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Number 66

A Preliminary Background Notes on Food and
Nutrition Policy in Thailand

by

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Number 67

Technique of Production and Technology Transfer:
With Some Reference to Thailand

by



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A Preliminary Background Notes on Food and
Nutrition Policy in Thailand*

Chirmsak Pinthong

Ammar Siamwalla

March, 1978

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**A Preliminary Background Notes on Food
and Nutrition Policy in Thailand**

**by Chirmsak Pinthong
Anmar Siamwalla**

1. Background of Thai Agriculture

Thai agriculture can be divided into four sub-sectors:

- a. Rice
- b. Upland Food Crops
- c. Upland Non-Food Crops
- d. Livestock and Fisheries

Tables 1.1 to 1.5 give some basic data on trends in each of the sectors. The main story of post-war expansion of Thai agriculture is the diversification of production away from rice largely into upland cropping as is evident from Tables 1.1 and 1.3.

The Rice production as can be seen from the Value Added expands quite slowly in comparison with other crops, chalking up a growth rate of about $2\frac{1}{2}\%$ per annum over the period 1961-1975 - indeed much of the growth was concentrated in the early 1960's, since then growth has been at around $\frac{1}{2} - 1\%$ per annum. In fact, the wet season production has stagnated and in the 1970's, practically all the growth has been achieved through the expansion of dry-season production.

TABLE 1.1

GROWTH RATE AND SHARE OF AREA, PRODUCTION AND VALUE ADDED OF RICE

	Area			Value Added		
	1st Crop Hectares	2nd Crop Hectares	Total Hectares	(Million Baht in 1962 Prices)	Share of Total Rice's Planted Area in Total Culti- vated Areas (%)	Share of Total Rice's Value Added in Agricul- ture Value Added (%)
<u>Magnitude</u>						
1961-1966	6,641,985.9	18,821.8	6,660,807.7	9,890	69.18	40.30
1967-1971	7,501,160.9	92,482.4	7,593,643.3	10,957.6	60.86	36.14
1972-1976	8,069,944.4	281,737.5	8,351,681.9	11,468	50.66	30.18
<u>Growth Rate</u>						
1961-1966	3.85	26.96	3.89	6.69		
1967-1971	2.11	29.66	2.30	0.6		
1972-1976	2.18	37.75	2.89	1.05		

NOTE: 1) Figure above is in average term.

2) Agriculture Value Added = Crops' + Livestock's + Fisheries' Value Added.

3) Total Cultivated Area = Paddy Land + Under Field Crops + Under Fruit Tree + Under Vegetables

SOURCE: Division of Rice, Department of Agricultural Extension,
Ministry of Agriculture & Cooperatives.

TABLE 1.2

GROWTH RATE AND SHARE OF AREA AND VALUE ADDED OF NON-RICE-FOOD CROPS

Period of Time	Area			Value Added		
	Magnitude (Hectare)	Growth Rate (%)	Share in Total Cal- culated Area (%)	Magnitude (Million Baht at 1969 Prices)	Growth Rate (%)	Share in Agricul- ture Value Added (%)
1961-1966	1,719,609.5	10.76	17.71	6,164.4	6.63	25.08
1967-1971	2,754,975	8.11	22.02	8,660.5	6.80	28.43
1972-1976	4,691,595.6	11.91	27.87	14,951.7	8.78	34.61

- NOTE: 1) ~~Figure above is in average term.~~
- 2) Total Cultivated Area = Land Use of Farm holding
exclude Housing Area and Woodland.
- 3) Agriculture Value Added exclude Forestry's Value Added.
- 4) Non-Rice-Food Crops include Coconut, Sugarcane, Maize, Sorghum, Groundnut, Mungbean, Soybean, Cassava, Sesame, Onion, Garlic, Chili and Bud Pepper, Vegetables and Fruits.

- SOURCE: 1) Office of the National Economic and Social Development Board, National Income of Thailand, 1961-1976.
- 2) Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Agricultural Statistics of Thailand, 1961-1976.

TABLE 1.3

GROWTH RATE AND SHARE OF AREA AND VALUE ADDED OF NON-FOOD CROPS

Period of Time	Area			Aalue Added		
	Magnitude (Hectare)	Growth Rate (%)	Share in Total Cal- culated Area (%)	Magnitude (Million Baht in 1962 Prices)	Growth Rate (%)	Share in Agricul- ture Value Added (%)
1961-1966	1,339,867.9	15.22	13.72	3,132.3	10.26	12.65
1967-1971	1,562,336.0	1.81	15.56	4,104.4	2.33	13.52
1972-1976	2,035,099.4	-2.13	13.04	4,985.6	1.81	13.16

- NOTE: 1) Figure above is in average term.
- 2) Total Cultivated Area = Land Use of Farm holding exclude Housing Area and Woodland.
- 3) Agriculture Value Added exclude Forestry's Value Added.
- 4) Non-Food Crops include Rubber, Casterbean, Tobacco, Cotton, Kenaf, Kapok, Ramie, Jute and Other Non-food Crops.

- SOURCES: 1) Office of the National Economic and Social Development Board, National Income of Thailand, 1961-1976.
- 2) Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, Agricultural Statistics of Thailand, 1961-1976.

TABLE 1.4

GROWTH RATE AND SHARE OF VALUE ADDED OF LIVESTOCK

Period of Time	Magnitude (Million Baht at 1962 Prices)	Growth Rate (%)	Share in Agriculture Value Added (%)
1961-1966	3,234.2	2.92	13.23
1967-1971	3,991.1	5.19	13.15
1972-1976	5,612.6	7.09	14.72

NOTE: 1) Agricultural Value Added = Crops' + Livestock's + Fisheries' Value Added.

2) Figure above is in average term.

SOURCE: Office of the National Economic and Social Development Board, National Income of Thailand, 1961-1976.

TABLE 1.5

PRODUCTION AND VALUE ADDED OF FISH

Period of Time	Total Catches (ton)	Value Added (Million Baht at 1962 Prices)	Growth Rate (%)	Share of Fishery's Value Added in Agricul- ture Value Added (%)
1961-1966	501,963.5	1,364.7	18.75	5.63
1967-1971	1,248,452.2	3,578.6	19.50	11.24
1972-1976	1,606,051.7	4,613.4	0.28	11.64

NOTE: 1) Figure above is in average term.

2) Agriculture Value Added exclude Forestry's Value Added.

SOURCE: Department of Fisheries Ministry of Agriculture and
Cooperatives.

The slow movement in rice expansion can be explained as a consequence of the ending of the surplus in paddy land area. It is this land surplus which propelled Thailand into the top rank among rice-exporting nations. With growing population, one would expect Thai farmers to begin intensifying rice production within the existing paddy land area. Two factors prevent this from happening:

- a. A low-price policy for rice pursued by the government.
- b. The availability of a great deal of upland areas opened up by the malaria-eradication programme.

These two factors therefore push rice farmers into upland crop production. In this, it turns out that much of the effort of the farmers went into food crops, e.g. maize, cassava and sugar-cane. Non-food crops played a sub-ordinate role throughout the period.

Most of the upland-crop production went largely into exports. It is the expansion in upland crops that fuelled Thailand's export expansion in the 1960's and 1970's and it is because Thailand is a major food exporter that its perception (or lack of it) of the food problem is quite different from most of the other less-developed countries.

Fisheries, particularly marine fisheries, shared the same experience with upland crop production, but more recently over-fishing has led to an abrupt half in the expansion of fisheries.

Livestock development is the one area of food and agricultural

product that closely responds to and is constrained by domestic demand conditions. There are two major developments that should be borne in mind:

a. The long-term and accelerating decline in the demand for animals (particularly water-buffaloes) for use as draught animals.

b. The growth of a large-scale animal feed industry since 1970 which have led to the growth of a more commercially-oriented system of livestock raising. This development is complete with chicken production and is emerging in swine production.

2. The Overall Policy Context

2.1 Objectives

In formulating its food and agricultural policy most Thai government would claim that they are guided by the following objectives:

a. They would desire to raise agricultural production as a means to raise farm income.

b. They would desire to raise the farm-gate price to producers, again as a means to raise farm income.

c. But they would also like to keep urban food prices low, so as to aid the urban poor.

d. They would also like to be able to earn more from agricultural exports so as to earn more foreign exchange.

These are four objectives which all governments have to pay lip-service to. In reality, only those objectives are relevant which can and will be clearly monitored, and when monitored, it must be done by the politically vocal groups. Judged by these two criteria, we can strike out all objectives save (c)

We can eliminate objective (a) because there is nobody to monitor government failures in developing agricultural production. Being a food exporting nation, a lack of concern with production does not carry any penalty for the government. After all, any short run fall in production can always be countered by drawing on the export surplus. Luckily no Thai government has as yet had to face a long-run chronic food deficit, thanks to the energetic Thai farmers.

Objective (d) has been generally overlooked again the Thai farmers have always come up with sufficient production to fuel a fairly rapid expansion in exports over the past two decades.

Objective (b) should be a key objective, as a fall in farm-gate price is easily monitored. However, in the instances when this objective has become a live issue, as for example during the Kukrit premiership, it has always lost out to objective (c), because the latter is monitored by a politically far more vocal group.

Nonetheless, objective (b) is a useful totem for the politician. The stark contrast between this objective and objective (c) is usually

obfuscated by attributing the depressed farm-gate price to evil middlemen. It is in this context that the very widespread prevalent views concerning the middlemen should be born in mind.

In what follows, we shall assume that urban considerations are dominant in the formation of government policies, and that in fact the main aim of governments is to "stabilize" urban prices. This is true for policies on rice, maize and livestock among the commodities to be examined. The sole exception is in sugar, where because of a more active and politically organized pressure group from the supply side, government policies on sugar have been more even-handed, with a bias, if anything towards the producers.

2.2 Instruments

Again as a habitual exporter, the logical point at which the government would exert pressure most efficient would be at the export point. The actual methods used vary between quantitative controls as in rice and maize and export taxes as in rice and sugar.

The government did not make any attempt to interfere in internal marketing and procurement of food crops. (The government has had a strong impact in the marketing of only one non-food crop, tobacco. Where it has attempted to do so, as in early 1976 with the Kukrit scheme to set a guaranteed farm-gate price, it has failed.

The government has however, attempted to control the livestock trades as part of its attempt to control slaughtering. Again the results have been largely negative.

In sugar, the government tries to control sugar production and domestic trade in sugar. Again the results have been mixed. The attempts to control sugar production have always met with failure. Intervention in the domestic sugar trade is largely by imposition of price controls. These price controls in a sense convert the sugar industry into a cartel, with the government setting the price for the cartel. The cartel will work only insofar as the members (i.e. sugar-mills) want it to work. AS the government has no means to enforce its will, in particular, as it cannot control production, these attempts at price control have always met with failure unless supplemented by export policies.

In short, the Thai government's main policy instruments is the regulation of export trade, where it has departed from these classical instruments, it has seldom achieved its aim.

2.3 Actors

A chronic problem of economic policy-making in Thailand is the multiplicity of independently-acting units of government pressing forward in different directions. This is no different in the area of food and agriculture. There is nonetheless a pecking order among the various

ministries.

Because of the dominance of the urban price objective and the export instrument, the Ministry of Commerce emerges as the strongest among the government units having an impact on food and agricultural policies. In rice and maize it is the policy-making body. In sugar, it is somewhat subservient to the Ministry of Industry which controls the sugar-mills. Whilst the Ministry of Interior reigns supreme in the area of livestock, because of its regulations on slaughtering and internal movements of meat, the Ministry of Commerce even here exerts some influence through its regulation of the live animal export trade.

The Ministry of Agriculture and Co-operatives counts very little in this policy set-up. In order to be able to control events affecting the farmers more directly, it has established a Marketing Organization for Farmers (MOF). So far its role, except as fertilizer distributors, has been negligible.

A point that should be noted here is that policy discussions concerning food and agriculture in Thailand has been organized on a commodity by commodity basis. Even in a field such as livestock, there is very little discussion of the interrelations through consumption substitution of the various types of livestock, e.g. between swine and poultry or between livestock and non-livestock products, e.g. between lard and vegetable oil.

3. Policy on Specific Commodities (Out-puts)

3.1 Rice

Problems

- Stabilize general price level by suppressing domestic rice price
- Growth rate of rice production has been declining
- Drought in the Northeast, North, and some part of Central plain reduce total production and export down by approximately 1.5 million ton.

Policy Objectives:

The principle rice policy objectives in Thailand at the end of World War II was to buy a low price rice in the country and export to the Allies at zero price as war reparations.

Soon after the reparation payments ended the multiple exchange rate was used which was in effect a tax on rice exports and the rice exchange rate was kept particularly low.

Actually, the principle rice policy objectives of the Thai government is to control the volume of rice exports in order to make sure domestic supplies are adequate to maintain a desired Bangkok consumer price

level for rice. The objective of maximizing foreign exchange earning comes into consideration only after domestic supplies are assumed.

Instruments:

Before 1955 (Right after War time)

- Government Rice Office monopolize in buying rice in country and submit to the Allies as war reparations
- Multiple exchange rate as a source of government revenue.

After 1955

Five mechanisms have been used to control the volume of rice export and hence domestic rice price.

1. Export licensing and export targets or quota.
2. Export levy in form of an export tax rice premium.
3. Rice reserve requirement.

Among these three mechanism quotas, rice reserve requirement and rice premium are the most economically effective. The Ministry of Commerce has full authorization to adjust or change these. The following is the descriptive of each policy in brief. Quotas have been used during the time when domestic supply is short and are abolished with normal supply conditions. Actually, there is a quota restriction authorized by the Minister of Commerce on January 12, 1978. The quotas are distributed to private exporters who have been previously selected based on their

past performance.

Rice Reserved Requirement, established in 1962, is a mandatory sale by the exporter to government with a fixed proportion of rice of a specific grade for every tons of rice exported. The main purpose of rice reserve is to obtain a cheap source of rice for the government to sell in urban rice shops in Bangkok at a price below the current retail market price. The reserve requirement is usually suspended during the periods of surplus domestic supplies, when retail price are below what the government feels to be politically acceptable ceilings. The rice reserve ratio has been abolished from time to time but in 1977 (because of the drought), the ratios have been increased from 20 % in March to 40 % in July and lately to 50 % in November.

The rice premium is a fixed tax per ton of rice exported and vary with the grade of rice. Previously, the rice premium is used as a method of absorbing excess profits of private trader arising out of licensing system. But the premium is actually used as a policy instrument to control the domestic supply in order to stabilize the local price and as a big source of government income as well.

Apart from these policies for supporting consumer, Kukrit's government had initiated the floor price at the farm level. The farm price was set at 2,500 Baht/ton paddy equally to every region. However, this policy was never successfully implemented, and with the political

changes since then, has dropped out of the picture.

A final note about rice is to call attention to the rate of growth of the rice production and the previous and the actual rice policy. Due to the fact that the amount of cultivated land cannot be further expanded, the amount of fertilizer used is very low, the growth rate of Thai rice production is declining.

If the government does not change the policy of protecting consumer, the relative price ratio of rice and fertilizer will not be favorable enough to induce farmers to use more fertilizer and hence increase their yield. For how many years can Thailand still export their rice surplus?

3.2 Sugar

Problems :

One major problem of sugar is excessive production. For many years, government policies were designed to solve the short run problems but not the long run ones. Supporting sugar cane farm price and export subsidy, (in order to clear domestic market), would induce the farmer to grow more than the amount that the market needs. And since, there are very many political interests involved in term of prices hence the amount of production has been distorted.

Policy Objectives :

As mentioned above that government has made a policy to solve the short run problems, the obvious policy objectives are to clear the domestic market and stabilize domestic price. At times when there is a domestic surplus, in order to keep the domestic price high, the government subsidises export. But whenever, there is a shortage on the world market and the world sugar price is high, the government imposes an export tax (called sugar premium) in order to stabilize the domestic price. A policy to subsidise consumers and producers at the same time was also introduced in Kukrit's regime. The government set the farm floor price at 300 Baht/ ton and the consumer ceiling price at 5.50 Baht/kg., which mean government had to subsidise the sugar mills.

Crisis and Policy Instruments :

In 1961-1966, due to excessive world sugar production, the world price of sugar was very low. Eventhough, Thai sugar production was over the domestic demand, Thai government wanted to keep the domestic price higher than the world price, (in order to help the producers). It set a very high import tariff for sugar and finally banned all sugar import. Moreover, she granted an export subsidy for every ton of sugar exported in order to clear the market. This particular policy finally induced the sugar cane farmers to expand their sugar cane production. It was the short run policy which cause the long run problem of excessive of production.

From 1966 to 1971, the government tried to expand the foreign market in order to absorb the increasing of domestic production. She

managed to obtain a small scale of the U.S. quota.

In 1973 to 1974 (Sanya's regime) due to the world food shortage in 1972, the world price of sugar was very high. The government (Ministry of Commerce) impose an export tax (called sugar premium) in order to stabilize the domestic sugar price. Since the sugar mills had practically made an advance contract with the sugar cane farmer, the increase in world price would make an excessive profit to the sugar mills. The government, then, claimed that the windfall gain should go to the government revenue in term of sugar premium. The government also set the domestic consumer ceiling price at 4.50 Baht/kg.

In 1975 (Kukrit's regime), the world sugar supply became excessive again. The world price declined. In order to support the farmers as well as the consumers, government set floor price for sugar cane at farm level at 300 Baht/ton and set a ceiling retail price for sugar at 5.50 Baht/kg. By doing so, the government has to spend 441.6 million Baht supporting the sugar mills at the rate 92 Baht per sack.

In 1976 (Seni's regime), holding the same objective as the previous government, the new government subsidized export at the rate 200 Baht/ton for the sugar which could be export at the price below 4,800 Baht/ton. But, if the export price is over 6,670 Baht/ton the margin which is over 6,670 Baht will be subject to pay 100 percent tax (called premium). The effect of such policy was to maintain the sugar cane farm price at 300 Baht/ton.

Since 1961, the government operated in the domestic sugar market in a fashion counter to the world price cycle. When the world price is low, the government will try and raise domestic price * and use the revenues to subsidize exports. When the world price is high, it will tax exports to maintain domestic price at the lower level. In terms of effectiveness, however, there is an asymmetry. It is easier to keep domestic price low when world prices soar than the other way round. The latter requires production restraint. This proves impossible for the government. Nevertheless, the temporary effectiveness of government's attempt to keep prices up provide a magnet for new sugar-mills to enter the industry. The consequence is the almost continuous expansion of the sugar industry until it has reached the present status.

Thailand has joined and left the International Sugar Organization (ISO) many times. Recently (December 1977), the Thai government has again decided to join ISO. The benefit for joining such organization is to get the export quota equal to the average of three years past performance. Actually, Thailand gets 1.2 million ton at the price 13¢/lb. However, the amount of export quota that Thailand gets will be adjusted by 5 percent for every 1 ¢ per lb. change in prices.

The actual government (in 1977-78) has no policy of supporting sugar cane farm price but the farm price is still officially

* The domestic price is usually kept high either by a cess on production (as in 1964-1965) or by imposing restraints on domestic production.

TABLE 3.1

GROWTH RATE OF SUGARCANE CULTIVATED AREA, FARM PRICE, AND PRODUCTION

Year	Cultivated Area		Farm Price		Total Product		Year Rai
	Magnitude (rai)	Growth Rate (%)	Magnitude Baht/ton	Growth Rate (%)	Magnitude Million Ton	Growth Rate (%)	
1965/66	532,000 (85,120) ¹	-	102.30	-	3.045	-	5.81
1966/67	361,379 (57,821)	-32.0	160.18	56.57	2.535	-16.7	7.01
1967/68	447,777 (71,644)	23.9	203.65	27.14	2.379	-6.2	5.25
1968/69	646,243 (103,399)	44.3	150.97	-25.87	4.399	84.9	6.29
1969/70	738,583 (118,173)	14.3	136.22	-9.77	5.102	16.0	6.37
1970/71	861,806 (137,889)	12.6	144.90	6.37	6.586	29.1	7.64
1971/72	872,494 (139,599)	1.2	150.45	3.83	5.926	-10.0	6.79
1972/73	1,133,439 (181,350)	29.9	179.72	19.45	9.513	60.5	8.39
1973/74	1,616,304 (258,609)	42.6	199.64	11.08	12.694	33.4	8.09

TABLE 3.1 --continued

Year	Cultivated Area		Farm Price		Total Product		Year Rai
	Magnitude (rai)	Growth Rate (%)	Magnitude Baht/ton	Growth Rate (%)	Magnitude Million Ton	Growth Rate (%)	
1974/75	1,935,253 (309,640)	19.7	298.66	49.60	13.109	3.3	6.77
1975/76 ²	2,387,300 (381,968)	23.4	301.91 ³	1.09	19.099	45.7	8.00

NOTE: 1. Unit in hectare (1 rai = 0.16 hectare)
 2. A primary data
 3. The official floor price in this year is 300 Baht/ton

SOURCE: Ministry of Industry

at 300 Baht/ton. This is because the drought have limited the supply of sugar cane.

The sugar industry in Thailand is very much involved with politics. Many sugar mills are run by the politically powerful families. The sugar cane farmer is in general much richer and more politically organized than the rice farmer. Thus, many policies have been pushed which favor the sugar millers and sugar cane farmers. Eventhough, governments seem to understand the problem of over-production, they still impose the policies which give incentive to the farmers to expand their cultivated land and production.

3.3 Maize

Problems and Background:

Maize exports constitute the second or third most important category in Thailand's foreign trade account. About 2.5 to 2.7 million tons of maize were produced and about 90 % of them are export to Japan, Taiwan and some neighboring countries and only 10 % are consumed domestically (although this export proportion is declining). This places Thailand fourth or fifth among maize exporters with about a 5 % share of the international maize market.

In general Thai government never imposed any policy to the maize economy. Until 1962, when Thai government conclude annual

bilateral export agreements with Japan, the largest importer which share almost 50% of the total amount of Thai export, and recently with Taiwan (share almost 20% of the total export). The agreements specified both price formulas and export quantities for maize exports to these two countries. The price formulas are based on price quoted on the Chicago futures market and export quantities are distributed to many private firms as a quota.

Policy Objective:

Trade Officials, Ministry of Commerce, believes that free trade in this commodity generally led to disorderly trade. The objectives of the export agreement are:

- To "stabilize" the trade of Thai maize.
- To stabilize export quantity and prices.
- To assure the export quality and prevent breach of contract.

Development and Method of the Export Agreement:

In 1961 to 1965, government promulgated a new law requiring all exporters to obtain permission from the Department of Foreign Trade (DFT), Ministry of Commerce, before exporting and also set a minimum export price and quality standards. In 1962, the Government introduced an export quota based on the past export performance. However, breach of contract still occurred. During this time, some agreement was reached between DFT and Japan in term of advance price setting and quantity assurance.

A year to year annual contracts between Thailand and Japan was first settled. The main contexts are to set a fixed price (using Chicago future market prices quoted as a basis) and an annual fixed amount of trade. A trade committee in Thailand composed of 3 government officials from Ministry of Commerce, 5 or 6 persons from among the private exporters. The representatives of the private exporters have to be members of the Maize Exporter Association. This committee negotiates and concludes the agreements firstly with Japan and more recently with Taiwan.

Government has distributed the total quantity to be exported to Japan as quotas to private exporters. The rule of distributing is that only 70 percent of a firm's quota is based on previous export performance and the other 30 percent is based on an equal distribution basis. However, no firm can have a quota greater than 5 percent of the total quotas allocated each year.

Criticism:

Even though, many trade officials claim that the export quota system is the best device to stabilize price and to prevent the monopoly as well as preventing breaches of contract. There are some argument against this system. One major argument, which Chaiwat Konjing has made, is that the actual quota system (70% on past performance) make the large exporters suffered. This is because their market shares gradually declined each year as a result of the large and ever-increasing number of small exporters moving into the maize business in order to obtain export quota rights. As large number of small firms enter the market,

the tendency toward more market fragmentation is well established. This would cause the diseconomy of small size and ever-increasing ocean freight rates. To overcome these diseconomies exporters resort to two devices: the first is to transfer the quotas among firms which may contribute to the problem of local prices. These quotas are sold ranging from US\$2 to US\$8 a ton. This is a windfall gain for the quota holders, who did nothing at all to earn it. Clearly such a system leaves something to be desired.

The second method is for some firms who want more of quotas to establish dummy companies to obtain new quota allocations.

Konjing concluded that "Thai maize policy is operated so as to protect the interests of small exporters and the middlemen at the expense of the domestic maize producer and suppliers. Such policy is costly and a reflection of the unwillingness of many Thai commodity merchants and government officials to rely on free trade" (Konjing, pp. 140-141)

The final criticism is being made on the speculation of the maize rural wholesaler. Quoting price from Chicago future prices cause the rural wholesaler to hold maize as long as the storage cost is less than the export price spread. Exporters have a difficulty to fulfill their agreement since all maize is held by rural wholesaler. The latest news which the government takes action in this problem is that to let the export trade run freely.

3.4 Livestock (Cattle, Buffaloes and Swine)

Background and Problems:

Almost all cattles and buffaloes until recently are agricultural working animal, and raised on rice farms. Only 5 percent of the cattles and buffaloes are commercially produced for consumption purpose. The rest of them begin as working animals and only when their working life is over are they need for human consumption. All of the swine are raised for human consumption. About fifty percent of pork supplied to the market come from large commercial farms. The rest of them are raised in small farms which do not raise swine as a main business.

Table 3.2 shows number of cattle, buffalo and hog population. The percentage growth rate of these three animals are not high. Moreover, the statistics here show that their populations have decreased in some year. This implies that the animals/human population ratio has been deteriorating. One may hypothesize that this is because the human meat consumption is increasing. Since the human population are consistantly increasing at the rate 3% per year. And if there is no effective policy to increase the animals population as it was, the long run prospect of Thai meat consumption will not be very bright.

F.A.O. statistic shows that the meat per capita consumption of Thailand in 1963 was 13.5 kg./year (buffalo 2 kg., pork 6.2 kg., poultry 3 kg. and others 2.3 kg.) Urban per capita annual consumption of meat and egg was 27.5 kg. and rice was 90 kg., while the rural per capital annual consumption for meat and egg was 10.8 kg. and rice was

TABLE 3.2
CATTLE, BUFFALO AND HOG POPULATION

Year	Cattle		Buffalo		Hogs	
	Number (Heads)	Net Change (%)	Number (Heads)	Net Change (%)	Number (Heads)	Net Change (%)
1961	3,542,415	-	4,963,582	-	3,286,457	-
1962	3,594,555	1.47	5,101,055	2.76	3,391,739	3.20
1963	3,624,359	0.83	5,147,034	0.90	3,284,334	-3.16
1964	3,752,913	3.54	5,220,249	1.42	3,493,315	6.36
1965	3,887,534	3.58	5,297,051	1.47	3,718,238	6.43
1966	4,028,553	3.62	5,377,534	1.52	3,960,473	6.51
1967	4,176,320	3.66	5,461,794	1.56	4,221,517	6.59
1968	4,290,256	2.72	5,549,933	1.61	4,503,005	6.66
1969	4,451,590	3.76	5,642,057	1.66	4,806,746	6.74
1970	4,666,969	4.83	5,734,500	1.63	5,132,244	6.77
1971	4,460,230	-4.42	5,574,176	-2.79	3,883,870	-24.32
1972	4,484,962	0.55	5,361,338	-3.81	3,982,133	2.53
1973	4,335,226	-3.33	5,941,683	10.82	4,460,372	12.01
1974	4,432,385	2.24	5,946,715	.08	3,515,559	-21.18
1975	4,310,655	-2.74	5,441,674	-8.49	3,211,414	-8.65
1976	4,546,813	5.47	5,678,678	4.35	3,104,341	-3.33

SOURCE: Division of Agricultural Economics, Ministry of
 Agriculture and Cooperatives, Agricultural Statistics
 of Thailand, Crop Year 1972/1973 and 1975/1976; pp. 73, 77.

178 kg. (F.A.O., Livestock Development Survey, Thailand). However, the statistics have shown only the cross section consumption pattern arising from both income differences and taste differences between rural and urban people. The above hypothesis of increasing in human meat consumption is still not proven. The effect of income, taste, population growth, and others to human per capital meat consumption should carefully be investigated. To answer this, further research should be conducted.

Due to the fact that only a small percentage of livestock come from large and commercial farm, the actual marketing system create an inadequate time, form and place utility. Animals suffer considerably bruising and other injuries in transit because of the absence of proper care as much of the transit is illegal, meat packaging and storaging are in general still improper.

The problems of unsanitary slaughterhouse are serious, most slaughterhouse, except two modern are in Bangkok and Ban Pong, did not only lack important facilities but also poor in general condition and existing facilities from a sanitary standpoint. (Hathamart, p. 3) An attempt to solve this problem have been to try to centralize (i.e. monopolize) slaughtering. This does not help, however, the only result seems to be a vast increase in illegal slaughtering. Most of the cattle, buffaloes and hogs have been slaughtered by illegal or unauthorized slaughterhouses. "It has been estimated that an illegal slaughter accounts for as high as 75% of the total volume of actual slaughtering." (Hathamart, p. 10).

For an economic policy viewpoint, there is no obviously specific national policy to livestock except (i) to control slaughtering and (ii) to make the price as low as possible, both objectives being in most instances quite contradictory. As in other commodities, the government imposed policy only to solve particular short run problems. In general, the government allows each changwat (province) to set their own pricing policy. The maximum retail price (ceiling price) of each changwat is set by the local price commission composed of the officers from Ministry of Interior (who controls the slaughterhouse) and from the Ministry of Commerce. In order to make these legal policies successful, the government has not permitted meat delivery across changwat.

Bangkok is the largest meat market in the country. Even 1942 to now, the marketing system in Bangkok has taken on two distinctive features, a monopoly system and free trade system. A monopoly is imposed on the Bangkok meat market, ostensibly to maintain sanitary standards on slaughtering. At one time the slaughterhouse procured and marketed its own pork and thus could extend its monopoly upstream and downstream. There has since been a change, the slaughterhouse is to provide custom service for all would-be traders. Nevertheless the market is still highly imperfect and many traders prefer slaughter illegally outside Bangkok and "smuggle" it to sell to a Bangkok retailer. The widespread illegal slaughtering has rendered totally meaningless the original aim of controlling sanitary conditions by centralizing slaughtering.

Declining in animals/population ratio is due to many factors e.g. growth rate of animals population less than growth rate of human population, increasing in people income, and especially suppressing in the livestock prices. This would cause the problem to the Livestock Development Department (LDD), Ministry of Agriculture in expanding the livestock production.

3.5 Fisheries

Background and Problems:

Thailand is one of the leading Southeast Asian countries which has been able to produce substantial amount of fishes for her own consumption and for export.

Fisheries have provided employment for nearly 250,000 people along the eastern and western coast of Thailand. It has contributed about 3% to the Gross National Product for the period of 1971-1975 and about 10% of the GNP originating from the agricultural sector.

Fish is an important source of animal protein in the regular diet of the Thai people. About 50% of animal protein derived from fish. While the production of fish has been somewhat increasing, the domestic consumption of fish has been declining at about 6% per year. Thus, one of the primary objectives of the current fisheries development program is to maximize the utilization of catches, in order to provide an average regular diet of 20 kg. of fish per capita (which is the target in the fourth national plan). Nowadays, the proper utilization of food fishes has not been attained.

The production of fish in Thailand can be classified in 2 types: trash fish (trawl by-catch) and non-trash fish. Trash fish contributes more than 50% of total catch but it is mostly used for animal feeding i.e. as the raw material for fishmeal industry and as the animal food for catfish. Incidentally, the catfish farmers cannot compete with the fishmeal industry in demand for trash fish since they have to pay transportation cost and the trash fish landings have declined since 1973, hence its price increased. Thus, the production of catfish during 1973-1975 was decreased significantly. Therefore, a source of human consumption food has gone down.

For non-trash fish, especially pelagic fish e.g. sardinella, russel's scad, has increased in the quantity of landings. However, it is not much consumed by Thai people. Consequently, the supply of food fish for domestic consumption is less than it should be.

In the meanwhile, it is expected that the supply of food fish, especially demersal fish, will decline in the future, due to 2 main factors:

1. The result of the establishment of exclusive economic zones of the coastal neighboring countries, Thailand is likely to loose between 400,000 tons and 600,000 tons of annual catch from fishing grounds exploited by its fishing vessels at the present time. Also, it will affect the reduction of foreign currency by 2,000-3,000 million baht. (Department of Fishery, Brief on Fisheries Situation in Thailand, p. 1).

FISH UTILIZATION, 1967-1975

Year	Total Catch		Food		Feed	
	(Ton)	(%)	Marine (%)	Freshwater (%)	Marine (%)	Freshwater (%)
1967	847,443	100	73.81	9.98	16.12	0.09
1968	1,089,303	100	77.25	7.81	14.91	0.03
1969	1,270,034	100	63.50	11.35	25.12	0.03
1970	1,448,404	100	69.79	7.76	22.43	0.02
1971	1,587,047	100	72.42	7.27	20.21	0.10
1972	1,679,540	100	70.37	7.81	21.80	0.02
1973	1,678,901	100	56.85	8.39	34.75	0.01
1974	1,510,466	100	52.11	10.52	37.36	0.01
1975	1,555,300	100	52.16	10.32	37.51	0.01

SOURCE: Department of Fisheries, Ministry of Agriculture and Cooperatives.

2. The fishery policy has no control in the number of vessels used in fishing activity. The country's fishing fleet is therefore growing at a very high rate. At present, fishing vessels are being built without any prior clearance or permit. Once the construction is completed, the owner applies for a navigation certificate from the Harbour Department and then for fishing gear license from the Department of Fisheries. Insurances are automatic. According to the increase in fishing fleet, the aquatic resources were over-exploited and the amount of them decreased substantially.

To alleviate the deficiency of the food fish supply the Department of Fisheries formulates a program for expanding the utilization of fish for direct human domestic consumption. The target is to convert an additional quantity of 250,000 tons now used for animal feeding purposes to food fish by 1985. Approximately 150,000 tons of small pelagic fish and 100,000 tons of trash fish should be made available in suitable form to consumer on an annual basis. Additionally, to make the best use of freshwater fish is the proper objective.

In response to the announcement of 200 miles exclusive economic zones, Thailand has not proclaimed an exclusive economic zone but has chosen to take a pragmatic approach in a situation over which she has little control. She has been negotiating actively with some coastal neighboring states for quite sometime and has already concluded a number of fishing agreements and joint-venture arrangements, since Thailand has an abundance of fishing vessels, modern equipment and also specialized

and dedicated labor. Moreover, it is considered that demersal fishery resources in the inshore areas and particularly in the Gulf of Thailand are already fully exploited but on the other hand in various areas of the South China Sea in water under the jurisdiction of neighboring countries, significant potential yields are still not fully exploited and will remain underexploited for some years to come.

Finally, the establishment of a new licensing scheme is now proposed by F.A.O., in order to control the number and capacity of boats so as to make it compatible in the longer run with the fishery resources available. The continuation of uncontrolled entry into the fishery could result in an economic collapse of the industry thus bringing adverse economic and political repercussion for the country.

Policy & Institutional Arrangements:

Policy: The fisheries policy, is generally carried out by the Department of Fisheries through the Ministry of Agriculture and Cooperatives and is consistent with the national economic and social development plan. If the fisheries policy is concerned with the other neighboring countries i.e. the problem of announcing the 200 miles exclusive economic zones, the Ministry of Foreign Affairs and National Economic and Social Development Board will be in cooperation.

Institutional Arrangements: The government agencies concerned directly with fisheries include the Department of Fisheries, Fish Marketing Organization and the Cold Storage Organization.

Other agencies also impinging on fishery matters are:

1. The Forestry Department: The development of large scale brackish water aquaculture will involve large areas of mangrove swamp presently under the jurisdiction of the Forestry Department.

2. The Irrigation Department: In the development of dams and reservoirs and of irrigation systems, there is need for cooperation between the Irrigation and Fisheries Department.

3. The Harbour Department which has jurisdiction over crewing, licensing and inspection of vessels.

4. The Ministry of Communication, which regulates ship-to-ship and ship-to-shore communication.

5. The Ministry of Industry regulates in manufacturing and process plant industry.

4. Policies on Inputs

4.1 Fertilizer

Background and Problems:

Both organic fertilizer and inorganic fertilizer are used in Thailand. Organic fertilizers are not very popular among farmers and constitute only less than 3 percent of total fertilizer usage. (Mano-lee-hakul and others, p. 15). All organic fertilizers are produced by one government "plant" located in Bangkok which has a capacity of about 20,000 ton/year. Chemical fertilizers constituted a very high share of

the farmer usage. At first, only Nitrogen fertilizer were used but lately a mixed fertilizer (N, P, K) are popular. Therefore, the following description will pay more attention to the Chemical fertilizers and ignore the role of organic fertilizers.

Table 4.1 shows that almost all of the fertilizer are used in agricultural sectors. The annual percentage growth rate of agricultural usage is not consistantly high as the annual percentage growth rate of the industrial usage. The table also shows that more than 80 percent of total fertilizer usage are imported and only less than 20 percent are produced domestically.

Before the time when mixed fertilizer became popular, the domestic production of Nitrogen fertilizer had been a monopoly, because in order to support the sole domestic producer, the government banned all Nitrogen fertilizer import in 1964. However, since the monopoly firm could not supply the fertilizer as much as the domestic demand, the government allowed the same firm to monopolize all Nitrogen fertilizer imports. Many criticism have been made that these policies have strongly depressed the rice production and distorted an allocation of resources.

Obviously, the domestic price of fertilizer during the monopoly time was much higher than the world price. This would effect the fertilizer usage in Thailand to be as low as 2.4 kg/Hec. in 1964 and 10.7 kg/Hec. in 1973. Table 4.2 shows the comparison of fertilizer usage among some selected countries and among ASEAN countries. Thailand has

TABLE 4.1

PRODUCTION, IMPORT AND USAGE OF FERTILIZER IN THAILAND

Year	Import ¹		Domestic Production ²		Industrial Usage ³		Agricultural Usage ⁴		Total Usage Within the Country ⁵		Import as % Share of Total Usage	Domestic Production as % Share of Total Usage
	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)		
1962	65,598	-	3,884	-	360	-	69,122	-	69,482	-	94.41	5.59
1963	95,749	+45.96	9,591	+146.94	420	+16.67	104,992	+49.25	105,340	+51.89	90.90	9.10
1964	104,811	+9.46	12,775	+33.20	1,080	+157.14	116,594	+11.05	117,586	+11.63	89.14	10.86
1965	83,305	-20.52	11,029	-13.67	1,280	+18.82	93,144	-20.11	94,334	-19.77	88.31	11.69
1966	131,408	-57.74	20,293	+84.00	1,550	+21.29	150,151	+61.20	151,701	+60.81	86.62	13.38
1967	206,459	+57.11	36,187	+78.32	2,035	+31.29	240,611	+66.25	242,646	+59.95	85.89	14.91
1968	248,860	+20.54	28,635	-20.87	2,625	+28.89	274,872	+14.24	277,495	+14.36	89.68	10.32
1969	248,217	-0.26	20,049	-29.98	3,402	+29.70	264,864	-3.64	268,266	+3.33	92.53	7.47
1970	248,401	+0.07	45,420	+126.54	4,102	+20.58	289,719	+9.38	293,821	+9.53	84.54	15.46
1971	233,404	-6.04	49,855	+9.76	6,010	+46.51	277,249	-4.30	283,259	-3.59	82.40	17.60
1972	388,322	+66.38	43,760	-12.03	8,105	+34.86	427,987	+54.37	432,082	+52.54	89.05	10.95
1973	395,029	+1.72	39,236	-10.34	9,051	+11.67	395,300	-7.64	434,265	+0.51	97.76	2.24

TABLE 4.1 --continued

Year	Import ¹		Domestic Production ²		Industrial Usage ³		Agricultural Usage ⁴		Total Usage Within the Country ⁵		Import as % Share of Total Usage	Domestic Production as % Share of Total Usage
	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)	Magnitude (Ton)	Growth Rate (%)		
1974	338,586	-1.63	48,065	+22.50	10,107	+11.67	376,544	-4.74	386,651	-10.96	87.57	12.43
1975	425,538	-9.51	127,286	+164.82	13,720*	+35.75	540,086	+43.43	552,824	+42.98	76.98	23.02
1976	621,024	+45.94	153,592	+20.67	18,625*	+35.75	755,991	+39.97	774,616	+40.12	80.17	19.83

1 - Department of Customs

2 - Calculated from domestic production firms

3 - Division of Agricultural Economics, Ministry of Agriculture & Cooperatives

4 - Calculated from import and domestic production - industrial usage (in reality, there should be some portion of fertilizer remaining in the stock but, since there is no record of such quantity and we expect it to be small, the total fertilizers are assumed to be used up every year)

5 - Calculated from import + domestic production

* - Estimated

SOURCES: Manoleenakul, P. and others, Fertilizer, a Thai Farmers Bank report, 1978.

TABLE 4.2

RATE OF FERTILIZER USAGE IN SOME SELECTED COUNTRIES

Country	kg./hectare					
	1964	1965	1966	1967	1968	1969
Developing Countries	71.0	76.6	82.4	87.9	88.1	89.6
Developing countries	6.2	6.5	8.0	8.9	10.0	12.1
U.S.A.	55.3	63.0	71.4	77.4	77.0	76.3
Netherlands	556.8	580.8	610.2	626.2	622.4	691.4
Belgium	438.5	474.9	526.7	565.6	515.6	590.0
United of Soviet Socialist Republics	19.5	24.8	27.1	30.3	32.1	34.4
China Mainland	14.3	18.1	22.7	21.1	26.7	29.6
Japan	310.3	332.2	357.1	387.4	398.5	393.4
South Korea	166.1	149.1	184.6	210.4	206.3	231.3
Singapore*	171.4	192.3	192.3	192.3	250.0	250.0
Malaysia (West)*	20.3	24.5	30.3	29.9	31.2	41.9
Philippines*	10.9	13.7	12.8	13.8	16.8	22.7
Indonesia*	5.7	5.6	8.2	7.1	15.1	9.8
Thailand*	2.4	2.5	5.0	7.6	7.4	7.8

TABLE 4.2 --(continued)

Country	kg./hectare				
	1970	1971	1972	1973	1974
Developing Countries	94.6	95.7	100.4	105.9	94.6
Developing countries	13.3	14.8	16.9	18.1	18.8
U.S.A.	81.1	79.3	82.9	86.5	76.7
Netherlands	749.3	708.9	719.5	759.0	756.5
Belgium	578.6	578.0	599.5	617.7	577.3
United of Soviet Socialist Republics	40.3	44.8	49.3	54.1	58.8
China Mainland	33.5	34.7	38.1	45.0	44.6
Japan	372.6	333.6	362.8	407.1	374.9
South Korea	241.6	248.4	272.1	317.2	350.4
Singapore*	250.0	300.0	272.7	272.7	333.3
Malaysia (West)*	53.9	48.5	66.9	85.1	103.2
Philippines*	22.4	20.9	19.0	25.3	27.7
Indonesia*	13.1	12.4	24.5	25.7	29.5
Thailand*	6.0	9.3	11.6	10.7	13.4

* - The ASEAN Countries

SOURCES: FAO, Annual Fertilizer Review, 1975.

used the lowest amount of fertilizer per Hectare among the ASEAN countries. The figures also show that Thailand use fertilizer even less than an average of the usage of developing countries. Table 4.3 presents the average rate of fertilizer usage among 7 different crops in 1971. Rice uses very few amount of fertilizer comparing to the other crops.

Due to the Nitrogen fertilizer price was high, the farmer began switching to the use of more mixed fertilizer (N, P, K), in this way avoiding the ill effects of the protective policies. Table 4.4 shows the comparison of fertilizer price index and an agricultural price index during the monopoly time using 1967-1968 as a base year. The table shows that the fertilizer price index have been increasing at the rate higher than the agricultural price index. This would effect the ratio of fertilizer price index over the agricultural price index shown in the last column to be increasing.

In 1975, a domestic mixing plant was constructed. This mixing plant has lately asked for government protection by claiming that the domestic market is facing dumping from foreign producers. This is the point where government claim of setting 20 percent import tax to the imported fertilizer in January 1978. Many criticisms have been made that the actual government policy would lead to a re-establishment of a monopoly, to a misallocation of resource and a depression of agricultural production.

Apart from the policies on the production side, the Ministry of Agriculture also bought in 1975 fertilizers in a large volume,

TABLE 4.3

RATE OF FERTILIZER USAGE IN SOME SELECTED CROPS (1971)

Crops	(kg./rai)	
	Rate of Fertilizer Usage in Fertilized Areas	Rate of Fertilizer Usage in Total Cultivated Areas
Rice	6.56	4.04
Sugarcane	32.02	28.63
Rubber	138.62	2.89
Tapioca	47.95	5.75
Maize (annual feed)	8.38	--
Pine-apple	52.50	2.25
Soybean	24.75	--

SOURCES: Division of Agricultural Economics, Ministry of Agriculture.

TABLE 4.4

COMPARISON OF FERTILIZER PRICE INDEX AND AGRICULTURAL PRICE INDEX

Year	Fertilizer			Agricultural Product			Ratio of Fertilizer Price Index and Agricultural Price Index
	Fertilizer Price Index	Percentage Change from Base Year	Percentage Change in Each Year	Production Price Index	Percentage Change from Base Year	Percentage Change in Each Year	
1967-1968	100	--	--	100	--	--	--
1967	104.84	4.84	--	108.49	8.44	--	0.97
1968	99.60	0.40	5.00	100.94	0.94	-6.96	0.99
1969	94.76	4.24	4.86	90.57	-9.42	-10.27	1.05
1970	97.58	2.42	2.97	84.91	-15.09	-6.25	1.15
1971	93.15	6.85	4.44	73.58	-26.42	-13.34	1.27
1972	99.19	0.81	6.48	90.57	-9.43	23.09	1.09
1973	157.66	57.66	52.95	138.68	18.68	53.12	1.14
1974	241.94	141.94	53.46	174.53	74.53	28.85	1.39
1975	219.84	119.84	22.10	174.53	74.53	--	1.25

NOTE: Agricultural Production Price Index in 1975 is approximately equal to those in 1974.

SOURCE: Division of Agricultural Economics, Ministry of Agriculture and Cooperatives.

100,000 tons, and sold directly to the farmers. This policy was intended to help farmers to buy fertilizer at a low price and with credit. However, almost all of the credit turned out to be non-recoverable. Also, the government bought the fertilizers when the price trend is declining. Signing the contract at a fixed price but for future delivery, the government lost. Furthermore, the administrative cost of selling fertilizer directly to farmers is very high. Many commentators at the time concluded that this programme is a political one and not economic.

ASEAN Fertilizer Project:

The ASEAN countries have agreed on a joint fertilizer project which assigns Indonesia and Malaysia to produce Nitrogen fertilizer. The other countries will import from these two. The details of the programme are as follow:

Investment: This is to be a joint venture between the producer countries and the importing countries. Sixty percent of the total investment is put in by each producer country and the remaining 30 percent are distributed to the other 3 countries equally at 10 percent each. Thailand seems to accept this joint venture and plans to distribute 2/3 of her 10 percent share of the total investment to the private sector.

Marketing and Pricing: The countries member are asked to set an import tariff of fertilizer for non-ASEAN countries. Some countries have proposed a ban on all fertilizers imported from non-ASEAN countries. However, agreement on this point has not so far been reached. For the

pricing system, the producer countries propose to set a price range (maximum and minimum price) of fertilizer. This is again still in the negotiating stage.

Production: The argument at this stage is whether the importing countries should produce some of their own fertilizers or not. No agreement has been reached.

What are the benefit and cost we will have from joining the ASEAN project and what would the effect be on the domestic price of fertilizer? These two questions have still not been answered. This is still open for further research.

4.2 Irrigation

Background and Problems:

Table 4.5 shows number and share of irrigated area in 6 regions. The figure in 1976 shows that the largest percentage share, more than 33%, of irrigated area is in the Central Plain. The second and third largest which is about 18% and about 16% are in the West and the North respectively. The regions where they are the two lowest irrigated share are in the Northeast (about 10%) and in the South (about 6%). The percentage growth rate of irrigated area for the whole kingdom is not consistently equal. Some years the rate has gone up to about 8% but in some other years the rate has gone down to less than 1%.

Table 4.6 shows the percentage of irrigated area to the total

TABLE 4.5

NUMBER AND SHARE OF IRRIGATED AREAS BY REGION

(Thousand of Rais)

	Central	West	North	East	North- East	South	Whole Kingdom	
							Magnitude	Growth Rate
1961	2,142.3 (33.1)	1,117.0 (17.2)	531.2 (8.2)	1,601.5 (24.7)	901.2 (13.9)	187.6 (2.9)	6,480.7 (100)	
1962	2,272.3 (33.2)	1,150.8 (16.8)	599.2 (8.8)	1,638.0 (24.0)	910.1 (13.3)	269.6 (3.9)	6,840.0 (100)	5.54
1963	3,896.6 (43.6)	1,321.7 (14.8)	795.2 (8.9)	1,703.0 (19.0)	957.6 (10.7)	269.6 (3.0)	8,943.7 (100)	3.76
1964	4,538.5 (47.1)	1,321.7 (13.7)	795.2 (8.3)	1,703.0 (17.7)	980.2 (10.2)	302.2 (3.1)	9,640.8 (100)	7.79
1965	4,538.5 (46.5)	1,395.7 (14.3)	795.2 (8.1)	1,721.5 (17.6)	990.2 (10.1)	322.2 (3.3)	9,763.3 (100)	1.27
1966	4,538.5 (46.4)	1,395.7 (14.3)	810.2 (8.3)	1,721.5 (17.6)	1,003.9 (10.3)	322.2 (3.3)	9,792.0 (100)	0.29
1967	4,538.5 (46.1)	1,395.7 (14.2)	863.1 (8.8)	1,721.5 (17.5)	1,003.9 (10.2)	322.2 (3.3)	9,844.9 (100)	0.54
1968	4,538.5 (46.0)	1,395.7 (14.1)	863.1 (8.7)	1,721.5 (17.4)	1,019.2 (10.3)	339.2 (3.4)	9,877.2 (100)	0.33
1969	4,538.5 (43.1)	1,395.7 (13.3)	1,463.1 (13.9)	1,721.5 (16.3)	1,044.2 (9.9)	339.2 (3.2)	10,534.2 (100)	6.65
1970	4,538.5 (42.8)	1,395.7 (13.2)	1,463.1 (13.8)	1,721.5 (16.2)	1,101.2 (10.4)	356.2 (3.4)	10,613.2 (100)	0.75
1971	4,538.5 (41.8)	1,395.7 (12.9)	1,737.1 (16.0)	1,721.5 (15.9)	1,101.2 (10.1)	363.2 (3.3)	10,859.2 (100)	2.32
1972	4,538.5 (39.1)	1,847.5 (16.0)	1,885.1 (16.2)	1,721.5 (14.8)	1,101.2 (9.5)	525.9 (4.5)	11,621.7 (100)	7.02

TABLE 4.5 --continued

(Thousand of Rais)

	Central	West	North	East	North- East	South	Whole Kingdom	
							Magnitude	Growth Rate
1973	4,640.4 (36.7)	2,307.3 (18.3)	2,190.4 (17.3)	1,856.3 (14.7)	1,124.0 (8.9)	532.9 (4.2)	12,651.3 (100)	8.86
1974	4,650.5 (36.4)	2,307.5 (18.1)	2,237.6 (17.5)	1,856.3 (14.5)	1,144.0 (9.0)	567.7 (4.5)	12,768.6 (100)	0.93
1975	4,650.0 (35.6)	2,591.8 (19.8)	2,256.2 (17.3)	1,856.3 (14.2)	1,145.6 (8.8)	567.7 (4.3)	13,073.0 (100)	2.38
1976	4,650.0 (33.6)	2,591.8 (18.7)	2,271.0 (16.4)	2,193.3 (15.8)	1,333.1 (9.6)	814.2 (5.9)	13,858.9 (100)	6.01

SOURCE: Royal Irrigation Department, Ministry of Agriculture and Cooperatives.

TABLE 4.6

IRRIGATED AREAS AS % OF CULTIVATED AREAS (ALL TYPES), WET SEASON

(Thousand of Rais)

	1961	1962	1963	1964	1965	1966	1967	1968
Central	38.0	39.6	67.1	77.9	77.0	75.7	77.1	77.1
West	32.1	32.7	35.6	33.8	34.5	33.6	34.8	33.6
East	42.1	42.4	44.0	44.3	43.8	42.7	42.7	43.0
South	6.6	8.7	8.8	9.8	9.8	9.5	9.2	9.6
North	7.7	7.5	7.3	6.6	8.6	8.1	9.0	8.6
North-East	5.3	4.6	5.1	5.8	5.9	4.7	6.1	5.2
Whole Kingdom	16.6	16.0	20.8	22.7	23.3	20.6	23.2	21.6

TABLE 4.6 --(continued)

(Thousand of Rais)

	1969	1970	1971	1972	1973	1974	1975	1976
Central	75.5	75.8	77.2	82.3	83.6	84.3	82.7	83.5
West	33.2	34.0	34.5	45.9	58.6	60.2	61.0	66.3
East	41.0	40.0	41.5	43.5	44.1	44.8	42.1	49.2
South	9.6	10.3	9.7	13.9	13.8	14.6	14.6	24.7
North	12.1	11.9	13.1	16.1	16.7	16.9	16.2	18.8
North-East	4.6	4.8	4.6	5.6	5.1	5.9	4.5	5.1
Whole Kingdom	20.8	20.7	20.5	24.7	25.3	26.5	23.3	26.0

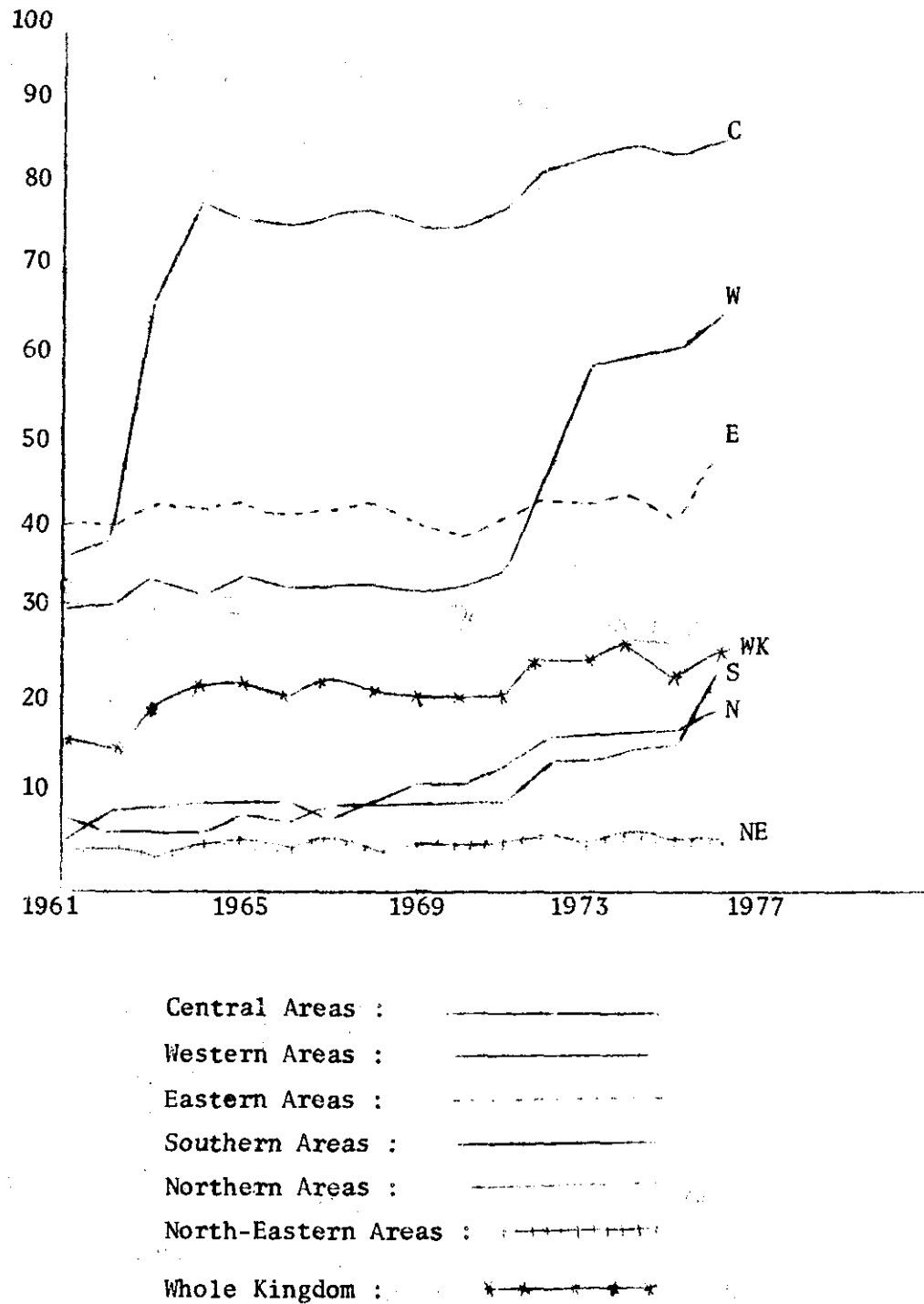
SOURCE: Royal Irrigation Department, Ministry of Agriculture and Cooperatives.

cultivated area in each region. About 26 percent of total cultivated land for the whole Kingdom in 1976 are irrigated. The figure also shows that more than 80% of the cultivated area in Central Plain are irrigated while only about 5% of the cultivated area are irrigated in the Northeast region. Figure 4.1 also demonstrates the result of the comparison of the percentage of irrigated area to the total cultivated area of each region. West and East regions have the percentage of irrigated area to total cultivated area higher than the average whole kingdom while South and North are lower than the average. However, this percentage for every-region except in the Northeast seems to be increasing since 1971.

It seems that the government has built irrigation system based on two constraints, financial constraint and technical constraint. The income redistribution impact of each project have been of less concern although there is some evidence to show that irrigation benefits medium scale farmer at the expense of large and small farmers. Actually, the economic consideration has become more important and the government has pay more attention on this matter. The government also pays more attention in a small and medium size of irrigation system.

Table 4.7 shows the classification of irrigated area by type of irrigation system in each region in 1976. (Definition of each topic is on the foot note of the Table). Statistic shows that almost every regions, except in the Northeast region, have mainly irrigated by type II. Type III is in general share about 15 to 20 percent of the total irrigated area except only in Central Plain and in the West where the percentage of type III are only 0.4 and 5.1 percent respectively. Type I

FIGURE 4.1
COMPARISON OF THE IRRIGATED AREAS AS % OF CULTIVATED AREAS
OF EACH REGION (WET SEASON)



SOURCE: Same as Table 4.6.

TABLE 4.7

IRRIGATED AREAS OF EACH REGION BY TYPE OF IRRIGATION SYSTEM (1976)

Regions	(Thousand of Rais)			
	Type I	Type II	Type III	All Types
North	3.0 (0.1)	1,731.6 (76.3)	536.4 (23.6)	2,271.0 (100.0)
North-East	669.4 (50.2)	352.2 (26.4)	311.5 (23.4)	1,333.1 (100.0)
East	8.5 (0.4)	1,683.3 (76.7)	510.0 (23.2)	2,193.3 (100.0)
West	--	2,460.4 (94.9)	131.4 (5.1)	2,591.8 (100.0)
Central	21.8 (0.5)	4,609.7 (99.1)	18.6 (0.4)	4,650.0 (100.0)
South	--	490.2 (60.2)	324.0 (39.8)	814.2 (100.0)
Whole Kingdom	699.7 (5.0)	11,327.3 (81.7)	1,831.9 (31.2)	13,858.9 (100.0)

NOTE: Type I (the most complete system, composes of either SIFR, of SIPD, or SIFH, or SI.

Type II composes of either I, of ID, or IC or ICRD, or IPD, or ICD.

Type III composes of either C, or D, or P, or FC, or CDF, or PD, or PC, or CF, or DC, or F.

where S = Storage of water

D = Drainage

I = Irrigation

H = Hydro-electric power

F = Flood control

C = Conservation

R = Reclamation

P = Pumping

SOURCE: Royal Irrigation Department, Ministry of Agriculture and Cooperatives.

is special case where about one half of the irrigated area in the North-east are served by this type. But each of the rest of regions have the irrigated area by this type less than one percent.

Similarly, the government policy on the irrigation should consider the question of: What should have given more benefit in the investment of each one of the following: (Small, p.p. 262-312).

- 1) Improve drainage condition in order to increase wet season crop production.
- 2) Improve the distribution system in order to increase dry season crops production.
- 3) Improve water distribution and land leveling in order to increase and promote "upland crop" in dry season.

Allocation problem is also one of the interesting economic problem. Since different crops need different level of water and different timing, here are questions of externalities that have to be resolved. These are not only of nice academic interest, but is of burning practical interest as disputes concerning rights to water are growing in volume and intensity.

5. Nutritional Problems in Thailand

There are two major nutritional problems in Thailand: Over nutrition and under nutrition. Only less than 30% of the city people have over nutrition problem and face the problems of Diabetes Mellitus,

Obesity, Hypercholesterolemia, Hyperlipemia and Hyperlipoproteinemia (Ramathibodi Rach. Center). Over nutrition is not yet a priority problem that we have to worry. The main problem that should be paid more attention is under nutrition.

Seven major diseases are caused wholly or partially by under nutrition (ranked on the serious problem)

1. Protein-Calories Malnutrition
2. Iron Deficiency Anemia
3. Urinary Bladder Stone Disease
4. Endemic Goiter
5. Beri-Beri (Vitamin B₁ Deficiency)
6. Vitamin A Deficiency
7. Others: Dental Caries, B Complex Deficiency.

Among these seven categories the first one, Protein-Calories Malnutrition (PCM), seems to be the most serious. It occurs almost everywhere in Thailand (including Bangkok). The factors which cause this problem are both medical and socio-economic. The last six categories are less serious than the first one in term of the number or percentage of the cases we have. The solutions to these last six problems are as not difficult comparing to the first one since it does not require expensive programmes.

Table 5.1 shows the nutrition deficiency disease in Thailand compiled from 62 provincial hospitals in 1967. The figure shows that

TABLE 5.1

NUTRITION DEFICIENCY DISEASE IN THAILAND, 1967*

1. Protein-Calories Malnutrition	11,328	cases
2. Anemia	9,569	"
3. Bladder Stone Disease	6,110	"
4. Vitamin B ₁ Deficiency	5,869	"
5. Golter	1,865	"
6. Vitamin B ₂ Deficiency	1,742	"
7. Vitamin A Deficiency	524	"
8. Vitamin C Deficiency	395	"
9. Pellagra	116	"
10. Miscellaneous	150	"

* Compile from 62 provincial hospital, Ministry of Health.

SOURCE: Ramathibodi Research Center.

among all nutritional deficiency disease, PCM is the most serious problem. Table 5.2 shows the estimated figure of PCM in Thai children aged 0-6 years old. Sixteen percent of Thai total population or about 6 million people are aged between 0-6 year old. Using Gomez's criteria (weight and height) it can be concluded that 63% of the children aged between 0-6 years have PCM problem, among these 30% suffer from first degree PCM 30% from second degree PCM 3% from third degree PCM. The figures also vary from one region to the others. The percentage of total PCM in the south are greater than the total average but the degree of seriousness is less. This is because 45% of the PCM problem are in the first degree. Second degree PCM is 20% and third degree PCM is zero. The main reason which explains this phenomenon is because the people in the south consume more of fish and sea food than the other regions.

In the Northeast region which comprises a fairly large section of the population (12/1 mills in 1976) has more PCM problem than the other regions. Total percentage of PCM of the children are up to 67%. The first degree is 33%, the third degree is 4% while the second degree is remained 30%. Since the most serious one is the third degree, the Northeast regions should be paid more attention. One of the main factors which Ramathibodi Research Center discovered is because the people in this region consume less oil and fats. Other factor that affect this region is because the family income of the people in this region is low.

The degree of PCM in the North and in the Central Plain are about the same as the average for the whole country. The first degree PCM in the Central Plain is a little bit less. One special case in the

TABLE 5.2

ESTIMATED TOTAL PCM IN THAI CHILDREN BY REGION (0-6 YEARS)

<u>Region</u>	<u>Degree PCM</u>	<u>% Prevalence</u>	<u>PCM Cases (millions)</u>
Whole Kingdom (1)	1st	30	2.0
	2nd	30	2.0
	3rd	3	.2
	Total	63	4.2
South (2)	1st	45	.3
	2nd	20	.2
	3rd	0	0
	Total	65	.5
Northeast (3)	1st	33	.6
	2nd	30	.6
	3rd	4	.1
	Total	67	1.3
North (4)	1st	30	.4
	2nd	30	.4
	3rd	3	.1
	Total	63	.9
Central (5)	1st	26	.5
	2nd	30	.5
	3rd	3	.1
	Total	59	1.1
Bangkok Slum Area	1st	29	-
	2nd	46	-
	3rd	7	-
	Total	82	-

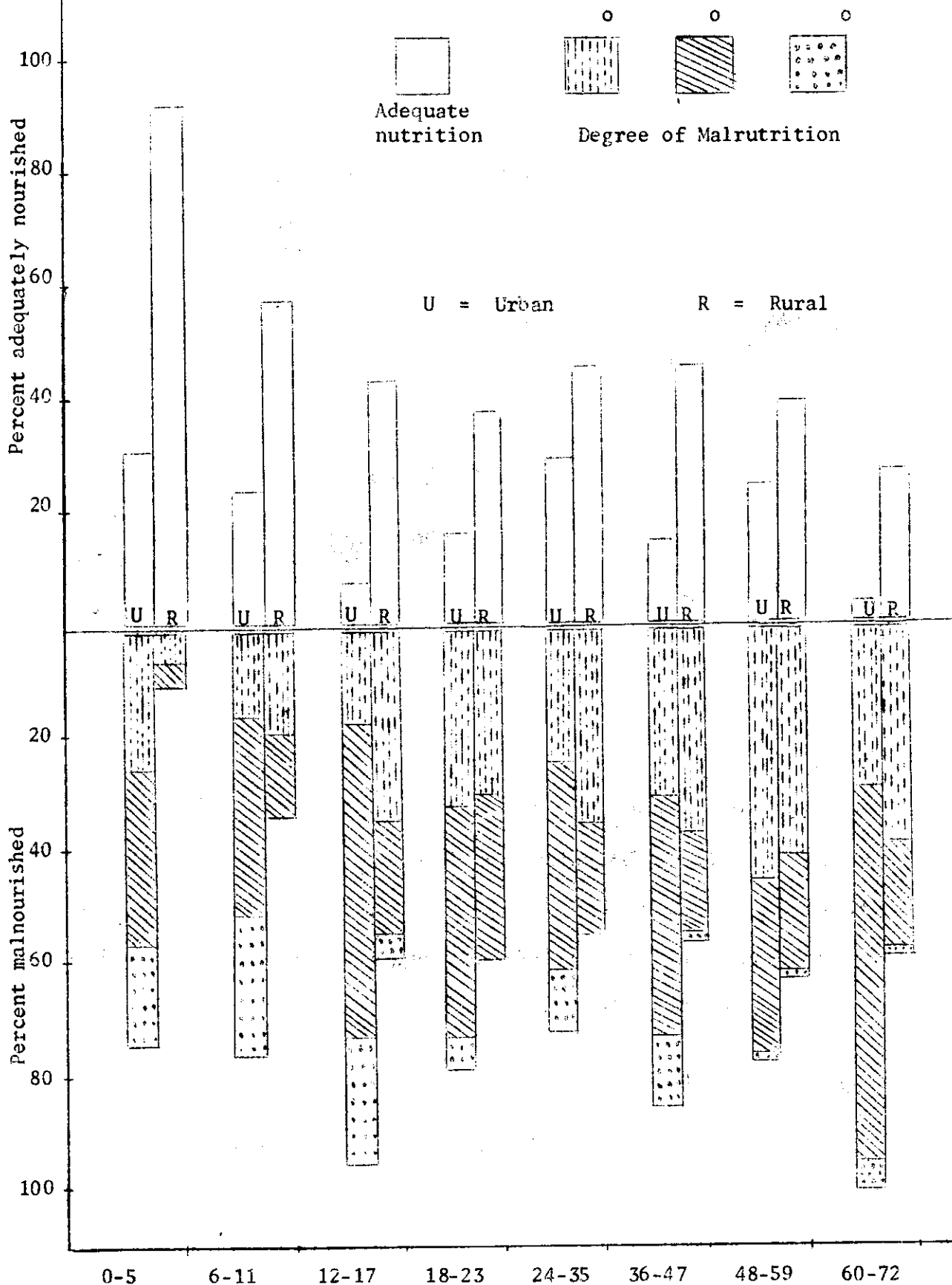
Note: (1) Estimated Population 0-6 years old in Thailand = 6.0 millions.
 (2) " " " " " = 0.7 " "
 (3) " " " " " = 1.9 " "
 (4) " " " " " = 1.3 " "
 (5) " " " " " = 1.8 " "

SOURCES: Ramathibodi Research Center.

Central Plain is the case of Bangkok slum area. The figure shows that 82 percent of the children aged 0-6 years in the Bangkok slum area suffer from PCM. The percentage are also distributed as 29% to first degree PCM, 46% to second degree PCM and 7% to third degree PCM. The important factor that could explain this is the family income. The people in the slum area are poor and not able to consume what they can grow as the people in agricultural sector. Most of the mothers in the slum area have to work outside. The milk that they used may not be proper. Some used condensed milk or improper powdered milk. Parent's education is also an important factor. The parents may not realize the benefit of the breast feeding and use the bottled milk instead. This is because the lack of parent's education or a demonstration effect of the Bangkok people. However the precise cause or causes have not been pin-pointed.

Figure 5.1 compares the nutritional status of pre-school children, aged 0-6 years, in Bangkok slum and rural village in 1970 that Pensri Khanjanasthiti and Joe D. Wray have studied. In general the children in the rural village is in a better shape. The degree of PCM problem in the rural village in general is less than in the Bangkok slum. Especially, none of the rural village children age under 12 months have the third degree malnutrition while there are many in the slum area. This is because the mother in the rural area breast-feed their children. The fact that mothers in rural area use breast feeding in higher percentage than the mothers in urban areas is also confirmed by the study of nutritional character in the Greater Mae Klong Area (Tanpichitr and Tanamitr p. 249).

Figure 5.1 : Nutritional Status of Pre-school Children in Bangkok Slum and Rural Village, Thailand, 1970



From Health Problems in infant and Preschool Children, Marginal Areas of Bangkok By Dr. Pensri Khanjanasthiti M.D. and Dr. Joe D. Wray M.D.

The statistic shows that 58.3% of the children in rural area, 46.5% of the children in sanitary districts and 26.9% of the children in municipal area are fed on their mothers' milk.

Typically, the nutritional problems are treated as a pure medical problem of research interest only to medical doctors and nutritional scientists. Currently, the study of nutritional problems have also been paid more attention in term of some socio-economic factors such as income, education, family size, occupation and etc. Some studies have looked at the correlation of these socio-economic factors to the nutritional problem. The study of the nutritional character of the Greater Mae Klong Area and the study of food habit in Kanchanaburi reach the same conclusion that family income and the parent's education, are negatively correlated with the nutritional problems. On the issue of family size factor the two studies conclude differently. The study in Mae Klong area have shown that if the family member is larger than 6 people the nutritional problems will be more. But Virajsairee has concluded in her study in Kanjanaburi that "a larger family will inevitably acquire good food habits" (Viragsairee, ep.54). However, the study of correlation between a socio-economic factor to the nutritional problems would benefit from more advanced technique and also more carefully defined and classified factors.

Nutritional Policy:

There is no specific national policy on nutrition except only the one specified in the actual National Economic and Social Development:

Plan. The four year plan proposed have made on food and nutrition program for infant, pregnant and lactating woman as follows:

1. Target Population

- Total population of Thailand 45 millions
- Pregnant and Lactating Women 3 millions
- Infant and Children 0-6 years 16% of population 6 millions
PCM 4.2 millions.

2. Goal

- 30% of Pregnant and Lactating Women 926,000
 - 0-6 months Infants 668,250
 - 0-24 months Children 628,750
 - Feeding Stations 6,000 units
 - Supplement food production for 0-24 months children 32,126 tons
- (628,750)

3. Strategies

3.1 Pregnant and Lactating Women

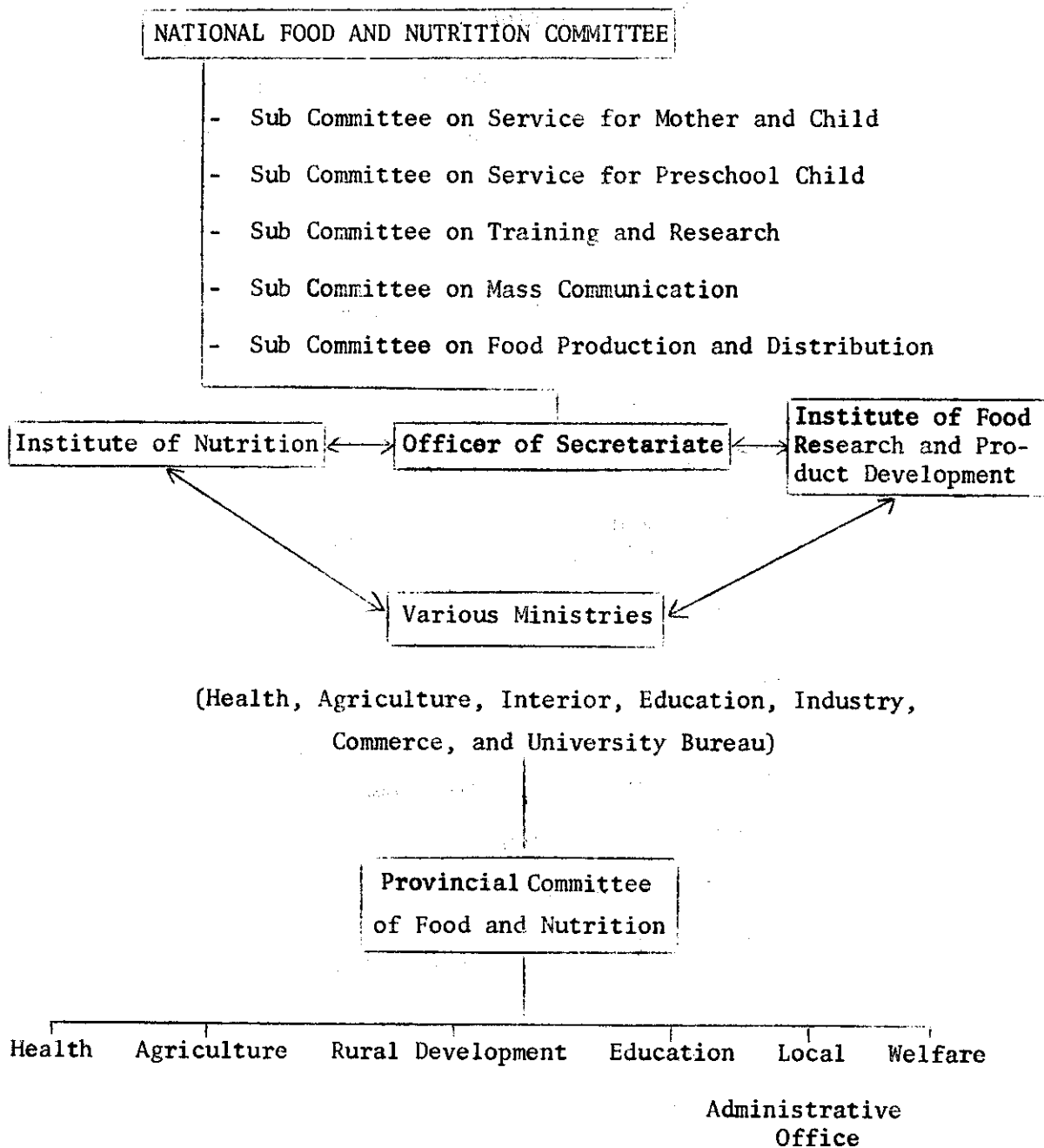
- Nutrition education
- Health promotion
- Food supplement, Food assistance
- Family planning

3.2 Infant

- Breast feeding promotion
- Supplementary feeding

- Establishment of feeding station
- Home delivery of food

4. Working Committee



Summary and Conclusion

In short, the agricultural policies in Thailand have been made mostly to solve the short run problems of each commodity via trade policies. The government rarely considers long run policies. In practice, the government sets up a special committee for solving each problems on a case by case basis. The consideration of indirect effects of one-commodity policy on other commodities have never been adopted. Direct and indirect substitibility of consumption and production among commodities should have been studied and considered. For example, Timmer hypothesized that the linkage of substitution of consumption among commodities should be livestock. Further studies of the linkage of consumption and production among commodities, livestock feeding, agricultural inputs and nutrition problems will help the government make meaningful decision on future policies.

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Technique of Production and Technology Transfer:
With Some Reference to Thailand

by

Praiphol Koomsup

The paper presented in this series are intended to be tentative in nature and should not be quoted without the author's permission. Comments and Criticisms of paper presented are welcomed and will be included (if the commentor so wishes) with any subsequent dissemination of the corresponding discussion paper.

Abstract

The paper discusses the problem of technical choice for the less developed countries, with a special emphasis on the effect of production techniques on employment. It proves that, given some simple assumptions, the use of second-hand machines by the LDC's can be more privately and socially profitable than that of new machines. Two alternatives of solving the problem of technological dependence in the LDC's are discussed, namely technology assimilation and technology adaptation - creation. The industrial promotion policy by the Board of Investment is found to have encouraged capital-intensive production techniques in the promoted industries. A case study of the textile industry in Thailand gives an empirical evidence that the industrial promotion policy has created a labor-saving bias.

There are several criteria that can be used in choosing techniques of production. The choices are to be made in order to, for example, maximize employment, output, the rate of growth of output, or to create better income distribution. Generally, there is no contradiction among these objectives if we assume two factors of production (capital and labor), a single neoclassical production function, and one type of output. But there are exceptional cases in which the objectives are conflicting. For instance, rice milling using labor-intensive pestle-and-mortar techniques requires considerably less capital per man, but also produces less output per unit of capital, than machine milling -- a conflict between maximum employment and maximum output.^{1/} Capital-intensive production techniques, while generating less employment now, may lead to more employment later if they yield higher savings and investment.^{2/}

In this study we put a special emphasis on the effect of production techniques on employment, since it has become clear that the most acute problem facing less developed countries today is urban unemployment and rural underemployment. Given a level of output to be produced and a set of factor prices reflecting social opportunity costs, the optimal use of available resources in most LDC's (where labor is abundant and capital is scarce) would mean using more labor-intensive techniques of production rather than less.^{3/}

The problem of LDC's in adopting the right production techniques is enhanced by the fact that in most cases they have to rely on the more advanced, industrialized countries as sources of technologies. International technology transfer is made difficult by several factors. Technology may not be a free good, available to all producers in the world because of high costs of transfer and monopoly power exercised by companies in advanced countries. More important is the fact that most techniques available are designed for usage in developed countries where factor endowments are different from those found in most LDC's. While the direction of technical progress made by research and development in developed countries has been toward more capital intensity in production to overcome the increasing relative scarcity and cost of labor as a factor of production, less capital-intensive technologies are needed in LDC's to absorb more labor.

One possible solution to this problem of technological dependence is for the LDC's to import used machines from developed countries. Apart from being cheaper, second-hand machines generally employ more labor than new ones since technical progress is of a labor-saving type. Using a simplified model, it can be shown that the use of second-hand machines by the LDC's is more profitable than that of new machines -- the more labor-saving the technical progress in advanced countries is the more this is true.

In this simplified model,^{4/} we have the following assumptions:

- 1) There are two factors of production: labor and machine (capital), producing one type of output. No working capital is used.
- 2) There are two (or two groups of) countries:

A is an advanced country with relatively abundant capital; and B is a backward country with relatively abundant labor. Consequently, the real wage level in A is higher than that in B:

$w_a = \lambda w_b$ where $\lambda > 1$, w_a and w_b are real wages in countries A and B respectively. Also let r be the real interest rate in country A.

- 3) All machines are built in country A only, and all have a working life of two years. Hence, at a point of time there are only two types of machine: new machines and one-year-old machines. For simplicity, let us define one unit of all machines such that one machine can produce one unit of output per year throughout its whole life in both countries. There is no scrap value. A machine of older vintage needs at least as much labor to work with as a new machine to produce one unit of output, i.e.

$l_j = \gamma l_i$ where $\gamma \leq 1$, l_i and l_j are labor coefficients of old and new machines respectively.

Fixed-coefficient production is assumed for both types of machine and in both countries, i.e., l is, for a type of machine, the same in both countries.^{5/}

Let P be an amount of net output from a machine:

$P_i^a = (1 - w_{a1_i})$ is net output of an old machine in country A.

$P_j^a = (1 - w_{a1_j})$ is net output of a new machine in country A.

P_i^b and P_j^b are similarly defined for country B.

Let V be a present value of a machine (a discounted value of a stream of net output):

$V_j^a = P_j^a \left[\frac{1}{1+r} + \frac{1}{(1+r)^2} \right]$ is the present value or the price of a new machine of new vintage in country A.

$V_i^a = P_i^a \left[\frac{1}{1+r} + \frac{1}{(1+r)^2} \right]$ is the present value or the price of a new machine of older vintage in country A.

At a point of time, an entrepreneur in country B has two alternatives with regard to the purchase of machines from country A. He can import either a completely new machine or a second-hand (one-year-old) machine, both at the prices prevailing in country A. We assume further that the transport and installation costs of the machines bought by country B are negligible. Thus, we can compare the profitability (from the point of view of the entrepreneur in country B) of two cases:

Case 1: An old machine is imported and use for one year until the end of its life. Let a profit rate per year in this case be α per cent.

Case 2: A new machine is bought and used for one year, and is then sold back to country A at the prevailing price.^{6/} Let a profit rate in this case be β per cent per year.

$$\begin{aligned}
 \text{In case 1: } \alpha &= \frac{p_i^b - \frac{p_i^a}{1+r}}{\frac{p_i^a}{1+r}} = \frac{p_i^b}{p_i^a} (1+r) - 1 \\
 &= \left(\frac{1 - W_b l_i}{1 - W_a l_i} \right) (1+r) - 1 \\
 &= \left(\frac{1 - W_b l_i}{1 - \lambda W_b l_i} \right) (1+r) - 1
 \end{aligned}$$

$$\begin{aligned}
 \text{In case 2: } \beta &= \frac{p_j^b - \frac{p_j^a}{(1+r)^2}}{\frac{p_j^a}{1+r} + \frac{p_j^a}{(1+r)^2}} = \frac{p_j^b}{p_j^a} \left(\frac{(1+r)^2}{2+r} \right) - \frac{1}{2+r} \\
 &= \frac{1 - \gamma W_b l_i}{1 - \lambda \gamma W_b l_i} \left(\frac{(1+r)^2}{2+r} \right) - \frac{1}{2+r}
 \end{aligned}$$

Let $W_b l_i = x$,

$$\alpha - \beta = \left(\frac{1-x}{1-\lambda x} \right) (1+r) - 1 - \left(\frac{1-\gamma x}{1-\lambda \gamma x} \right) \left(\frac{(1+r)^2}{2+r} \right) + \frac{1}{2+r}$$

Let $\gamma = 1$, and $G = \frac{1-x}{1-\lambda x}$,

$$\begin{aligned}
 \alpha - \beta &= G(1+r) - 1 - G \left(\frac{(1+r)^2}{2+r} \right) + \frac{1}{2+r} \\
 &= \frac{(1+r)(G-1)}{2+r}
 \end{aligned}$$

Since $\lambda > 1$, G is greater than 1, and $(\alpha - \beta) > 0$. For $\gamma < 1$, as γ gets smaller, so does $\frac{1-\gamma x}{1-\lambda \gamma x}$, and β also becomes smaller.

Hence, this means that $(\alpha - \beta)$, which is greater than zero as long as $\gamma \leq 1$, is even greater when $\gamma < 1$ than when $\gamma = 1$.

The conclusion we draw here is that with no labor-saving technical progress ($\gamma = 1$), it pays LDC's to use second-hand machinery from advanced countries rather than to use brand new machinery. It is even more profitable for them to do so when technical progress in advanced countries is increasingly labor-saving ($\gamma < 1$),----- a more likely case in the world today where labor is getting relatively more expensive in the industrialized economies.

Thus, according to our model, there should be a tendency for the LDC's to use more second-hand machines, not only because it is more privately profitable, but also because it creates more employment. But advocates for second-hand machine use by LDC's are less than unanimous. They differ as to whether second-hand machines require more or less skilled labor which is rather scarce in most LDC's, and whether spare parts for the machines are easier or less easy to buy and manufacture. One thing they seem to agree upon is that importation of second-hand machinery is made difficult by lack of expertise required in assessing and ascertaining old equipment, and by limited information on the world markets for used machines.^{7/}

Evidence shows that the use of second-hand machines varies from country to country. A.K. Sen observed that small-scale industries

in Japan bought second-hand machinery in considerable quantity.^{8/} Strassman found in Puerto Rico, the United States, and Mexico that more half of a sample of plants examined used second-hand equipment.^{9/} On the other hand, less than 10 per cent of a sample of Indonesian firms employed second-hand machinery.^{10/} In most cases, the difference can be partly explained by differences in government attitude toward imported used machinery. Some countries, e.g. Indonesia, even impose prohibitions on the importation of used machinery.

Another line of alleviating the problem of technological dependence in LDC's involves their ability to adapt and assimilate foreign technology by means of domestic innovative ingenuity. Citing the successful case of Japan, Fei and Ranis believe that "it is the adaptation of imported technology to the existing (domestic) factor endowment.....which lies at the heart of the matter."^{11/} The process of technology assimilation is facilitated by the development of human resources, e.g. entrepreneurial skills, and technical skills. The assimilation of imported technology may take the form of multiple shifting, machine speed-ups, changes in handling and other peripheral processes, variation in plant size, structure and organization.^{12/}

Borrowing, admittedly without any adaptation or assimilation, their model explaining technology assimilation in Japan, we apply the data of Thailand to it in order to see how well Thailand fares in this respect. The model is represented by a set of equations as follows:

- 1a) $\eta_L = r$ (constant population growth rate)
where $\eta_x = \frac{dx}{x \cdot dt}$ is the growth rate of x.
- 1b) $I = sQ$ (saving function, where s is a saving ratio)
- 1c) $\frac{dK}{dt} = I$ (investment is the increment to capital stock)
- 1d) $k = \frac{K}{Q}$ (k is the capital-output ratio)
- 1e) $n = \frac{N}{Q}$ (n is the labor coefficient and N the employed labor force)
- 1f) $U = L - N$ (U is the technical unemployment)
- 1g) $\eta_K = \frac{s}{k}$ from 1b, c, d.

Let $p = O/N = 1/n$ be labor productivity, and

- 2a) $p = p_0 e^{it}$ or $\eta_p = i$ (i is the growth rate of labor productivity)
- 2b) $i = j^\alpha n^{1-\alpha}$ or $j = p^\theta$ where $\theta = \frac{1-\alpha}{\alpha}$
(unit contour of a Cobb-Douglas type representing the technology shelf; j is the "imported" pre-assimilation capital-output ratio)
- 2c) $m = j/k$ (m is the degree of capital stretching, and k the "effective" post-assimilation capital-output ratio)
- 2d) $m = (p/p_0)^c$ (c is the capital stretching coefficient)

The differentiation between k and j can be seen in diagram 1 where before technology assimilation a unit of output is produced at a capital-labor combination represented by point A, while after assimilation it is shifted to point B where capital-labor ratio

is smaller, i.e. the adapted technology becomes more labor-intensive. Equation 2d) indicates that m is causally determined by the cumulative effect of labor productivity increase (p/p_0) , emphasizing the importance of education and learning by doing in adapting imported technology.

$$3a) \quad k = j/m = ap^b \quad \text{where } a = p_0^c, \quad b = \theta - c \quad \text{from 2b, c, d.}$$

$$3b) \quad Q = Q_0 K^B N^{1-B} \quad \text{where } B = 1/(1+b) = \alpha/(1-c\alpha),$$

$$\text{and } Q_0 = p_0^{(1/(1-\frac{1}{c\alpha}))} \quad \text{from 3a, 1d, 2b, d.}$$

$$4a) \quad \eta_k = b\eta_p = bi \quad \text{from 3a, 2a.}$$

$$4b) \quad \eta_{\eta K} = \eta_{(s/k)} = -\eta_k = -bi \quad \text{from 1g and 4a } (\eta_s = 0)$$

$$4c) \quad \eta_K = \eta_0 e^{-bit} \quad \text{from 4b.}$$

$$4d) \quad \eta_{K/N} = \eta_{kp} = \eta_k + \eta_p = bi + i = i(1+b) = i(1+\theta-c) = i\left(\frac{1}{\alpha} - L\right)$$

$$5a) \quad \eta_Q = \eta_{K/k} = \eta_K - \eta_k = \eta_0 e^{-bit} - bi \quad \text{from 4a, c.}$$

$$5b) \quad \eta_N = \eta_{Q/P} = \eta_0 e^{-bit} - bi - i \quad \text{from 5a and 2a.}$$

$$\text{Let } Q^* = Q/L \text{ and } N^* = N/L,$$

$$5c) \quad \eta_{Q^*} = \eta_{Q/L} = \eta_Q - \eta_L = \eta_0 e^{-bit} - bi - r \quad \text{from 5a and 1a.}$$

$$5d) \quad \eta_{N^*} = \eta_{N/L} = \eta_N - \eta_L = \eta_0 e^{-bit} - bi - i - r \quad \text{from 5b and 1a.}$$

The criterion of success is for η_{Q^*} and η_{N^*} to rise over time. From equation 5c and 5d, this requires that bi be negative. Since i is always positive, we need b to be negative, i.e.,

$$\theta - c < 0 \quad \text{or } c > \theta \quad \equiv \quad (1-\alpha)/\alpha$$

Applying the Thai data for the period 1950-1969 (see table 1), we obtain the following results: 13/

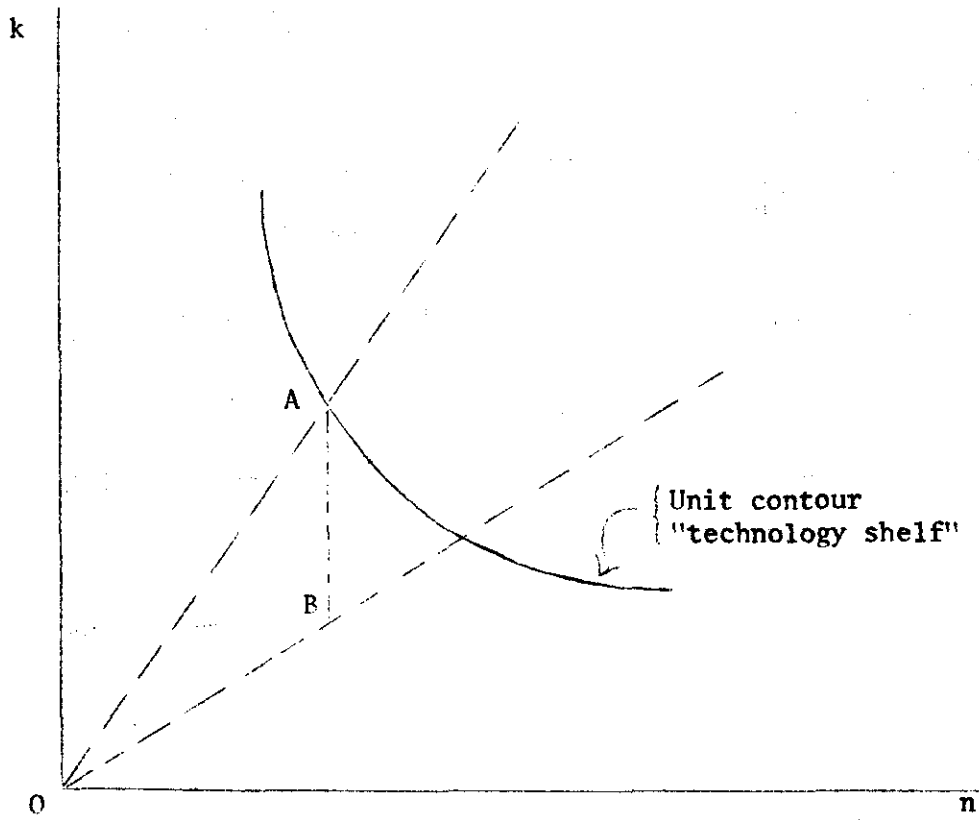


Diagram 1

Table 1: Thai Data on Non-agricultural Gross Domestic Product, Capital Stock, Labor Force, and Total Population (1950-1969)

Year	Non-Ag. GDP (Q) ('62 prices) (billion ฿)	Non-Ag. Capital-Stock (K) ('62 prices) (billion ฿)	Non-Ag. Labor Force (N) (million)	Popula-tion (L) (million)	p=Q/N	k=K/Q	s=I/Q
1950	16,853	36,970	1,567	19,921	10.755	2.194	.1121
1951	18,153	38,860	1,635	20,481	11.103	2.141	.0033
1952	19,734	38,920	1,702	21,135	11.595	1.972	.1130
1953	22,945	41,150	1,776	21,847	12.919	1.793	.0933
1954	23,774	43,290	1,858	22,552	12.795	1.821	.0479
1955	28,698	44,430	1,943	23,286	14.770	1.548	.0376
1956	27,623	45,510	2,027	24,087	13.627	1.647	.0963
1957	30,737	48,170	2,115	24,757	14.533	1.567	.0560
1958	28,994	49,890	2,205	25,559	13.149	1.721	.1673
1959	33,445	54,740	2,299	26,319	14.548	1.637	.1205
1960	34,700	58,770	2,414	27,094	14.374	1.694	.1199
1961	38,214	62,930	2,519	28,015	15.170	1.647	.1588
1962	41,000	69,000	2,631	28,969	15.583	1.683	.2029
1963	43,300	77,320	2,754	29,953	15.723	1.786	.1508
1964	49,396	83,850	2,880	30,969	17.151	1.697	.1415
1965	54,967	90,840	3,011	32,016	18.255	1.653	.2167
1966	58,400	102,750	3,179	33,095	18.370	1.759	.2200
1967	66,200	115,600	3,342	34,205	19.808	1.746	.2240
1968	71,500	130,430	3,485	35,347	20.516	1.824	.2376
1969	77,000	147,420	3,646	36,520	21.119	1.915	----

SOURCE: K,N,L: from Wilaiwan Wannitikul, Productivity Growth in Thailand, 1950-1969, M.A. Thesis, Faculty of Economics, Thammasat University, June, 1972.

Q: from Year Books of National Account Statistics, Volume 2, of the years 1957, 1960, 1967, 1972, U.N. Statistics Office.

$$p = \hat{p}_0 e^{\hat{i}t} \quad \text{from 2a,}$$

$$\hat{p}_0 = 10.7006 \quad (\ln \hat{p}_0 = 2.3703), \quad \hat{i} = 0.0322, \quad R^2 = 0.93.$$

$$k = \hat{a} \hat{p}^{\hat{b}} \quad \text{from 3a,}$$

$$\hat{a} = 2.8717 \quad (\ln \hat{a} = 1.0549), \quad \hat{b} = -0.1797, \quad R^2 = 0.15$$

$$\text{Thus, } c = \ln \hat{a} / \ln \hat{p}_0 = 0.4451$$

$$\alpha = 1 / (1 + \hat{b} + c) = 0.7903$$

$$\text{and } \theta = 0.2653$$

Therefore, as in the case of Japan where Fei and Ranis observe the success of technology assimilation (the Japanese c and θ are 0.427 and 0.229 respectively), we obtain the result that indicates that $c > \theta$, and that some degree of capital stretching existed in Thailand over the period 1950-1969. However, as we will see later, the process of capital stretching came to a stop in the second half of the period, due to the government policy of investment promotion which has been implemented since 1959.

There is another school of thought which believes that adaptation of imported technology (old or new) through domestic innovative efforts alone does not solve the problem of labor absorption in the LDC's.^{14/} In view of the historical development of technical progress in the industrialized countries, one would expect a labor-saving trend to occur in the future. Even though the LDC's could import used machinery to make production as labor-intensive as possible, it would be difficult not to follow the path of labor saving

bias generated by the technical progress in the advanced countries. The reason is that over time the older and labor-using machines will not be produced and will be in limited supply and costly to maintain. The actual choice of techniques is therefore narrower than some models assume it to be.

Moreover, it is argued that technical progress tends to be "localized" around one technique of production in the sense that technological improvements change only one technique and perhaps others nearby but not the others^{15/} ----- there is an inward movement of one cluster of the iso-product curve and not a general shift (e.g. a shift from point A to point A' in diagram 2). If technical progress in the advanced countries is localized, either via research activity or learning by doing, it will not affect the less capital-intensive techniques that are suitable for the LDC's. In fact, the localization effect may be so strong that the capital-intensive techniques dominate the labor-intensive ones, as technique C in diagram 2 is dominated by technique A' which employs less of both factors. This may lead to the use of the improved capital-intensive techniques, which is detrimental to labor absorption efforts.

Thus, it is suggested that "the LDC's should produce their own machinery, copying initially the earlier more labor-intensive designs of the industrialized countries".^{16/} Only in this way can the LDC's gain control over the direction and speed of technological change, and use it to realize the goal of significant labor absorption,

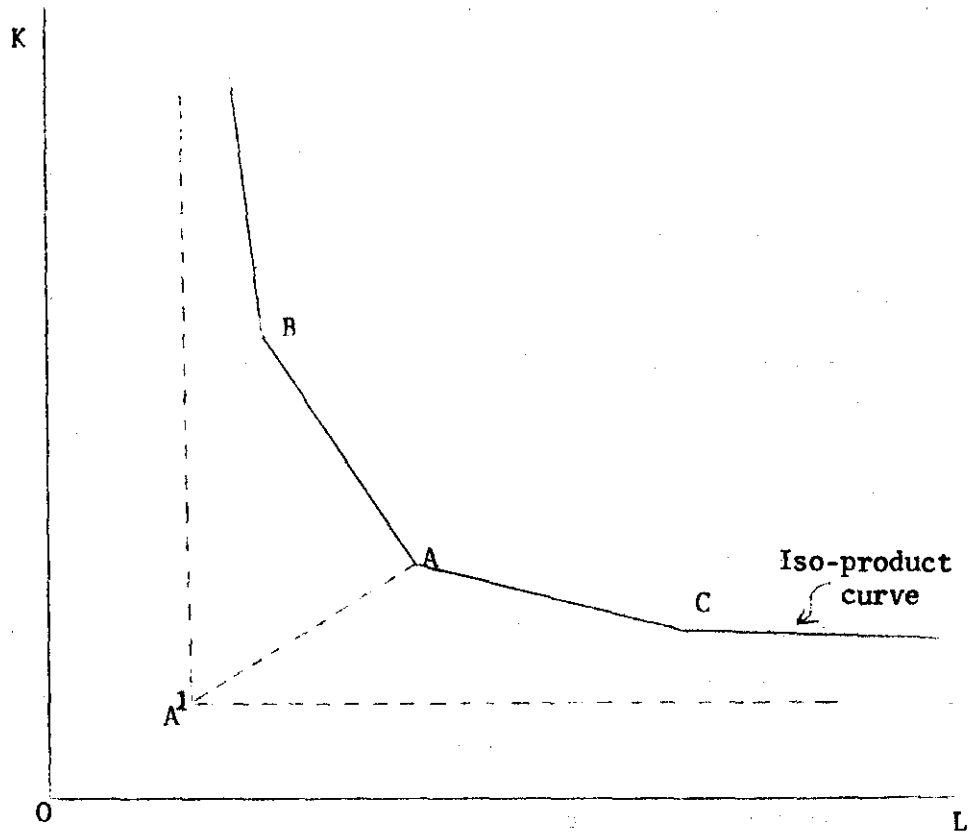


Diagram 2

e.g. improving technique C in diagram 2 such that it is no longer dominated by technique A'. A domestic capital-goods industry producing machinery and equipment in an LDC also has other advantages.^{17/} It can be a major source of external economies to other industries in providing skilled labor to those industries. It is also found to be relatively efficient with the small scale production; there are no substantial economies of scale in machine production. It is also found in the U.S. and Japan to have a relatively low capital-labor ratio. However on this last point, it is likely that a low capital-labor ratio may mean a requirement of a considerable number of skilled labor which is evidently lacking in most LDC's.

If the establishment of a domestic machine industry is to be successful in generating the appropriate technology in the LDC's, it is necessary to have research organizations, set up by individual governments or international agencies, designed specifically to influence the direction and speed of technical change according to their own needs. The main drawback of this strategy is that these institutions tend to be isolated from producers, causing difficult and irrelevant dissemination and practical implementation of research findings.

Perhaps one of the most important prerequisites for the appropriate use of technology by the LDC's is the absence of domestic factor price distortions. In many LDC's factor prices do not reflect real social opportunity costs; and in most cases government policies have been blamed for it.^{19/} The minimum wage legislation could raise

wages paid by industry above the marginal social cost of labor. On the other hand, capital tends to be underpriced as a result of duty-free or low-duty importation of machines and equipment, overvalued currency, low interest rates in organized capital markets due to low ceiling rates, government credit subsidies, and allowance for fast depreciation for tax purposes. These distortions tend to make private profitability of capital-intensive techniques higher than their social profitability, thus encouraging entrepreneurs to import highly capital-intensive and labor-saving manufacturing equipment. We will have more to say about this in the context of Thailand.

Techniques of Production in Thailand

It has been found that the contribution of the industrial sector to employment growth over the last decade has been disappointing in many LDC's.^{20/} Thailand is no exception. Though the employment statistics in Thailand cannot be considered "reliable", some rough figures indicate that its manufacturing industry since the end of the second World War has employed only a small portion of employed labor force. (See table 2)

It is possible that industrialization has aggravated the problem of unemployment by encouraging migration from rural areas to cities and towns, thus creating urban unemployment which is a more serious social and political problem than unemployment and underemployment in rural areas. To make the matter worse, the government policy, which is found to favor capital-intensive techniques in the

Table 2: Estimates of Employment in Manufacturing in Thailand

Year	Age Group	Percentage of Labor Force
1947	14 ⁺	2.2
1960	15 ⁺	3.6
1969	11 ⁺	4.0

SOURCE: J.C. Ingram, Economic Change in Thailand 1850-1970,
(Stanford University Press, Stanford, 1971), p. 285.

industrial sector, has made industrialization a poor device of labor absorption.

Industrial promotion in Thailand was initiated when the Board of Investment (BOI) was created by the government in 1959. In the investment promotion legislation various incentives are given to encourage both local and foreign private investment. Investors are given guarantees against nationalization and state competition, the rights to own land, to repatriate profits and capital, exemption from import duties and business taxes on imports of equipment and machinery to be used in new plants, exemption from income tax for the first five-year period of operation. The "promoted" industries, covering most manufacturing industries, are classified into three groups according to the degree of being "vital and necessary" to the Thai economy. However, no clear criteria are specified as to the meaning

of being "vital and necessary". Full exemption from import duties and business tax on raw materials and inputs for a five-year period is given to Group A industries, 50 per cent exemption to Group B, and up to $33\frac{1}{3}$ per cent exemption to Group C.

On examination of the lists of these groups of promoted industries, Silcock concludes that those in groups A and B are very capital-intensive industries such as metal smelting and chemicals.^{21/} Approval is usually needed from the BOI for the machines and equipment used in promoted firms. There is a concern that the BOI has insisted on too modern and sophisticated equipment. Moreover, minimum production capacity and international standards are required in some promoted industries. Such requirements reflect an importance placed on export and import-competing performance by the promoted industries. The danger is that these requirements are such as to prevent "creative innovations and adaptations of small-to-medium scale operations to fit Thai factor costs and managerial capabilities, thus precluding an evolution of industry after the Japanese pattern".^{22/} The industrial promotion policy in Thailand seems, therefore, to encourage labor-saving techniques, in spite of scarce domestic capital.

In order to test this tentative hypothesis that the industrial promotion policy in Thailand leads to less capital stretching, we divide the data in table 1 into two periods: the period before the promotion policy (1950-1959), and the post-promotion period (1960-1969). Applying the two-period data to the Fei-Ranis capital-assimilation model that we saw above, the empirical results are as follows:

The pre-promotion period (1950-1959)

$$\begin{aligned}
 p &= \hat{p}_0 e^{\hat{i}t} & \hat{p}_0 &= 10.8023 \quad (\ln \hat{p}_0 = 2.3798) \\
 & & \hat{i} &= 0.0323, \quad R^2 = 0.73 \\
 k &= \hat{a} \hat{p}^{\hat{b}} & \hat{a} &= 27.8468 \quad (\ln \hat{a} = 3.3267) \\
 & & \hat{b} &= -1.0728, \quad R^2 = 0.98 \\
 c &= \ln \hat{a} / \ln \hat{p}_0 & &= 1.3979 \\
 \alpha &= 1 / (1 + \hat{b} + c) & &= 0.7546 \\
 \theta &= (1 - \alpha) / \alpha & &= 0.3251
 \end{aligned}$$

The post-promotion period (1960-1969)

$$\begin{aligned}
 p &= \hat{p}_0 e^{\hat{i}t} & \hat{p}_0 &= 13.6891 \quad (\ln \hat{p}_0 = 2.6166) \\
 & & \hat{i} &= 0.0443, \quad R^2 = 0.98 \\
 k &= \hat{a} \hat{p}^{\hat{b}} & \hat{a} &= 0.8832 \quad (\ln \hat{a} = -0.1242) \\
 & & \hat{b} &= 0.2368, \quad R^2 = 0.45 \\
 c &= \ln \hat{a} / \ln \hat{p}_0 & &= -0.0475 \\
 \alpha &= 1 / (1 + \hat{b} + c) & &= 0.8408 \\
 \theta &= (1 - \alpha) / \alpha & &= 0.1893
 \end{aligned}$$

In the pre-promotion period, the results show that there existed some capital stretching, since $c > \theta$, and b is negative, complying with the criterion of successful technological assimilation. On the other hand, the post-promotion results that c is negative and less than θ , and b is positive, confirm our belief that the investment promotion policy indeed reversed the process of technological assimilation by encouraging capital-intensive production techniques in the promoted industries.

A Case Study of Techniques of Production in the Textile Industry^{23/}

Another approach used here to illustrate how the promotion policy has affected the use of production techniques is to present a case study on the technology used in the textile industry in Thailand.

Virtually all machinery and equipment used in the Thai textile industry are imported predominantly from Japan. Apart from the fact that they are relatively cheap and of reasonable quality, the Japanese textile machines are preferred by the Japanese investors and technicians who operate most of the large textile mills. Not only machinery, but its parts and accessories, some of which could be produced in Thailand, are also supplied by Japan. This situation plus the fact that the Japanese tend to keep their technical know-how to themselves are important obstacles to the technical diffusion and to the development of capital-goods producing industry in Thailand.

Most machines, particularly in the promoted firms, are bought new and, as experts put it, their working conditions are better than those found in other Asian less developed countries. The degree of mechanization differs considerably among the textile mills in Thailand. An attempt is made to determine capital-labor ratios and to use them as an index of the degree of capital-using. Included in capital (K) are land, buildings, machinery, equipment, and other fixed assets (in thousands of baht). There are two definitions for labor. One is salaries and wages paid to employees (in thousands of baht), denoted by L_1 ; and the other is the number of employees,

denoted by L_2 . Based on the data obtained from the survey, the results are tabulated in table 3.

Table 3: Mean Values of Capital-Labor Ratios in Promoted and Non-promoted Textile Firms*

	K/L_1	K/L_2
Promoted firms	18.69	91.37
Non-promoted firms	8.68	59.40

* The average size of the promoted firms is larger than that of the non-promoted ones.

When a statistical test is made to see how significantly the mean values of K/L_1 and K/L_2 for the promoted firms are greater than those of the non-promoted ones, the result is that those of the promoted firms are higher with no less than 90 per cent degree of confidence. With this piece of evidence, we conclude that the industrial promotion policy tends to favor big firms and results in a higher degree of mechanization, at least in the textile industry. This can be explained by two factors. The first and obvious one is the promotional right allowing tax exemption on machinery and equipment which is a direct subsidization of capital-using. The other factor, which tends to be more important in the textile industry than

in other promoted industries, is that the industry has the highest percentage of foreign investment. Foreign investors, unaccustomed to labor-using techniques and lacking the knowledge of potentials for factor substitutability, tend to bring in relatively more capital-intensive techniques to be used in their factories.

Concluding Remarks :

We have seen in this paper how the problems of selecting production techniques are to be solved, at least partially. They are by no means easy and simple. And there are other approaches which we neglect. For instance, no consideration has been given to the choice of products which certainly influences the kinds of technique a country chooses to use. Different products involve different degrees of capital intensity in production; and a less developed country can avoid too capital-intensive techniques by opting for labor-intensive products. A country may also be better off selecting some processes of production which require higher labor-capital ratios than the others involving the same products.

Our analytical and empirical examinations are directed mainly to industrial technology. This should not be implied that agricultural technology is in any way less important. It in fact can be very important in absorbing labor in most LDC's which are predominantly agricultural. The only reason we do not include it in our study is because work in this area is surprisingly scarce, and much more is left to be explored.

Footnotes:

- 1/ See Morawetz (10), p. 500. This kind of conflict also occurs when there is the "factor-proportions" problem. See Eckaus (3).
- 2/ Galenson & Leibenstein (5) argue for capital-intensive techniques by emphasizing the growth rates of output and employment, rather than current output and employment. But this has been criticized as putting too much weight on the future at the expense of the present generation's well-being.
- 3/ Hirschman (6), on the other hand, argues for capital-intensive techniques on the ground that labor-intensive techniques require scarce skilled labor.
- 4/ The model is adapted from Sen's analysis of used machines. See Sen (16).
- 5/ This assumption may sound rather unrealistic, since l_i in country B, for example, could be greater than that in country A. However, this complication does not change our conclusion if the degree of "labor-intensity stretching" is the same for both types of machines.
- 6/ Our conclusion holds true even if the entrepreneur buys a new later-vintage machine and uses it until the end of its life. Let r' be the real interest rate in country B. The present value of a net output of an old machine in country B is $P_1^b / (1+r')$; the same of a new machine in country B is

$\frac{P_j^b}{1+r'} + \frac{P_j^b}{(1+r')^2}$. The ratio of the former to the market

value of an old machine is $\frac{P_i^b/(1+r')}{P_i^a/(1+r)}$, while the ratio of

the latter to the market value of a new machine is :

$$\left[\frac{P_j^b}{1+r'} + \frac{P_j^b}{(1+r')^2} \right] / \left[\frac{P_j^a}{1+r} + \frac{P_j^a}{(1+r)^2} \right]$$

It can be shown that the first ratio is always larger than the second ratio, as long as $r' > r$.

- 7/ See Chudson (2), pp. 11-12, and Waterston (23), p. 96. On the most recent analyses of second-hand machines, see Schwartz (14), and Smith (19).
- 8/ Sen (16), p. 346.
- 9/ Strassman (21), p. 207.
- 10/ Wells (24).
- 11/ Fei & Ranis (4), p. 7.
- 12/ Ranis (12). In this respect, one can distinguish between the degree of mechanization (a ratio of two stock figures, i.e. machines and laborers), and capital intensity (a ratio of a stock of machines and a flow of labor working with it). (See Sen (17), p. 395). Hence, technological assimilation allows the degree of mechanization to be the same in different countries,

~~but capital intensity to differ. The assimilation of foreign~~
technology in Japan is always cited as a successful case. But one should realize that the factors that make Japan succeed in doing so, (e.g. the engineering and technical skills required to convert foreign techniques) may be lacking in most LDC's.

- 13/ It should be noted that while Fei & Ranis use the data of output, capital and employment for the whole Japanese economy, we select to use the data for the non-agricultural sector of Thailand instead, since we believe that, as far as Thailand is concerned, imported technology has been applied predominantly in the non-agricultural sector. Ideally, data for the manufacturing industry should be also used, but they are unfortunately unavailable.
- 14/ See Pack & Todaro (11), Todaro (22), and Schumacher (13).
- 15/ Atkinson & Stiglitz (1).
- 16/ Todaro (22), p. 59.
- 17/ Todaro (22), pp. 60-61.
- 18/ Morawetz (10), p. 521.
- 19/ Little, Scitovsky & Scott (8), Ch. 3.
- 20/ Morawetz (10).

21/ Silcock (18), p. 269.

22/ Ingram (7), p. 290.

23/ The textile industry accounted for about 15-25% of total employment in the manufacturing sector in Thailand. The data and observations in this section are based on a survey done in 1972-3 covering about 60% of the textile industry in terms of output. Both promoted and non-promoted firms, foreign-owned and domestically-owned, were included in the survey.

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