht) while wooden articles of furniture did not reach one million baht. Exports of all kinds of furniture were only some half million baht. A somewhat similar picture applies in the case of fixtures but on a very much smaller scale, the major item of external trade being imported iron or steel door and window frames, valued at 3 million baht in 1966.

Some of the major furniture factories in Bangkok are Scandia, Raja, Sweet Home, and Silom Shanghai Furniture. Raja Furniture L.P. is the only factory, apparently, which makes knock-down furniture.

Wooden and metal fixtures are often made on the job, but there are about 120 shops making and selling door and window frames and insect screens in Bangkok- Thon Buri. The largest of these are Su Chin Hua, P. Piya, and Barco.

(i) Major group 27: Manufacture of paper and paper products

(i) Group 271: Manufacture of pulp, paper and paper-board

Approximately 141,960 tonnes of paper and paper products were absorbed by Thailand in 1967. Only about 6 per cent of this was met by local production and the rest had to be imported. Local production has shown little growth since 1964. The percentage increase in imports is therefore quite representative of the growth in consumption.

Apparent paper consumption

(tonnes)

	1961	1962	1963	1964	1965	1966	1967
Import	67,827	66,580	85,254	75,230	85,441	113,780	128,132
Local production	3,627	5,768	7,890	13,577	13,330	12,241	13,830
Apparent consumption	71,454	72,348	93,144	88,807	98,771	126,021	141,962
Consumption trend	100	101	130	124	138	176	199

Thailand's paper industry is of recent origin. At the end of 1964, seven mills operated but only two were of fair-sized capacity. They are the Kanchanaburi Pulp and Paper Mill and the Bang Pa-In Paper mill, both government-owned. Total output for the industry was some 13,600 tonnes in 1964 and 13,300 tonnes in 1965, but no kraft or paperboard is made. Bamboo is the principal source of pulp for one of the government mills (Kanchanaburi) while the other (Bang Pa-In) uses rice-straw in combination with imported long-fibre pulp.

Presently Thailand's paper industry mainly produces writing and printing papers. However, the industry is now moving towards more diversified products, specifically, packing and wrapping papers, newsprint and cardboard. In 1969 two new mills: one for kraft paper and one for unfolded cardboard manufacturing, are scheduled to start operation. Plans of a project to produce newsprint locally are also in an advanced stage.

When these new mills are in operation, Thailand's paper production will be increased substantially from the present level of around 13,500 tonnes a year. The kraft paper mill has a planned annual production capacity of 52,000 tonnes and the other two mills together about 25,000 tonnes. Even then, local

production will still below the present level of consumption.

Home demand, by type

(tonnes)

	1961	1962	1963	1964	1965	1966	1967
Newsprint	24,460	15,458	26,608	21,361	25,949	34,981	32,712
Writing and printing papers	20,000	21,770	25,590	21,600	20,170	23,960	23,110
Kraft papers	5,756	6,881	8,209	7,526	9,489	11,967	12,974
Other packing and wrapping papers	998	1,344	1,880	2,146	3,136	4,841	4,355
Paperboard and cardboard	12,944	17,373	22,132	27,537	28,694	36,753	47,103

The prospective new ventures for kraft paper and newsprint production will also help meet the home demand. In fact the kraft paper target of 52,000 tonnes a year is considerably larger than Thailand's present requirements which are only in the region of 15,000 tonnes per annum. Demand for newsprint is about 25,000 tonnes a year, and the mill which is to be set up will be able to meet about four-fifths of this. But of the other paper products such as paperboard, cardboard, and other finer-textured paper materials, the majority will still have to be imported.

Details of firms in the industry are:

Siam Kraft Paper Co., Ltd. (Ratchaburi) a joint U.S.-Thai venture, with a total investment of 720 million baht, the largest single industrial investment in Thailand since the introduction of the Promotion of Industrial Investment Act of 1962. The undertaking comprises two projects, first, a paper-making and pulp factory drawing 40 per cent of its pulp from local bagasse and the remainder from import. The second project involves enlargement of the pulp factory by using local bamboo and kenaf as well as bagasse and waste-paper. The resulting pulp will make the paper plant independent of import. The completed complex will supply (in 1975) 70-80 per cent of Thailand's requirements of kraft paper and will use 22,450 tonnes of bagasse and kenaf-waste pulps and 22,900 tonnes of bamboo pulp per year.

Bang Pa-In Paper Mill, has a capacity 14,400 tonnes p.a. and produced about 12,000 tonnes in 1965. It uses local rice-straw and imported chemical wood-pulp. The mill produces plain white paper for writing and printing purposes. It could also produce brown paper for wrapping and packaging but this is less profitable than white paper.

According to the Bangkok Bank Ltd., "Monthly Review", October, 1968:-

"The Bang Pa-in Paper Mill, which is the largest and most modern in the country, has been plagued with some serious problems ever since it started operation. The main problems appear to be the high production costs and the poor quality of the products. This coupled with the fact that the machinery always seems to be breaking down, has prevented the mill from expanding its production capacity. Although it has a capacity to produce 100 tonnes a day, it has been presently turning out only about 40 tonnes a day. The mill was originally designed so that it could double its initial production capacity, but with the difficulties it has been facing, it has been forced to operate even below the original capacity. Another factor on the debit side is the large loan repayments that have to be made. It is thus not surprising to learn that heavy operating losses are being sustained by the mill.

The actual value of the mill is baht 250 million and yet it appears that it was constructed at the high price of over baht 400 million. Having been backed by such a large investment, it is therefore distinctly unfeasible for the mill to operate so far below its capacity. The Government, finding itself in the predicament, has been seriously thinking of either selling or leasing out the mill to a private enterprise. And yet the desire to keep it as a state enterprise has been equally strong. Several measures have been taken to try and make the mill operate more efficiently, but have so far met with conspicuously little success. Production costs are still absurdly high and the quality of the products has shown absolutely no improvement. The mill still operates below capacity. In the circumstances, it would seem that the Government has no choice but to invite private enterprise to take over the operation of the mill.

The Bang Pa-in Paper Mill could be equipped to produce up to 50,000 tonnes of writing and printing papers a year. This would be

about twice the current domestic demand for the materials. The mill could also be equipped to manufacture plain brown wrapping paper, but no step has been taken in this direction. Local consumption of wrapping material is over 4,000 tonnes a year. Thus through efficient operation, the mill could more than satisfy domestic demand for writing, printing, and plain brown wrapping papers."

Kanchanaburi Pulp and Paper mill. This mill is also government-owned. It produces bamboo pulp from local material and makes bleached writing and printing paper and also a little brown wrapping paper. The production is about 10 tonnes per day but output could be increased by 50 per cent, given some improvements in processing.

Bangkok Paper Mill Co., Ltd. Located in South Samrong, Phra Pradaeng. Samut Prakah, it has been operating under promotional privileges from the BOI since September 1962 and began production in December, 1964. The establishment started operations with 30 million baht total investment and 10 million baht registered capital. All share-holders are of Thai nationality. Present production includes various kinds of packing paper, poster paper, paper for typewriters and printing, and other papers with a weight range of from 30-100 grammes per square metre. The total annual production capacity is rated at 6,750 tonnes. The company has been awarded incentives from the BOI to carry out an expansion programme with a target of increasing its present capacity from 6,750 tonnes to an annual capacity of 9,750 tonnes.

The Siam Newsprint Plant is still in the pre-engineering stage and is expected to be producing about 35,000 tonnes of newsprint p.a. by 1972. It will use about 100,000 cubic metres of pine-wood from the Chiang Mai area and is expected to save about 100 million baht in foreign exchange when in full production.

Other paper mills. Nine other paper and board mills are registered at the Ministry of Industry, but there are no available data on production, although this is believed to be of the order of 5,000 tonnes p.a. Most of them produce low grade cardboards, straw-papers, wrapping-papers and printing papers from waste-paper they are:-

1.	Luck-Si Paper factory	156 Mu 5, Bang Khen, Bangkok
2.	Asia Cardboard factory	956 Taksin Road, Thon Buri
3.	South-east Asia Paper factory	118 Phetkasem Road, Thon Buri
4.	Sri Thai Paper Industry	857/1 Charoen Nakhon Road, Thon Buri
5.	Tak-Rung Paper Industry	Phetkasem Road, Thon Buri
6.	Yuy Khang Industry	Pathum Thani, Province
7.	Meinum Paper Industry	Samut Prakan
8.	C.A.M. factory	Samut Prakan
9.	Sumsen Paper Mill	Sumsen Road, Bangkok

(ii) Group 272: Manufacture of articles of pulp, paper and paper board

This group covers the manufacture of pressed and moulded pulp goods; paper bags and cartons; stationery; wallpaper, toilet paper, and dress-patterns.

In 1966, import value for the entire class "Articles of pulp, of paper, of paperboard or of cellulose wadding, n.e.s." was 164 million baht. Selected items were:-

	Tonnes	Million baht
Paper towels, napkins, tablecloths and similar articles	795	11
Toilet paper in sheets or in rolls	1,626	15
Sanitary towels		14
Articles of pulp, of paper, of paperboard or of cellulose		75
Paper bags	1,374	7
Cardboard boxes and other containers	494	6
Envelopes	185	3
Paper for writing, typewriting, etc, cut to size	425	5
Albums, diaries, memo books	204	5
Carbon paper, cut to size	118	6

According to Ministry of Industry registrations, 1965, there were then 161 mechanized paper conversion factories in Bangkok-Thon Buri and 162 in the entire kingdom. The corresponding numbers of drinking straw factories were 15 and 15. The Industrial Census by NSO in 1963 showed that only

16 per cent of paper products factories had 10 or more employees. The proportion for drinking straw factories was 33 per cent with 10 or more employees.

In the case of cartons, some of the large manufacturing facilities are captive to plants that make other products, e.g. soap. Adhesives used appear to be tapioca starch for the body of the carton and sodium silicate for the final closing after packing.

(j) Major group 28: Printing, publishing and allied industries

(i) Group 280: Printing, publishing and allied industries

In 1963, there were 127 establishments in Thailand in the printing, publishing, and allied industries which had 10 or more employees, but at the end of 1963, in Bangkok and Thon Buri alone, there were 751 such establishments registered with the Ministry of Industry. Thus, the industry includes a large percentage of very small units.

Of the 127 establishments with 10 or more employees, 24 published newspapers and periodicals, 98 undertook the printing of books, maps, etc., and 5 were engaged in photo-engraving and etching.

Daily newspapers are confined to the Bangkok and Thon Buri area which has 18 daily newspapers and at least 28 periodicals. Of the daily newspapers, 11 are in Thai, 5 in Chinese and 2 in English. Provincial towns have no daily newspapers of their own but the larger towns have one, or perhaps two, weekly newspapers. About 35 of such provincial newspapers are published.

Although Thai script affords some natural protection to the printing and publishing industry in Thailand, there is a considerable import of books, newspapers, periodicals and other printed matter from abroad, amounting to over 90 million baht in value in 1964. The United Kingdom is the major supplier.

Import of printed matter to Thailand from several countries (1960-64)

Year	Japan	Hong Kong	Singapore	Indonesia	Netherland	United state of America	United Kingdom	Federal Republic of Germany	Switzerland	France
1960	5,642,676	10,745,343	1,257,636	-	1,262,351	7,979,873	32,541,988	1,430,482	746,663	199,625
1961	6,834,001	12,406,778	1,216,582	450	824,256	8,209,692	41,082,345	2,217,585	1,282,540	579,645
1962	7,532,113	12,925,576	1,108,056	7,145	838,777	8,166,656	51,059,860	2,117,796	819,554	752,842
1963	9,111,576	12,668,062	649,989	16,228	621,311	9,842,138	55,637,027	2,257,966	714,691	605,584
1964	10,153,844	14,633,825	718,370	-	1,016,067	11,782,002	48,256,393	3,004,893	800,986	1,043,407

Source: Thailand Statistical Yearbook 1965, No. 26; National Statistical Office, Office of the Prime Minister.

The following table gives data on book production:-

Production of books in Thailand: 1960-1964

Subject groups	1960	1961	1962	1963	1964
Total	1,328	1,106	1,062	8,172	4,198
Generalities	98	15	453	4,832	313
Philosophy	38	31	54	142	114
Religion	164	162	139	490	450
Social Science	242	235	173	703	1,015
Philology	88	79	77	189	150
Pure sciences	38	-	5	81	115
Applied sciences	46	-	6	174	223
Arts	45	42	27	324	136
Literature	429	387	93	993	1,266
Geography, History	140	112	35	244	416
Unspecified	-	43	-	-	-

Source: Ministry of Education, Fine Arts Department, Official Records.

In addition to the printing of reading matter, there is, of course, a great deal of jobbing commercial printing. In its Private Investment Opportunities in Thailand, USOM estimated that over 9,000 tonnes of kraft paper were printed and converted into paper bags in 1964.

The largest members of this trade in the private sector, are said to be Thai Watana Panich, (which includes art-printing in its activities) and Pharacha-Charg.

The Government sector in Thailand has numerous printing facilities and in 1962 the number of government presses was 31, including those shown below, whose stated income was 5.8 million baht compared with a total income for the industry of 227 million baht. While relatively small, the government sector has some special facilities and a new organization has recently been announced by the Thai government which will print bank-notes, bonds, cheques

and registrable documents.

Table showing operations of some government printing presses

operation data

(millions of ฿)

Year	1962		1963		1964	
	Income	Profit	Income	Profit	Income	Profit
Government Savings Bank Press	2.719	0.158	4.077	1.061	7.135	4.225
Police Press	5.353	0.367	3.235	0.282	4.180	0.242
W.V. Sena Press	N.A.	N.A.	2.588	0.080	3.580	0.110
P.M. Office Press	-	-	-	N.A.	-	-
Lottery Press	-	-	-	N.A.	-	-

Source: USOM, 1965,: "State-owned enterprises of Thailand."

The Government also has a monopoly in the printing of playing cards, of which 535,250 packs were printed in 1966-67.

(k) Major group 29: Manufacture of leather and leather-and-fur products except footwear and other wearing apparel

(i) Group 291: Tanneries and leather finishing plants

Goods, wholly or partly of leather, were imported into Thailand to the value of some 12 million baht in 1966. This is roughly equal to the value of similar goods-produced in the Kingdom in 1963 and suggests that Thailand is only fairly self-sufficient in this class of manufacture.

Tanning of leather is carried out in Thailand in one large state-owned enterprise, two fairly large private enterprises, and some sixty small private tanneries. Together they process a little over 50 per cent of the locally-available hides and skins leaving some 5,500 tonnes of hides as well as skins for export.

The Leather Tanning Organization, 90 per cent to 95 per cent of whose output is for the Armed Forces, processes 250 animal skins (90 % are cattle and buffalo hides and the rest pig and sheep-skins) per day and, under the Second Five Year Plan, this will rise to 300. Output, however, is said to have fallen from 269 tonnes in 1960 to 261 tonnes in 1965.

The tanning industry uses about 1,000 tonnes annually of imported tanning compounds, such as Mimosa extract from South Africa, Chestnut extract from France and Italy, and Quebracho from the Argentina. Small tanneries use locally produced extracts of the bark of Kiay and Kabun, which are said to be acceptable but not as good as the imported product.

Little detail is known of the operations of the private sector of this industry.

Exports of leather in 1966 were valued at about 4 million baht, the bulk going to Singapore and the U.S.A.

(ii) Group 292: Manufacture of fur products, except wearing apparel

Little is known of this industry in Thailand: as the climate is not conducive to the growing of thick pelts, it is probable that activity is confined to the preparation of wild-animal skins for display.

(iii) Group 293: Manufacture of leather products except footwear and other wearing apparel

There is some local production of leather luggage, brief cases, etc. but no details are available.

(1) Major group 30: Manufacture of rubber products

(i) Group 300: Manufacture of rubber products

In 1966 Thailand produced 220,000 tonnes of crude rubber and exported about 200,000 tonnes as crude rubber and 120 tonnes as manufactured goods, mainly rubber bands. Thailand imported just over 900 tonnes of rubber in primary form and about 220 million baht' worth of rubber goods of which nearly 80 per cent was in the form of tyres (the weight of rubber goods imported is not recorded, but would be roughly of the order of 7,000 tonnes)

Thus, it would appear that Thailand was, at that stage, able to manu-

facture about 75 per cent of her demand for rubber goods: only one large manufacturer of tyres, Firestone, had then commenced production.

In 1965, there were 221 mechanized rubber products factories in Bangkok, most of them quite small, producing rubber footwear and household utensils. Cycle tyres also feature largely. Major products produced in that year were:

Type	Quantity (units)
1. Automobile tyres	200,000
2. Automobile tubes	200,000
3. Tyres for pedal cycles	1,115,500
4. Tubes for pedal cycles	1,646,000
5. Retreaded tyres	25,245
6. Rubber shoes and slippers	4,486,000
7. Medical appliances	14,000
8. Household utensils	521,100
9. Sporting goods & dolls	236,000
10. Rubber tiles	422,000

In 1965 also, the Firestone Tyre Co. Ltd. had come into operation with an initial capacity of 180,000 tyres a year and has since expanded to 300,000 tyres per year and is planning to expand capacity a further 50 per cent. It makes 142 different types of tyres ranging from those for motor-scooters to those for tractors. It also makes inner-tubes.

Bridgestone Tyre Co., a joint Japanese-Thai venture, expects to come into production of tyres by the end of 1968, with a capacity of 200.000 tyres p.a. The Universal Tyre Company is building a factory with a capacity of 70,000 units p.a

The Goodyear Tire Co., of the U.S.A. has also announced its intention of commencing tyre production in Thailand and has received a Promotion Certificate for construction of a 240,000 tyre-per-year plant.

The new Goodyear factory, which will cost 350 million baht, will produce tyres for passenger cars, trucks, and tractors as well as tyre tubes and rubber flaps. Employment will be about 500 when the factory is in full operation.

By the end of 1970, local production of motor tyres is expected to reach 900,000 units p.a. and to be able to satisfy demand.

In the rubber foot-wear field, the Bata Shoe Co. and Nanyang Manufacturing Co. (Thailand) Ltd. are the major producers. Nanyang also makes tyres and tubes for pedal cycles.

(n) Major group 31: Manufacture of chemicals and chemical products

In 1966, Thailand imported the following major groups of chemicals as follows:-

	Million baht
Inorganic chemicals	205
Organic chemicals	135
Coal-tar dyestuffs and natural indigo	69
Dyeing and tanning extracts and synthetic tanning materials	20
Pigments, paints varnished and related materials	182
Medicinal and pharmaceutical products	467
Essential oils, perfumes and flavour materials	55
Perfumery, cosmetics, soaps, and cleansing and polishing materials	100
Fertilizers, manufactured	224
Explosives	1,269*
Miscellaneous chemical materials and products	720

The aggregate value, 3,446 million baht, represented about 14 per cent of Thailand's total import bill. Exports of chemicals in 1966 were 11 million baht in value. Main exports were glycerine (2.3 million baht), medicinal and

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* This is a vast increase from previous years when imports were under one million baht in value. The increase is probably due to inclusion of material for military use.

pharmaceutical products (3.8 million), and soaps and toilet preparations (2.2 million).

Chemical manufacture is well developed in a few sectors such as soaps and detergents, paints, chemical fertilizers and vegetable oils, as well as in a number of individual chemicals, such as sulphuric acid, caustic soda, chlorine, hydrochloric acid, alum, alcohol, and some industrial gases. In the great majority of items, the country is far from being self-sufficient, as the import statistics show. There are no large integrated chemical complexes and no petro-chemical installations of any kind.

Details of individual sections of the chemical industry are given below.

(i) Group 311: Basic industrial chemicals including fertilizers

This section of the chemical industry is developing fairly rapidly in Thailand and there are now some 22 factories making about 30 different types of chemicals, including vegetable oils. Development is hindered somewhat by the lack, so far, of indigenous raw materials such as sulphur, bauxite, copper, zinc, phosphates, coking coals, and extensive petroleum deposits. Salt, however, is plentiful and cheap.

Established manufactures include the following:-

Aluminium sulphate ("Alum")

The Alum Factory, Department of Science, commenced the production of alum for use by the Bangkok Water Works in 1955. Alum is made from Japanese alumina tri-hydrate and local sulphuric acid. Originally local alumina-bearing clays were used.

Production in 1965 was 10,000 tonnes and selling price 1,450 baht per tonne. The Water Works purchases alum as a 50 per cent solution and the paper-industry buys in solid form, usage for paper in 1964 being 900 tonnes. The operation is apparently profitable (see table below) and demand in both types of usage should increase. Import of aluminium sulphate in 1966 was 202 tonnes valued at 241,769 baht.

Operations data of the government alum factory, (millions of baht)

Year	1962	1963	1964	1965	1966	1967	1968
Income	6.630	8.600	12.760	15.950	22.610	17.500	18.730
Expenses	4.820	6.020	9.680	11.960	17.460	14.455	15.230
Profit	1.810	2.580	3.080	3.990	5.150	3.045	3.500
Net worth	7.070	7.750	9.600	12.060	15.300	16.470	18.150

(Artamonoff, 1965)

Ammonia and ammonium sulphate

Both ammonia and ammonium sulphate are made by the Chemferco plant at Mae Moh in northern Thailand (see "Fertilizers"). There are, so far, no other producers of ammonium salts in Thailand.

Caustic soda, chlorine, hydrochloric acid, and calcium hypochlorite

Electrolytic caustic soda and chlorine are made by several organizations, but the largest output for sale is by Thai-Asahi Caustic Soda Ltd. which produces 1,000 tonnes as 50 per cent solution. The company also makes hydrochloric acid and calcium hypochlorite utilizing hydrogen and surplus chlorine from its electrolysis plant.

Caustic soda and chlorine are also made by two government paper mills, the Bang Pa-in mill and the Kanchanaburi mill. Most of the output in both cases is captive.

Thai Churos Factory, one of three makers of monosodium glutamate, announced its intention of producing caustic soda and chlorine, both of which are used in MSG production. A check with the three factories regarding their supplies of sodium hydroxide and chlorine or hydrochloric acid is desirable, as each, with a capacity of 1.200 tonnes p.a., would require about 700 tonnes of caustic soda and 1,200 tonnes of hydrochloric acid annually.

Hydrochloric acid, as mentioned above. is made by Thai-Asahi Caustic Soda Co. Earlier, Siam Chemicals Co., Ltd. were in production and the three makers of MSG had plans for its manufacture. Kjornkiat Trading Co., Ltd. were listed as producers. Here again, a check with the firms themselves as to the present position is desirable.

Calcium hypochlorite is made by Thai Asahi Caustic Soda Company, largely

as a means of disposing of surplus chlorine: some of the production is sold but most is buried. This is symptomatic of many developing markets for products of the electrolysis of brine. As markets for chlorine, such as PVC and chlorinated organic pesticides develop, the tables are turned and caustic soda becomes the surplus product. The problem, so far as Thailand is concerned, is exacerbated by the fact that Malaysia, Indonesia and the Philippines, amongst others, have similar chlorine surpluses.

However, the Thai-Asahi company is now building a 12,000 tonne p.a. PVC resin plant on the opposite bank of the Chao Phraya River from the caustic soda-chlorine plant and this is expected to absorb the surplus chlorine when it comes on stream in 1970, including the added surplus which will arise from the doubling of Thai-Asahi's plant to be complete by the end of 1968. Provided demand for caustic soda continues to increase in 1969, the company will further expand production to a total of 3,000 tonnes per month, as well as installing facilities for making solid caustic soda.

Locally-produced caustic soda (50 per cent solution) is now selling at about 1,000 baht per tonne in Bangkok compared with about 1,600 baht per tonne for imported solid caustic soda.

One other chemical company has recently received a promotion certificate to construct a 1,000 tonnes per month caustic soda plant.

Dicalcium Phosphate and Ossein are both produced from bones by Thai Bone Industries Ltd., Don Muang.

Ethyl alcohol

Industrial alcohol is made in Thailand only at the Ayutthaya Alcoholic Spirits Distillery which is owned and operated by the Ministry of Finance. The Distillery also makes potable spirit as do a number of distilleries throughout Thailand (see Major group 21: Beverage industries).

The Ayutthaya Distillery makes a 95 per cent alcohol which is undenatured and a 90 per cent product which is produced from the 95 per cent alcohol on denaturation. The former is used chiefly in medicine, the latter in non-potable applications such as the making of shellac solutions.

The output of the Ayutthaya Distillery has been increasing quite recently as the following figures show:-

	1965	1966	1967
Raw material usage (tonnes)			
Molasses	16,594	22,390	33,103
Glutinous rice	226	47	-
Alcohol produced (litres)			
95 %	1,050,156	1,007,614	1,998,158
90 %	824,689	222,365	1,076,654
Liquor 30 %	8,305,380	14,744,161	14,191,863

Molasses usage for January to April, 1968, was 10,482 tonnes, equivalent to 31,446 tonnes p.a.

Molasses is preferentially bought from government sugar factories and any short-fall in supply made good by purchases from merchants and from abroad (1967). Shortfalls appear to be unpredictable, for example, the distillery has contracted for 50,000 tonnes of molasses for the current year (January 1968 to January 1969) although usage is only some 60 per cent of this. Molasses price also varies greatly, a recent price paid to merchants being 933 baht/tonne delivered. Prices to government sugar factories do not include transport cost.

Profits of the distillery have shown a distinctly rising trend in recent years.

Year	Income (millions of baht)	Expenses (millions of baht)	Profit (millions of baht)
1962	24,460	19,850	4,610
1963	35,200	32,960	2,240
1964	41,260	39,120	2,140
1965	24,602	20,922	3,681
1966	30,422	20,432	9,990
1967	36,957	26,864	10,093

Sources: 1962-1964, Artamonoff, 1967

1965-1967, directly from distillery

The distillery sells 95 per cent alcohol at 8 baht/litre, ex-factory, and Business and Municipal Tax bring this price up to 16.36 baht per litre, ex-factory. Even without these taxes, the price is some three times that for alcohol in the U.S.A. and U.K. and militates against its use as a starting point for synthesis or as a solvent. With rising profits, it seems, superficially at least, that the price could be reduced.

Industrial gases

Two companies, Air Chemicals Co., Ltd. and Pure Gas Co., Ltd., make carbon dioxide for sale and, since there is little or no recorded import of oxygen and acetylene, it is possible that these are made also, but little is known of the companies operations.

The Amarit Brewery collects the off-gas from its fermentation for the manufacture of soda-water while the Boon Rawd Brewery makes its soda water from CO_2 prepared by combustion of fuel oil. So far as is known, spirit-makers in Thailand waste their CO_2 off-gas. (see Major group 21: Beverage industries).

The Thai-Asahi Co. produces chlorine for sale (see "Caustic soda, chlorine, etc." above) and also hydrogen from its brine-electrolysis.

Fertilizers

The only producer of chemical fertilizer in Thailand at present is the Chemical Fertilizer Co., Ltd. (Chemferco) plant at Mae Mot which came into production in 1966 and has a capacity of 60,000 tonnes of ammonium sulphate and 30,000 tonnes of urea annually. The company, owned 49.9 per cent by the Thai government, commenced marketing ammonium sulphate at 1,050 baht per tonne competitive with imported fertilizer but when the imported price was lowered to 900 baht per tonne, Chemferco accumulated an unsold stock of some 35,000 tonnes.

Following appeals to the government to limit import competition, licensing of import was introduced at the end of June, 1968, the government preferring this system to imposing a tariff which would raise the cost to farmers.

In addition to the Chemferco plant at Mae Mot, two U.S. concerns were reported in 1967 to be (separately) investing in Thailand for chemical fertilizer production.

One, the Allied Chemical International Corporation (ACI) was forming a joint-venture with Chemferco on a 50-50 basis to build, at Si Racha, a 400 million baht factory to produce 120,000 tonnes of NP and NPK compound fertilizers per year, requiring the import of sulphur, rock phosphate, and potassium carbonate from National Iranian Oil Co. of which ACI is a joint-shareholder.

The other chemical fertilizer venture, Thai Agricultural Chemical Industries (TACI), also planned to build a factory at Si Racha to produce NPK compound fertilizers. The overseas partner is International Minerals and Chemical Corporation (IMC), a leading world producer of phosphate and potash rocks. The other partner, Thai Oil Refinery Co., Ltd., would supply nitrogen and sulphur from off-gas and surplus refined products, its off-gas being estimated to be able to supply about 5,000 tonnes p.a. of sulphur. (Private advice from TORC suggests that off-gas would supply very little of the materials required for fertilizer, and that feedstock, presumably napthenes, would need to be imported.)

Production capacity of the TACI factory was indicated as being between 225,000 and 670,000 tonnes per annum. Even at the lower output of 225,000 tonnes p.a., total fertilizer output would be 435,000 tonnes p.a. The present rate of growth in fertilizer usage of 17 to 20 per cent per year means only a usage of 240,000 to 280,000 tonnes by 1970.

The extent to which fertilizer usage could be increased is conjectural. An ECAFE survey in 1963 showed that Thailand was the lowest user in the region: Japan used 304 tonnes per 1,000 hectares, Taiwan 204 tonnes, Korea 135 tonnes and Thailand 1.8 tonnes. The AID Report, 1966, stated that "if farmers followed fertilizer recommendations on crops grown on land suitable for fertilization the national annual usage would be near 550,000* tonnes."

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* The AID Report leaves it in some doubt as to whether this quantity is as tonnes of actual fertilizer or as tonnes of nutrients. Appendix II Table 1, in the Report quotes "Maximum potential fertilizer need" as 234,521 tonnes N, 178,460 tonnes P_2O_5 and 143,624 tonnes of K_2O, a total of 556,605 tonnes of nutrients. In the context of the Report itself, however, the 550,000 tonnes is compared with "a present usage.....of 108,000 tonnes per year," the latter figure certainly being "as fertilizer" not "as nutrients." (See page 29, "A report on the Thailand Fertilizer Situation and Potential" AID., 1966).

Thai demand for ammonium sulphate in mid-1968 was put at 43,000 tonnes and for urea at 2,250 tonnes p.a.

The Bangkok City Council has a plant which produced 20,000 cubic metres of an organic, compost-like fertilizer from garbage in 1965 and at that time planned to increase capacity to 80,000 cubic metres.

Some fertilizer mixing has been carried out in Thailand by Yip-in-Tsoi Co., Ltd. The company has a small mixing and granulation plant and annually has produced about 2,000 tonnes of nitrogen-phosphate mixtures for local consumption. The granulation process primarily consists of coating ammonium sulphate crystals with superphosphate using sulphuric acid as a granulation aid. This plant has not been extensively used and negotiations are believed to have been under way to sell it to Chemferco

Potassium nitrate

According to W.A. Graham (1924), "a remarkably pure saltpetre" has been obtained by boiling bat-guano with wood-ashes, the guano occurring thickly on the floor of numerous caves "at Trang and all through the hilly regions which form the east and west boundaries of Central Siam." The saltpetre has "been used locally from the earliest times and has now become an article of export." Export, if not also production, of this saltpetre appears to have long since ceased and Thailand has been an importer for many years, the import in 1966 of potassium nitrate being 1,217 tonnes valued at 3,346,422 baht.

Sodium silicate

Sodium silicate is imported into Thailand in ever-increasing quantities, the import in 1966 being about 2,000 tonnes valued at 2.5 million baht. This quantity includes both liquid and solid forms. Main use is in detergents, with a declining use as an adhesive in packaging, and a growing use in textile dyeing.

Thai Acid Industry Co. produced liquid sodium silicate at one stage and there is some current interest from abroad in establishing local manufacture. The Board of Investment has recently accorded Promotion Privileges to sodium silicate manufacture.

Sodium chloride

Salt is harvested along the shores of the coast of Thailand some 50 to 100 kilometres from Bangkok. Production is of the order of 360,000 tonnes

Thailand: Exports of salt 1960-1966

Country	1960		1961		1962		1963		1964		1965		1966	
	Qut. (t)	Value f.o.b. (baht)	Qut. (t)	Value f.o.b. (baht)	Qut. (t)	Value f.o.b. (baht)	Qut. (t)	Value f.o.b. (baht)	Qut. (t)	Value f.o.b. (baht)	Qut. (t)	Value f.o.b. (baht)	Qut. (t)	Value f.o.b. (baht)
Borneo	8,172	1,143,419	8,037	1,307,504	8,669	1,706,890	8,746	1,480,305	7,333	1,129,468	4,789	824,600	4,324	804,616
Hong Kong	12,264	1,322,447	18,168	2,476,150	19,008	2,606,215	13,468	1,650,987	888	155,369	192	22,131	2,664	291,317
India	1	400												
Malaysia	33,159	3,063,000	32,880	4,050,754	33,153	4,041,123	35,911	4,351,133	35,161	4,944,497	48,390	7,094,642	55,466	7,614,500
Penang	7,368	1,102,314	7,495	1,272,267	9,001	1,819,242	10,054	1,848,054	10,137	1,998,509	4,224	704,004	191	34,663
Singapore	22,115	2,998,218	21,655	3,530,858	22,588	3,917,882	20,912	3,173,934	20,118	3,491,317	16,433	2,905,562	20,839	3,529,011
Laos	2,162	633,592	1,930	612,054	2,245	623,793	2,096	622,437	2,304	667,196	2,180	495,220	1,194	344,715
Burma	1,249	339,112	974	204,724	1,484	449,042	1,473	461,205	1,269	388,831	555	167,920	129	38,340
Japan	137,127	11,140,050	98,835	7,767,927	38,763	3,140,799			62,588	4,952,983				
Philippines	100	14,840												
Saudi Arabia	2	3,848												
United Kingdom		60												
Cambodia			10	1,868										
South Korea											5,000	468,000		
Total	223,719	21,761,300	189,984	21,224,106	134,911	18,304,986	116,760	15,497,052	139,798	17,706,170	81,763	12,682,079	84,807	12,657,160

Source: Department of Customs, Bangkok.

yearly, of which 140,000 tonnes was exported in 1964. In 1965 and 1966, however, this fell to a little over 80,000 tonnes due to the total withdrawal of Japan from the market; in 1964 Japan took 63,000 tonnes, about the same amount as was taken by Singapore—Malaya, the other major customers. In 1968 Japan took 30,000 tonnes, and will probably take a similar amount in 1969. (See attached table of exports, 1960—1966.)

The average NaCl content of Thai salt is just under 90 per cent, and while this is low by international standards, the most serious "impurity" is water. Nevertheless, the low NaCl content seems to have deterred Japanese buyers from purchasing larger quantities.

However, on the 19th of September 1968, the "Bangkok World" reported the Department of Science as stating, "Thai salt is now of high quality... *following successful research undertaken four years ago.*"

Sulphuric acid and sulphur

Three plants in Thailand produce sulphuric acid, but that produced by the Chemferco plant at Mae Mot is captive for its production of ammonium sulphate: capacity for this use is rated at 75,000 tonnes of sulphuric acid annually.

Thai Acids Industry Co., Ltd. has a capacity for 35,000 tonnes of sulphuric acid per annum and, in addition, can produce 6,000 tonnes of oleum. Siam Chemicals Co., Ltd. is also a producer as also is Bangkok Chemical Co.

Sulphuric acid is almost wholly made from imported elemental sulphur although a little produced at Mae Mot from process gases which contain H_2S and this, in turn, arises from the lignite on which the system is based. It is also said that waste gases from TORC and Summit Industrial Corporation contain some 8,000 tonnes of hydrogen sulphide annually, which at present is not recovered.

Imports of sulphuric acid into Thailand 1960-1966

Year	Quantity (kg)	Value c.i.f. (baht)
1960	1,575,276	2,170,734
1961	41,150	202,084
1962	21,276	143,028
1963	1,099,398	1,442,837
1964	287,238	471,876
1965	18,086	147,217
1966	22,047	183,121

Source: Department of Customs, Bangkok.

Synthetic resins

There is as yet no basic manufacture of plastic intermediates in Thailand but there is an extensive plastics moulding industry. This is dealt with under Group 399, "Manufacturing industries not elsewhere classified," where mention is also made of proposals to produce synthetic resins.

Zinc chloride

Zinc chloride is made by Paknam Chemical Co., Ltd. but imports for 1967 (Port of Bangkok only) were 270 tonnes with a value of 1.5 million baht.

Products of atomic fissian and fusion

An experimental atomic reactor, subsidized by the U.S. Atoms for Peace Programme, has been in operation in Thailand for several years.

On 6th January 1969, it was announced that the Yanhee Electricity Authority had selected a site in Chon Buri Province for Thailand's first atomic power plant. The plant will commence production in 1976, will cost 2,500 million baht and will have an output between 350,000 and 500,000 kilowatts.

(ii) Group 312: Vegetable and animal oils and fats

Animal oils

Thailand imports the greater part of her requirements of animal oils and fats, by far the biggest item of which is tallow. Import of tallow in 1966 was 2,606,021 kg valued at 10,859,766 baht. There is some production of tallow mainly at the Bangkok Municipal Slaughter house; Marsden, 1966, estimated total production would expand to 7,000 tonnes p.a. by 1971, thereby meeting fully the demand for soap which itself, would decline in the meantime, diminished by the increasing use of synthetic detergents.

Lard and lard oil are the principal animal oils and fats used in Thailand and swine slaughter in Thailand suggests there could be 70,000 to 80,000 tonnes of lard arising in Thailand annually. The main production, however, appears to be in the home, from pig-fat either pared from pork meat or from fat specifically bought for rendering.

There is reputedly no marine oil production, the six small fish and sea-food reduction plants with a combined capacity of 9,000 tonnes of meal

p.a., having no reduction facilities. It should be noted, however, that in both 1965 and 1966, a small export (408 litres in 1965 and 432 litres in 1966) of "oil from fish and marine animals, n.e.s." was recorded as going to Malaysia.

Vegetable oils

Thailand is both an importer and an exporter of vegetable oils but, as the following statistics show, she was decidedly a net exporter in 1966 so far as quantity is concerned but was approximately in balance in monetary terms.

Production of vegetable oils in Thailand covers rice bran, coconut, kapok seed, soya bean, sesame, groundnut, castor, parinarium, and kenaf seed oils. Marsden, 1966, calculated that oil seeds production in Thailand exceeded 300,000 tonnes. The Ministry of Agriculture's latest figure, 1965, gives a total of 452,100 tonnes for oil-seeds production, covering the following:-

	1965 production (tonnes)	Oil content (%)	Oil equivalent (tonnes)
Castor beans	31,600	45	14,200
Peanuts	130,600	35	46,000
Sesame	18,300	47	8,600
Soya bean	19,100	18	3,400
Cottonseed	40,000	20	8,000
Coconut (as copra)	212,500	63	134,000
	452,100		211,200

Of these seeds, not all are, of course, available for oil production. Some groundnuts are eaten as is, while the figure for copra is derived by the Ministry simply by applying a factor to the total production of nuts. However, at least 25 per cent of coconuts are used other than for copra, so that Marsden's estimate seems reasonable.

To this potential must, however, be added the potentials from rice bran, kapok seed, kenaf seed and parinarium seed. Of these, rice bran has by far the greatest potential, availability of bran being between 600,000-700,000

tonnes p.a. equivalent to 100,000-140,000 tones of oil. Kapok seed production in Thailand in 1965 was 310,000 tonnes and its oil content of 25 per cent gives a potential production of almost 80,000 tonnes p.a.

Despite the importance of kenaf as a fibre crop, the seed seems unlikely to feature largely as an oil source for several reasons, principal of which are, first that fibre and seed are not concomitant crops and secondly that the oil, and therefore the press-cake contain a principle malvalic acid, with untoward effects to some animals, at least. Parinarium seed oil is apparently in sporadic production as a drying oil notably for coating paper umbrellas made near Chiang Mai. The tree grows wild throughout Thailand but nowhere in dense stands and the oil seems unlikely to be developed commercially in the near future although it may have some unique chemical properties.

It is most unlikely, of course, on economic grounds, that the full oil-production potential of some 400,000 tonnes p.a. for vegetable oils would be fully realized and the above discussion is merely to set an upper, rather theoretical limit, on immediate potential.

Vegetable oils. Thailand is both an importer and exporter of vegetable oils as the following statistics show:-

Commodity	Imports 1966		Exports 1966	
	Quantity (litre)	Value c.i.f. (baht)	Quantity (litre)	Value f.o.b. (baht)
Linseed, oil	89,371	724,508		
Linseed oils, oxidized blown or boiled	617,501	4,944,176		
Linseed oils hydrogenated	18,565	148,733		
Soyabean oil	50,524	425,845		
Soyabean oils, oxidized, blown or boiled	3,636	29,105		
Soyabean oils, hydrogenated	1,690	22,280		
Olive, oil	15,600	313,943		
Olive oils, oxidized, blown or boiled	5,481	103,498		
Olive oils, hydrogenated	183	4,162		
Palm oil	50,684	382,399		

The statistics showing imports and exports of vegetable oils (continued)

Commodity	Imports 1966		Exports 1966	
	Quantity (litre)	Value c.i.f. (baht)	Quantity (litre)	Value f.o.b. (baht)
Palm oils, oxidized, blown or boiled	8,180	77,748		
Palm oils, hydrogenated	375,074	2,070,668		
Castor oil	59,210	523,486	37,690	236,326
Tung oil	16,559	177,952	13,400	111,421
Sesame oil	8,275	195,453		
Maize oil	1,680	21,940		
Bean oil, n.e.s.	11,121	97,699	21,320	100,704
Mustard oil	3,600	65,550		
Salad oil	26,371	178,096		
Oils from seeds, nuts, and kernels n.e.s.	68,311	661,454	688	4,044
Edible oils, n.e.s. oxidized, blown or boiled	5,406	74,644		
Oils, n.e.s., oxidized, blown or boiled	10,928	109,427		
Edible oils, n.e.s. hydrogenated	162,841	1,537,045		
Oils, n.e.s. hydrogenated	42,414	318,263		
Peanut oil			1,824,682	11,520,817
Coconut oil			18,000	81,260
Rice oil			672,557	835,238
	1,553,205	13,208,074	2,593,337	12,889,810

There remains the very real fact that Thailand exports some oil seeds in significant quantity, as the following data for 1966 show:-

	Export (tonnes)	Equivalent as oil (tonnes)	Import of oil (tonnes)	Import of oil (baht)
Groundnuts	17,557	6,150	-	-
Copra	1,439	910	-	-
Soyabeans	5,608	1,010	47	425,845
Cotton seed	17,664	2,510	-	-
Castor beans	43,859	19,400	55	523,486
Sesame	5,288	2,490	7	195,453
	91,415	31,470		

Source: Department of Customs, Bangkok.

In other words, Thailand exports about one twelfth of her total availability of oil-seeds. It would also seem, from the above table, that she imported over a million baht worth of vegetable oils which could have been produced here. Furthermore, the table also suggests that seeds were exported equivalent to some 30,000 tonnes of oil roughly of the value of 300 million baht.

Structure and operation of the industry

Marsden, 1966 stated there were 50 mills in 1965 of which 8 were major oil mills working on copra and 42 were very small-scale working on groundnut, soyabeans, and miscellaneous seeds, but some also handled copra. The larger mills had integrated soap production facilities; many of the small mills used only locally-made wooden presses.

The Promotion of Industrial Investment Act (1962) appears to have resulted in the establishment of larger operations in this field, since the Act requires a minimum daily capacity of not less than 500 kilogrammes for "vegetable oil" and a "use of not less than fifty thousand kilogrammes of rice bran daily," in the case of rice bran oil. This is equivalent to between 4 and 9 tonnes of rice bran oil daily dependent on the method of extraction.

In issuing Promotion Certificates, the Board of Investment thus makes a distinction between rice bran oil and vegetable oil other than rice bran oil. Nevertheless, most of the factories producing or planning to produce

rice bran oil can also produce other vegetable oils, an economically desirable versatility because of the short season during which rice bran is available each year and the rapidity with which the oil becomes rancid before extraction.

Data published by the Board of Investment in this field show the following:-

Vegetable oil	Capacity per day	Start-up date
East Union Plantation Oil Co., Ltd.	Coconut oil / Castor oil } 1 tonne	28-6-63
Sudathip Co., Ltd.	Coconut oil 1½ tonne	1-8-66
Industrial Enterprises Co., Ltd.	Vegetable oil ½ tonne	16-8-67

Rice bran oil	Annual capacity	Start-up date
Universal Rice Bran Oil Co., Ltd.	Rice bran oil 2,000 tonnes p.a.	11-9-61
Industrial Enterprises Co., Ltd.	" " 50 tonnes	16-10-67
General Industries Co., Ltd.	" " 3,600 tonnes	11-10-67
Thai Development Rice Bran Oil Co., Ltd.	" " 1,500 tonnes	not yet commenced
Rice Bran and Vegetable Oil Industry Co., Ltd.	" " 4,000 tonnes	" "
Vegetable Oil Co., Ltd.	" " 5,000 tonnes	" "
Stellar Co. (Thailand) Ltd.	" " 2,592 tonnes	" "

Hermans* (1967) concluded that by the beginning of 1969, the industry will have a capacity for utilizing 600 tonnes of rice bran per day, which is nearly 20 per cent of the total rice bran production.

No recent statistics are available on the actual current production of vegetable oils but the following estimates of 1964 output were made by Marsden (1966).

* "Preliminary study of the economic feasibility of stabilization of rice bran in relation to rice bran oil production in Thailand" by Wilhemus C.J.Hermans. Report No. 2 on Research Project No. 13/6 (Rice bran stabilization treatments) ASRCT unpublished report.

	Estimated production 1964 (tonnes)
Coconut oil	10,500
Peanut oil	12,500
Soya bean oil	3,070
Rice bran oil	2,000
Palm oil	-
Linseed oil	1
Castor oil	38
Miscellaneous oils (Kapok, cottonseed, tung, etc.)	413
Total	28,072

Oil-meal

Thailand is a substantial exporter of oil-meals (oil-cake) as 1966 statistics show:-

Export of oil-meals (oil-cakes) from Thailand, 1966

	Quantity (kg)	Value f.o.b. (baht)
Peanut cake	11,856,571	21,953,837
Bean cake, n.e.s.	1,627,980	2,970,745
Copra cake	11,797,412	15,215,537
Soyabean cake	2,885,360	5,146,956
Oil-seed, cake and meal and other vegetable oil residues	153,100	171,320
Total	28,320,423	45,458,404

It is perhaps significant that she is also a substantial importer of "Animal feed mixed with chemical and biological products," which, in 1966, totalled 372,816 kg valued at 5,130,192 baht. As noted by Marsden (1966). "The commercial production of prepared animal and poultry feeds is still in

its relative infancy in Thailand," and the growing export of oil-cakes appears to be corroborative evidence of this.

Margarine and shortening

There are two manufacturers of margarine and shortenings, one of which is Levers Bros. (Thailand) Ltd. Marsden, 1966, estimated total capacity at 2,400 tonnes p.a. and stated that the plants use local coconut oil and imported hardened palm oil (having no hydrogenation facilities of their own). The product was reported to contain 15 per cent of water and the fat moiety to comprise 70 per cent hardened palm oil and 30 per cent coconut oil. Marsden estimated 1964 production at 720 tonnes and considered production would rise to 1,100 tonnes by 1971. The bulk of margarine is believed to be used in local commercial baking and coffee roasting. About 460 tonnes of margarine worth 3.9 million baht were imported in 1966.

(iii) Group 313: Manufacture of paints, varnishes and lacquers

Demand for paint and related materials in Thailand is estimated at 19,000 tonnes p.a. and this is increasing at the rate of 15 to 20 per cent annually. The bulk of the demand is for flat paints based on polyvinyl acetate, as the import statistics below will indicate. In 1967, imports supplied some 12,000 tonnes of total demand 7,000 tonnes arose from local production.

The industry comprises 10 promoted companies (3 of which are not yet in production) about 20 unpromoted firms of medium size and a large number of small "mixers" who merely buy pva paste and stir in water and pigment. Total capacity of promoted firms is about 15,000 tonnes p.a. and of the 20 larger unpromoted firms about 5,000-6,000 tonnes p.a. Thus, total capacity is about 20,000 tonnes p.a.

Output in 1967 came mainly from unpromoted firms (5,000-6,000 tonnes) only 1,000-2,000 tonnes coming from promoted firms, few of which are yet properly under way.

In June, 1967, the Board of Investment ceased to consider further applicants for promotional privileges in this field, but is understood to be considering approving further applications.

Few local raw materials are used by the Thai paint industry, the main items being kaolin and calcium carbonate with small quantities of soya bean,

tung, and parinarium oil.

Details of promoted firms are:-

Firm	Capacity (tonne/day)
Metropolitan	6
Thai Udom	5
Jotun	7
Sissons	5
Nippon	10
Nat. Lead*	5
Sri Thai Kansai*	5
Sigma*	5
Total	48

Sticklac, seedlac and shellac

Thailand is the second largest lac producing country after India and cultivates the scale insect in northern and north-eastern Thailand. Sticklac is cut from the trees in June and November and removed by steam to form seedlac, which can be processed to form shellac.

However, the bulk of the crop is exported as seedlac because, in this form, it keeps almost indefinitely whereas bleached shellac breaks down after about 6 months, of which 2 months is often taken up in shipping. The Thai Lac Association also claims that the price difference between seedlac and shellac is too small to justify local production of the latter. Domestic consumption of lac products is minimal. Exports of the various items in recent years has been as follows:

* will commence production in 1969

Year	Sticklac		Seedlac		Shellac	
	Quantity (kg)	Value (baht)	Quantity (kg)	Value (baht)	Quantity (kg)	Value (baht)
1964	2,882,605	9,280,628	8,100,208	30,290,735	60,468	544,231
1965	2,804,960	10,555,695	14,423,542	53,269,971	978,806	6,399,895
1966	2,977,209	9,904,415	12,285,681	45,844,566	653,951	5,006,548
1967	2,140,875	10,434,320	5,565,275	26,252,391	87,731	762,308
1967, to U.S.A.	*	*	3,525,901	16,169,852	33,625	243,360

* 1967 Port of Bangkok only.

Source: Department of Customs, Bangkok.

The following table shows imports of paint and related materials.

(iv) Group 319: Manufacture of miscellaneous chemical products

This group covers chemical products other than basic chemicals, oils and fats, paints and other liquid organic surface coatings. Hence it covers soaps and other washing and cleansing compounds: pharmaceuticals and toiletries; polishes, inks; matches, candles; and insecticides.

There are seven major producers of soap in Thailand and two major producers of detergents and other cleansing compounds. Lever Bros (Thailand) Ltd. and Colgate-Palmolive (Thailand) Ltd. are the major producers of detergents and carry out sulphonation of imported alkyl-benzene for this purpose.

Levers are also the major producer of toilet soap, while Colgates, although they market a toilet soap in competition, have it custom-made by Wan Far Long Co., Ltd., a company making toilet soap and margarine, as well as laundry soap.

In addition to Levers, Colgates, and Wan Far Long, the other producers of soap in Thailand are:-

- Tuay Tong Manufacturing Co., (i.e. Gold Cup Manufacturing Co.), manufacturing laundry and toilet soaps and margarine
- Lion Bangkok Ltd.
- Chula Industries Co., Ltd.
- Union Trading Soap Co., Ltd.

Imports of paint, enamel, lacquers, varnishes, distempers, and printing ink

Commodity	1962		1963		1964		1965		1966		1967	
	Quantity (tonnes)	Value (10^3 ฿)	Quantity (tonnes)	Value (10^3 ฿)	Quantity (tonnes)	Value (10^3 ฿)	Quantity (tonnes)	Value (10^3 ฿)	Quantity (tonnes)	Value (10^3 ฿)	Quantity (tonnes)	Value (10^3 ฿)
Paint, prepared	3,771	40,640	4,441	48,293	5,473	57,509	6,003	64,166	8,328	84,029	8,363	89,497
Enamels	760	12,032	923	14,145	1,187	17,551	1,310	17,438	1,609	21,341	1,589	23,502
Lacquers	567	16,806	680	10,838	902	13,362	977	13,637	1,108	24,088	1,422	20,480
Varnishes, oil, and cellulose	240	3,967	270	4,275	320	4,798	481	6,045	492	6,706	825	10,433
Distempers	129	531	70	262	118	439	21	105	8	48	0.4	15
Ink, printing and lithographic	471	8,662	614	10,655	662	14,125	709	15,555	697	16,380	863	19,747

Sources: Department of Customs, Bangkok

According to Marsden, 1966, there were also six significant but smaller manufacturers of toilet soaps using purchased soap-base as well as some very small manufacturers. Marsden estimated 1944 production of laundry soap at 2,963 tonnes and toilet soap at 4,558 tonnes p.a. He foresaw a decline in laundry soap demand to 2,000 tonnes p.a. in 1971 due to the inroads of detergents. Production of toilet soap on the other hand would, he considered, rise to 7,130 tonnes p.a. by 1971. Marsden considered that total capacity for soap production was already well in excess of 1971 demand.

A recent survey of potential glycerine availability in Thailand suggests that soap production may be of the order of 5,500 tonnes p.a.

Toothpaste is made by Colgate and by Lion (Bangkok) Co., Ltd.

The most popular mild-abrasive cleaning compound appears to be "VIM" made by Levers.

Glycerine

In 1966, Thailand imported over 500 tonnes of glycerine and exported 380 tonnes, the imported material presumably being refined and that exported being a concentrated crude. Recent enquiries by ASRCT show that Levers and Wan Far Long are the exporters and that if sweet-water (i.e. 5 % of glycerine) from all major soap-makers were converted to 80 per cent glycerine, some 700 tonnes would be available.

Negotiations are afoot to concentrate some of the sweet-water now run to waste. Moreover, a plant installed by Wan Far Long about 5 years ago but never used, could produce about 100 tonnes per annum of USP grade and attempts are being made to bring this plant into operation.

Candles

Two types of candles are made in Thailand, household and votive candles. Household candles are generally made of 100 per cent paraffin wax while votive candles may be 100 per cent beeswax or 50 per cent beeswax and 50 per cent paraffin. The aroma of burning beeswax is important in votive candles.

The industry is apparently small scale, Thavornthanasarn, 211 Chakrawat Rd., Bangkok, claiming to be the largest producer. Paraffin wax is imported and beeswax comes largely from import supplemented from local sources.

Waxes

"Beeswax" is the only wax known to be produced in Thailand. It is derived from the large forest bee (Apis dorsata) and is more properly known as "Ghedda wax," having a lower acid value and a higher ester value than normal beeswax from A. mellifera (Smith, 1960).

There is some interest in production of wax arising from the extraction of rice bran, but as yet there is no commercial output

Fire-works

Statistics issued by the Ministry of Industry indicate that, in 1967, there were 19 factories producing "fireworks and explosives" in Bangkok and Thon Buri and two such factories in the provinces.

Compounding of pesticides

Import of the major pesticides into Thailand in 1966 is recorded as follows:-

	Kilogramme	Baht
Insecticides	6,371,243	127,130,228
Fungicides	403,974	4,720,186
Disinfectants	1,304,182	64,407,941
Weed-killers	834,842	11,368,569

There is no manufacture of basic ingredients as yet but some compounding from imported active ingredient is undertaken by the Shell Co., of Thailand Ltd., and by others. The ECAFE Secretariat* estimated 1959 production of compounded pesticides in Thailand as follows:-

	Tonnes
DDT, 5 %	137
BHC (Lindane)	6
Aldrin, 25 %	2
5 %	6
Chlordane 75 %	5

* "Sectoral study on pesticides and insecticides." Prepared for Asian Conference on industrialization. 6-20 December 1965, Manila.

The production of compounded pesticides in Thailand, 1959 (continued)

	Tonnes
Parathion	16
Pyrethrum	0.2
Copper sulphate	0.2
Dry bordeaux mixture	0.2
Mercury compounds	4
Fumigants ("Fumogas")	0.1
Zinc phosphide	0.9
Endrin 19.2 %	17

No more recent data are available but, though individually small, the range of materials compounded was even then quite extensive. It is understood that the inert material is, in most cases, of local origin, so that foreign exchange is conserved.

There is current interest in making some active ingredients locally, and the Department of Customs has been asked to follow a more specific break-down of these items in future publications of its statistics.

Pharmaceuticals

Although there were three government pharmaceutical factories and a number of private manufacturers including associates of six or seven international pharmaceutical companies, import of medicinal and pharmaceutical products in 1966 was valued at over 467 million baht, the major items being:-

	Million baht
Mixed vitamin preparations, n.e.s.	46
Analgesics and antipyretics, n.e.s.	55
General anti-infectives, n.e.s.	20
Hormones, n.e.s.	22
Medicines, n.e.s. for external use	32

Exports in 1966 were about 4 million baht in value of which "medicines, n.e.s." constituted about half.

Production by the government pharmaceutical factories is "modest" (Artamonoff, 1965) and the international companies are, generally speaking,

little more than repackers of finished products imported in bulk from their overseas parent companies. As artamonoff (1965) notes, "true production in the full sense of the word is limited to a line of biologicals (vaccines), absolute alcohol, water for injections, soft cotton and gauze". But despite all the apparent scope for import replacement, the local industry appears to be doing poorly.

The three government factories are:-

The Government Pharmaceutical Laboratories owned by the Ministry of Public Health, was started in 1941 and now 80 per cent of its production goes to the Government for hospitals and dispensaries and 20 per cent is sold to private dealers. Vaccines form an important part of production. In 1964, net worth of the Laboratories was set at 12.5 million baht, sales at 17 million and profit at 2.73 million.

The management is anxious to expand and seeks a joint-venture operation.

Pharmaceutical Laboratory, Ministry of Public Health, Nonthaburi, simply fills capsules with imported cod-liver oil for free distribution. Capacity was stated at 80 to 90 thousand capsules daily in 1965.

Armed Forces Pharmaceutical Laboratories. Ministry of Defence, at Thon Buri, produces encapsulated distilled water for injections, multi-vitamin tablets, ointments and other compounded products, and supplied (in 1965) about half the Armed Forces requirements. Value of production was then (1965) three to four million baht. Their production coincides to a large extent with that of the Government Pharmaceutical Laboratories.

The private sector is composed of branches of overseas companies and a large number of smaller factories (over 300 were registered (i.e. "mechanized") in 1965).

Amongst the major overseas companies with branches here are Merck, Sharp and Dohme Co., Ltd., Glaxo-Vidhasom Ltd., Lepetit Co., Ltd., Hoechst-Thai Co., Ltd., Bayer-Thai Co., Ltd.

Merck Sharp and Dohme (Thailand) Ltd. was established at Paknam in 1959 as a joint-venture with Thai capital. The Company's own statement claims that it "is now capable of producing over one hundred different types of pharmaceutical products including vialed narrow-spectrum anti-biotics, cortico-steroids, diuretic products, anti-hypertension agents and non-steroid anti-

inflammatory products." The Company's statement also claims that a "sizable portion of the plant contains the chemical manufacturing section where raw materials for diuretics, steroids, vitamins and other products are manufactured." These statements, made in 1966, are somewhat at variance with those of Artamonoff, 1966, as quoted above.

Glaxo-Vidhasom Ltd. is owned 90 per cent by Glaxo, United Kingdom, and has a small Thai participation. It commenced in 1964 and operations comprise mainly the blending and repacking of imported components. In 1965, Artamonoff noted the company's complaints that:-

(i) Tariff on imported pharmaceuticals is 10 per cent whereas tariff on raw materials is 30 per cent (The latest Tariff Schedule suggests that this anomaly has since been corrected: both items now carry a tariff of 30 per cent.

(ii) There was "illicit manufacture of inferior quality and cheaper products by small concerns, at times even copying the trade marks of well known brands."

Lepetit (Thailand) Co., Ltd., is owned 70 per cent by Lepetit, Italy, and 30 per cent locally. Artamonoff, 1965, reported that 95 per cent of all basic raw material is imported, that there are two divisions of the Company - "a pharmaceutical and a separate chemical synthesis plant." The company was also "prepared to sell their products to anyone." Artamonoff reported that the company had also been showing losses for the past three years and expected other companies also to be losing due to the reasons above-mentioned under "Glaxo-Vidhasom Ltd."

Match manufacturing

Import and export of matches are negligible, and match manufacturing is not a promoted industry, capacity presumably being considered adequate.

According to Marsden, 1966, there were 6 privately-owned manufacturers of wooden matches, of which two shared the same plant facilities. The largest private plant accounted for approximately 25 per cent of total production and operated at 70 per cent of capacity on a one-shift-basis. A seventh factory, accounting for 10 per cent of production, was considered as part of the Sarit Estate and so passed to the Ministry of Finance. However, a court decision on 26th June, 1968, allotted the shares in question to the United Match Co.,

which acts as a wholesaler-distributor for all seven companies, except in the case of wooden book matches which are sold direct.

Excise is payable on matches and in the fiscal year, 1966, such payment was levied on 372,978,080 boxes.

There is no domestic manufacture of paper matches.

In 1966, about 9.5 tonnes of "red and yellow phosphorus" was recorded as an import, most, presumably for match manufacture.

(n) Major group 32: Manufacture of products of petroleum and coal

Indigenous fuel resources in Thailand, based on exploratory work to-date, are quite limited. Coal deposits are mostly lower-grade lignites which require on-site use to justify their recovery. A lignite deposit is being worked at Mae Moh in northern Thailand, partly for electricity generation, partly for fertilizer production (see under Group 311, above). Another lignite deposit is being worked at Krabi in southern Thailand for electricity generation.

Oil production is limited to very small pumping and refining operations in the Fang area of northern Thailand conducted by the Ministry of Defence: the output is dedicated to defence.

Two oil-shale deposits have been recognized in Thailand - one at Mae Sot in north-western Thailand and one in Changwat Krabi on the southern peninsula. Neither deposit has been worked or fully appraised but the Mae Sot deposit is looked on as the second-richest known occurrence of significant size in the world, with inferred reserves of 420 million tonnes of oil.

Six companies have applied for exploratory rights to conduct oil-drilling off the coast of Thailand. One of these has already signed a formal agreement with the government and the others are expected shortly to follow. Even if favourable geological structures are found relatively quickly, it would be some three to five years before full-scale commercial production of crude-oil began.

Import of coal is almost negligible and in 1966, only some 3,000 tonnes of coke were imported, presumably for foundry use. Quite large quantities of coal-tar chemicals come into Thailand, however, - in 1966, for example,

some 600 tonnes of "mineral" creosote, worth almost a million baht were imported.

(i) Group 321: Petroleum refineries

Thailand obtains her requirements of refined petroleum products partly by locally refining imported crude and partly by supplementing this with imports of products already refined.

Present and projected refinery capacity is as follows:-

Refinery	Present daily capacity (barrels)	Projected daily capacity (barrels)	New capacity available
TORC	36,000	65,000	1970
ESSO	7,000	35,000	1970
SUMMIT	5,000	20,000	1968
FANG	1,000	1,000	-
	49,000	121,000	

It should be noted that not all refineries produce gasoline and that some production is captive.

The position with each of the refineries is briefly as follow:-

TORC (Thai Oil Refinery Co., Ltd.) commenced production at Si Racha in 1964. Capital came from French financiers and technical assistance is provided by Royal Dutch Shell Company. The original agreement between the Thai Government and TORC was that the company had the right to operate the refinery for ten years during which time 25 per cent of the profit must go to the Government and at the end of the period, the refinery becomes the property of the Government.

During 1967, the Thai Government agreed to allow the expansion of the TORC refinery from a capacity of 36,000 barrels per day to 65,000 barrels per day, the increase to take effect at the beginning of 1970. Under the new agreement, the Government will have its share of the net profit raised from 25 per cent to 30 per cent and has agreed to permit TORC an extension of 7 years before the refinery ownership is transferred to the Government i.e. the transfer will take place in 1981.

TORC draws its crude from the Middle East and its refinery comprises a distillation unit, a hydrotreater, a platformer and a cat-cracker. Hydrogen arises in the refinery from the dehydrogenation of saturated compounds in order to raise the octane number. This hydrogen is said to be nicely in balance with the requirement for desulphurizing the incoming crude. It is also said that the refinery is "tailored" to suit Middle East crude and would need alteration if, for example, a Miri (Indonesian) crude, which is waxy, or a shale-oil crude were to be used.

Output from TORC is said to be at the following annual rate:-

Liquid gas	15,000	barrels
Jet fuel	795,000	barrels
Ordinary benzine (83 octane)	3,758,000	barrels
"Super" benzine (95 octane)	146,000	barrels
Kerosene	785,000	barrels
Diesel oil		
for cars	3,070,000	barrels
for industry	1,020,000	barrels
Bunker oil	4,096,000	barrels
Asphalt	315,000	barrels
Total	14,000,000	barrels

Note: 14 million barrels p.a. is somewhat more than the refineries rated capacity of 36,000 b.p.d.

There also arise 50,000 tonnes of refinery gases yearly, which contain

1,000 tonnes of ethylene
7,000 tonnes of propylene
4,000 tonnes of sulphuretted hydrogen.

The Esso oil plant. Esso Standard Thailand Ltd. announced on 27th July 1967, that it had completed an agreement to purchase the plant of the Thai Asphalt Manufacturing Co., Ltd. (TAMCO) and certain facilities owned by Summit Industrial Corporation (Panama) at Si Racha.

TAMCO, which was owned 51 per cent by the Summit and 49 per cent by a Thai group, commenced operations in 1965. The main product was asphalt and

7,000 barrels of crude were processed per day. Esso plans to step up capacity to 35,000 barrels per day, with naptha, rather than asphalt, as the main product. From naptha, the refinery will produce all types of petroleum products, except motor gasolines: in its earlier agreement with TORC, the Government stipulated that no other production of motor gasoline would be permitted so long as output from TORC sufficed the local demand. The Esso refinery will have a catalytic reformer and can therefore make motor gasolines, if Government permission is forthcoming.

Unlike the agreement with TORC, there is no provision for the Government to take over the Esso refinery.

SUMMIT. In 1958, the Ministry of Defence began construction of a refinery at Bang Chark, a suburb of Bangkok. Subsequently, the Ministry leased the refinery to the Summit Industrial Corporation. Conditions of the lease include raising refinery capacity from 5,000 to 20,000 barrels per day, and require sale of the products of the refinery to the Government's Fuel Oil Organization at prevailing market prices.

The lease to Summit is for a period of 15 years and expanded production is expected to commence early in 1968. Based on earlier figures, a 20,000 barrels per day capacity would give rise to 30,000 tonnes of refinery gases p.a., containing

2,700 tonnes of ethylene
5,900 tonnes of propylene
8,000 tonnes of sulphuretted hydrogen

A small Claus unit is to be included which will produce 3,500 tonnes of sulphur annually. At an earlier stage, (when refinery output was planned at 15,000 barrels of crude per day), production of green coke was under consideration at the rate of 35,000 tonnes p.a.

The Fang refinery, near Chiang Mai, operates on crude oil found in the vicinity. Its capacity is 1,000 barrels of crude per day; it is owned and operated by the Ministry of Defence and its products are dedicated to defence. Thato (1967) mentions certain of the difficulties encountered in the operation.

An application for a Promotion Certificate has been lodged with the Board of Investment by Thai Lubricant and Asphalt Ltd. (TLAL). If approved, this company will produce asphalt and luboils.

Import of petroleum products

The series of tables and graphs herewith show:-

(i) The rapid rise in crude-oil imports

(ii) The steep decline in imports of petroleum fuels (except av.-gas) and bitumens, as local refineries came on stream.

(iii) The continuing rise in imports of products not yet made here i.e. lubricants, mineral jellies, waxes and aviation gasoline (except jet-fuel).

The local refining industry expects civilian demand for petroleum products to rise by about 10 per cent per year and to have about doubled by 1975. By far the most rapidly rising component will be civilian aviation gasoline, demand for which will have increased almost five-fold by 1975.

Future military demand depends, of course, on the war in Vietnam. If, for example, hostilities were to cease in 1968, total demand in Thailand would be about 32 million barrels p.a. compared with a projected refinery capacity of some 44 million barrels p.a. Even so, the industry believes it will be unable to supply all demands in all categories, so that some import will still be necessary. This is of course, due to the disparity between components of demand and the nature of the crude. In 1966, for example, the following petroleum products were exported from the Port of Bangkok:-

Gasoline or benzine for general use	11,726,900	litres
Diesel oil	1,220,800	"
Heavy fuel oil	250,783,800	"
Lubricating oil	305,763,00	"

Raw materials and adjuvants

Imports for 1966 of materials used in petroleum refining were as followings:-

Prepared additives for mineral oils	660 tonnes	6.9	million baht
Viscosity improvers	640 tonnes	6.9	million baht
Gum inhibitors	28 tonnes	442,000	baht
Oxidation inhibitors	34 tonnes	582,000	baht
Anti-knock preparations	1.2 tonnes	35,000	baht

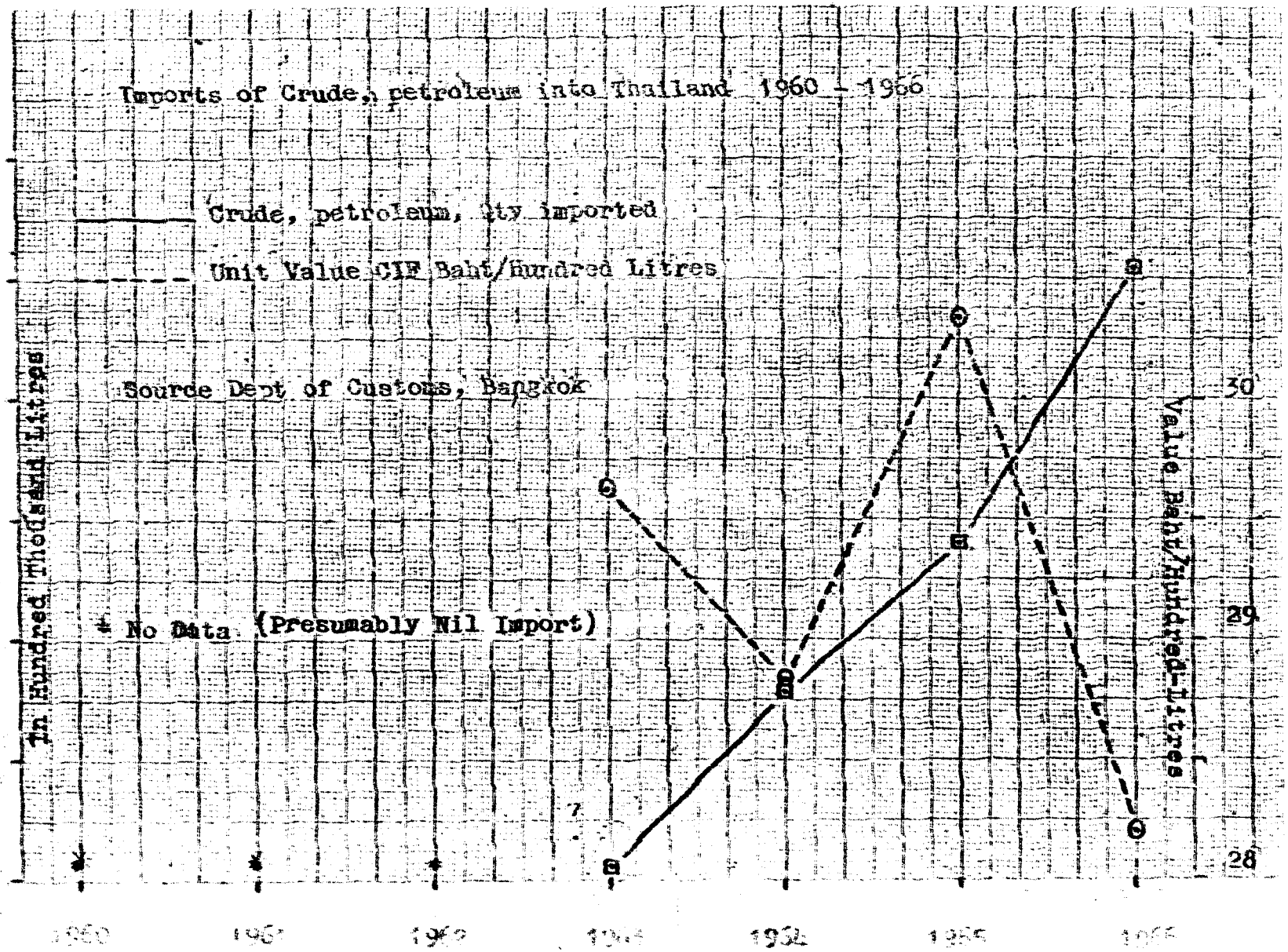
There are no separate statistics for refinery catalysts nor for filter-aids used by refineries.

Imports of crude, petroleum into Thailand 1960-1966

Year	Quantity (hundred-litre)	Value c.i.f. (baht)	Unit value c.i.f. (baht/hundred-litre)
1960	*	*	*
1961	*	*	*
1962	*	*	*
1963	638,916	18,928,502	29.62
1964	7,952,495	229,244,474	28.82
1965	14,089,209	427,469,020	30.33
1966	25,550,285	720,967,669	28.21

Source: Department of Customs, Bangkok.

* No data.

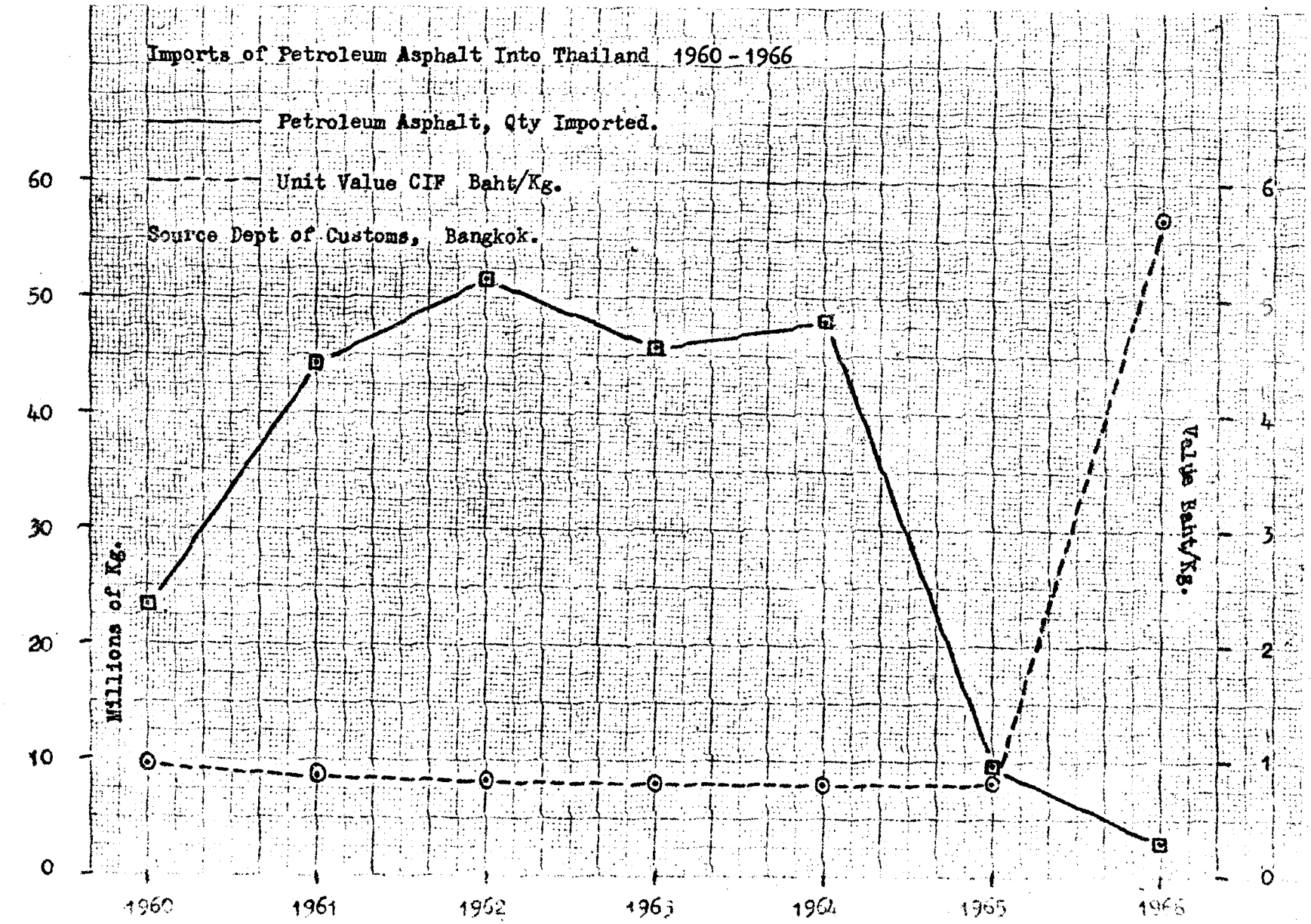

Imports of Crude, petroleum into Thailand 1960 - 1966
Crude, petroleum, qty imported
Unit Value CIF Baht/Hundred Litres
Source Dept of Customs, Bangkok
* No Data (Presumably Nil Import)
In Hundred Thousand Litres
Value Baht/Hundred-Litres
30
25
20
15
10
5
0
30
29
28
1960
1962
1964
1966

Imports of petroleum asphalt into Thailand 1960-1966

Year	Quantity (kg)	Value c.i.f. (baht)	Unit value c.i.f. (baht/kg)
1960	23,210,792	22,289,355	0.96
1961	44,314,024	38,382,077	0.86
1962	51,527,998	42,944,542	0.83
1963	45,639,543	36,618,827	0.80
1964	47,921,827	37,995,382	0.79
1965	9,796,525	7,974,775	0.81
1966	3,064,123	17,437,711	5.69*
Jan. to Nov. 1967	3,801,798	3,841,702	1.01

Source: Department of Customs, Bangkok.

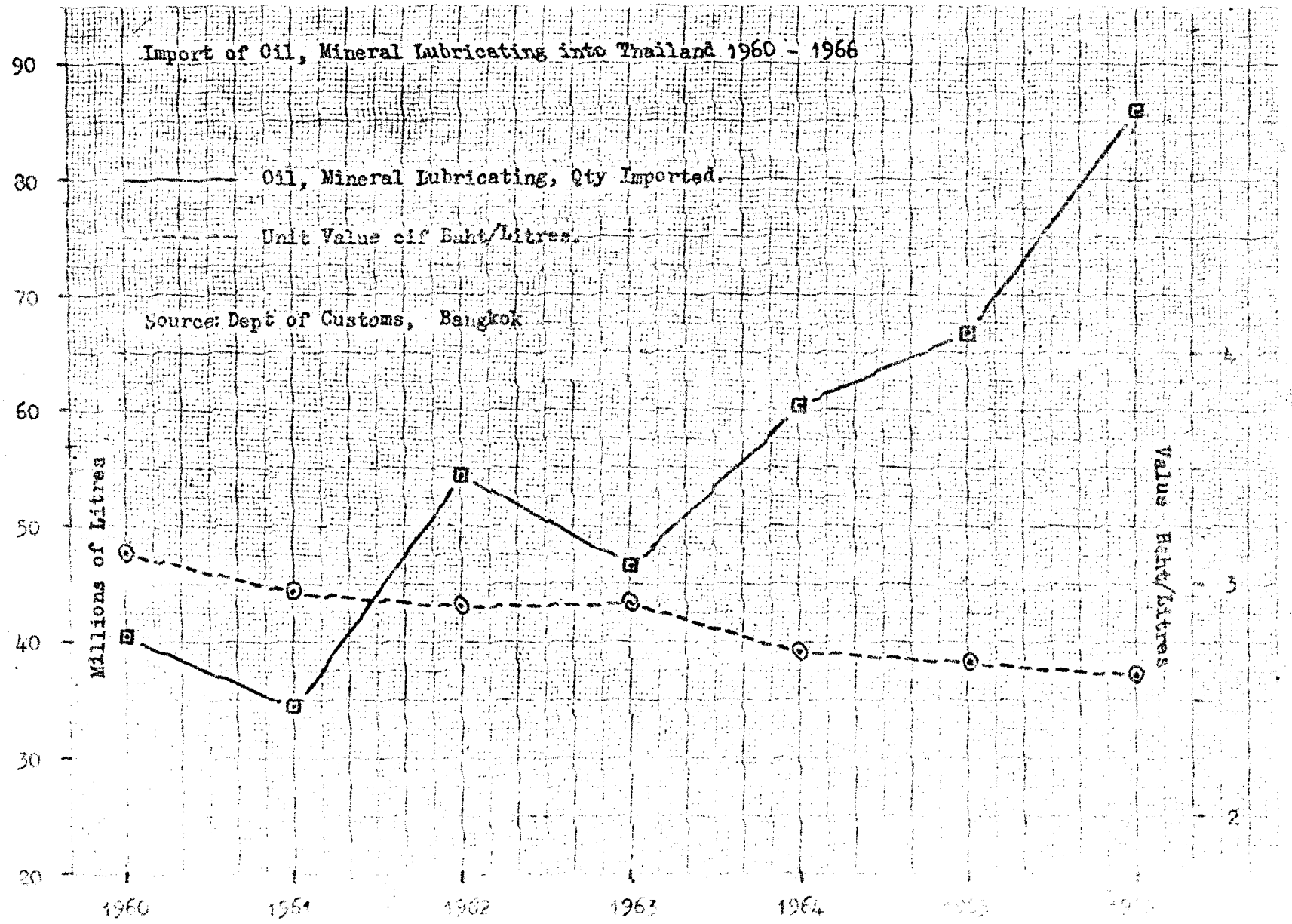
* No reason can be adduced for the anomalous unit value in 1966.


Imports of Petroleum Asphalt Into Thailand 1960 - 1966
Petroleum Asphalt, Qty Imported.
Unit Value CIF Baht/Kg.
Source Dept of Customs, Bangkok.
Millions of Kg.
Value Baht/Kg.
60
50
40
30
20
10
0
6
5
4
3
2
1
0
1960
1961
1962
1963
1964
1965
1966

Imports of oil, mineral lubricating into Thailand 1960-1966

Year	Quantity (litres)	Value c.i.f. (baht)	Unit value c.i.f. (baht/litres)
1960	40,601,066	127,412,042	3.13
1961	34,511,432	102,172,520	2.96
1962	54,433,807	158,022,215	2.90
1963	46,526,199	135,746,575	2.91
1964	60,407,157	164,040,333	2.71
1965	66,789,398	178,707,332	2.67
1966	85,966,708	225,686,560	2.62

Source: Department of Customs, Bangkok.


Import of Oil, Mineral Lubricating into Thailand 1960 - 1966
Oil, Mineral Lubricating, Qty Imported.
Unit Value cif Baht/Litres.
Source: Dept of Customs, Bangkok
Millions of Litres
Value Baht/Litres
90
80
70
60
50
40
30
20
1960
1961
1962
1963
1964

(iii) Group 329: Manufacture of miscellaneous products of petroleum and coal

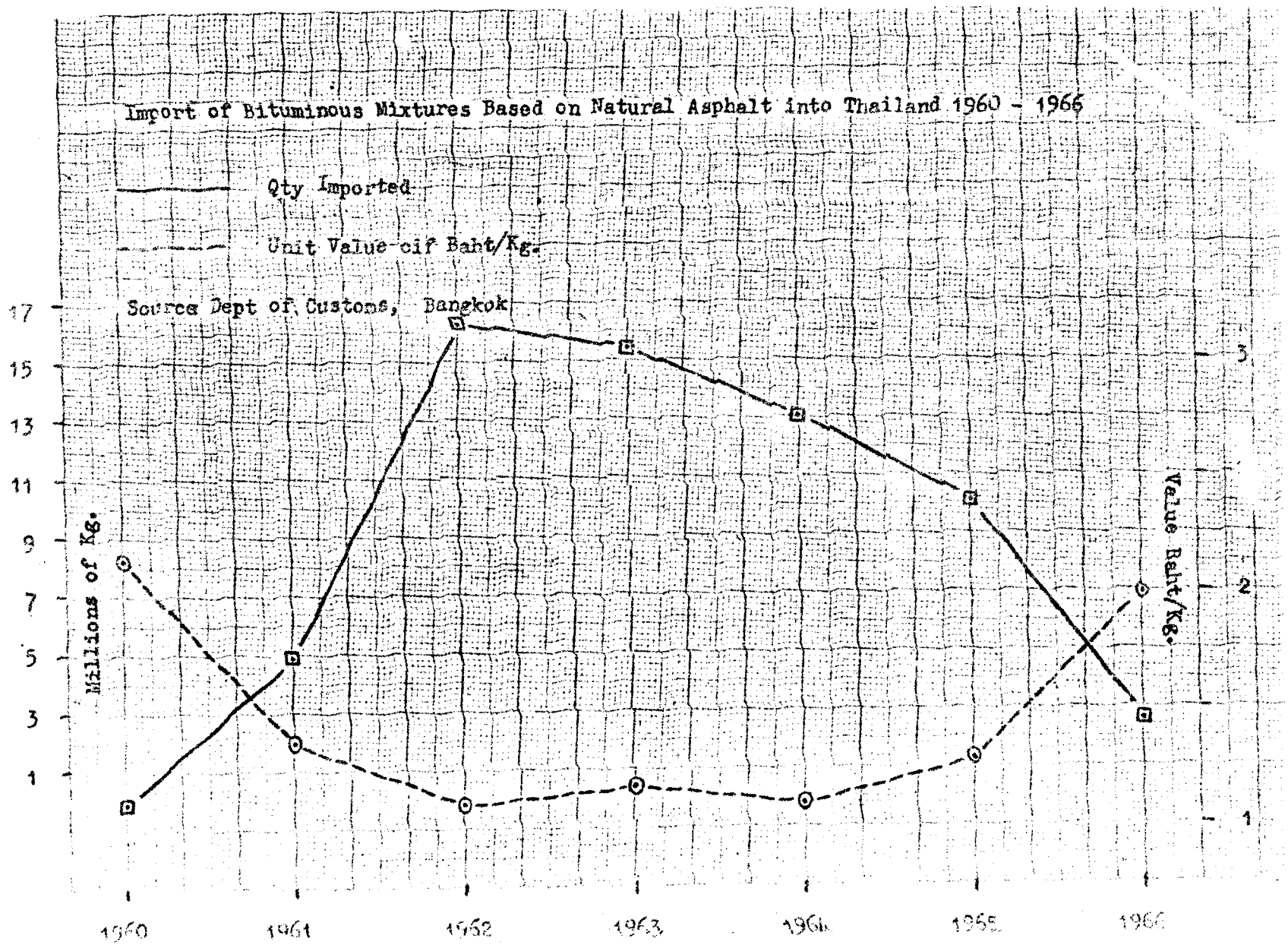
Asphalt paving and roofing materials

There is no known local manufacture of these materials which comprise a low-cost paper felt impregnated with "blown" (i.e. oxidized) bitumen. No blown bitumen is, in fact, made in Thailand.

Imports of bituminous mixtures based on natural asphalt, natural bitumen, petroleum bitumen, mineral tar of mineral tar pitch into Thailand 1960 - 1966

Year	Quantity (kg)	Value c.i.f. (baht)	Unit value c.i.f. (baht/kg)
1960	94,241	202,781	2.16
1961	4,970,202	6,811,455	1.37
1962	16,283,271	18,035,382	1.10
1963	15,409,933	17,049,960	1.17
1964	13,072,534	14,442,679	1.10
1965	10,161,226	13,089,124	1.28
1966	2,687,261	5,365,220	1.99

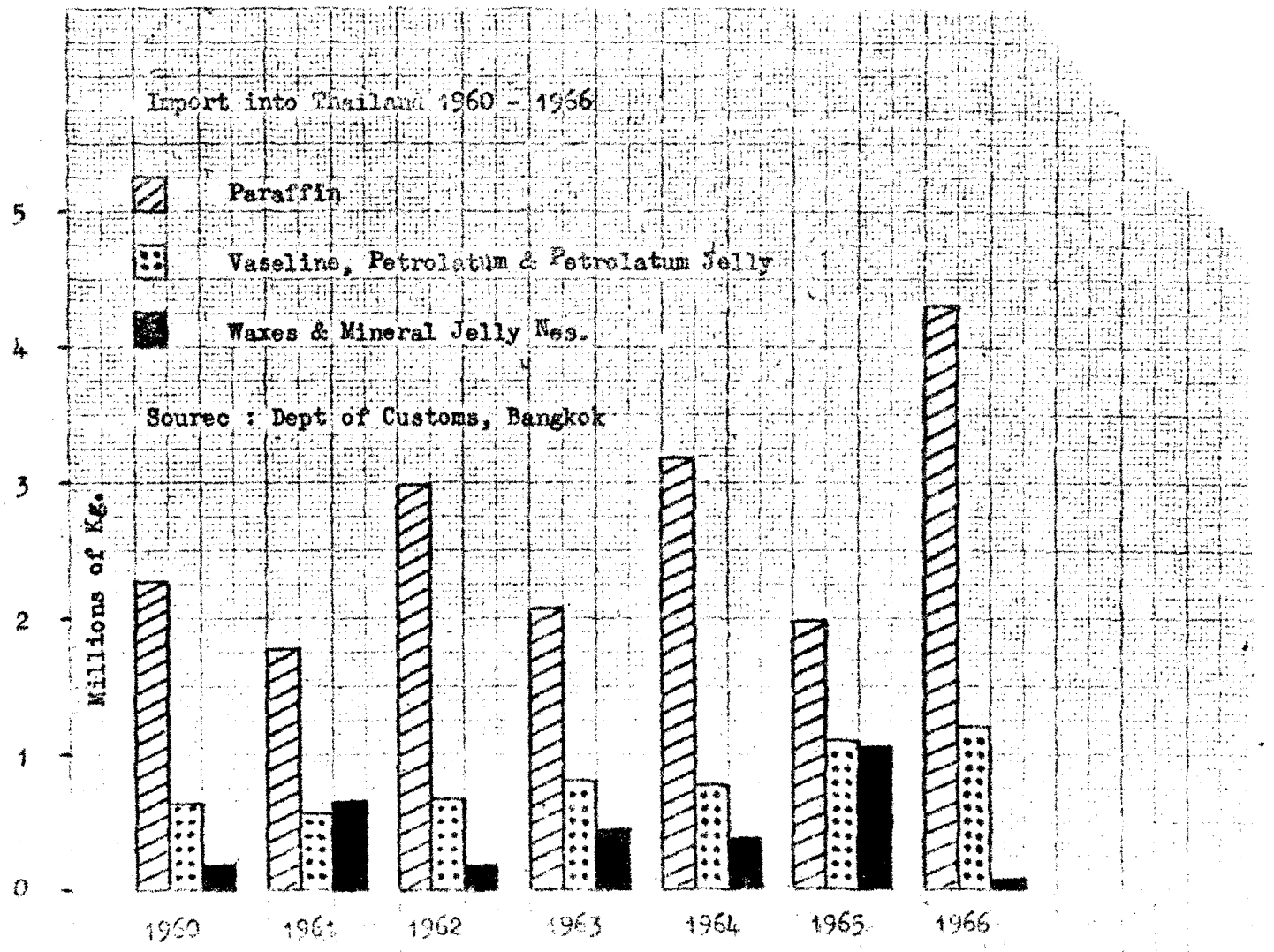
Source: Department of Customs, Bangkok.

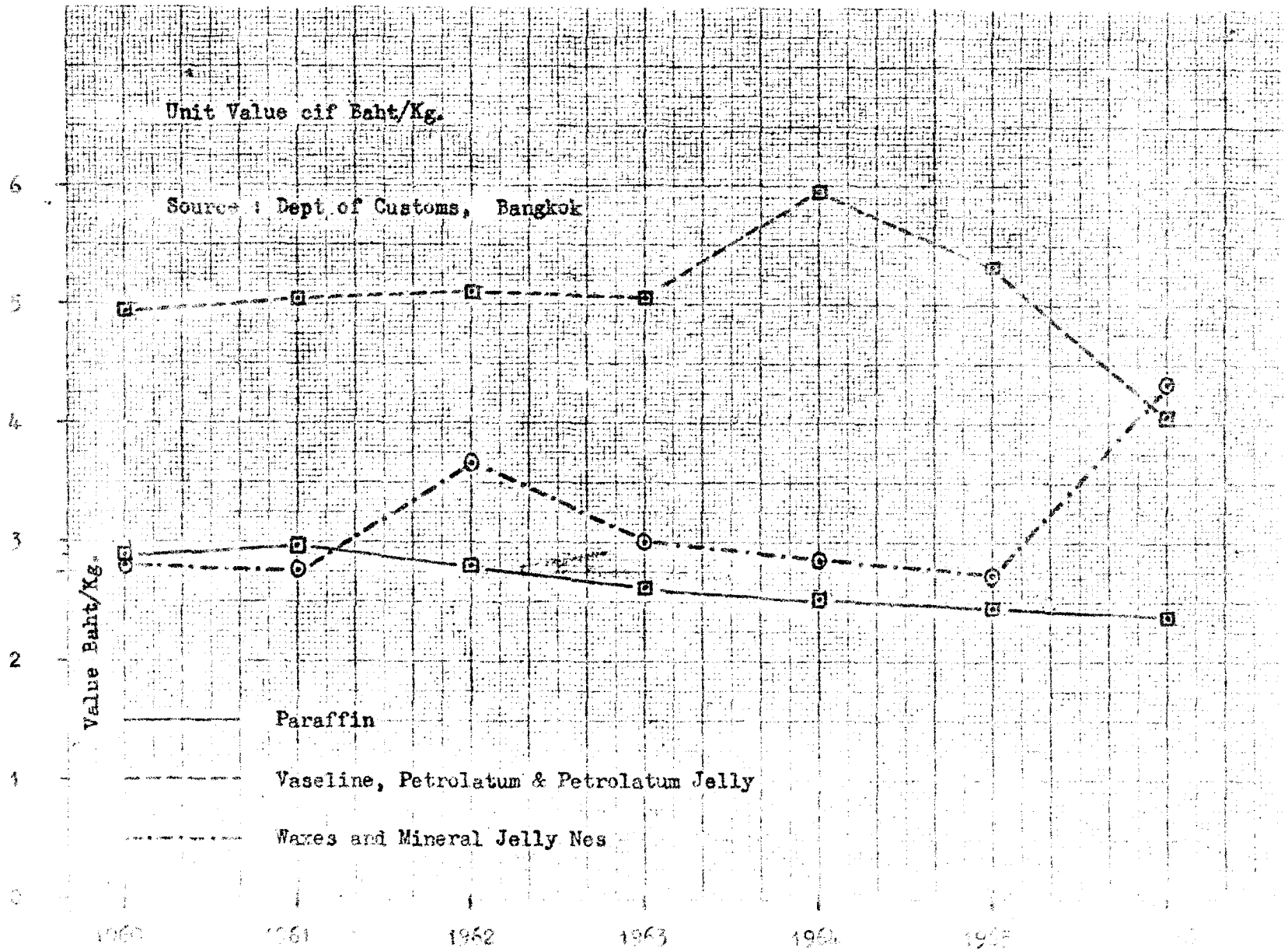

Import of Bituminous Mixtures Based on Natural Asphalt into Thailand 1960 - 1966
Qty Imported
Unit Value-cif Baht/Kg.
Source Dept of Customs, Bangkok
Millions of Kg.
Value Baht/Kg.
17
15
13
11
9
7
5
3
1
5
2
1
1960
1961
1962
1963
1964
1965
1966

Imports of paraffin, vaseline, petrolatum and petrolatum jelly & waxes and mineral jelly n.e.s. into Thailand 1960-1966

Year	Paraffin			Vaseline, petrolatum and petrolatum jelly			Waxes and mineral jelly, n.e.s.		
	Quantity (kg)	Value c.i.f (baht)	Unit value c.i.f. (baht/kg)	Quantity (kg)	Value c.i.f (baht)	Unit value c.i.f. (baht/kg)	Quantity (kg)	Value c.i.f. (baht)	Unit value c.i.f. (baht/kg)
1960	2,257,428	6,480,396	2.87	637,257	3,144,256	4.93	175,748	496,564	2.82
1961	1,785,928	5,305,527	2.97	561,276	2,828,434	5.03	644,077	1,783,552	2.76
1962	2,989,897	8,342,427	2.79	657,937	3,360,695	5.10	163,528	596,285	3.64
1963	2,089,991	5,480,589	2.62	808,996	4,084,255	5.04	449,465	1,352,322	3.00
1964	3,184,115	8,016,138	2.52	768,856	4,576,494	5.95	372,900	1,062,450	2.85
1965	1,973,658	4,831,292	2.44	1,107,941	5,879,106	5.30	1,083,351	2,954,377	2.73
1966	4,318,418	10,253,733	2.37	1,215,111	4,939,642	4.06	94,457	409,494	4.33

Source: Department of Customs, Bangkok.

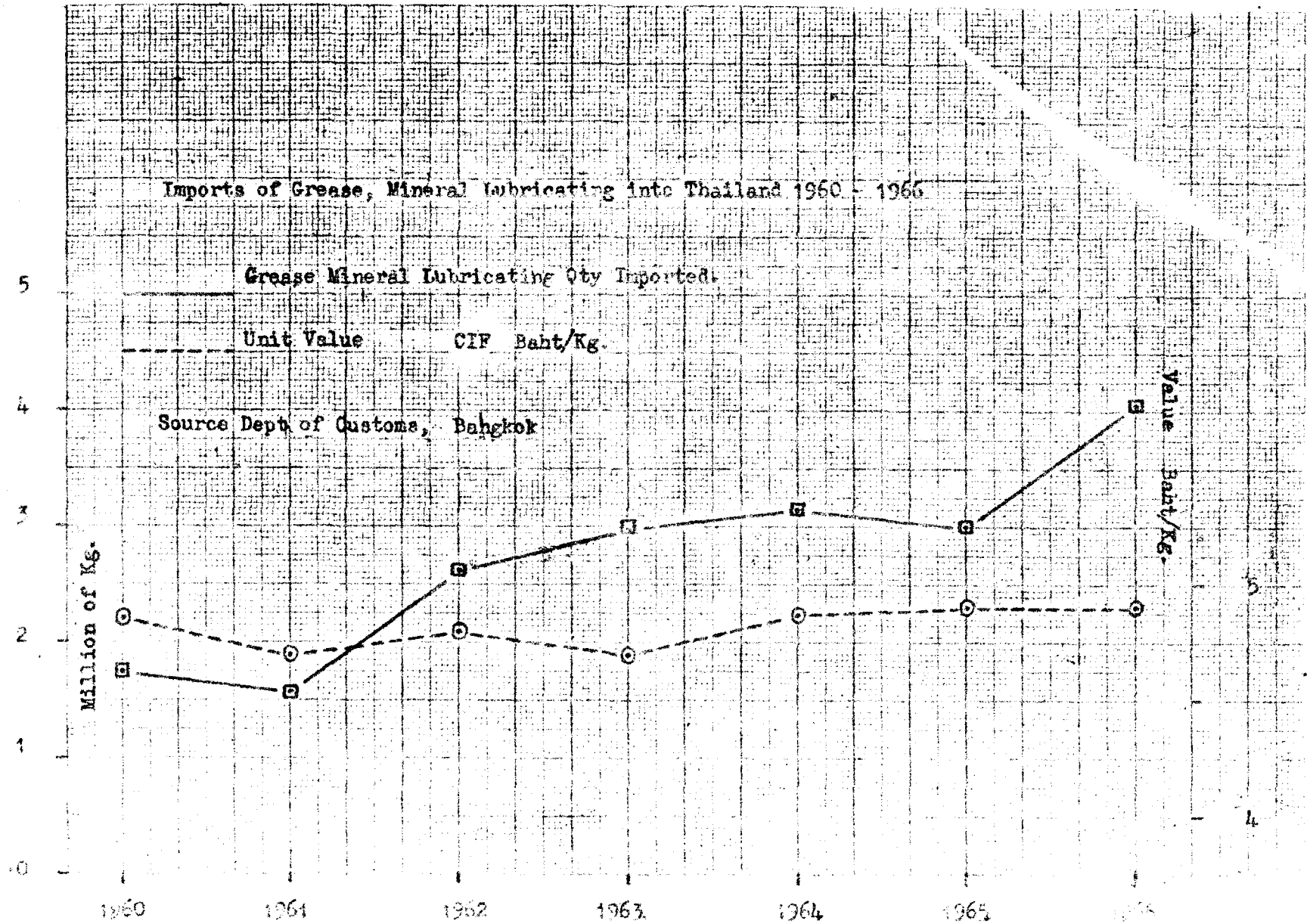

Import into Thailand 1960 - 1966
Paraffin
Vaseline, Petrolatum & Petrolatum Jelly
Waxes & Mineral Jelly Nes.
Sourec : Dept of Customs, Bangkok
Millions of Kg.
0
1
2
3
4
5
1960
1961
1962
1963
1964
1965
1966


Unit Value cif Baht/Kg.
Source : Dept of Customs, Bangkok
Value Baht/Kg.
6
5
4
3
2
1
0
Paraffin
Vaseline, Petrolatum & Petrolatum Jelly
Waxes and Mineral Jelly Nes
1960
1961
1962
1963
1964
1965

Imports of grease, mineral lubricating into Thailand 1960-1966

Year	Quantity (kg)	Value c.i.f. (baht)	Unit value c.i.f. (baht/kg)
1960	1,748,189	8,510,182	4.86
1961	1,576,351	7,400,501	4.69
1962	2,629,489	12,671,419	4.81
1963	2,990,128	13,758,506	4.69
1964	3,151,345	15,350,909	4.87
1965	3,034,003	14,881,368	4.90
1966	4,088,146	20,047,279	4.90

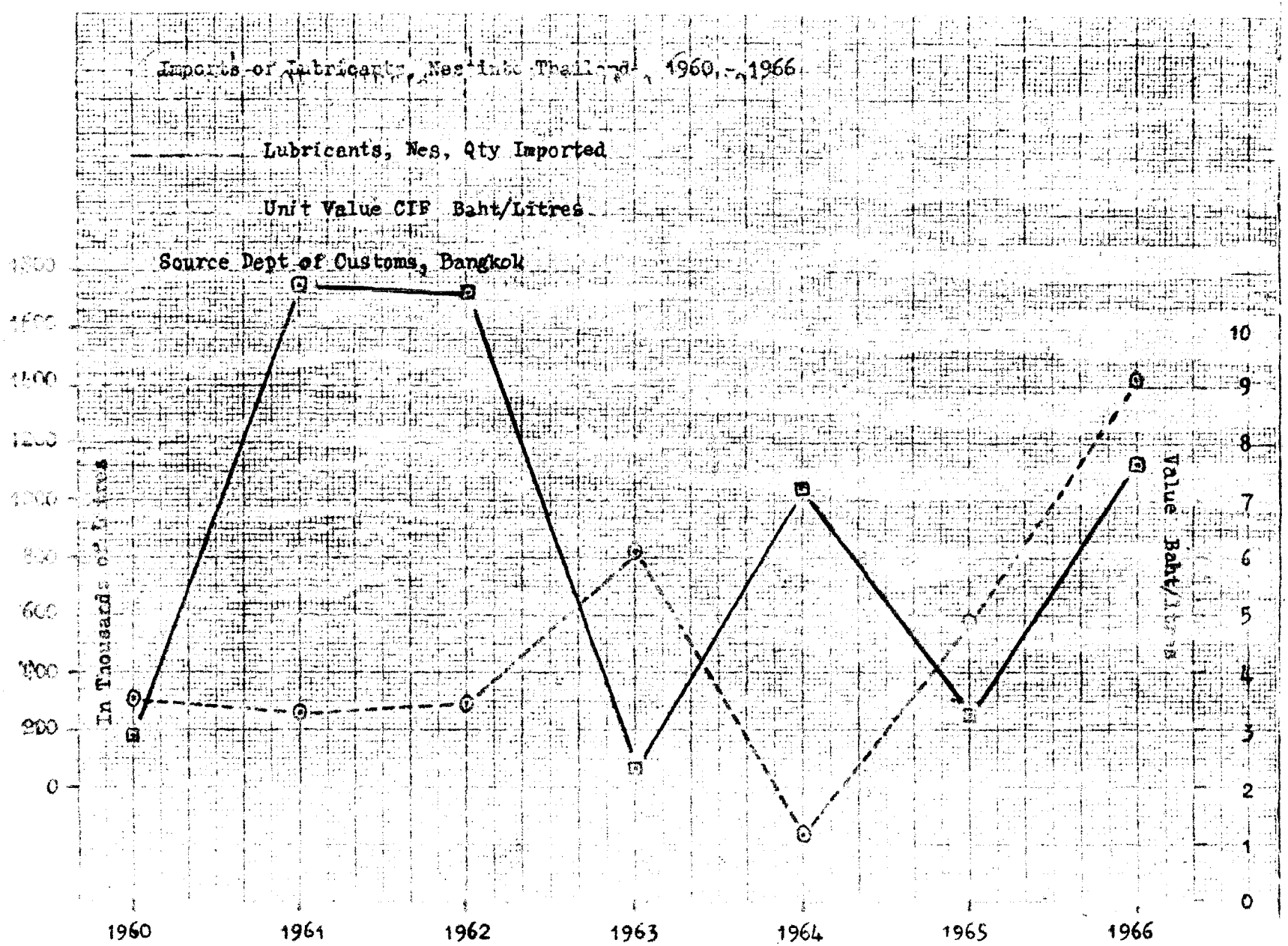
Source: Department of Customs, Bangkok.


Imports of Grease, Mineral Lubricating into Thailand 1960 - 1966
Grease Mineral Lubricating Qty Imported.
Unit Value CIF Baht/Kg.
Source Dept of Customs, Bangkok
Million of Kg.
Value Baht/Kg.
5
4
3
2
1
0
1960
1961
1962
1963
1964
1965

Imports of lubricants, n.e.s. into Thailand 1960-1966

Year	Quantity (litres)	Value c.i.f. (baht)	Unit value c.i.f. (baht/litres)
1960	184,302	657,875	3.56
1961	1,757,183	5,826,351	3.31
1962	1,728,990	5,948,961	3.44
1963	70,138	428,549	6.11
1964	1,043,210	1,238,843	1.18
1965	250,497	1,226,732	4.88
1966	1,136,508	10,394,481	9.12

Source: Department of Customs, Bangkok.

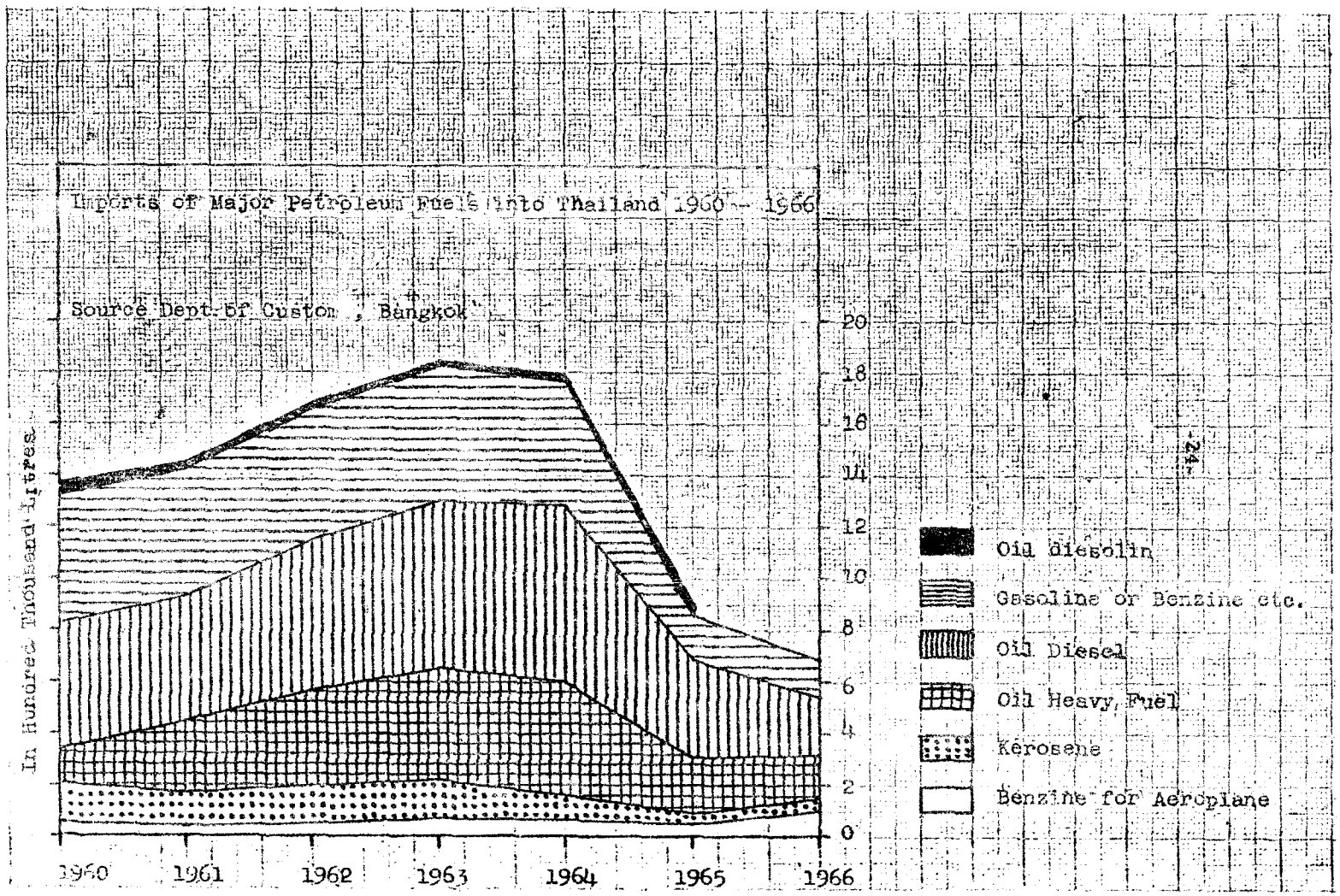

Imports of Lubricants, Nes into Thailand, 1960 - 1966
Lubricants, Nes, Qty Imported
Unit Value CIF Baht/Litres
Source Dept of Customs, Bangkok
In Thousands of Litres
Value Baht/Litres
0
200
600
1000
1400
1800
0
1
2
3
4
5
6
7
8
9
10
1960
1961
1962
1963
1964
1965
1966

Imports of major petroleum fuels into Thailand 1960-1966

Year	Gasoline or benzine for general use		Benzine for aeroplanes		Kerosene		Oil, diesel		Oil, diesolin		Oil, heavy fuel n.e.s.	
	Quantity (hundred-litres)	Value c.i.f. (baht)	Quantity (hundred-litres)	Value c.i.f. (baht)	Quantity (hundred-litres)	Value c.i.f. (baht)	Quantity (hundred-litres)	Value c.i.f. (baht)	Quantity (hundred-litres)	Value c.i.f. (baht)	Quantity (hundred-litres)	Value c.i.f. (baht)
1960	5,074,065	319,431,322	484,230	51,659,632	1,658,711	105,163,167	4,887,690	297,156,965	419,605	20,146,549	1,253,397	50,893,324
1961	4,944,143	298,153,038	450,265	47,189,478	1,294,997	80,826,574	4,851,122	269,169,806	138,324	7,876,926	2,715,471	90,299,129
1962	5,214,140	294,073,081	501,669	46,176,318	1,431,434	82,857,667	5,850,309	313,559,476	90,300	7,577,169	3,717,085	119,148,191
1963	5,043,049	264,211,729	691,511	57,539,848	1,542,157	86,229,347	6,628,156	351,983,122	128,304	8,793,935	4,303,710	118,509,033
1964	4,905,019	249,518,085	674,248	57,965,957	924,183	56,940,430	6,824,573	342,015,365	115,850	9,429,609	4,414,677	119,633,952
1965	1,830,921	93,591,847	517,837	52,272,476	476,670	30,805,150	3,711,350	174,611,099	147,904	12,248,723	2,175,583	63,848,301
1966	1,465,765	77,654,471	1,046,726	102,569,837	516,540	26,061,150	2,164,477	94,556,370	*	*	1,708,121	40,813,221

Source: Department of Customs, Bangkok.

* No data (presumably nil import).


Imports of Major Petroleum Fuels into Thailand 1960 – 1966
Source Dept. of Custom, Bangkok
In Hundred Thousand Litres
20
18
16
14
12
10
8
6
4
2
0
1960
1961
1962
1963
1964
1965
1966
Oil diesolin
Gasoline or Benzine etc.
Oil Diesel
Oil Heavy Fuel
Kerosene
Benzine for Aeroplane

(o) Major group 33: Manufacture of non-metallic mineral products

(except products of petroleum and coal)

(i) Group 331: Manufacture of structural clay products

The production of building materials based on clay is still at a low level regarding both output and manufacturing techniques. Building bricks, tiles and a limited quantity of clay pipes are produced by a large number of small-scale producers. It is predominantly a seasonal home industry. A great majority of the plants are entirely unmechanized and the variations in the quality of products occur as a result of different fuels and types of kilns used.

Bricks

Brick manufacturing methods are rudimentary and capital investment, in a majority of cases, negligible. There are no available exact data showing the production and consumption of bricks in Thailand. Of a total of 136 brick, tile, and earthenware factories registered in 1965 with the Ministry of Industry, 122 were producing bricks. Accurate figures are not available, but one can estimate from the marketing of bricks in Bangkok (about 20 million per year) and average capacity of plants, that the total brick production for Thailand amounts to between 50 and 60 million per annum. Only three factories employ more than ten workers and these produce standard size (7.5 x 10.5 x 23 cm) bricks with a total capacity of about 7 million bricks per year. The production is mainly located in one area (Pamok, Ang Tong province) and the management is well organized. With the exception of the pressing operation which is carried out in two stages, first by hand moulding and then using a hand operated screw press, the manufacturing process is manual. The bricks are burnt by direct contact with a live wood fire in beehive kilns. On special order, factories also produce floor tiles and silica bricks. The Government Glass Organization makes refractory bricks for outside sale.

The greatest part of bricks produced in Thailand, (estimated at 80 per cent), are hand-made, small size bricks. They are made on family-size, cottage-industry-scale, and fired in paddy husk heaps. The size of the brick varies even within the same plant but it is approximately 16.8-18.8 cm by

7-8 cm by 3.6-5.2 cm.

Ceramic tiles and pipes

In addition to bricks, clay product manufacture also includes a small production of roofing and flooring tiles, hand moulded drainage pipes, facing glazed bricks, and decorative ceramic details but this is not significant. The tiles, made in Chon Buri, Ratchaburi, Chanthaburi, and Chiang Mai province are mainly used on religious and administrative buildings. The output varies and a big part of production is made on order. The tiles are notable for brilliant glazes and a noticeable example of their application is in the roofing of the Siam Inter-Continental Hotel in Bangkok. The method of manufacture is almost exclusively manual and improvements and extensions are planned mainly through the use of better firing methods and replacement of wood with gas fuel. Labour is almost exclusively female and there is a high proportion of child labour. Accurate production figures are not available. Total maximum annual production capacity is roughly estimated at 60 million roofing tiles, and 5 million floor tiles.

The Board of Investment granted in July 1967 promotional privileges to the Construction Materials Industry Co., Ltd. to produce floor and wall ceramic tiles in Pathum Thani with an annual capacity of 15,000 tonnes. This project will involve a total investment of 4.8 million baht.

Salt glazed drainage pipes are made manually in a limited quantity. The quality is very poor; CTNSS Technical Comittee on Stoneware pipes is preparing a Draft Thai National Standard Specification for Glazed Vitrified Clay Sewer Pipes.

(ii) Group 332: Manufacture of glass and glass products

Although Thailand has three sizable glass factories and has had some recent export successes in this field, import of glass items is still quite large. Customs Code items covering glass articles are numerous but the major items can be summarized as follows (Imports 1967, through the Port of Bangkok):-

	Million baht
Sheet, plate, and other structural glass	25
Hollow glass articles, except as below	40
Ampoules and vials for injection	10
Glass fibre	2.5
Total	77.5

Major items of export for 1967 were:-

	Million baht
Glass in plate or sheet form	1.3
Glass bottles, jars, pots, and tumblers	2.5
Total	3.8

Two of the three glass factories in Thailand make bottles and other hollow glass-ware while Thai Asahi Glass Co., Ltd. makes sheet glass.

Thai glass manufacturers is a wholly-owned subsidiary of Australian Consolidated Industries Ltd. It is currently engaged in a major expansion programme whereby its bottle production will be increased to 135 tonnes per day by the end of 1968. Its range of products includes not only bottles (including medicine bottles) but tumblers, food jars, ampoules, vases, and ash-travs.

The other manufacturer of glass hollow-ware is the Glass Organization at Bang Na, which belongs to the Ministry of Defence. It produces only soda-lime glass although it has plans to produce boro-silicate glasses for ampoules.

The Glass Organization also makes a refractory brick for its own use as well as for outside sale. Production in 1967 was 125 tonnes of bricks per day, their composition being 65 per cent silica, 30 per cent alumina, with melting points of 1,500°C and 1,600°C (two types). Artamonoff (1965) noted that the bricks accounted for about 10 per cent of total sales.

The Glass Organization has 1,200 employees working 3 shifts a day. Capacity for glass production is variously put at from 80 to 140 tonnes per day. Artamonoff was favourably impressed by the efficiency of the plant.

The third and largest of the three companies, Thai Asahi Glass Co., Ltd., is also the newest. It is producing at capacity, i.e. 30,000 tonnes p.a. of sheet glass ranging in thickness from 2 mm to 6 mm. By 1970 it plans to be producing 40,000 tonnes p.a. of sheet glass. It has exported to various countries including U.S.A., Australia, Laos, and Singapore.

In 1965, the Ministry of Industry registered 26 glass factories in Bangkok-Thon Buri and 27 in the whole Kingdom.

The success of Thai glass manufacturers in the export field suggests that Thailand may have some natural advantages in the way of raw materials as well as labour. Glass companies draw their sand from Songkhla which is extremely pure (99.2 to 99.7 per cent SiO_2) but rather fine and their limestone from Saraburi or Ratchaburi. Soda ash is imported - either from Magadi or, in the case of Thai-Asahi, from Japan. Thai-Asahi Glass Co., Ltd. has plans to make soda ash locally.

Magadi soda-ash is probably the cheapest in the world particularly in this region, and tariff was recently lowered from 30 to 10 per cent. Songkhla sand requires no beneficiation as many other glass sands do and haulage by boat from Songkhla is cheap.

Used bottle collection is an energetically pursued enterprise in Bangkok - Thon Buri and this also probably helps in lowering new bottle prices.

(iii) Group 333: Manufacture of pottery, China and earthenware

Thailand has a long history of ceramics dating back to the end of the 13th century when Chinese-type glazed stoneware appeared. By the 14th century an export trade to India, Indonesia, and the Philippines had been developed. In the intervening years, a number of distinctive types of ornamental pottery and a large range of utility ceramics have developed. But, by and large, further development of the industry into new types of ceramics is hindered by the apparent absence in Thailand of ball clays and of suitable fluxing materials such as feldspar or nepheline.

Moreover, the sources of clays for the Sukhothai and other pots are no longer obvious and the present range is thereby deficient.

Import statistics for 1966 indicate the deficiencies of the local industry:

	roximate value
Ordinary tableware, etc.	700,000 baht
Table and other ware of faience or fine earthenware	9.4 million baht
ditto of chinaware or porcelain	17.2 " "

It is noteworthy that imports of ordinary baked clay or stoneware declined from 5.3 million baht in 1964 to 600,000 baht in 1966.

Exports in this field are comparatively negligible, the major item being "other household articles of faience or fine earthenware," export of which has increased markedly in recent years reaching almost one million baht in value in 1966. This item is believed to be comprised mainly of objects d'art, especially large decorated water-jars sent abroad as collector's pieces.

The present range of Thai ceramics comprises largely stone ware (notably celadonware and storage jars up to 50 litre capacity or more) and domestic earthenware. There is some local production of ordinary tableware, a fitfull production of insulators and no production of ceramic sanitary-ware.

(Production of earthenware building materials is treated in Group 331)

In 1963, the Ministry of Industry recorded the number of factories engaged in the "Home Ceramic Industry" in Thailand as follows:-

Home ceramic industry in Thailand (1963)

Province	Glazed pottery		Unglazed pottery	
	No. of factories	No. of employees	No. of factories	No. of employees
1. Kalasin	5	11	114	251
2. Kamphaeng Phet	-	-	10	20
3. Khon Kaen	-	-	240	642
4. Chanthaburi	1	7	-	-
5. Chachoengsao	4	42	10	69
6. Chon Buri	4	42	7	53
7. Chai Nat	1	1	-	-

Home ceramic industry in Thailand (1963) (continued)

Province	Glazed pottery		Unglazed pottery	
	No. of factories	No. of employees	No. of factories	No. of employees
8. Chaiyaphum	4	10	86	145
9. Chumphon	-	-	1	6
10. Chiang Rai	82	117	292	445
11. Chiang Mai	10	110	796	1,091
12. Trang	1	3	-	-
13. Tak	-	-	2	16
14. Nakhon Pathom	-	-	21	85
15. Nakhon Phanom	20	20	49	106
16. Nakhon Ratchasima	2	2	380	836
17. Nakhon Si Thammarat	1	5	30	114
18. Nakhon Sawan	-	-	20	40
19. Nonthaburi	1	2	53	209
20. Nan	12	12	241	464
21. Pattani	-	-	6	27
22. Ayutthaya	-	-	7	36
23. Phichit	3	3	8	36
24. Phitsanulok	-	-	5	9
25. Phetchabun	-	-	17	60
26. Phrae	2	10	48	120
27. Maha Sarakham	-	-	154	328
28. Mae Hong Son	-	-	11	11
29. Roi Et	7	10	5	15

The industry, as most ceramic industries do elsewhere, tends to be sited near sources of major raw material and the characteristics of its products to be largely conditioned by the nature of those materials. In Lampang, for example, three small plants use the local clay for body materials but one plant, at least, uses imported glazing and decorating materials Similarly, almost all the small village industries making domestic ware,

cooking pots, flower-pots, mortars, etc., produce from a local buff-to-red-burning clay and no opportunity exists of developing a high-grade porcelain-type body because the materials are absent. The nature of the raw materials not only determines the composition of the product but the technique of its production - traditional techniques which have grown out of the environment.

Many of the techniques are primitive and depend on cheap labour for their continued existence. Thus, unglazed, semi-porous, earthenware, water-jars are polished with a pebble and all jars are fashioned on kick-wheels.

At present, only one attempt is being made to produce medium-grade porcelain-ware on a production-line basis. This is at the Sthiaraphap Ceramic Plant, 30 km east of Bangkok. The plant employs 300 and produces 20,000 pieces per day. It was set up with Japanese technical assistance and it has an oil-fired tunnel kiln in contrast to the wood-fired beetle kilns in the small factories. The plant has been operating for 6 years and Darragh,* (1967) reported that a large expansion programme was under way (6 million baht for a new tunnel kiln) to produce European-style dinner-ware with German technical assistance.

Some 15 years ago, the Department of Industrial Promotion, Ministry of Industry, established a plant to make table-ware and two years later, this was extended to include a range of low-tension insulators.

The plant operated for 13 years had a capacity of 80,000 insulators per month, and supplied insulators to several government departments at half the price of imported insulators. However, adverse publicity appeared to militate against sales, although views on the reasons for failure of the company are confused.

Several other companies have also tried to make ceramic insulators, including V. Kaolin and, quite recently, Serapun, but they, too, seem not to have succeeded for unknown reasons.

Two Promotion Certificates have been issued for production of ceramic wall and floor tiles.

A list of known, existing, factories is attached.

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*. "The ceramic industry in Thailand: present situation and future prospects" by P.J. Darragh. Appraisal Report No. 4. ASRCT unpublished report.

Glazed pottery factories (November 1965)

Name of factory	Production	No. of employees			Capital (1,000 baht)	Production per year (1,000 pieces)			Annual value (baht)
		Male	Female	Total		Noodle bowls	Curry bowls	Other products	
Lampang									
1. Thailand Tableware Factory	Noodle bowls, curry bowls, tea pots, spoons, switches.	35	50	85	1,200	450	-	-	342,000
2. Thaweephon Factory	Switches, curry bowls.	10	40	50	1,200	-	63	Switch, 90	123,500
3. Yin Hua Heng Factory	Noodle bowls, flower pots, rice pots.	9	6	15	120	144	-	Flower pot, 4.5	47,400
4. Saeng Arun Factory	Saucers, tea cups.	6	10	16	70	-	-	Saucer and tea cup, 2, 160.	72,670
5. Thuai Cham Lampang Factory	Noodle bowls, curry bowls, dessert bowls.	15	15	30	70	60	48	8	85,870
6. Thuai Cham Chao Lampang Factory	Noodle bowls, curry bowls, dessert bowls, tea cups.	23	27	50	200	432	-	-	110,800

Glazed pottery factories (November 1965)(continued)

Name of factory	Production	No. of employees			Capital (1,000 baht)	Production per year (1,000 pieces)			Annual value (baht)
		Male	Female	Total		Noodle bowls	Curry bowls	Other products	
7. Thawee Khruang Khluap Factory	Curry bowls, dessert bowls, saucers, bowls.	4	10	14	60	1,080	-	-	56,200
8. Mit Thai Factory	Noodle bowls.	3	7	10	40	90	-	-	50,120
9. Charoen Sin Factory	Noodle bowls.	10	20	30	200	360	-	-	78,670
10. Laem Thong Factory	Noodle bowls, curry bowls, saucers and tea cups.	15	20	35	500	225	-	-	89,500
11. Sthiaraphap Industry Factory	Noodle bowls.	20	20	40	500	675	-	-	124,300
12. Suphaphon Factory	Noodle bowls, curry bowls.	4	16	20	200	252	252	-	69,500
13. Thai Khruang Khluap Din Phao Factory.	Noodle bowls, curry bowls.	7	5	12	110	63	90	-	35,900

Glazed pottery factories (November 1965) (continued)

Name of factory	Production	No. of employees			Capital (1,000 baht)	Production per year (1,000 pieces)			Annual value (baht)
		Male	Female	Total		Noodle bowls	Curry bowls	Other products	
Chiang Mai									
1. Thai Celadon Factory	Decoration and art work.	41	26	67	1,500	-	-	-	208,000
2. Chiang Mai Sangkhalok Factory	Decoration and art work.	15	10	25	150	-	-	-	194,000
Bangkok									
1. Pottery Factory (No name)	Curry bowls, kettles, flower pots.	17	5	22	1,000	12	-	-	60,000
Samut Sakhon									
1. Sthiaraphap Industry Factory	Bowls, kettles.	-	-	363	10,000	About 5 tonnes/day or 20,000 pieces			

Note: During the rainy season, factories stop work for about 2-3 months. Wages are about 7 baht/day for each person.

Source: Department of Industrial Promotion, Ministry of Industry.

(iv) Group 334: Manufacture of cement

Cement production has expanded very rapidly in Thailand in recent years to match a fast-growing demand from private and public building construction.

The first cement factory was established in Thailand in 1913, about half a century ago. This factory is owned by the Siam Cement Company, a private enterprise. Since 1913, the Company has extended its activities enormously. Apart from its first cement factory situated on the outskirts of Bangkok, it owns a second, a much larger cement plant in Tha Luang District, Saraburi Province, and in 1964 started building its third cement plant, this time in Tung Sang in the southern part of the country.

Apart from the three cement factories owned by the Siam Cement Company, there is another cement plant which was first put up by the Irrigation Department to provide cement for the construction of the Yanhee Dam. This plant which is situated in Takhli District, Nakhon Sawan Province, in the northern part of the country is owned by Jalapratarn Cement Company.

Production and productive capacity

Since the establishment of the first cement factory in the country in 1913, cement production has climbed steadily, except during the Second World War years. The combined production of all the factories passed the one million tonne mark for the first time in 1963, and in 1964 the production increased by 46,565 tonnes or about 4.6 per cent over that in 1963. In 1965 and 1966 production climbed further to 1,270,000 and 1,475,700 tonnes.

Currently, Thailand produces nearly 2 million tonnes of cement a year- 1.5 million tonnes from the Siam Cement Company and 400,000 tonnes from the Jalapratarn Cement Company.

About 50 per cent of the Siam Cement Company's output comes from its Tha Luang plant and 25 per cent each from the plants at Bangsue and Tung Song. The Company is installing a third rotary kiln at Tha Luang, said to be the biggest of its kind in South-east Asia, and when completed at the end of September, 1968, it will increase production capacity by 600,000 tonnes p.a. It also has government approval and has placed orders for equipment for a fourth factory in the North-east which could begin operating by 1971.

The Jalapratarn Company has also announced that it will build a second plant to be finished by the end of 1969, and this will have a production

capacity of 540,000 tonnes p.a. The new plant, costing 200 million baht will be at Cha-am District, Prachuab Khiri Khan.

Whether these expansion plans will result in a surplus or a deficit of cement over the next few years is controversial, much depending on future military operations and policies in the area.

Moreover, data published on actual and potential capacity as well as on output are sometimes conflicting. For example, in October, 1968, the Board of Investment quoted the current production rate as 1.5 million tonnes p.a. although from data announced by the two cement producers, output would have been 1.9 million tonnes. About 10 per cent of 1968 demand was said to have been supplied by import, including import of clinker which was then ground by the local factories and may have been included in "production".

According to a statement by the Siam Cement ("Bangkok World", 19th September, 1968) demand and supply of cement were projected as follows:-

	1968 (tonnes)	1969 (tonnes)	1970 (tonnes)	1971 (tonnes)
Total demand	2,000,000	2,369,000	3,807,000	3,341,000
Total production capacities	2,385,000	2,880,000	3,150,000	4,140,000
Surplus	385,000	511,000	343,000	799,000

However, a third company, Siam City Cement Co., Ltd., has called international tenders for cement-making equipment to be installed in a plant to be built at Saraburi, which will have a capacity of at least 500,000 tonnes p.a.

Another group has also applied to the Board of Investment. The group, headed by Mr. Thavorn Pornprapa, president of Siam Motor Works, envisages a production capacity of about 400,000 to 600,000 tonnes p.a. in a factory to be located possibly at Phrakhanong.

Thai cement was first exported as far back as 1917, when it was sold to Singapore, Penang, and Malaya. Since 1953, the export of locally-produced cement has become more extensive. In 1961, an international tender of 120,000 tonnes to the Republic of Vietnam was awarded to the Siam Cement Company. Exports of cement in recent years are tabulated below.

Thailand: Exports of cement, portland, 1960-1966

Year	Quantity (tonnes)	Value f.o.b. (baht)
1960	24,202	10,951,779
1961	156,916	51,297,516
1962	179,463	62,669,800
1963	143,600	54,515,590
1964	102,320	35,926,601
1965	105,580	40,944,500
1966	45,411	16,811,727
1967	*	*

Source: Department of Customs, Bangkok.

* No data, presumably no export.

Import statistics for cement and clinker reflect the recent deficiency in local production:-

Imports of cement, portland, into Thailand

Year	Quantity (tonnes)	Value c.i.f. (baht)
1960	11,970	6,247,458
1961	4,765	2,706,705
1962	6,683	3,932,990
1963	17,089	7,976,661
1964	7,576	4,759,010
1965	7,049	4,480,433
1966	119,076	49,407,211
1967*	209,947	80,630,640

* Port of Bangkok only.

Imports of clinker cement into Thailand

Year	Quantity (tonne)	Value c.i.f. (baht)
1960	*	*
1961	*	*
1962	*	*
1963	*	*
1964	*	*
1965	*	*
1966	139,876	38,395
1967+	61,121	17,881,448

Source: Department of Customs, Bangkok.

* No data (presumably nil import).

+ Port of Bangkok only.

(v) Group 339: Manufacture of non-metallic mineral products not elsewhere classified

This Group covers the manufacture of concrete, gypsum and plaster products including ready-mixed concrete, cut stone and asbestos products, as well as beneficiated "non-metallic" minerals.

The major items of import in this Group for 1967 were (Port of Bangkok only):-

	Million baht
Marble, worked, for buildings and monuments	2.0
Building materials of vegetable fibre agglomerated with cement, plaster or other mineral binding substances	2.6
Asbestos boards for building	10.9
Asbestos cement pipe	2.0

Exports in all cases were virtually nil.

The only producer of marble in Thailand is the Thai Marble Corporation at Saraburi, which is owned by the Ministry of Finance. The main product is a marble tile 3/4 inch thick, of which capacity is 1,500 square metres per year. The plant has its own quarry as well as cutting and polishing equipment. Artamonoff (1965) notes that the enterprise had been running at a loss since 1962.

Fluorite

There is no present beneficiation of fluorite in Thailand but an ore dressing plant is planned in the near future as a joint-venture between producers and exporters, according to a report in the "Bangkok World," of 9th October, 1968.

There are 24 fluorite mines in north Thailand, ten of them in Lamphun. There are other mines in Phetchaburi, Ratchaburi and Surat Thani provinces. In 1967, 133,151 tonnes of fluorite were produced and 123,495 tonnes exported to Japan. Value of production leapt from 1.3 million baht in 1960 to 55.9 million baht in 1967. There is a current boom in world fluorite usage, chiefly as a flux in iron smelting.

Because of the absence of a beneficiation plant, low grade fluorite is now discarded. Such "beneficiation" as is now done, is carried out simply by breaking the ore into small pieces and hand-sorting. Hitherto, only metallurgical and ceramic-grade material has been exported; no acid grade (97 per cent and over CaF_2) is produced.

China clay

Two production centres exist in Thailand: one at Lampang, the other at Ranong. The Ranong clay occurs in association with cassiterite and in fact, arises as a by-product of tin-mining.

Borworn and Sons at Ranong have been beneficiating the clay and selling the product to the local ceramic industry. The Technological Research Institute of ASRCT has shown that, as the reflectance is good (92 per cent) the clay has potential as a paper-filler.

It is estimated that local paper making companies have recently been using 3,500-4,000 tonnes p.a. of imported clay at 1,200 baht per tonne and usage is bound to increase with scheduled expansion of paper manufacture.

The "Bangkok Post," 6 August, 1968, reported that the kaolin was, in fact, being used in local ceramic, rubber, and paper industries and export outlets were being negotiated. The report also stated that two more mines are being planned at Ranong and that Lampang china-clay was being used in celadonware.

Export statistics for 1967, showed that 1.8 tonnes of "Clay and kaolin" were exported to Japan, possibly for testing.

Lime

Limestone is widely distributed in many parts of Thailand. Best known limestone formations are Thung Song, Kanchanaburi, and Ratchaburi. Nakhon Ratchasima series also contain thin limestone beds. No data are available on size of deposits, but it is obvious that the reserves are more than sufficient for the needs of the lime industry in Thailand.

Quicklime manufacture in Thailand is still at a very primitive level. A large number of small-scale producers, many of them seasonal, produce low quality quicklime.

Accurate data are not available, but one can estimate that the total production of quicklime and hydrated lime amounts to about 30,000 tonnes per year. Approximately twenty kilns, the majority having a capacity of about 300 tonnes per year, are in the Saraburi area and produce an estimated 7,000 tonnes per year. Larger shaft kilns producing between 10 and 50 tonnes per day are located in Ratchaburi (4,000 tonnes/year), Rangsit (15,000 tonnes/year), Kanchanaburi (2,500 tonnes/year) and Pak Chong (3,000 tonnes/year), and mainly produce quicklime for highway construction and masonry purposes.

Limestone extraction is mainly unmechanized. After the removal of overburden and blasting, the blocks are usually broken by hand-operated air-hammer drill and loaded by hand on trucks. The stone is separated by visual inspection into harder dolomitic type for road metal and softer type for lime burning. After burning some producers make hydrated lime by spraying quicklime lumps spread on the floor with water hoses.

Hydrated lime packaged in plastic bags is sold for construction work at a price which is comparable to that of the masonry cement (400-450 baht/tonnes). The users of quicklime are metallurgy (as flux), sugar factories (for clarification) and paper factories (sulphite process). There is a possible appli-

cation of quicklime for agriculture and horticulture. Inquiries have already been made regarding availability of lime for agricultural liming in the Rangsit area. The Land Development Department estimates that there is a need for about 40,000 tonnes of lime per year to combat acidity in soils.

The lime Industry Co. is planning to install four kilns, each with a capacity of 100 tonnes per day, in different parts of Thailand. The kilns will be of the shaft type and will use oil for burning. Present demand for lime in Thailand is estimated by the Ministry of Industry at about 200,000 tonnes per year. If plans for installation of new kilns are realized on time, Thailand will be self-sufficient in lime by 1970.

The availability of good quality lime with constant, predictable characteristics, will provide a possibility for the formation of other building material industries utilizing lime as binder, such as sand-lime bricks, cellular concrete, silica concrete and pozzolana-lime products.

Asbestos-cement sheets*

The Siam Fibre Cement Co., Ltd. was established in 1938 at Bang Sue and began working shortly before the outbreak of the Second World War. Siam Cement Company which was appointed managing agent before the war, obtained for itself in this way, an important new customer for its cement. During the war years, the company was faced with serious difficulties as a result of a shortage of asbestos fibre. After the war production expanded and since 1960 the company has run its own business as an independent concern. The largest single shareholder is the Crown Property Bureau.

The company manufactures flat sheets, corrugated roofing sheets and tiles as well as all necessary accessories, such as ridging material, etc. Present annual productive capacity is 12 million square metres of flat sheets (4 mm thick) and 13.7 million square metres of roofing sheets.

Actual production and value of asbestos-cement sheets from 1962 to 1967 are shown below:-

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* Description of the remaining sections in this Group is adapted from Pajevic M.M. (1967). "Part II: Survey of building materials industry of Thailand" Appraisal Report No. 8 (Construction and the building material industry of Thailand). ASRCT unpublished report.

Thailand: Production of asbestos-cement sheets 1962-1967

Year	Flat sheets		Roofing sheets	
	Production (m^2)	Value ($)	Production (m^2)	Value ($)
1962	1,000,000	480,000	5,500,000	3,450,000
1963	1,450,000	700,000	7,400,000	4,700,000
1964	2,600,000	1,271,000	7,700,000	4,900,000
1965	3,270,000	2,240,000	9,200,000	5,700,000
1966	7,600,000	3,600,000	10,000,000	6,600,000
1967*	12,000,000	5,800,000	12,300,000	7,400,000

Source: Siam Fibre Cement Co., Ltd.

* Estimated.

Though the statistics in the above table include both corrugated and flat sheets, the production may be regarded as dominated by the corrugated type. The purpose of the corrugations is, of course, to increase the strength of the material and it is for this reason that it is the form generally used for external work. The Siam Fibre Cement Co. has during the last few years developed a large number of roofing sheets with large and small corrugations as well as coloured sheets. Present plants include six "Magnani" aggregates for production of "Roman tiles", and five "Hatschek" aggregates for production of flat sheets and corrugated sheets.

The main use of asbestos sheeting is as general purpose roofing material; in this it has largely superseded sheet iron and roofing tiles, particularly in urban areas. Another important use is as external cladding and roofing material for industrial and commercial buildings, particularly as standard material for roofs carried on steel frames in single-storey industrial structures.

The figures set out in the table above indicate that the increase in the use of asbestos cement was substantial. Total production of smooth and corrugated sheets has increased during the period between 1962 and 1967, from 6.5 million square metres to more than 24 million square metres, i.e. almost

400 per cent.

Asbestos, the imported ingredient, accounts for only about 15 per cent of the contents of the sheets, the rest is portland cement, a commodity produced in Thailand.

Asbestos-cement-pipes

From 1961, the Siam Fibre Cement Company has also manufactured water pipes. In the beginning the machines were of a limited capacity and as a result of increasing demand, a new automatic high pressure pipe plant started operation in 1966. During the first year of operation the production amounted to 8,400 tonnes (valued at 906,000 dollars). Production in 1967, estimated at 20,000 tonnes, is adequate for domestic demand. After further expansion the production will reach in 1971 an output of 40,000 tonnes when part of the output will be available for export. The pipes are produced in various dimensions up to 600 mm inside diameter.

Since 1962, asbestos cement pipes and fittings have also been produced on a small scale in six plants located in the Nakhon Pathom province (3 in Kamphaeng Saen and 3 in Nakhon Pathom). Each plant produces about 200 pipes of standard length and 3, 4 and 5½ inch diameter per day, as well as a corresponding number of fittings.

Total capital investment for all plants of the Siam Fibre Cement Company amounts to 13,350,000 dollars. All plants together employ about 600 people.

The Table below gives quantity and value for net import of asbestos-cement products. Variable quantities of asbestos-cement pipes has been imported throughout the whole period 1962-1967. The manufacture of pressure pipes started in 1966 and already in the same year the production amounted 8,400 tonnes, i.e. more than double of the maximum quantity imported. With the increased output from the new factory at Thung Song, which reached its full capacity of 1,000 tonnes per day during the second half of 1967, it was expected that the demand for asbestos-cement pipes would be fully met by domestic production.

Asbestos-cement boards were both exported, mainly to Laos and Malaya, and imported. During the 1962-1966 period, the export always exceeded import, but both the value and quantities are not significant in comparison with values of local consumption.

Concrete products

The largest and most mechanized factory producing a variety of concrete products is situated in Bangkok and belongs to the Concrete Products and Aggregate Company Limited (CPAC). The promoter of the company was Siam Cement Company. Products include hollow blocks, pre-stressed posts and piles, reinforced and plain concrete pipes, pre-cast elements for prefabricated construction, and pre-mixed concrete.

Concrete blocks of different sizes (mainly 14.0 x 19.5 x 39.5 cm, 19.0 x 19.5 x 39.5 cm, and 9.0 x 19.5 x 39.5 cm), are made in accordance with standard requirements. Maximum capacity at present is between 3.5 and 5.0 million per year. In 1966 production amounted to 2 million.

CPAC plants also produce a large number of small and large size concrete piles (0.18 x 0.18 m, and 0.35 x 0.35 m and up, respectively), and pipes. In 1966, 300,000 metres of small size and 88,000 metres of large size piles were produced.

Concrete pipes of a diameter between 30 and 120 cm and one metre length are produced in accordance with AASHO* standards.

Capital investment in the manufacturing plant is 1.8 million dollars. The company employs 1,200 people.

Actual production and value of CPAC concrete products between 1962 and 1966

(20.8 baht = 1 U.S. dollar)

Year	Total production (tonnes)	Value (thousand dollars)
1962	24,000	1,000
1963	70,000	2,000
1964	110,000	2,500
1965	155,000	3,000
1966	235,000	5,500

Source: The Concrete Products and Aggregate Co., Ltd.

* AASHO = American Association of State Highway Officials.

A second major producer, Thai Concrete Products Company, started operation of its concrete plant in 1967. Products include concrete blocks, pipes, and piles. Registered capital is 3 million baht. The plant, located in Bangkok, employs at present 40 workers.

Maximum daily capacity is 10,000 blocks, 400 pipes (30-150 cm diameter), and 200 piles (6-8 metres long and with an average diameter of 35 cm). The company has plans to establish branches in Ubon and Sattahip.

Combined maximum capacity of CPAC and TCPC plants amounts to about 6 to 8 million blocks, 800,000 to 900,000 metres of piles and 200,000 to 300,000 pipes. Many other smaller companies are also manufacturing blocks, pipes and other reinforced and pre-stressed concrete products.

Gypsum products

Thai Gypsum Co., Ltd., at present operates a pilot calcining plant at Nonthaburi, a few kilometres from Don Muang Airport. Two kettles each with a 2-tonnes capacity, produce stucco plaster (Gypsoplast), molding plaster (Patima B) and writing chalk. Maximum capacity of plaster production is about 16 tonnes per day.

The pilot plant also produces a small amount (a maximum of about 200 square metres a day) of fibrous plaster boards. About 4 per cent by weight of imported sisal is added as fibre. Capacity of production is variable depending on demand. The price is, in spite of small capacity and primitive methods of manufacture, very competitive. There are great possibilities for improvements, both from the point of view of quality (better uniformity of size and quality) and manufacturing process. The boards are mainly used for ceilings and interior wall lining.

Production of plaster and fibrous plaster sheets

Year	Plaster		Fibrous plaster sheets	
	Quantity (tonnes)	Value (baht)	Quantity (m^2)	Value of sales (baht)
1963	Nil	Nil	Nil	Nil
1964	79.2	52,000	1,880	no sale
1965	297.5	208,000	26,200	149,000
1966	307.5	283,000	26,600	345,000

New plaster board plant

The recently formed Thai Gypsum Product Co., Ltd. plans to commence a production of plaster boards and plaster at the beginning of 1969. Registered capital of the company is 20 million baht and total necessary capital investment is estimated at about 40 million baht (one and two million dollars, respectively). The factory will be located in Rangsit, about 30 kilometres north of Bangkok. The capacity of the plant will be about 5,000 square metres of plaster board and 15 tonnes of stucco gypsum per day. The equipment will be imported from Japan and the process will be fully automatic. The factory will employ about 30 skilled workers.

Wood-wool board

There is only one factory producing wood-wool boards in Thailand under the trade name "Cellocrete." The plant was established in 1956 with a capital of 2.7 million baht and is located in Bangkok.

Until now the only raw material used was somphong (Tetrameles nudiflora). Experiments are being made to replace somphong with yang phara (Hevea brasiliensis) or cheap and easily available khi nun. Timber is supplied mainly from the central region, 100-200 km from Bangkok. Main problem is lack of raw material because of transport difficulties. Split wood pieces are first stored in water tanks for about 4 weeks, with copper sulphate and "Bittan" added to prevent decay of the wood. Split pieces of 40 cm length are fed to wood-wool making machines where a wool of 2 by 0.5 by 400 mm is made. Portland cement which is used as bonding agent, is mixed with wood-wool in a mixing drum. Boards are formed in a mechanical spindle press, clamped for two days and air-dried for another two days.

There are altogether 78 employees, working in one shift. Maximum daily capacity is 300 boards, based on 1 by 2 mm, $\frac{1}{2}$ inch thick.

Cellocrete boards are used as partitions, linings, insulating structural roof decks and pitched roofs as well as insulating shuttering. As a lining or partition material, cellocrete comes between the light concrete blocks and slabs and the boards and panels such as asbestos cement, fibre board, and shaving board. It is primarily a partition material and has the fire-resistant qualities of most cement products.

Thailand: Manufacture of wood-wool board (cellocrete)

Year	Value of production (baht)	Quantity* (m^2)
1962	1,512,894	52,200
1963	1,389,440	47,800
1964	1,617,966	55,600
1965	1,816,370	62,500
1966	2,260,813	78,000

Source: Cellocrete manufacturer.

* Based on 1.00 x 2.00 x 0.025 m boards.

(p) Major group 34: Basic metal industries

(i) Group 341: Iron and steel basic industries

This group covers the production of iron in blast furnaces through to the basic forms of iron and steel such as rolled and drawn products (e.g. sections, plate and sheet, wire, tubes, and pipes) as well as tinplate, galvanized sheet steel, castings, and forgings.

Although Thailand has appreciable iron ore reserves and in 1966, exported 700,000 tonnes of ore to Japan, she depends mainly on imports for her supplies of primary shapes and ferrous articles. In 1966, import of pig-iron, blooms, bars, rods, plate, sheet, (including tinned and galvanized sheet), wire, pipe, tube and other similar ferrous materials, was 512 million tonnes valued at 1360 million baht. Production of similar items in Thailand was some 150,000 tonnes but of this, production of shapes was largely from imported steel in primary form since blast furnace capacity hitherto, has only been about 7,200 tonnes p.a.

The only blast-furnace operation in Thailand is that of the Siam Iron and Steel Co., Ltd., at Tha-Luang, Saraburi, set up some ten years ago. It uses iron ore from a Lop Buri deposit with reserves of 7 million tonnes. Hard charcoal is purchased at 400 baht per tonne and limestone comes from a nearby deposit. Steel is made in a 3,600 tonne-per-annum oil-fired basic

open hearth furnace and a 1,800 tonne-per-annum electric-arc furnace. Steel is made from a combination of iron from the blast furnace together with scrap obtained locally and by import.

The Siam Iron and Steel Co., Ltd. has two additional small blast furnaces under construction which will bring total capacity in 1968 to about 22,000 tonnes p.a. The company makes rounds (particularly reinforcing rods: the company is part of the Siam Cement Group), angles and other sections as well as castings. It plans to expand both its pig-iron and its round-steel capacity. One of the major factors in such a plan is, of course, the absence of coking coal deposits in Thailand.

The "Bangkok World" of 14th August, 1968, reported that "the Siam Iron and Steel Co., a subsidiary of the Siam Cement Co., has placed an order worth about 200,000 pounds sterling for furnace equipment for a new steel-works in Thailand with a British firm, Birlec Ltd.

Birlec Ltd. of Aldridge, Staffordshire, will supply a 30 tonnes direct arc melting furnace with ancillary equipment for producing mainly low carbon steels.

The furnace will operate in conjunction with a continuous casting plant.

The steel-works is expected to produce 150,000 to 200,000 tonnes of concrete reinforcing bars and other steel sections annually.

Other announcements (e.g. Board of Investment Newsletter, February, 1968) stated that two new furnaces of 25 tonnes each and two rolling mills will be installed in 1968. The plant is expected to be complete in five years.

The Bangkok Bank Monthly Review for April, 1968, quoted the Board of Investment as disclosing that a well-established Japanese firm "has decided to set up a steel plant in Thailand which will be capitalized at 600 million baht is to be in production within three years. The plant will produce 150,000 to 200,000 tonnes of steel sheet annually. Raw materials such as iron ore and coal will, in the initial stages, be imported."

Thus, if both projects come to fruition, Thailand would have two plants producing steel from iron ore. The position is, however, somewhat confused by a statement attributed to Dr. Amnuay Viravan, Secretary-General of the Board of Investment, in which he is reported to have said ("Bangkok Post", 12 March, 1968) it had been agreed with Singapore National Development Board

that "Singapore will manufacture pig iron and Thailand will set up rolling mills to produce plates and sheets."

More recent developments include an announcement that "Koppers Co., Inc., the Pittsburgh steelmakers, is believed ready to challenge a Japanese bid to establish rolling mills for the production of flat steel sheet in Thailand. A report of a feasibility study made by Koppers is now in the hands of the Board of Investment..... The Board is awaiting a Japanese government sponsored report on how the steel industry should be developed in Southeast Asia before considering either the Japanese or the Koppers plans..... Indications suggest that a green light will be given for a steel industry worth approximately 500 million baht" ("The Investor", December, 1968).

Still more recently ("Bangkok Post," 30th December, 1968), "a huge conglomeration of Japanese and Thai companies have applied to the Board of Investment to set up an integrated iron and steel mill in Thailand at an estimated cost of 8,000 million baht.

It appears that this new proposal was presented to counter a similar one submitted last month by Mr. Chow Kwanyuen..... for an international combine to establish a 8,000 million baht integrated iron and steel industry."

According to the latter report, the Japanese companies included most of the large steel producers while Thai companies comprised Sangkasi Thai Co., the Thailand Iron Works Co., Ltd. and the Far East Iron Co., Ltd. The first stage of the project is aimed at producing 120,000 tonnes p.a. of hot and cold rolled iron sheets, for which current demand was placed at 200,000 tonnes p.a. Other companies also make steel round and sections and several make pipe. Details appear in the schedule from which it will be noted that a considerable expansion is planned for the industry overall.

Type of product	Operation started	Estimated capacity in existence (tonnes/year)	Planned* capacity (tonnes/year)	Name and address of firm
Pig iron	1959	3,000	150,000 -200,000	Siam Iron & Steel Co., Ltd. 816 Techavanich Road Bangkok, Tel. 48081 Factory, Tha Luang Saraburi
Round steel	1966	10,000		Bangkok Steel Co., Ltd. 627-638 Khlong Tom Lane Bangkok, Tel. 68202, 22442
	1966	4,700	155,000	Siam Iron & Steel Co.,Ltd. 816 Techavanich Road Bangkok, Tel. 48081 Factory, Tha Luang Saraburi
	1962	3,000		Thai Steel Industry 471 South Sathon Bangkok, Tel. 68202 Factory, Pathum Thani
	1966	24,000		Bangkok Producing Steel Co., Ltd. 333 Soi Mungkhon Bangkok, Tel. 20172
			130,000	G.S. Steel Co., Ltd. 51 Group 4 Tambon Bang Duan Samut Prakan
			10,000	Universal Steel Work 865 Rama I Road Pathumwan, Bangkok Tel. 30963, 30964
			24,000	Round Steel Inc. Co.,Ltd. 158 Sukhumwit Road Bangkok, Tel. 910586

* According to Promotion Certificates issued by the Board of Investment.

Type of product	Operation started	Estimated capacity in existence (tonnes/year)	Planned* capacity (tonnes/year)	Name and address of firm
Steel pipe	1965	6,000		Thai Steel Pipe Industry Co., Ltd. 129 Ratchawong Road Bangkok, Tel. 30788, 36776
	1965	9,000		Thai American Steel Work Co., Ltd. 35 Suksawat Road Samut Prakan Tel. 68105, 68111, 61402
			35,000	Catadrium Co., Ltd. 93 Mansion 10 Ratchadamnoen Road Bangkok, Tel. 24795
			6,000	Bangkok Steel Pipe Co., Ltd. 50-52 Soi Suwansawat Thung Mahamek Bangkok
Steel shapes, angles and sections	1966	3,000		Siam Iron & Steel Co., Ltd. 816 Techavanich Bangkok, Tel. 48081 Factory, Tha Luang Saraburi
	1966	8,100		Bangkok Steel Co., Ltd. 627-633 Khlong Tom Lane Bangkok, Tel. 22442 Factory, Samut Prakan
	1963	8,200		Thai Steel Factory Co., Ltd. 71-73 Captain Bush Lane New Road Bangkok, Tel. 34755
			15,000	Universal Steel Work 865 Rama I Pathumwan angkok, Tel. 30963-30964

* According to Promotion Certificates issued by the Board of Investment.

Type of product	Operation started	Estimated capacity in existence (tonnes/year)	Planned* capacity (tonnes/year)	Name and address of firm
			40,000	Thai Steel Co., Ltd. 247 Soi Sarasin Ratchadamri Road Pathumwan Bangkok, Tel. 55072
			500	Boonsong Panichakarn Co., Ltd. 2522/2 Tok Road Bang Kho Laem Bangkok
			800	Thai Casting Co.,Ltd., 1062-1064 Charoen Krung Bang Rak Bangkok

Apart from Siam Iron and Steel Co., Ltd., other major companies in the industry are the following:-

G.S. Steel Co., Ltd., a joint Thai-Japanese venture, is claimed to be (Board of Investment Newsletter, February, 1968) the largest producer of steel-bars in Thailand. The plant is claimed to be the largest and most modern in the Kingdom and plans to produce 100,000-120,000 tonnes of steel bars annually, using two 20-tonne capacity electric furnaces and a rolling mill with capacity 20-30 tonnes per hour.

Two steel pipe plants were opened in 1965, the Thai Steel Pipe Industry Corporation with 70 per cent Japanese capital and an annual capacity of 160,000 tonnes of seamless steel pipe, and a Thai-American Steel Works Co., with predominantly U.S. capital.

The Far East Iron Works Co., Ltd. opened a third galvanized sheet plant in 1964 in Khorat with a capacity of 1,500 sheets per month. In addition, the Thai Sheet Manufacturing Ltd., has a reversing mill in Bangkok capable

* According to Promotion Certificates issued by the Board of Investment.

of producing 10,000 tonnes of steel-sheets monthly.

Hot-dip tinplate

Hot-dip tinplate is produced by one company, the Thai Tinplate Manufacturing Co., Ltd., capacity of the plant is said to be 24,000 tonnes p.a. but in May, 1967, only two of the five dipping lines were in operation (i.e. 40 % capacity) while in 1966, imports of tinplate were 22,000 tonnes valued at 64 million baht. The position is believed to be approximately the same at present.

Only the petroleum companies use local tinplate, the reasons why other canners do not, according to Thai Tinplate Manufacturing Co., Ltd., are:-

(1) Small factories prefer an inferior and cheaper grade (local tinplate is prime-grade only).
(2) Big factories often get tax exemptions on imported materials.
(3) Better credit terms, e.g. 150 days, are available from overseas suppliers as against 30 days from the local manufacturer.

Galvanizing

Galvanizing is done by a large number of small factories (451 in 1965, according to Ministry of Industry Statistics). There are 5 major hot-dip galvanizing plants which have received Promotion Certificates but are not yet in production. Of the five factories already established, two form and coat galvanized pipe from imported skelp, and three others make galvanized flat and corrugated sheet. Details are:-

Name	Operation started	Kind of product	Capacity (tonnes/year)
Thailand Iron Works Co., Ltd. 2552/2 New Road Bang Kho Laem Bangkok, Tel. 36690-1	1959	Galvanized steel sheet, flat and corrugated	50,000-80,000 44,000
Thai Zinc Co., Ltd. 37 Sukhumwit Road Tambon Bang Duan Samut Prakan	1960	Galvanized sheet, flat and corrugated	82,000

Name	Operation started	Kind of product	Capacity (tonnes/year)
Far East Iron Works Co.,Ltd. 216-220 Ratchawong Road Bangkok, Tel.21374,24626	1964	Galvanized sheet,flat and corrugated	20,000
Thai American Steel Works Co., Ltd. 35 Suksawat Road,km 14.5 Samut Prakan Tel. 68105, 68111, 61402	1965	Galvanized steel pipe	9,000
Thai Steel Pipe Industry Co., Ltd. 129 Ratchawong Road Bangkok, Tel. 30788,36776	1965	" "	6,000
Cathasdrian (Thailand) Co., Ltd. 93 Building 10 Ratchadamnoen Ave. Bangkok, Tel. 24795	not yet started	" "	5,000
Boon Sang Panitchakarn Co., Ltd. 2522/2 Tok Road Bang Kho Laem Bangkok	"	" "	20,000
Bangkok Steel Pipe Co., Ltd. 50-52 Soi Suwansawat Tung Mahamek Bangkok	"	" "	6,000
Sin Tanee Industry Co., Ltd. 57-61 Icing Factory Lane Talad Noi Bangkok, Tel. 33537	"	Galvanized steel shapes	500
Kung Sang Industry Co.,Ltd. 62-64 Pipatuthit 3. Road Hat Yai Songkhla	"	" "	500
Thai Sul-In Co., Ltd. 902 Rama IV Road Bang Rak Bangkok, Tel. 32189	"	" "	2,500

Besides producing flat and corrugated sheets, Thai Zinc Co., Ltd. also coats such sheets with epoxy resin to enhance corrosion resistance.

In 1966, Thailand imported 974 tonnes of hot - and cold-rolled galvanized flat and corrugated sheet. The above schedule shows that existing capacity is far in excess of this — about 150,000 tonnes p.a. of which capacity, about 50 per cent is believed to be in use.

Established capacity for galvanized pipe is 15,000 tonnes p.a. which will rise to 46,000 tonnes p.a. when the new plants come into operation.

Welding electrodes

Welding electrodes are to be produced by Thai Kobe Welding Co., toward the end of 1968. Initial capacity is to be 150 tonnes p.a. rising to 3,000 tonnes later. The factory, at Suksawat Road, Samut Prakan, has received promotional privileges.

Ferrous foundries

The Ministry of Industry registered 1188 "Foundries or Metal-Turning Shops" in Bangkok-Thon Buri in 1965 and 1574 in the entire kingdom. Not all of these would, of course, have been iron and steel foundries, in fact the majority cast non-ferrous metals sometimes in conjunction with iron-founding. A few are captive and probably the largest is the foundry of the Royal State Railways at Makkason.

Most of the independent private foundries are small to medium in size, employment rarely being above 70. The following list gives the names and addresses of the larger ferrous foundries.

Name and address	Kind of products
Pothong 654 Phetkasem Road Wat Thapra, Thon Buri	Gray cast iron
Loepokli 16/65 Soi Wathana Bang Khun Thian, Thon Buri	Gray cast iron

Name and address	Kind of products
Sahakit watthana 30/11 Soi Watthana Bang Khun Thian, Thon Buri	Aluminium and cast iron
Ousunghee Near Khrung Thong Bridge Bangkok	Gray cast iron, aluminium and brass
Thaworn Foundry Shop 112 Phromphong Lane Sukhumwit Road Bangkok	" "
Bumoungporn Phromphong Lane Sukhumwit Road Bangkok	Gray cast iron
Tenghuatlee 233 Phromphong Lane Sukhumwit Road Bangkok	" "
Last Shop Phromphong Lane Sukhumwit Road Bangkok	" "
Tong Wa Heng Soi Wat Phai Trok Chan Bangkok	" "
South East Service Soi Wat Phai Trok Chan Bangkok	" "
Chiengmowkim Soi Wat Phai Trok Chan Bangkok	" "
Oupakorn Partnership 504 Soi Wat Phai Trok Chan Bangkok	" "

Name and address	Kind of products
Videe Lohakarn 4187 T. Soi Phrarat Trok Chan Bangkok	Gray cast iron
Luanhaheng 612 Lat Ya Road Thon Buri	" "
Senghengtai Wat Yai Si Suphan Lane Thon Buri	Gray cast iron and brass

Source: Ministry of Industry, Bangkok.

(ii) Group 342: Non-ferrous metal basic industries

This group covers the processes of smelting, alloying and refining, rolling, drawing, founding, and casting of non-ferrous metals (exclusive of precious metals, for which see Group 394). The group therefore covers production of ingots, bars and billets, sheets, strips, sections, rods, tubes, and pipes as well as castings and extrusions. Non-ferrous wire is covered under Group 370.

During 1967, total imports of each type of unmanufactured non-ferrous base metal in its various forms were (Port of Bangkok only):

	Million baht
copper	8
nickel	0.5
aluminium	8.9
lead	0.4
zinc	7.1
tin	0.08
miscellaneous non-ferrous base metals	0.2
Total	25.18

Note: These totals include the value of some wire which belongs to Group 370.

In addition, there is an unspecified part of ordnance (11.4 million baht) and manufactures of metals, n.e.s. (71 million baht) which would be composed of non-ferrous base metal. The group, however, is obviously much smaller in value than the import value of comparable iron and steel products (117 million baht) and even smaller in quantity because of the higher unit values.

Major items of import within the group (items over 10 million baht) are:-

	Tonnes	Million baht
Wrought bars, rods, angles, shapes and sections of copper, and alloys of copper	775	16
Wrought plates, sheets and strip of copper, and copper alloys	831	20
Wrought plates, sheets and strip of aluminium, and aluminium alloys	785	18
Aluminium foil, backed with paper or other reinforcing material	1,209	27
Wrought plates, sheets and strip of zinc, and zinc alloys	1,676	15

Although the Board of Investment has listed various operations in this group as being eligible for promotion, few certificates appear to have been issued. The Board, for example has listed as eligible, tin-smelting, lead-smelting, zinc-smelting, copper-smelting, antimony-smelting, tungsten-smelting, and manganese-smelting, the general requirement being that "the metal produced must have a purity of not less than 99.8 per cent with smelting losses of not more than 5 per cent."

The position with regard to each metal is examined below.

By far the largest single item of import is unwrought zinc almost all

of which is used either for galvanizing (Group 341) or as containers for dry cells (Group 370).

There has been some recent interest in the exploitation of the rich (35 per cent Zn) zinc deposit ("one million tonnes of unmixed zinc ore worth 2,000 million baht") at Mae Sot in Tak Province, north-west Thailand.

In October, 1967, the "Bangkok Post" reported Mineral Deposits Ltd., Australia, (a subsidiary of National Lead Co., U.S.A.) had successfully tendered for the lease on the Mae Sot deposits and was "looking into the possibility of setting up a complete zinc industry in Thailand." More recent reports on the world zinc situation, however, indicated that there was increasing over-production and this, of course, may deter developments in Thailand.

The "Bangkok World" of 7th January, 1969, announced that Electrolytic Zinc Co., of Australia was hesitating because of lack of cheap power and other minerals (needed in processing) as well as the high cost of transportation. The Yanhee Electric Authority was unable to supply the large amount of power needed at a cheap price, and although the Mae Sot - Tak Highway would be completed in 1970, transport over the mountainous terrain from Mae Sot to Bangkok was considered prohibitive.

Apart from zinc the only other non-ferrous base metal which appears to have major potential for import replacement is copper. Copper ore deposits at Loey are estimated at 78 million tonnes with a metal content of 0.77 per cent, but no firm plans are known for exploitation.

Tin

Tin has been the most important mineral in Thailand for almost a century. It was not, however, until mid-1965 that smelting of the metal was begun by Thailand Tin Smelting and Refining Co., Ltd., Phuket. Capacity for tin-smelting is now 18,000 tonnes per year and most of the metal is exported in ingot form. Some is used locally for making tinplate (Group 341).

Lead

Lead concentrate is produced at Kanchanaburi, output in 1966 being almost 15,000 tonnes with an assay of 35-45 per cent lead and 10-17 per cent zinc. The Lead Ore Antimony Mining Ltd. Pt. has a Promotion Certificate and

plans to produce about 2,500 tonnes of lead concentrate of not less than 70 per cent lead content, but there are no plans for the smelting of lead in Thailand, all concentrates being exported.

A small quantity of antimony metal is produced by Visakakij Thai American Mining Co., Ltd. which has a smelting capacity of 500 tonnes p.a. and, in 1965, produced 172 tonnes of metal. There was an export of "Antimony, wrought" in 1965, viz. 5.1 tonnes valued at 116,171 baht, and an export of "Antimony, unwrought" in 1966, viz. 24.4 tonnes valued at 526,573. This appears to confirm that some of the antimony produced is used locally, possibly for battery plates or printers' metal. There was no export of antimony, wrought or unwrought, through the Port of Bangkok in 1967.

Some local manufacturers of storage batteries (Group 370) stamp their battery plates from an alloy which they make themselves from imported virgin lead and local antimony. The resultant alloy has from 5 to 7 per cent antimony. Currently, about 900 tonnes p.a. of this locally alloyed metal appears to be used for stamping battery plates.

The larger letter-press printers use some make-up lead and antimony in their type metal - possibly up to one tonne annually of make-up type metal.

There are a number of small re-melters of lead, antimonial lead and printers' metal who buy scrap metal - or more often exchange one kg of new metal for 2 kg of scrap.

(q) Major Group 35: Manufacture of metal products, except machinery and transport equipment

(i) Group 350: Manufacture of metal products, except machinery and transport equipment

This is a large and miscellaneous group covering such items as tin cans, hand tools, cutlery, plain and enamelled holloware, springs, bolts, nuts, washers, rivets, collapsible tubes, lighting fixtures, fabricated wire-products, ordnance, etc.

The value of imports in 1966 falling within this group was:-

	Million baht
Ordnance	349
Manufactures of metals, n.e.s.	1,014
Sanitary, plumbing heating and lighting fixturess fittings (port only)	86

The group therefore accounted for about 5 per cent of total imports in that year.

Employment in the industry, according to Department of Public Welfare data, showed a steady increase from 1961 to 1964, viz.:-

1961	1962	1963	1964
3089	3739	4792	5109

Tin cans

Tin cans are made by a number of plants some of which are captive to food and other manufacturers. About 18 manufacturers offer them for sale.

Metal Box Co., (Thailand) Ltd., was building a factory at Samut Prakan to supply cans to the tinned milk industry by the end of 1968. The company has promotional privileges. Metal Box Company in Malaysia and Britain hold 55 per cent of shares, a Japanese can-maker, 15 per cent, while 30 per cent (equivalent to 12 million baht) will be publicly held.

According to the Promotion Certificate, the company will make 40 million metal containers and 6 million collapsible tubes annually.

Water-tanks

Water-tanks of galvanized iron are produced in numerous small metal-working shops, most of which specialize in this product. Buckets and other small vessels of plain, tinned, and galvanized iron are similarly made by hand in small "tinsmiths'" shops.

Two categories of factory according to the Ministry of Industry classification, would appear to be relevant to this type of manufacture, viz.:-

		Registered No. of Factories, 1965	
		Bangkok-Thon Buri	Whole Kingdom
Class 89	Galvanized iron, zinc, lead or aluminium articles factories	402	451
Class 90	Mechanized metal conversion factories	609	633

A Promotion Certificate was granted to Thai Industry Metal Drum Manufacturing Co., Ltd. in 1959 covering a capacity of 3.6 million drums p.a. A Certificate was also granted to Thai Metal Work Co., Ltd. in 1961 covering a capacity of 2,200 tonnes of aluminium containers p.a.

Cutlery

Knives, choppers and the like are made by a number of small factories in Thailand, but no statistics exist on the industry which is believed largely to use hand-crafting.

There is no known manufacture of scissors or razors.

Safes

Safes are supplied very largely by import, but there are four small shops producing safes in Chakkrawat Road, Bangkok.

Nails, bolts, nuts, hinges, and washers

According to Ministry of Industry registration there were 23 factories manufacturing these products in Thailand in 1965. Five of them are medium to large as shown in the accompanying table and have been promoted by the Board of Investment.

Name	Operation started	Kind of product	Capacity (tonnes/year)
Thai Nail Work Co., Ltd. 46 Suksawat Road Bangkok, Tel. 68007	1961	Various kind of nails	19,000
Kanyong Trading and Manufacture Co.,Ltd. 745/26-28 Phetburi Rd. Bangkok, Tel.57195, 70460	1962	Nails, bolts, nuts, hinge	1,000
Bangkok Nail Works Co., Ltd. 78 Bamrung Muang Rd. Bangkok, Tel. 814494	1962	Nails of various kind	3,100
Thai Salukphan Co.,Ltd. 197-99 Songwat Road Bangkok, Tel. 34294	1967	Bolts, nuts, and screws	6,000
Thai Tin Plate Co.,Ltd. 511 Mahaphruttharam Road Bangkok, Tel. 38270	1967	Nails of various kind	2,700

The industry appears to have achieved a high degree of import replacement, at least as far as nails are concerned. Thus, in 1966, over 24,000 tonnes of nail-wire was imported, valued at 56.3 million baht while only 3,350 tonnes of nails, worth 18.9 million baht, came in.

There still appears to be scope for further import replacement in the case of nuts and bolts and especially in some other items of simple hardware, e.g.:-

	Import into Thailand, 1966	
	Quantity (tonnes)	Value (millions of baht)
Bolts, nuts, screws, rivets of iron and steel	4,392	41.9
Bolts and nuts of other metal	56	0.6
Hinges	737	7.4
Locks and Padlocks	412	19.5
Fittings and mountings	523	14.2

Enamelled holloware

Enamelled holloware up to the size of large basins is made by a number of factories, the registrations by the Ministry of Industry in 1965 being 12 in Bangkok-Thon Buri and 14 for the entire Kingdom. Thai Enamelling Co., Ltd., appears to be the largest. Enamelling of baths and other large vessels or "glass-lining" does not seem to be undertaken.

Import of "Vitrifiable enamels and glazes" through the Port of Bangkok in 1967 was almost 24 tonnes valued at 248,351 baht; import in 1966 was under half a tonne.

Hand-tools

In 1966, imports in this field were as follows:-

	C.I.F. import value (million of baht)
Spades, hoes and changkols	24.3
Axes	2.7
Saws and saw blades	24.0
Timber wedges etc.	1.0
Pliers and pincers	3.3
Spanners and wrenches	15.3

	C.I.F. import value (million of baht)
Files and rasps	11.5
Hammers	3.5
Carpenters tools	5.5
Drilling, threading, tapping tools	5.6
Knives and cutting tools	4.1
Interchangable tools	28.7
Hand tools not classified	22.1
	151.6

Demand for hand-tools has risen rapidly: in 1950, import was valued at 26 million baht, in 1961 at 76 million baht, whence it has more than doubled.

According to the Ebasco Report on Hand Tools (1963) "there is practically no production of hand-tools in Thailand at present, of commonly accepted types and quality. There are no mechanically equipped forging shops engaged in such production. On the other hand, numerous small blacksmith shops produce a variety of crude farm implements including forks, scoop shovels, rakes knives,and cutting blades of assorted kinds.

The Ebasco report held that local production was negligible except for shovels, forks, rakes, sickles, scythes,and knives. Two small shops in Bangkok, said the Report, "produce shovels fairly comparable to imported types at a lower price, despite a minimum of tooling..... In addition, many still smaller family shops produce primitive shovels, scoops,and other crude tools from old oil drums and other salvaged materials."

"Carpenter or Blacksmiths' Tools Industry" is accorded Promotional rights by the Board of Investment but no Certificates are known to have been issued. The reason may be, as the Ebasco Report suggested, that although the import figures overall appear large and the manufacture simple, the number of variations in size and type within each class is many so that an economic production run with modern tooling may be hard to achieve. Moreover, duty is only 15 per cent ad val. except in the case of those tools used in agriculture, which enter duty free. Furthermore, steel, the major item of variable cost, would hitherto have needed to be imported.

(r) Major group 36: Manufacture of machinery, except electrical machinery

(i) Group 360: Manufacture of machinery, except electrical machinery

This group covers machinery and prime-movers other than electrical equipment, marine engines, and engines for motor vehicles and aircraft. (Major group 38) but the group does include tractors.

Tractors and agricultural implements

Mechanization of agriculture in Thailand has caused a rapid increase in demand for tractors and certain other types of agricultural implements. The following table indicates the import in 1966:-

	Unit	C.I.F. import value
Tractors	4,540	398,498,859
Tractor parts		94,248,768
		492,747,627
Agriculture equipment		
Ploughs	26,378	17,199,432
Harrows	15,869	1,185,652
Cultivators	21	134,082
Seed distributors	31	173,285
Fertilizer distributors	29	86,173
Machinery for soil preparation and cultivation	2,370	4,773,428
Parts of agricultural and horticultural	185,038	2,879,251
Harvesting machines	12	479,879
Hay & grass mowers	4,287	4,136,082
Other agriculture equipment used in poultry keeping etc.		2,500,000
Total		33,547,264

Source: Department of Customs, Bangkok.

Two companies are at present assembling tractors from imported parts Louis T. Leonowens (assembling Massey Ferguson Tractors) and Thai Motor Industry (Ford tractors). Two additional Promotion Certificates have been issued, details being:-

Name	Operation started	Kind of product	Capacity (tonnes/year)
Tractor			
Louis T. Leonowens (Tractor) Co., 723 Hong Kong Bank Lane Bangkok, Tel. 35916-7, 32917-9	1962	Tractor assembly	700
Thai Motor Industry 149 Surawong Road Bangkok, Tel. 38961-5	1961	"	834
Thai Pradith (Assembling Plant) 388/3 Phetburi Road ,Bangkok.	not started	"	100
Toyota Motor Co., Ltd. 180 Surawong Road , Bangkok. Tel. 38951-3, 32036, 34101	"	"	100

The large import value for tractors and parts suggests that further import substitution could be undertaken but, so far as tractor parts are concerned, a position obtains similar to that outlined and Group 383-Manufacture of Motor Vehicles.

Two Promotion Certificates have been issued for the manufacture of agricultural implements but so far as is known, neither company has yet commenced operation:-

Name	Operation started	Kind of product	Capacity (tonnes/year)
Agriculture implements			
Thai Industrial Machinery Co., Ltd. 589/2 Si Ayutthaya Road, Phaya Thai Bangkok, Tel. 56334	not yet started	Agriculture implements	312,000
Thai Crocodile Agriculture Implement, Co., Ltd. 415 North Samrong Samut Prakan	"	Hoes	1,000,000

Machine tools and other non-electrical machinery

This is an extremely large and somewhat heterogeneous sub-group which covers non-electric factory equipment, some individual units of which, such as a blast furnace, a steel rolling-mill or a cement kiln, can be extremely expensive. Total value of import of the group in 1966 was 1,244.7 million baht, but the diversity of the group and importance of individual items can best be illustrated by quoting the relevant customs classification in detail

	C.I.F. value in million baht
Machine tools in metal working	68.5
Rolling mills	2.7
Machine tools for working wood, cork, plastic etc.	12.3
Machine tools for paper making	6.0
Machine tools for preparing or working printing, blocks, plates, or cylinders	34.0
Machine tools in textile industry, including machinery for washing, cleaning, bleaching, and machines for printing a design	115.6
Sewing machines	56.3
Icemaking machines, air condition, and refrigerator equipment	34.9

	C.I.F. value in million baht
Mechanical appliances used in preparation, serving or conditioning of food or drinks e.g. crushers, fruit juice preparation, bakery, chocolate, sugar, cereal, coffee making	17.1
Machinery for cleaning, washing, packing, sealing, labelling, wrapping	22.9
Machinery for tanning and hide producing	1.1
Machine tools for making stone, ceramic, cement etc.	46.8
Mechanical equipment for pharmacy & laboratory	25.9
Machinery and appliances for treatment of material by process of changing temperature	97.2
Machine tools, unclassified, and parts	236.1
Construction machinery such as road rollers, lifting, handling, loading or unloading machines	142.3
Excavators used in mining industry	325.0
	1,244.7

Despite the high value of foreign exchange involved in import, this sub-group offers comparatively little scope for import replacement because of the sophisticated nature of the equipment and the small local demand.

Sewing machines have, however, been a notable exception, the Singer Industry (Thailand) Co., Ltd., not only assembling domestic sewing machines from imported parts, but also using some local materials. Some looms in Thai kenaf factories have been locally-made or at least been locally modified.

Other companies, in addition to Singer, which have received Promotion Certificates are:-

Name	Operation started	Kind of products	Capacity (unit/year)
Thai Union Electric Industry	1963	Welding machines	600
Wong Wai Wit Machine tool Manufacturing 190 Sukhumwit Road Samut Prakan, Tel. 32375	1966	Rolling machines Cogs	20 7,000 pieces
Bangna Chakkal 78 Chaloemkhet 1, Suan Mali Bangkok, Tel. 812460	1967	Rolling machines Weaving machines Piecing machines	60 300 100

Office machinery

Imports in 1966 totalled 67.8 million baht and were comprised as follows:-

	Unit	C.I.F. value (million baht)
Typewriters	12,357	24.3
Calculating machines	5,913	21.4
Accounting machines and others use in statistics	333	8.6
Hectographs	147	6.0
Other office machinery		7.5
		67.8

There appears to be no local manufacture of any of the above types of equipment. Repair services are largely in the hands of agents for the overseas manufacturers.

Pumps

Import statistics for 1966 show the following:-

		Units	Value (million baht)
(i)	Pumps for fire-fighting	559	0.6
(ii)	Special pumps for liquid, fuel	68,841	35.7
(iii)	Pumps, other, including motor pumps and turbo pumps	60,923	48.6
(iv)	Parts of pumps, n.e.s.	445,839	28.9

With a high water-table and a large area of relatively well-watered land, Thailand has obviously a large demand for water-pumps, particularly in rice-growing, the nation's major industry.

Originally, simple wind-driven "dragon-bone" pumps were used extensively and still are to an extent. They are cheap, reasonably efficient with the low wind-speeds over most of Thailand and sufficient to raise water a few feet from a canal to a field. There has also been a traditional demand for pumps for raising water from deep wells.

More recently, motor-driven pumps have rapidly increased in popularity, the import in 1960 of 11,166 in category (iii) above, having increased five-fold by 1966. This category includes various types of water pumps such as centrifugal rotary, turbine, reciprocating and others. However, according to the Ebasco report on Water-pumps (1962), demand for reciprocating pumps to augment water pressures in Bangkok, was then declining sharply. The report also considered that 65 per cent of all pumps in this category were of the centrifugal type.

Manufacture, mainly of self-priming centrifugal pumps began in Thailand in the mid 1950's and has increased markedly since. In addition, two firms received Promotion Certificates:-

	Kind of product	Capacity (unit/year)
Thai Industrial Machinery Co., Ltd. 589/2 Si Ayutthaya Road Bangkok, Tel. 56334	Water pump	6,000
Bangkok Sip Yip Co., Ltd. 194/5-6 Surawong Road Bangkok, Tel. 33445	"	20,000
		26,000

Demand for other types of pumps has also increased rapidly as the following figures show:-

	Import, units p.a.	
	1960	1966
Pumps for fire-fighting	71	559
Special pumps for liquid, fuel	2,800	68,841

(s) Major group 37: Manufacture of electrical machinery, apparatus, appliances, and supplies

(i) Group 370: Manufacture of electrical machinery, apparatus, appliances, and supplies.

Imports under this heading in 1966 totalled 1,028 million baht or some 4 per cent of the total imports in that year.

The major divisions of the industry are household electric appliances, communication apparatus and other electric machinery, supplies, and equipment including storage batteries and dry-cell batteries.

In the field of Household Electric Appliances, a number of factories are operating mainly assembling from imported parts. A further factory has a Promotion Certificate and is about to start. The names and activities of the factories are:-

	Operation due to start	Kind of product	Capacity (unit/year)
Air conditioners			
Universal Electric Co.,Ltd. 317 Silom Road Bangkok, Tel. 32183	1963	Air condition assembling	200
Kanyong Electric Co., Ltd. 745/26-28 Phetburi Road Bangkok, Tel. 57195, 70460	1965	"	3,000
			3,200
Refrigerators			
Universal Electric Co.,Ltd. 317 Silom Road Bangkok, Tel. 32183	1963	Refrigerator assembling	850
Kanyong Electric Co., Ltd. 745/26-28 Phetburi Road Bangkok, Tel. 57195, 70460	1965	"	3,000
Essential Synthetic Co., Ltd. 109/2 Phetburi Road Bangkok, Tel. 72441	1963	"	2,760
			6,610
Electric stoves			
Thai Union Electric Industry 14 Soi Wat Piren, Tambon Ban Bat Bangkok, Tel. 23903	1963	Electric stoves	36,000
Kan Yong Electric Manufacturing 145/26-28 Phetburi Road Bangkok, Tel. 57195, 70460	1965	"	15,000
			51,000

	Operation due to start	Kind of product	Capacity (unit/year)
Electric fans			
Kan Yong Electric Manufacturing Tel. 57195, 70460	1965	Electric fans	50,000
Meyer Co., Ltd. 48 Rama Road Bangkok, Tel. 36861	not yet started		100,000
			150,000
Mayer (Thailand) Ltd.	1964	Electric torches	1,200,000
Electric lamps and bulbs			
Phillips Electric Co., of Thailand Ltd. 99 Sukhumwit Road Bang Na Bangkok, Tel. 910627	1963	Electric bulbs (Phillips and Pope Osram)	(Depends on demand)
Thai Union Electric Industry 14 Soi Wat Piren Tambon Ban Bat Bangkok, Tel. 23903	1963	Electric lamps	60,000 set
Kan Yong Electric Manufacturing 745/26-28 Phetburi Road Tel. 57195	1965	"	40,000 "
Bangkok Lamp Co., Ltd. 324-326 Phlup-phla Chai Road Bangkok, Tel. 28512	1965	Bulbs, fluorescent tubes	6,000,000 unit
Thai Lamps Co., Ltd.	1962	Bulbs	7,000,000

	Operation due to start	Kind of product	Capacity (unit/year)
Radio Assembling			
Tanin Industry Co., Ltd. 126 New Road Bangkok, Tel. 21600	1963	Radio and assembling	29,600
National Thai Co., Ltd. 484-490 Maha Chai Road Bangkok, Tel. 26921	1962	Radio	10,000
Charray Industries Co., Ltd. 155 Sam Yot New Road Bangkok, Tel. 21077	1966	"	36,000
Chantrapa Industries Co., Ltd. 108 Wisut Kasat Road Bangkok, Tel. 49743	1966	"	10,000
			85,600
Television Assembling			
Tanin Industries Co., Ltd. 126 New Road Bangkok, Tel. 21600	1963	Television assembling	5,000
National Thai Co., Ltd. 484-490 Maha Chai Road Bangkok, Tel. 20921	1962	"	3,000
Dumont Electronic (Thailand) Co., Ltd. 360 Luang Road, Suan Mali Bangkok, Tel. 24885	1967	"	5,000
			13,000

Even though operations were then fairly well established, imports of this class of finished goods was over 328 million baht in 1966.

A factory known as I.T.T. Thailand Co., Ltd. has been promoted and expects to produce Communications Apparatus including 30,000 telephone sets, accessories and associated equipment. In 1966 imports of these items totalled 33,666 sets valued at over 25 million baht.

The field of Electric machinery and other Electric supplies and equipment covers a wide range of apparatus for the generation, transmission and transformation of electrical energy. According to Ministry of Industry data, there were 117 factories in this field in 1965 but most were probably small.

Promotion Certificates have been issued to the following firms:-

Company	Operations due to start	Kind of product	Annual capacity
Pacific Electrical Engineering (Thailand) Co., Ltd.	1962	Electric wires	2,000 tonnes
Thai Electric Cable Co., Ltd.	1964	Electric wires,	1,000 tonnes
		Switches,plugs, etc.	10,000 units
Thai Yazaki Electric Co., Ltd.	1962	Electric wires	800 tonnes
Thai Union Electric Industry Co., Ltd.	1963	Transformers	96,000 units
		Welding machines	600 "
		Battery chargers	600 "
		Cut-out switches	1,000,000 "
		Electric motors	20,000 "
Thai Industry Machinery Co., Ltd.	not get started	Electric motors	12,000 "
		Miscellaneous electrical equipment	184,000 pieces

Again, it is noteworthy that although the electric lamp industry has been established for some years, imports in this field in 1966 included.

	Units	Baht
Domestic filament bulbs	4,207,356	7,485,934
Flash-light bulbs	13,403,071	2,891,403
Bulbs for motor vehicles	1,451,146	1,876,698
Fluorescent tubes	2,066,615	15,193,667
Electric bulbs and tubes, n.e.s.	316,785	5,663,891

Presumably the above constitute the larger and more unusual types of bulbs and tubes.

Battery manufacture, of both primary and secondary types is well-established. Ministry of Industry data indicates that in 1965 there were 212 "Battery or dry cell or transformer manufacturing or repairing factories" in Thailand.

Four Promotion Certificates were issued for the production of dry-cell batteries, the recipients being:-

Company	Operations due to start	Kind of product	Annual capacity	
Sri Thailand Battery Co., Ltd.	1961	Dry cells	17,000,000	units
		United Batteries	12,000,000	"
Ray Lamp Battery Co., Ltd.	1960	Dry cells and radio batteries	24,000,000	"
Eveready Thailand Co., Ltd.	1960	Dry cells	12,000,000	"
National Thai Co.,Ltd.	1962	Batteries	12,000,000-	"
			36,000,000	"

Storage batteries. Four factories make storage batteries in Thailand, namely:-

Bang Na Battery Organization
Yuasa Battery Thailand Co., Ltd.
Siam Motors Co., Ltd. (G.S. Battery)
Raylam Battery Co., Ltd.

Of the four, the Bang Na Battery Organization is government-owned (Ministry of Defence), the others are privately-owned.

Production of storage batteries in 1968 is estimated at 120,000 units, in both 6 volt and 12 volt types but with a strong trend toward increasing production of the 12 volt type.

The Bang Na Battery Co., has announced plans for expansion to 90,000 batteries annually as well as progressive establishment of battery components such as lead oxides, plates, cores, and separators. This expansion is envisaged as being complete late in 1969.

Some of the private battery manufacturers also have expansion plans under way and one of them, at present merely assembling batteries from imported parts, plans to undertake a more radical production.

(t) Major group 38: Manufacture of transport equipment

(i) Group 381: Ship-building and repairing

Waterway transportation has been the traditional mode of conveyance of goods and passengers in most of Thailand until fairly recent years when the beginnings of an efficient road system were laid.

In general, the smaller craft, particularly of wooden construction, are made locally; larger vessels are imported. In 1966, value of vessels exceeding a gross tonnage of 250, of tugs over 100 tonnes and of dredges, totalled 76 million baht, while import of launches, small boats and craft otherwise was 44 million baht in value. The total value of imported craft was therefore 120 million baht or some 4 per cent of the total import of surface transport equipment (2,814 million baht).

There are no production statistics for water-craft made in Thailand but registrations with the Department of Harbours show that only five per cent of the motor launches registered were imported while 20 per cent of non-power vessels were imported. The following table shows the actual registrations:-

	Steam vessels		Motor vessels		Non-Power vessels		Total	
	number	gross-tonnes	number	gross-tonnes	number	gross-tonnes	number	gross-tonnes
1962	-	-	5,501	12,975	354	7,609	5,855	20,585
1963	1	6,448	6,831	19,677	409	8,884	7,241	35,009
1964	-	-	7,620	19,659	459	9,568	8,079	29,227
1965	-	-	6,205	20,775	530	20,866	6,735	41,641

Source: Harbour Department.

There is a number of plans afoot to develop and consolidate the ship and boat-building industry in Thailand:-

(a) The Royal Thai Navy has ear-marked 15 million baht for installing facilities at the Bangkok Dock, Yanawa, to build ships of 1,200 tonnes intended for coastal and inland water-way traffic. A basic feature of the design is that ships so built may be docked, serviced, and repaired anywhere in the ECAFE region: ECAFE experts are assisting with the plan.

(b) The Ministry of National Development has allocated 400,000 baht for the acquisition of 10 rai of land at Nong Khai for building 12 river ships of 100 tonnes burden to ply the Mae Khong. The project, already begun, will take 5 years to complete and cost 16 million baht of which 10 million baht may come from U.N. aid.

(c) Bangkok Dock plans to expand its repair facilities which at present can handle only 20 ships per year of up to 100 metres in length.

(d) There is also a general plan by the government to convert existing wooden cargo lighters into self-propelled vessels of 95 tonnes capacity.

(ii) Group 382: Manufacture of railroad equipment

The Royal State Railways of Thailand is the only public operator of rail services in the kingdom.

In general, it imports its rails, locomotives and rolling stock. In 1966, import of railway rails was valued at 10 million baht, locomotives at 11 million, goods vans and trucks at 86 million and other mobile equipment at 17 million baht.

The major function of the RSR Workshops at Makkhasan has been repair, but in 1967-68, 61 Bogie Flat Waggons and 48 undercarriages for Tank Waggons were built. The building of more is under way, as well as construction of 54 passenger cars.

The RSR Workshops employ over 3,000 and have major facilities for casting, forging, machining and fabrication and a complete modernization of such facilities is planned.

(iii) Group 383: Manufacture of motor vehicles

The import of motor vehicles and parts therefore, absorbs a considerable

proportion of Thailand's foreign exchange earnings. In 1966, for example, imports of the major items in this field were:-

	Millions of baht
Passenger motor vehicles, n.e.s. including station waggons	434
Motor vehicles for rustic uses	107
Trucks, lorries, vans, incl. under-30-seater buses	1,047
Buses, over-30-seaters	6
Chassis fitted with engines for trucks, vans, buses, etc.	46
Chassis, frames and other parts and accessories for road motor vehicles, n.e.s.	274
Total	1,914

Total value of all imports in 1966 was 25,347 million baht so that passenger motor vehicles comprised almost 8 per cent, or about half the income from rice exports in that year. (Motor cycles and parts added a further 268 million baht - see Group 385). Import in 1968, is expected to exceed 2,500 million baht. The attached tables show the trend in imports over recent years. Actual numbers of vehicles registered in 1967 appear below:-

Vehicles registered, 1967

	Kingdom	Bangkok Thon Buri
Personal cars	102,776	82,499
Taxis	16,005	8,998
Buses	9,987	2,796
Vans and trucks	90,057	33,966
Other motor vehicles	21,991	6,271
Motor-cycles	213,162	47,316
Motor tricycles	8,623	6,855
Total	462,601	188,701

Source: Police Department, Bangkok.

"It is estimated ("The Investor", December, 1968), that about 70 per cent of vehicles sold in Thailand are imported in built-up condition. Of the 55 makes of passenger car on sale in Thailand, 11 are locally assembled; of the 30 commercial vehicles, 12 are locally-assembled.

There are currently 10 firms assembling cars, trucks, and buses in Thailand, and these are located in Bangkok, Thon Buri, and Samut Prakan. Output, in 1967, ranged from one to 15 units per day but, according to "The Investor," (December, 1968), only two of the companies are assembling on a full CKD basis. "The definition of CKD in force, permits importation of sub-assemblies requiring only one master assembly jig so that most of the local plants provide labour for modified assembly, metal finish, paint and trim, in garage-type facilities."

As of November, 1967, the total annual capacity of the promoted industries in the field of automobile and truck assembly was 16,783 units per year.

The industry is a promoted one. Details of the firms and their activities are:-

Name	Operation started	Kind & models of product with retail price	Approximate capacity (unit/year)
Kanasuta General Assembly Co.,Ltd. 98 Sukhumwit Road Soi 26, Bangkok Tel. 910941-2	1963	Passenger cars Fiat 1100 Special @ ฿ 66,000 " 1800 B @ ฿ 85,000 " 1100 D @ ฿ 65,000 " 1500	300
Thon Buri motor Co., Ltd. Building 3, Ratchadamnoen Road Bangkok, Tel. 20433, 22779	1963	Passenger cars - none Trucks Mercedez-Benz Diezel Model L328/42 @ ฿ 120,000 Fargo D500/175 @ ฿ 110,000	400
Siam Motors and Nissan Assembly Co., Ltd. 865 Rama I Road Bangkok, Tel. 56940, 56835	1963	Passenger cars Datsun Blue bird @ ฿ 59,000 Trucks Nissan Junior (with gasoline engine) @ ฿ 55,000	3,200

Name	Operation started	Kind & Models of product with retail price	Approximate capacity (unit/year)
		Nissan Junior (diesel) @ ฿ 57,000 Nissan Chassis 6 wheel(with gasoline) @ ฿ 70,000 Nissan Chassis 6 wheel @ ฿ 86,000 Nissan Chassis 6 wheel(diesel)@ ฿ 103,000 Nissan Chassis 10 wheel (diesel) @ ฿ 115,000	
Mitsubishi Thailand Co., Ltd. (Isuzu Motors)	1963	Passenger cars - none Trucks from 1500-2500 cc. Isuzu Diesel Model TXD 50 HJ @ ฿ 101,000 Isuzu Diesel Model TWD 80 HJ @ ฿ 115,000 Isuzu Diesel Model TDD 11 @ ฿ 54,500 Isuzu Diesel Model TDD 11 G @ ฿ 50,000	4,800
Toyota Motor Sales Co., Ltd. 180 Surawong Road Bang Rak, Bangkok Tel. 32036, 34101	1963	Passenger cars Toyota 700 UP10 @ ฿ 41,000 Toyota Tiara RT 20 @ ฿ 56,000	400

Name	Operation started	Kind & Models of product with retail price	Approximate capacity (unit/year)
Factory 187 Group 9, North Samrong Samut Prakan		<u>Trucks</u> Toyota RK 100-1 @ ฿ 42,000 Toyota RK 100C @ ฿ 49,500	
Anglo Thai Motors Co., Ltd. 149 Surawong Road Bangkok, Tel. 38961-5, 33062-63		<u>Passenger Cars</u> Ford Cortina 1200 Ford Consul 1500 Ford Anglia 1000	5 per day
		<u>Trucks</u> Anglia Van, 1000 Thames 800	1 per day
Prince Motor Co.,Ltd. 283 Surawong Road Bangkok, Tel. 30984	1966	<u>Passenger cars</u>	350
Saha Patana Yanyond 22 Suksanat Road Phra Phradaeng Samut Prakan Tel. 68033	1966	<u>Passenger cars and buses</u>	300
Thai Pradit Co., Ltd. 388/3 Phetburi Road Bangkok, Tel. 75081-3 71552 Factory,329/3 Charoen Sanit Wong Rd. Thon Buri	not yet started	<u>Trucks</u> Deutz Diesel	300

Name	Operation started	Kind & Models of product with retail price	Approximate capacity (unit/year)
Heno Motor Sales Co., Ltd. Phetburi Road Bangkok	1966	Passenger cars - none Truck	

In addition to CKD assembly, several firms engage in semi-knocked down (SKD) truck assembly, and this work is usually done in dealers' garages. Unlike CKD, SKD assembled vehicles must pay full customs duty and business tax.

In addition to CKD and SKD assembly, many firms engage in truck and bus-body building, 113plants being registered with the Ministry of Industry in 1965, but only 25 of these were in Bangkok and Thon Buri. Some of these plants also operated transportation services, a notable example being the Express Transport Organization (ETO). In this operation, the chassis, engine, radiator, dashboard, and wind-shield are imported, almost all cabs and bodies being added by local craftsmen.

Name and addresses of some major plants engaged in trucks - and bus-body building are:-

Express Transportation Organization Co., Ltd. (Ministry of Communication)	Si Ayutthaya Road Tel. 56429
Haison	338 Maha Chai Road Tambon Samranrat, Bangkok
Yongtailong	287 Surawong Road, Bangkok
Phraengputorn Garage	17/1 Phraeng Phuthon Lane Bangkok
Pipatkarnchang	48-50 Maha Nak Road, Bangkok
Mr. Suradej Pimolsit	58/8 Wat Sao Thong, Tambon Bang Sue, Bangkok

Udomkarnchang	25/2 Phramuan Road Si Lom , Bangkok
Nai Lert Co., Ltd.	888 Phetburi Road Bangkok, Tel. 58238
Vengkee	10 Rong Muang Road Soi 3, Bangkok
Chaiyapan	15-26 Boriphat Road Tambon Thepsirin, Bangkok
Bankluai Garage	40 Group 2, Tambon Khlong Ton

Source: Ministry of Industry.

According to statistics of import, the major sources of passenger motor cars in 1967, were:-

Japan	35	per cent
West Germany	27	" "
Italy	13	" "
United Kingdom	9	" "
Australia	5	" "
U.S.A.	5	" "
France	4	" "
Other	2	" "

Major sources of vans and buses were:-

Japan	48	per cent
West Germany	30	" "
United Kingdom	18	" "
Australia	2	" "
Other	2	" "

Thailand: Trends of imports of motor vehicles, 1965-1967

	1965		1966		1967*	
	Quantity (unit)	Value c.i.f. (million baht)	Quantity (unit)	Value c.i.f. (million baht)	Quantity (unit)	Value c.i.f. (million baht)
Passenger cars	12,544	358.7	16,544	524.3	19,640	554.8
Buses	33	3.7	47	6.2	270	30.8
Trucks, pick up, vans	8,097	400.6	17,857	1,005.6	14,401	417.1
Chassis with engine to convert into either bus or truck	7,757	375.8	7,055	363.1	7,596	448.8
Part-frame and accessories		235.9		267.1		274.0
Total	28,401	1,374.7	41,513	2,166.3	41,907	1,725.5

Source: Department of Customs, Bangkok.

* Port of Bangkok only.

Manufacture of vehicle spare parts and accessories: Eight plants have received Promotion Certificates in this field and there is a large number of small work-shops which fabricate the simpler spare parts and accessories.

The "promoted" factories

Name	Operation started	Kind of product	Approximate capacity (unit/year)
Tongchai Phanit Co., Ltd. 84 Si Phaya Road Bangkok, Tel. 33449	1963	Radiators Fuel tanks Air filters Hub covers Other car accessories	18,000 units 1,000 " 3,000 " 10,000 " 13,000 "
Yontrphan Chanich Co., Ltd. 91-97 Worachak Lan Luang Road Bangkok, Tel. 20378	1962	Car accessories	300 tonnes
Sammitr Motor Co.,Ltd. 34/4 Phetkasem Road Bangkok, Tel. 62233	1963	Spring leaves Other car accessories	1,200 tonnes 750 "
N.H.K. Springs (Thailand) Co., Ltd. 6 Nawa Building New Road, Bangkok Tel. 32671	1964	Screws, bolts, nuts, and spring leaves	2,200 "
Somboon Spring Manufacturing 71/5-81 Luang Road Tambon Worachak Tel. 24011 Factory, 48/1 Sukhumwit Bangkok, Tel. 910519	1965	Spring, axle, gear Brake and clutches	1,200 tonnes or 72,000 units 600 tonnes

Name	Operation started	Kind of product	Approximate capacity (unit/year)
Aoyama Thai Co., Ltd. 130, Group 19 South Samrong Samut Prakan Tel. 241	1966	Car accessories	1,080 units
Thailand Bearing Co., Ltd. 32 Sukhumwit Soi 49 Bangkok	not yet started	Bearing	91,000,000 units
Thai Spareparts Co., Ltd. 3 Phatphong Road Bangkok Tel. 35792 Factory, Amphoe Ban Mo, Saraburi	not yet started	Car accessories	900 tonnes

Note on local substitution of imported parts in motor vehicles

Under the Promotion of Industrial Investment Act (1962), the Board of Investment, in issuing a Promotion Certificate, is empowered to insist that local materials or components must be used, provided these are equal in price and quality to imported materials or components, and that availability is sufficient.

In the case of motor vehicle assembly, however, experience has been that assemblers claim that, quality aside, the throughput of any one model of a motor vehicle in Thailand is so small as to make local production of components uneconomic. Moreover, as engines are imported already assembled and tested, substitution of local engine components would require dis-assembly and re-

testing. In fact, utilization of locally-made parts by the vehicle assembly industry in Thailand appears to be limited to some nuts and bolts, small rubber mouldings, spark-plugs, batteries, and a battery tray.

(iv) Group 384: Repair of motor vehicles

In 1965, there were about 550 factories registered with the Ministry of Industry, which were listed as repairing motor vehicles. Of these, 314 were in Bangkok Thon Buri. The Industrial Census of 1963 (NSO) showed that 57 of the then existing repairers employed ten or more workers. Total receipts of these 57 repairers was placed at 52.6 million baht or just under 900,000 baht p.a. each.

Some of the repair-shops are, of course, associated with agents for overseas manufacturers of cars and trucks; others are part of the organization of truck-transport and bus companies.

(v) Group 385: Manufacture of motor-cycles and bicycles

In 1966, import of motor-cycles, bicycles and parts were:-

	Unit	Million baht
Motor-cycles	76,321	247.6
Motor-cycle and side-car parts	535,199	19.9
Bicycles	34,054	22.2
Parts of bicycles and of other cycles, not motorized	3,245,972	53.8

Motor-cycles are assembled by three Thai-Japanese companies as follows:-

Firm	Annual capacity	Total investment	Start-up date
Siam Yamaha Co., Ltd.	15,000 Units	7 million baht	6 June 1966
Thai Honda Manufacturing Co., Ltd.	30,000 "	49 " "	15 May 1967
Thai Suzuki Co., Ltd.	36,000 "		

Source: Board of Investment, Bangkok.

In addition, BNC Motors were issued a Promotion Certificate covering an annual capacity of 5,500 units.

The number of motor-cycles registered in Thailand in 1967 was 213,000 of which 47,000 were in Bangkok-Thon Buri. Motor-tricycles registered were 8,600 of which 6,900 were in Bangkok-Thon Buri.

Much of the bicycle assembly in Thailand is done in small work-shops using imported parts, often chrome-plated locally. A Promotion Certificate was, however, issued to Thai Bicycles Co., Ltd. in respect of an annual capacity of 20,000 units.

(vi) Group 386: Manufacture of aircraft

This group covers assembly and repair of aircraft as well as manufacture.

There is no manufacture of aircraft in Thailand. Fairly extensive repair and maintenance facilities exist, however, as the country is a nexus for a great deal of international air traffic. In 1966, the country recorded a total of almost 330,000 flights of which 70 per cent were international and 30 per cent internal. The number of flights in 1966 was an increase of 42 per cent over those in 1965. However, Bangkok is not a terminal airport for international traffic so that repair and maintenance facilities tend to be comparatively smaller than at the end of international routes.

The three major companies which have repair and maintenance facilities are Thai Airways Co., Ltd. which services piston-engine and turbo-prop aircraft but not jets; Thai-Am Aviation Co. which services all types, and Thai Avair Co. which is said to be government-sponsored and services some military as well as civilian aircraft. The Royal Thai Airforce also has its own repair and maintenance facilities.

Imports of aircraft, engines, and other parts from 1963 to 1966 show a rather unsteady picture:-

Year	Aircraft complete		Aircraft engines		Parts of aircraft		Total
	(unit)	(baht)	(unit)	(baht)	(tonnes)	(baht)	(baht)
1963	6	84,108,303	28	6,081,156	38	13,358,953	103,548,412
1964	15	62,010,436	24	7,966,111	33	27,875,957	97,852,504
1965	9	13,473,843	12	2,808,133	44	19,422,898	35,704,874
1966	21	162,691,597	12	1,863,627	27	8,141,277	172,696,501

Source: Department of Customs, Bangkok.

(vii) Group 389: Manufacture of transport equipment not elsewhere classified

This group covers mainly animal-drawn and hand-drawn carts.

In Thailand, being still largely a rural country, the use of ox-carts, buffalo-carts and hand-drawn carts has been, and still is to an extent, an important means of haulage. Manufacture of this type of equipment is, however, a dying industry because of the increasing use of motor vehicles. Such carts still exist on farms and in light forest. Many hand-carts are still in urban use.

The manufacture is a ubiquitous cottage industry largely based on small wheel-wright's shops which may make the entire vehicle, including the oxen's yoke or sell the wheels or sometimes only the naves and felloes for farmers themselves to assemble and construct the rest of the cart.

No statistics on the industry apparently exist.

(u) Major group 39: Miscellaneous manufacturing industries

(i) Group 391: Manufacture of professional, scientific, measuring and controlling instruments

Most of these instruments are imported but a few such as thermometers, beakers, and some of the simpler surgical instruments are made in Thailand.

(ii) Group 392: Manufacture of photographic and optical goods

No photographic goods are manufactured locally and, apart from three companies making spectacle frames and glasses, no manufacturers of optical goods are known.

One of the companies producing spectacle lenses, the Thai Spectacle Lens Industry Co., Ltd., Bangkok, was granted a Promotion Certificate in mid-1968 to expand its facilities with a total investment of 2.3 million baht.

(iii) Group 393: Manufacture of watches and clocks

There is as yet no manufacture of watches, clocks or other timing devices in Thailand. Repair services are widely available, some connected with local agencies of overseas watch and clock manufacturers.

(iv) Group 394: Manufacture of jewellery and related articles

This group includes the manufacture of articles using precious metals and gems. Cutting and polishing of gems and striking of medals and coins are included.

Gems

Thailand is an important source of sapphires and rubies and to a less extent of diamond, zircon, and emerald. This afforded the opportunity for establishing a local gem-cutting and polishing industry, the growth of which is evident from the following figures:-

Export of sapphires and rubies from Thailand

	Value (million baht)			
	1960	1965	1966	1967*
Sapphires, cut but not set	10.3	45.3	57.7	56.7
Rubies, " "	2.4	16.3	29.9	25.1

Source: Department of Customs, Bangkok.

* Port of Bangkok, only.

In 1967, about 90 per cent (in value) of sapphires exported were in the cut-but-not-set state, the remainder being uncut. For rubies, all but one per cent were in the cut-but-not-set state. Export of other precious stones, again almost wholly in the cut-but-not-set state, was 1.4 million baht in value.

(Note: export values tend to be lower than actual in this class of goods because of the large, unrecorded export via tourists.)

Thai Lapidary Co., Ltd. is considered the largest cutter and polisher of gems in Thailand, but in 1965 the Ministry of Industry registered 151 "Precious Gem Cutting Factories" in Bangkok - Thon Buri and 437 in the entire Kingdom.

There is also a sizable import of gemstones into Thailand, mainly in the uncut form, presumably required for cutting. Uncut sapphires are the largest item with a value of 3 million baht in 1966. Surprisingly, Burma does not appear as a source of any gemstone imports and here again, official statistics may be incomplete due to undisclosed trade across the border.

Pearls are cultured at Koh Yao Yai near Phuket by the Murata Pearl Co. of Kobe in conjunction with Thai Marine Products. The pearl blisters are sent to Japan for further processing. (According to ISIC, pearl culture is regarded as a primary industry--Group 041).

Import of jewellery is quite small - about 300,000 baht in value in 1967 through the Port of Bangkok but import of imitation jewellery is quite large - over 14 million baht in 1967. On the other hand export of jewellery was 2.8 million baht and of imitation jewellery only 20,489 baht in 1967. The USA and Hong Kong are the major destinations of exports.

Jewellery is made very largely in the "goldsmiths' shops" referred to in the next section.

Gold and silver articles

Manufacture of gold and silverware is a fairly important activity in Thailand, religious articles and ornaments, particularly in gold, being worn by most Thais. Gold ornaments and trinkets have also been a traditional form of saving, a practice which the banking system is only slowly displacing.

Import of "gold coins, bars and ingots" through the Port of Bangkok in

1967 totalled 6.1 tonnes valued at 145 million baht. As there is no gold coinage in circulation it is assumed that the import was principally in primary form intended for manufacture.

The government of Thailand grants a monopoly right each year for the import of gold bullion. From August 1968 for 12 months the right has been granted to Tong Chin Heng Co., Bangkok, to import 240,000 troy ounces of gold bullion, that company having offered the highest fee - 4.8 million baht - to gain the privilege.

Import of gold in manufactured form is not specified as such in Customs statistics but was certainly less than 350,000 baht in 1967.

There is obviously, then, a large local manufacture of articles of gold and this is carried out by goldsmiths who generally sell their own wares directly to the public. "Gold shops" are not only a feature of Bangkok and its suburbs, but of most provincial towns.

In 1967, export of "articles of goldsmith's wares and parts thereof amounted to 47.8 kg valued at 1.75 million baht". Some gold may also have been exported under the item "Articles of jewellery and parts thereof, of precious metal, or rolled precious metal, except of silver nielloware," which carried a value of 2.7 million baht in 1967.

The position with silverware is somewhat different. Silver features less as a form of savings than does gold and silverware articles are therefore, more intrinsically ornamental. Indeed, Thai nielloware, i.e. sterling silver-ware with an inlaid pattern of fused, black amalgam, enjoys a wide export market, exports in 1967 through the Port of Bangkok being 3.7 million baht in value; exports of silverware other than nielloware were valued at almost one million baht.

Silver filament also forms part of Thai silk brocades.

There is no production of native silver in Thailand, supplies being imported in the form of bars, thread and scrap. Import of silver bar in 1967 was 1639 kg, approximately equal to the niello and other silver-ware articles exported.

Most of the production of silverware occurs in Nakhon Si Thammarat in southern Thailand and in Ban Voi-a lai village near Chiang Mai, in northern Thailand. In the latter centre, 200 families are said to be engaged in

niello-ware production but only five are large producers.

(v) Group 395: Manufacture of musical instruments

According to the National Theatre, Bangkok, all non-Thai musical instruments are imported while Thai musical instruments are manufactured in numerous small-scale establishments.

In 1957, there was one factory making gramophone records and in 1965 the number had grown to three. It is assumed that records are made from imported blanks. Both Thai and foreign languages are recorded but much reproduction in Thai is also done in Japan from originals recorded in Thailand.

(vi) Group 396: Manufacturing industries not elsewhere classified

This group comprises a large range of miscellaneous products, such as toys, sporting goods, pens, pencils, costume jewellery, feathers, artificial flowers, brooms, tobacco pipes, badges, advertising signs, rubber stamps, etc. There are very few published data on these industries in Thailand, most of the industries being believed to be small if, indeed, some exist at all.

Union Industries Corporation Ltd., Bangkok, makes zipper fasteners in a joint enterprise with Yoshida Kogyo KK, Tokyo, Japan.

The group does, however, include moulded and extruded plastic products.

The USOM Report on Plastics (1967) placed the total market demand for plastic materials in Thailand in 1966 at 38,724 tonnes p.a. all of which were obtained by import. The breakdown of this demand into types is as follows:-

	Tonnes
Polyethylene compounds	18,400
PVC resins and compounds	3,510
PVC film, sheet and pipe	6,010
Polystyrene compounds	2,200
Urea formaldehyde resins, compounds, and prepared industrial glues	2,600
Other materials	6,004
	38,724

In the period, 1960-66, demand increased by 35 per cent p.a. and appeared to be accelerating. It is clear that opportunities for local manufacture of at least some plastics intermediates must already exist. In fact, as the Report pointed out, the following projected manufactures were then (1967) under consideration:-

	Proposed capacity (tonnes)
Low density polyethylene	30,000
PVC (suspension grade)	17,300
Polyvinyl acetate	1,000
	48,300

The Thai-Asahi Company is currently erecting a PVC resin plant (said to have a capacity of 12,000 tonnes p.a.) on the Chao Phraya River opposite its caustic soda-chlorine factory, and this is expected to begin production in 1970. Teijin Tetoron (Thailand) Ltd., has announced (September, 1968) that it will be starting to operate "the first polyester polymerization and fibre-making plant in south-east Asia" within 14 months.

Hoechst Chemical Industries Ltd., expect to commence production by the end of 1969 of polyvinyl acetate involving a capital investment of 20 million baht. The plant, at Thon Buri, will have an initial production capacity of 1,200 tonnes p.a. and may increase to 2,400 tonnes p.a. later.

Union Carbide (Thailand) Ltd., has a similar project.

Teijin Ltd., of Japan is setting up a 10 tonne per day polyester fibre plant while Toyo Rayon is planning to construct a polymerization plant to produce nylon chips from caprolactam.

The fabrication of plastics articles from imported intermediates is obviously well established and the USOM Report estimated that there were 300-400 plastics fabricators of which 35 were of significant size.

The USOM Report estimated that 90 per cent of the consumption of plastics products was supplied from local manufacture. The Report also stated that six types of end products accounted for 81 per cent of the plastics materials used domestically. In order of importance, they were: film and bags for

packaging; products fabricated from flexible film and sheet; moulded toys, novelties, containers and trays; rope, cord, and tape; pipe and hose; insulated wire and cable.

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