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Macro-Policies for Appropriate Technology: Case Studies in Thailand

by

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Macro Policies and Appropriate Technology

Case Studies in Thailand

It is commonly accepted that developing countries are overly endowed with labour resources in relation to capital. Thailand is not thought of as an exception. The standard neo-classical conclusion following such an assumption is that the appropriate technology for a typical developing country ought to be labour-intensive. Under this type of analysis, factors other than capital and labour are assumed constant.

Empirical studies in appropriate technology typically single out a product, a technology, or an industry in investigating the impact on employment (Wells, 1973 and Rhee and Westphal 1977). This approach is advantageous in that when properly conducted it is the only way to accurately quantify the extent of employment displacement that would have occurred as a result of separate policies.

The disadvantage of this approach is that detailed micro level data are not easily come by. A large number of micro-level studies are incomplete. Some failing to take account of interactive factors beyond macro policies, others merely provide descriptive evidence. Therefore an attempt to present an aggregation of disparate pieces of evidence may result in spurious generalizations and the total impact could be unduly amplified.

Few case studies in Thailand have directly attempted to investigate the impact of macro-policies on the choice of technology, and fewer still have succeeded. This paper which aims at summarizing case studies in Thailand runs the risk of committing a fallacy of eclectism. Therefore it is thought appropriate to begin this paper by providing an overall view of the economy and the employment situation in Thailand, to be followed by case studies in agriculture and manufacturing industries. Within each sector, the focus of the issue, the case studies and the impact of macro-policies are examined.

It should be noted at the outset that following the approach adopted by Frances Stewart (1987) macro policies are defined broadly here as policies that affect the environment in which an economic unit operates. Therefore agricultural pricing policy which strictly speaking is not a macro policy in a conventional sense will also be discussed.

1. AN OVERVIEW

The GDP growth of Thailand has averaged over 5 per cent per year in the last twenty-five years from 1960 to 1984 (Table 1). The manufacturing sector has clearly shown a very impressive performance in terms of value added growth. Between 1950-52, the share of agriculture averaged 46.5 per cent while the same for manufacturing

12.3 per cent. By 1986, the share of agricultural value added had fallen to 22.6 per cent while that of the manufacturing sector increased to 21.7 per cent. In 1985 the share of exports of manufactures (49.5%) exceeded the share of agricultural exports (37.9%) for the first time and in 1986 exports of manufactured products constituted more than half (54.9%) of the total exports of Thailand. The performance of the manufacturing sector has led some Thais and observers of the Thai economy to convince themselves that Thailand is becoming a newly industrializing country (NIC).

However when the employment situation is considered, the performance of the manufacturing sector is not impressive. The sector could absorb only 8.5 per cent of total work force in 1985. It is estimated that the promoted manufacturing sector the firms in which receive fiscal privileges from encouraged investment activities employed about 177,938 workers (Sibungruang, 1986) i.e. about 7.9 per cent of the total work force of the manufacturing sector. The promoted sector accounted for 5.6 per cent of the total gross domestic investments. Therefore the bulk of the labour force is left in the agricultural sector.

Table 1 Overall and sectoral annual growth rates

(% a year at constant prices)

	1960-70	1970-80	1980-83	1984	1985	1986
GDP	7.9	6.9	5.4	5.5	3.2	3.5
Agriculture	5.5	4.2	3.6	3.3	3.2	-0.7
Non-agriculture	9.3	8.0	6.0	6.2	3.2	4.7
- Manufacturing	10.8	10.0	5.9	6.3	0.8	6.7

Source: National Account Division, NESDB

Although the size of the agricultural employment varies quite significantly between the wet and the dry season, it is safe to say the sector takes up about two-thirds of total employment with the remaining work force being absorbed by the service sector.

It is estimated that the labour force will grow at a rate of 2.75 per cent between 1985 and 1990 and decline slightly to 2.38 per cent between 1990 and 1995 (TDRI, 1986). In absolute terms, the addition to the Thai labour force between 1987-1991 totals 3.96 million persons. Employment expansion has inevitably become one of the major objectives of the Sixth National Economic and Social Development Plan.

2. THE AGRICULTURAL SECTOR

2.1 Labour Absorption in Agriculture

After two and a half decades of industrialization the agricultural sector still absorbed 67 per cent of total employment. The absorption of substantial labour in agriculture was made possible by expanding land frontier and by expanding irrigated areas. Between 1960 and 1980, the ratio of cultivated areas per agricultural worker increased as shown in Table 2. The additional land was brought into use by two major means-deforestation and irrigation. Between 1960-1985, forest encroachment amounted to 77.9 million rai (TDRI, 1987a). This is an average of 3.24 million rai a year. Deforestation occurs in all regions of Thailand although not all of these areas are brought under cultivation as some are unsuited to permanent agriculture. As the percentage of forests in total land areas decreased from 41 per cent in 1975 to 31 per cent in 1982, agricultural land increased from 35 per cent to 39 per cent.

Irrigated areas in Thailand increased from 6.54 million rai in 1976 to 21.6 million rai in 1983 (OAE, 1976/77 and 1984/85). Irrigation has not only made a second crop possible and hence increased the employment need on the same piece of land but it has also enabled a switch from low value to high value crops such as vegetables and

Table 2 Agricultural labour force and arable land

	1960	1970	1980
1. Population, ages 15 and over (millions)	14.94	18.98	27.66
2. Economically active population, age 15 and over (millions)	12.68	15.01	21.84
3. Labour force in agriculture, age 15 and over (millions)	10.34	11.68	15.53
4. Share of agriculture in the labour force, age 15 and over (per cent)	81.55	77.81	71.11
5. Cultivated area (mn. hectares) a/	8.26	13.10	17.72
6. Cultivated area per agricultural worker (hectare/capita)	0.80	1.12	1.14

Notes: a/ Arable area refers to land under paddy cultivations, crops, fruit tree and tree crops and vegetables and flowers.

Lines 1 to 3: National Statistical Office, 1960 Population Census, 1970 and 1980 Population and Housing Censuses.

Line 4: (Line 3 / Line 2)*100

Line 5: Center for Agricultural Statistics Office of Agricultural Economics, Ministry of Agriculture and Cooperatives.

Source: Siamwalla and Setboonsarng (1987)

flowers which require relatively good water control as well as high labour requirement.

2.2 Farm Mechanization

2.2.1 Adoption and utilization of farm machinery

The empirical studies on the appropriate choice of technology in Thai agriculture have tended to focus on farm mechanization. A number of the mechanical equipment have been introduced in Thai agriculture, namely water pumps, tractors, threshing machines and so on.

The adoption of farm mechanization is related to irrigated areas (Table 3). The Central Plain, the best irrigated region, has the highest density of horsepower and the highest percentage of paddy threshed mechanically. The opposite is true for the Northeast where the proportion of irrigated areas is the smallest.

Cutom-hire service commonly practised in Thailand enables an effective use of large farm equipment. It is observed that to increase operating hours large tractors from the Lower North move to several provinces in the Upper North region. With multiple drivers, operating time may be stretched to 12 hours a day (Chancellor, 1983). In the well-irrigated aareas of Chiang Mai Valley in the Upper North, land preparation is done during the night.

Table 3 Thailand: Farm mechanization

Region	Tractorization 1/ (rai)	Cultivated areas (rai)	Rai/H.P.	Irrigated areas (rai)	Mechanized threshing 2/ (% of paddy areas)
Central	2,034,679	28,778,927	14.14	12,203,112	52.37
North	1,652,307	29,435,782	17.81	4,371,395	25.89
South	473,428	14,663,121	30.97	1,855,780	41.91
Northeast	635,540	54,265,067	85.38	2,759,360	4.51
Total/average	4,795,954	157,142,897	26.51	21,189,647	23.01

Note: 1 rai = 0.16 hectare or 1 hectare (ha) = 6.25 rai

Sources: 1/ OAE (1985)

2/ Mongkoltanatas (1985)

2.2.2 Impact of farm mechanization

In discussing farm mechanization, a distinction ought to be made between mechanization for land improvements and mechanization for production. Land improvement activity involves bringing additional land into cultivation or increases the intensity of land use. Large tractors are associated with land improvement and are generally used in clearing new land. The further the frontier, the more marginal land and hence more power needed. As the use of large tractors for such a purpose is once-and-for-all while the flow of the employment generated is on-going, the

introduction of large tractors during the expansion of the land frontier has not been thought to have had a negative employment impact in Thailand. They have not been used in order to replace labour per se but to perform tasks which would have been impossible or extremely tedious with labour.

Depending on the scales and the users, water pumping can be considered as either equipment for land improvement or for farm operation. Whichever classification it belongs, water pumping brings about land intensification i.e. growing more in one season or growing more than one crop a year on a piece of land. It is generally considered employment generating. Water pumping is more efficient in delivering water than traditional pedal methods especially when the water level of major canals is lower than the farms.

The debates on appropriate choice of technology centre around mechanization in farm operations. The impact of mechanization on employment cannot be to be considered by the task affected also by but its impact on related tasks and activities. It is generally accepted that although tractorization replaces labour at land preparation stage[1/], it enables more employment required for a second or a third crop.

1/ It was estimated that labour requirement for land preparation using two-wheel and four-wheel tractors can save labour by 63 and 74 per cent respectively (S. Sukharomana, 1984)

The power tiller has been used mainly to replace animal power. However in the process, it has also displaced labour required to tend to these animals which is quite substantial (Table 4). However, the displaced labour in this situation could mostly be child labour who would find alternative employment (and hopefully more remunerative in the longer run) in education.

Most Thai case studies on the impact of farm mechanization on employment centre on an axial flow thresher (Pathnopas, 1980; Kittikul, 1980; cited by Siamwalla et al forthcoming; Duff, 1985). The consensus is that mechanical threshing was both privately and socially acceptable in Thailand (Duff, 1986). The total gain to Thai users were US$2.84 per ton and about US$62 per farm because mechanical threshing cost between $3.8-$4.8 per ton compared with the alternative tractor and animal methods of US$7.0 to US$9.6 per ton.

The axial flow thresher was estimated to reduce labour requirement substantially. Duff (1986) citing evidence from Pathnopas' study indicated that labour required for mechanical threshing was 27.4 per cent and 55.4 per cent of the labour requirements for buffalo and tractor treading respectively. However mechanical threshing was believed to be socially acceptable in Thailand during the period considered for three reasons. Firstly, the hired labour class was thought to be small. Secondly land

Table 4 Labour requirements for using a hand tractor or buffalos in rice growing

(man hour)

	Man hours per hectare	
	Hand tractor	Buffaloes
Maintenance 1/	2.8	383.0
Land Preparation	31.2	109.0
Threshing	31.3	60.0 2/

Notes: 1/ Refers to feeding, protection from insects and thieves for buffalo and repairs and oiling for hand tractors.

2/ Five buffaloes are needed.

Source: Siamwalla et al., forthcoming

frontier has been expanding. Thirdly, real wages in the areas sampled were increasing (Pathnopas, 1980). Duff supported the second reason by citing the fact that about 75 per cent of the continuous increase in rice production for three decades after 1955 was from area expansion.

The common argument in favour of mechanization is the "timeliness" which allows increased cropping intensity and better quality output. For rice, Duff argued that axial flow threshing did not increase cropping intensity as water availability was a deciding factor. His argument is probably valid for rice which is intensive in the use of

water. For field crops which demand much less water than rice, mechanization allows the possibility of fitting two crops in rain-fed areas. For example, in maize and soybean production, the combination of tractor cultivation and mechanical threshing ensure the timeliness needed for a good quality output and a possibility of earning an additional income from a second crop. It is observed that in the Lower North of Thailand where agriculture is largely rain-fed, two crops have to be fitted within a fairly short period to fully exploit soil moisture for the second crop. A seeder (mechanical sowing) is useful for farms of 20 rai (3.2 ha) or more to complete sowing soybean seed when soil moisture is at the most optimal level. Even in irrigated areas, mechanization may be necessary to allow early planting and speedy harvest to avoid early conditional rain. For example in the Upper North soybean cropped after rice need to be harvested before early April to escape possible rain damage.

Duff's report and the timeliness argument hinge upon the assumption that there is labour shortage at periods of peak demand. If there is a large pool of idle and therefore cheap labour at these "peak" periods, mechanization may be socially unacceptable. It is important to note that at least until 1980-1982, the timeliness argument seems to be valid as land/man ratios were

Table 5 Cultivated land per agricultural worker by region, 1961-1985

(rai per worker)

Region	North		Northeast		Central			South	
	Upper	Lower	Upper	Lower	Plain	East	West	Upper	Lower
1961-63	2.39	5.45	4.19	4.44	7.46	8.68	5.31	6.73	5.86
1980-82	3.14	8.94	5.12	5.53	9.29	10.56	7.26	7.99	7.85
1983-85	2.82	9.19	4.99	5.49	9.34	10.03	7.12	7.47	7.71

Note: 1 rai = 0.16 hectare or 1 hectare (ha) = 6.25 rai

Source : Adapted from TDRI (1987b), p. 17, Table 2.

increasing in all regions (Table 5)1/. After 1983, land/man ratios fell in most regions except the Lower North.

Binswanger concluded in his report prepared for the World Bank that the situation in Thailand was drastically different from that in Indian Punjab where mechanization replaced employment of migrants from agriculturally stagnant areas. In Thailand, demand for labour in the seventies increased in all regions. Even in a relatively stagnant area such as the Northeast, substantial migration to the newly opened land in the Lower North has kept its land/man ratio from declining.

1/ Land-man ratios in all subregions in the Central Plain started to decline around 1977-1979.

"Socially inappropriate" farm mechanization, to the extent that it exists, impacts hired labour rather than family labour. Unfortunately, to the author's knowledge there has not been a study on this particular issue in Thailand. As expanding land frontier is becoming difficult, the issue is becoming more important. However, it is important to note that for a study on the impact of mechanization on hired labour, it is not sufficient to show how much hired labour has been replaced the study should investigate the probability of earning returns from alternative employment.

2.3 Government Policies Affecting Agricultural Employment

2.3.1 Farm credit policy

The Thai government subsidizes farm credits through the Bank for Agriculture and Agricultural Cooperatives (BAAC). Loans for agricultural mechanization were first issued by the Bank in 1979. At that time the maximum limit was only 6,000 baht; only one-fifth of the price of a mechanical thresher (Mongkoltnatas, 1985) and one-third of the least expensive type of a four-wheel tractor (Chakkaphak and Cochran, 1986). At present the Bank provides loans up to 80 per cent of the value of the equipment but farmers receive the loans in kind from a manufacturer that has registered with the BAAC. Fixed

assets are also needed as collaterals. The interest rate is 12 per cent.

Previous empirical studies do not suggest government-subsidized credit as a major source of fund for farm mechanization. Pathnopas (1980 p. 60) reported that 70 per cent of the farmers interviewed acquired funds for rice threshers from their own savings, and only 30 per cent from loans. The BAAC accounted for 73.7 per cent of the sources of loan. Pongsrikul (1983) observed that tractors were purchased through suppliers' credit without collateral requirements and with limited assistance from the financial intermediaries.

2.3.2 Research, development and extension (RD&E) policies

The Thai Government's policy towards farm mechanization can be described as "passive encouragement". The Agricultural Engineering Division (AED) is the agency responsible for research and development of farm machinery. A Farm-Mechanization Subsection was also set up under the Crop Production Division of the Ministry of Agriculture and Co-operatives. The AED has collaborated in joint research with a number of international agencies.

So far the most commercially accepted innovation (with some modification by the private sector) from the AED is the axial flow thresher the blueprints of which came from the International Rice Research Institute (Pongsrikul, 1983). A new public innovation which is becoming more and more accepted is a threshing machine for soybean. The two-wheel and four-wheel tractors have been credited to the pioneering work of the local private sector.

Extension activities of farm equipment are effectively carried out by the private sector through sales and widespread custom-hire service.

2.3.3 Protection of the farm machinery industry

Prior to 1982, imported farm machinery was subject to a very low tariff rate of 5 per cent. Imported components were subject to higher rates. Consequently domestic producers had to pay higher total taxes than importers (Looha-Unchit, 1983).

In 1982, in order to foster the local engineering industry tariffs on imported farm machinery and components were increased to 33 per cent. The total taxes including tariff and local taxes paid by importers increased from 20.32 per cent to 52.40 per cent while taxes paid by the local producers rose from 24.14 to 35.60 per cent. The increase in the total taxes paid by the local producers was

a result of a nominal tariff increase to 33 per cent for diesel engines. Hence the local producers are protected at the expenses of local farmers.

2.3.4 Agricultural pricing polices

The Thai government has affected agricultural prices through a number of instruments. The major ones are export taxes and export quotas. Field crop and their products such as cassava, maize, and sugar are subject to export quotas. Rice, the most important crop, is subject to a wide range of interventions. Government intervention with prices has different impact for different products. The rice premium which was intended to stabilize and to keep the domestic prices down tended to suppress paddy prices while export quotas for cassava products and sugar tend to raise their domestic prices.

Agricultural pricing policies do not directly affect the choice of technology, i.e. they are neutral to the choice of factor proportion. However these policies could have indirect impact through output mix and income. With increased cash income farmers will be able to better afford farm equipment to generate higher returns through ownership of capital and increased productivity.

Siamwalla and Setboonsarng (1987) estimated that except sugar government price intervention adversely affected the prices of rice, maize and rubber, the three crops which coustituted 44 per cent of the total crop value added in 1985. The negative income effect from these interventions was extended to the rice farmers of all income classes as well as the rich and the medium income non-rice farmers.

2.3.5 Agricultural infrastructure

Government expenditure on infrastructure for agriculture such as irrigation and road increases land use and land intensification which will result in increased demand for labour. This could also improve income of farmers and indirectly induce consumption of capital goods. A recent study (Siamwalla and Setboonsarng, 1987) indicated that for the four major crops considered namely rice, maize, rubber and sugar, the net resource transfers (government revenue from agriculture minus total government expenditure on agriculture) were negative for most of the periods between 1960 and 1982. In 1982, the agricultural sector obtained subsidies and infrastructural resources totalling 9.6 billion baht from the government including road infrastructure, whereas the government derived a total income of 1.2 billion baht from agriculture.

2.3.6 Industrial, trade, monetary and fiscal policies

Tariffs on imported goods mainly manufactures have been an important revenue raising device for the Thai governments. Since 1960, it has also been used to foster the growth of the urban-based manufacturing industries which are considered to be vital for national development. These promoted industries also receive fiscal privileges in the form of tax holidays, exemption of tariffs on imported inputs and so on. The foreign exchange rates of the Thai baht are believed to be overvalued between 1960 and 1984. The combined effects of these policies are to raise the prices of non agricultural products including the price of capital goods against the prices of agricultural commodities.

The total flow of resources from the agricultural sector to the rest of the economy as a result of the combinations of these policies and agricultural pricing policies was estimated to be positive and substantial but the flow has been declining (Siamwalla and Setboongsarng, 1987). When the government expenditures on agriculture were taken into account, the net real resource transfers out of agriculture arising from these polices were positive all through the period between 1960 and 1982.

Empirical studies concerning the choice of agricultural technology are limited to case studies in the

1970s. On the basis of the evidence outlined, it may be concluded that during this period while substantial employment has been generated through its massive infrastructural investment especially in irrigation, the agricultural pricing and other macro policies have suppressed farm income and discouraged the use of farm equipment despite the increases in land-man ratios. Its passive encouragement of the mechanization programs are quite compatible with the agricultural factor endowment in the 60s and 70s. It is safe to say that macro-policies have not been in favour of capital widening and deepening during the seventies.

With the closing of its land frontier, Thailand in the 1980s has entered a period when the issue of capital-labour substitution should be of great concern. In other words the appropriate mix of capital and labour becomes a relevant consideration this time when the third factor, land, is actually held constant. The two-factor model on technology choice will now have a proper place in the analysis of Thai agriculture.

3. THE MANUFACTURING SECTOR

The Thai manufacturing sector can be described as having a dualistic nature i.e. comprising a small modern manufacturing enclave (located in Bangkok and its adjacent

provinces) which is surrounded by a large subsector consisting of small and medium scale enterprises. The small and medium scale enterprises are believed to account for a much greater proportion of the manufacturing value added than the modern large scale manufacturers.

Studies on the manufacturing sector have mostly been concentrated on the modern large-scale sector especially the promoted sector. Although a large number of studies examined the choice of technologies in this sector the common approach of is to compute capital labour ratios based on various measurements of the value of fixed assets. Most of these studies are interested in comparing the capital labour ratios between foreign and local firms (for example Pancharoen, 1980 and Khanthachai et al. 1987).

To the author's knowledge, there have been only two major studies so far which made some references to the impact of macro policies on the choice of technologies in the Thai manufacturing sector. The first study (Santikarn, 1977) was an investigation into the employment and skill generating effect of different levels of spinning technology in the Thai textile industry. The sampled firms in this study were mostly promoted enterprises. The second study comprises case studies in the food canning, galvanized iron and tapioca pelletizing industries (Bell and Scott-Kemmis, 1987). However the aim of the second study is to

investigate the technological dynamism of the Thai industry. The study was not designed to trace the impact of macro policies but some of their findings may throw some light on the current issue. In the case study of the tapioca processing industry, the sampled firms are mostly non promoted firms. Therefore, before discussing the case studies, it may be helpful to look at the investment promotion policy which has been of focal interest in the discussion of factors influencing the choice of technology in the Thai manufacturing industries.

3.1 Investment Promotion Policy

Investment incentives were first granted in 1960 when the Board of Investment (BOI) was provided considerable power to grant and administer special benefits to firms operating in the activities deemed vital to national development. The benefits can be classified into four categories: guarantee, permission, protection and tax incentives. Promoted firms are guaranteed against nationalization, competition from state enterprises, price control and so on. They are permitted to bring foreign staff, to own land and to repatriate profits in foreign currencies. Import ban, surcharges and tax relief may be used to protect and foster the encouraged activities. Exemptions from corporate income taxes and from witholding taxes on goodwill, royalties and fees remitted abroad are allowed.

For firms located in promoted zone, double deduction from taxable corporate income of the cost of transport, electricity and water supply are allowed. Up to 25 per cent of investment in infrastructure may be deducted from taxable income for 10 years from the date of income earning. For export enterprises, imported duties and business taxes on raw materials and components are exempted.

Incentives which are considered to cause factor price distortions are exemption or reduction of import duties and business taxes on imported machinery. Between 1973 and 1985, exemption of import duties on machinery totalled 8,225 million baht, about 2 per cent of total government revenue from duties on machinery (Sribunruang, 1986). When exemption of duties on raw materials was included, the total exemption for the same period amounted to 26 billion baht or 5.8 per cent of total revenue of the two items. Although the BOI announced that it would no longer grant tax exemption on imported machinery which had local equivalents, lack of information and shortage of staff have prevented the BOI from effectivily implementing this policy.

Another common criticism against the Board is that owing to its requirements on minimum size and capital investment, small scale enterprises are not eligible for promotion. Moreover the larger the firm, the longer the period allowed for corporate income tax holidays. Consequently, many small agro-processing firms in traditional industries such as rice mills, tapioca processing plants are not promoted. The following section investigates the impact of the investment policy on the choice of technology.

3.2 The Choice of Spinning Technology: A Case Study

In 1974 the author conducted a factory-level survey of 25 out of a total of 26 spinning plants in Thailand. Information was available for detailed analysis for only 24 firms out of which only one plant was not a promoted enterprise. The study covered over 90 per cent of the national capacity at the time of the survey.

3.2.1 Choice of technology

Sampled frims are classified into four categories (Table 6) according to the technical characteristics shown in Appendix Table 1. It is evident that the range of technologies adopted by these modern-large-scale spinners was quite narrow. Most firms used 1960 (intermediate) and 1968 (semi-advanced) models.

Table 6 Classification of spinning firms according to types of technology

(Number of firms)

	Types of technology				
	Conventional	Intermediate	Semi-advance	Advanced	Total
Spinning					
Local firms	2	5	6	2	15
Foreign firms	-	4	5	-	9
Total	2	9	11	2	24
Average size (spindles)	12,000	26,941	23,144	100,120	29,352
Average size (labour force)	433	512	590	1,900	656

Source: Santikarn (1977), p. 282, Table 10.4

3.2.2 Employment and skill generation

Two earlier studies, the Textile Council (1969) and ECLA (1966a), provided labour requirements for each technological level, assuming that factors such as qualities of products can be held constant. This enables one to obtain a precise indication of the employment effects of shifting from one technology to another. The results of the two studies are presented with the findings of the Thai textile industry in Table 7. The estimates for the Thai industry suggest a strong labour-replacement effect.

Table 7 Index of labour requirements for production of yarn

	Technology			
	A	B	C	Open-end spinning
The Textile Council (a)	100	66	46	33
ECLA (a)	100	53	33	-
The Thai Industry (b)	100	55	34	-

Notes: A = conventional
B = intermediate
C = semi advanced

Sources: (a) Textile Council (1969, Annex C, Tables 6a, 6b, 6c, 11) and ECLA (1966a, Table L)

(b) Santikarn (1977), p. 313, Table 10.10

Table 8 presents the skill composition under the three technologies in the Thai textile industry. From Table 8 it appears that there was little difference in the amount of skills used under different technologies. This is because the effects of technology on skill composition are more than offset by the economies of scale in the use of skills in larger enterprises. The larger the firms, the easier they can economise on skills. When the average size of the group is over 1,000 workers, the proportion of skilled workers diminishes. In the two largest local firms that used the most advanced technology, skilled workers constituted an extremely small proportion of the total work-

Table 8 The use of technical and production skills in the Thai textile industry

Types of Firms	Average size (persons)	Average levels of skills (%)			
		Highly-skilled & skilled	Skilled & supervisory	Semi-skilled & unskilled	Total
Intermediate technology					
Thai	903	1.17	11.30	87.45	100
Foreign	1322	1.37	7.26	91.28	100
Intermediately advanced and advanced technologies					
Thai	2486	.68	6.26	93.05	100
Foreign	698	1.70	13.41	84.86	100

Source: Santikarn (1977), p. 315, Table 10.11.

force. However, looking at the first and the last row where the size of the firms is more comparable there is a clear indication of an increase, though small in magnitude, in the use of higher skills at higher levels of technology among the foreign firms. This trend is not observed for the Thai firms because the advanced firms in this group are also the very large firms that can economize on the use of skills. In general, higher skills constitute a very small proportion of the total work-force.

3.2.3 Impact of investment promotion policy

The managers of the sampled firms in the textile industries were further asked if they would have chosen a different level of technology had the Thai government not granted tax exemption on imported capital equipment. For this question, information was available from additional nine non-integrated weaving firms. The majority of the sampled firms (25 out of 34 firms) claimed that they were not affected by the policy. However, foreign firms seemed to be more affected than local firms (Table 9).

Table 9 The effects of the government tax concessionary policy on technology choice of the Thai texlite firms

(Number of firms)

	Not affected	Affected	Not available	Total
Foreign-controlled Joint ventures	11	6	1	18
Locally-controlled joint ventures and local firms	14	3	1	18
Total	25	9	2	36

Source: Santikarn (1977), p. 295, Table 10.6.

To further examine these responses, hypothetical unit costs of output of two spinning mills were calculated. The first mill represents an intermediate technology and the second semi-advanced technology found in the Thai textile industry at the time of the survey. To arrive at the hypothetical costs, the price of a complete spinning plant of the semi-advanced model of 10,000 spindles was obtained from the machinery suppliers and companies proposing textile production to the Board of Investment. These are the prices of 1973. The value of the complete plant of the intermediate model was estimated from the suggestion made during the interviews with machine suppliers and plant owners.

The rate of output, characteristics of capital equipment and labour requirements were based on the investment study scheme supplied by a leading textile machinery producer. Both plants were assumed to produce 290 kgs of 20s cotton yarn per hour. Appendix Table 2 lists other technical assumptions.

Additional assumptions are as follows: capital equipment was assumed to operate at full capacity (3-shift) and the depreciation period was ten years. The tax on capital was 15 per cent. Labour requirements included only direct labour. Productivity of Thai labour was assumed to be 35 per cent of the best European mill at the time of first operation and to be 70 per cent in the fifth year of

operation. Wage costs were based on the sample average wage of the local firms. Attempt was also made to use the average wage of the foreign group but the difference in the results was negligible. Fringe benefits were estimated to increase the money wage by 40 per cent. The total wage including fringe benefits was assumed to rise at the rate of 10 per cent per annum.

Table 10 presents hypothetical costs based on various assumptions. Only the costs of primary factors, namely capital and direct labour were considered. Situations I and III indicate the situation that an average sample firm would have faced had it not been promoted and if the interest rates were 20 and 9 per cent respectively. Situation II is one which was facing an average promoted firm at the time of the survey. Situation IV is one where the interest rate was raised to 20 per cent but capital equipment was allowed to enter Thailand free of import duties.

The most striking outcome of these cost estimates is that in the promoted case (Situation II) the unit cost was substantially lower than that in the non-promoted Situations I and III. It is evident that up to 1982, promoted firms would operate at a lower unit cost than non-promoted firms even if they selected relatively modern

Table 10 Hypothetical unit cost of primary factors in the Thai textile industry

(baht per kg)

Situation I: Assumptions (i) capital equipment tax 15%
(ii) interest rate 20%

Per unit cost	1973		1977		1982	
	(a)	(b)	(a)	(b)	(a)	(b)
Capital	4.06	2.72	4.06	2.72	4.06	2.72
Labour	.54	.74	.40	.54	.64	.86
Total	4.60	3.46	4.46	3.26	4.70	3.58

Situation II: Assumptions (i) no tax on capital equipment
(ii) interest rate 9%

Per unit cost	1973		1977		1982	
	(a)	(b)	(a)	(b)	(a)	(b)
Capital	2.24	1.48	2.24	1.48	2.24	1.48
Labour	.54	.74	.40	.54	.64	.86
Total	2.78	2.22	2.64	2.02	2.88	2.34

Situation III: Assumptions (i) capital equipment tax 15%
(ii) interest rate 9%

Per unit cost	1973		1977		1982	
	(a)	(b)	(a)	(b)	(a)	(b)
Capital	2.51	1.65	2.51	1.65	2.51	1.65
Labour	.54	.74	.40	.54	.64	.86
Total	3.05	2.39	2.91	2.19	3.15	2.51

Table 10 (cont.)

(baht per kg)

Situation IV: Assumptions (i) no tax on capital equipment
(ii) interest rate 9%

Per unit cost	1973		1977		1982	
	(a)	(b)	(a)	(b)	(a)	(b)
Capital	3.49	2.36	3.49	2.36	3.49	2.36
Labour	.54	.74	.40	.54	.64	.86
Total	4.03	3.10	3.89	2.90	4.13	3.22

Notes: (a) denotes semi-advanced technology
(b) denotes intermediate technology

Source: Santikarn (1977), p.303 Table 10.7

technology. Since capital cost takes up more than 70 per cent of total primary factor cost, the effect of the prices of capital on the reduction of absolute unit cost is most evident. However comparing Situations II, III and IV suggests that the increase in interest rates to 20 per cent has greater effects on unit cost than the removal of tax concessions. This probably explains why the majority of firms (25 out of 36 sample firms in Table 9) claimed that their choice of technology was not affected by the tax concessionary policy.

Having recognized the fact that promoted firms are able to operate comfortably with modern technology under

prevailing capital prices, an answer is still needed as to why firms would not use intermediate technology to maximize their profits. Under all situations, firms would be better off employing intermediate rather than modern technology. One answer is that firms may not be profit maximizers. Firms may consider an acceptable level of profits as an operational goal.

If the firms were profit maximizers, then how would one explain their seeming neglect of this difference in unit cost? Several answers may be put forward. First, part of this difference in unit cost may be sacrificed as premiums paid to avoid labour disputes which were rampant at the time of the survey. Secondly, although the depreciation period was assumed to be ten years, which is the normal accounting practice of most sample firms, in practice machinery will be used up to 20 years or more if it is properly maintained. After the first ten years of operation, the unit cost of the intermediate technology could be higher. Thirdly, the market for yarn may not be perfectly competitive since a non-promoted firm could coexist with promoting firms under different cost conditions. This also partly explains why in the same company spinning technology was usually observed to be more modern than weaving technology. Markets for fabrics are much more competitive than markets for yarn.

Finally, the above calculation depends on the validity of various assumptions. If entrepreneurs expected wages to rise at the rate of 20 per cent per annum, or if indirect labour and other cost items are considered, the difference in unit cost will be reduced.

Could this difference in unit cost reflect engineering aesthetics of textile entrepreneurs as suggested by Wells (1973)? The impression is that pleasure in modern technology could be indulged in only if the firms can afford it. In general, engineering aesthetic preferences are believed to be effectively constrained by economic factors.

The results that modern large-scale firms used more capital intensive technology than what is actually needed for profit maximization was supported by two other studies. In his study of 400 Thai firms in 12 industries, Lecraw calculated of the actual to the cost-mininizing capital labour ratio (D2). D2 greater than 1 suggests that firms chose excessively capital intensive technology. The results of his study are presented in Table 11. D2's for all industries examined are greater than one.

Lecraw offered another explanation-risks for this seemingly non-profit maximizing behaviour. He regressed D2-1 on a number of risk variables: technology risk, quality risk, size of the industry, projected profits experience of manager and so on. He found that these variables explained 97 per cent of the variation in D2-1.

Table 11 Deviations by firms in their choice of technology from a cost-minimizing technology

SIC	D2 = (K/L) actual / (K/L) cost-minimizing		
	Average	Standard deviation	Range
20	1.65	0.37	3.50-0.73
21	2.02	0.43	3.71-0.38
23	1.92	0.37	2.95-1.18
24	1.68	0.41	2.21-0.52
26	1.75	0.51	3.34-0.65
27	1.81	0.54	3.07-0.61
30	1.72	0.42	3.75-0.52
31	1.39	0.21	2.92-0.57
33	1.87	0.47	2.91-0.83
35	1.75	0.23	1.93-0.67
36	1.25	0.11	1.43-0.77
37	1.71	0.29	2.29-0.62
All manufacturing	1.63	0.43	3.71-0.52

Notes: 1. SIC = Standard industrial classification
2. K/L = The ratio of capital stock to the number of workers per shift.

Source: Lecraw (1979), p. 643, Table III.

Bell and Scott-Kemmis Study (1987) of the food canning industry also revealed that some firms adopted more capital-intensive technology than would have allowed by the investment promotion policy. Using a locally produced machinery with main units from Japan produced output at a lower unit cost than the fully imported technology. The authors attributed this to the failure in the market for technology. The linkage between the producers of cans and the producers of can-making equipment was weak. Technological capacity of equipment producers was not adequate and known.

3.3 Tapioca Pelletizing Industry

Tapioca pelletizing technology was first introduced in Thailand around the mid-1960s by two European trading firms for the production of feed component obtained from tapioca roots. Earlier, tapioca feed was shipped in the form of chips or meal. By pelletizing the dried chips, quality is improved; the weight per unit volume increases by 35% and the method also enables mechanical handling. The press which is the main machinery was imported.

As exports of tapioca pellets grew dramatically, small scale local factories, relying on locally built machinery mushroomed. A local machinery producer obtained the major technological principle for the production of the press from repairing the imported machines. Other local machine producers soon followed suit. Subsequent

adaptations and modifications were made and the minimum scale was reduced. Bell and Scott-Kemmis reported that by 1973, 200 plants were using the locally adapted technology. The unit cost of the new local technique was around 60 per cent of the original foreign technique.

3.3.1 Employment implication

The local technique requires 3.6 man hours per ton while the imported version requires 1.1 man/hours per ton. Bell and Scott-Kemmis estimated that if the employment of the related engineering industry was also considered the total employment generated from the local technique was four times greater than that implied by the foreign technique.

Local adaptation of imported technology also allows the switch of power source from electricity to diesel engines. Consequently plants can be located in areas without electricity. The local technology does not only create more jobs but also more jobs in the rural areas.

3.3.2 Impact of investment promotion policy

Bell and Scott-Kemmis did not directly investigated the impact of macro-policies but the findings of tapioca pelletizing industry contrasted sharply with their findings from other industries. The tapioca processing and the local engineering industries are well linked resulting in rapid expansion and technological

dynamism. Accumulation of technological capability of other industries namely, can-making and steel galvanizing industries are relatively insignificant. They observed that "The firms that financed the engineering development and initial production of local equipment were relatively small, more or less disconnected from government investment promotion measures that augmented other incentives to import capital embodied technology" (Bell and Scott-Kemmis, 1987, p. 8-31). In other words, investment promotion policy encourages investments of large plants that rely on fully imported technology which is relatively labour saving. These plants provide no links with the labour and skill intensive engineering industries.

The case studies in the manufacturing sector seem to suggest that in the promoted sector, investment promotion policy not only distorts relative factor prices in favour of the use of capital equipment but also provides high profitabilty. However the empirical studies seem to conclude that such distortions can not adequately explain the choice of high capital-intensity of the large-scale enterprises.

Outside the promoted sector local firms tend to use partly locally produced machinery which are relatively efficient both privately and socially. In this large sub-sector the factor prices are relatively free from distortions.

It ought to be remembered that while investment promotion policy works against employment generation, the cheap food policy, accomplished by taxing the main staple food-rice mentioned earlier, tended to keep urban wages low, which encourages the use of labour.

3.4 Some Final Remarks

Two final remarks are in order. First, the previous case studies in the manufacturing sector have been discussed under the framwork of two-factor analysis. Since 1973, the third factor, energy has emerged as an important factor. Although the two case studies discussed earlier are not affected by this trend owing to its low energy requirements, energy cost could not be ignored in many industries for which the two-factor model would cease to be an adequate framework for analysis. This is similar to the case studies in agriculture prior to 1980 when other factors could not be held constant.

Secondly, proponents of appropriate technology defined loosely as labour-intensive technology tend to rely excessively on micro-level evidence. While the present author agrees that relative factor price distortions should be eliminated as much as possible, the concept of "appropriate technology" should not be applied indiscriminately. The problems of unemployment may have to be considered within a macro rather than a micro framework.

Within such a framework, different sub-sectors may be allowed to play different roles using different techniques with different factor proportions so long as the overall balance will not leave any abundant resources idle. The appropriate choice for a certain industry may not be the appropriate (defined as the retalively labour intensive) technology.

4. CONCLUSION

It has been shown that until 1980, the agricultural sector has done its best to absorb fast growing labour force but the closing of the land frontier starting towards the end of the seventies has sharply reduced its capacity to nurture the additional work force. The modern large-scale manufacturing industry on the other hand has shown a limited capacity to generate employment. It is time to assess more rigorously and accurately the total outcome of macro-policies not only on the agricultural and manufacturing but also the service employment. This paper only gathers evidence from preliminary studies that have been undertaken. More work has to be done and hopefully done properly to provide at least a partial solution to the employment problem which would be the paramount issue in the next decade.

Appendix

Table 1 Technology classification for the Thai textile industry

	Technical Characteristics			
	Conventional	Intermediate	Semi-advance	Advanced
Spinning process				
Blow room	Manual feeding and blending	No change	No Change	Automatic feeding & blending continuous system
	Lap roll up to 20 kgs.	Pneumatic delivery Lap roll up to 28 kgs.	Same as intermediate	Finished at drawing
Cards	Flexible wire output 8 kgs. per hour	Rigid wire output 12 kgs. per hour	Same as intermediate 30 kgs. per houre	
Roving frames	800 RPM	950 RPM	1,000 RPM	Process eliminated
Ring frames	Up to 10,500 RPM (20s)	10,500-12,000 RPM	Over 12,100 RPM	Break or open-end spinning
Cone winding	Non-automatic	Non-automatic	Automatic	

Source: Santikarn (1977), p. 280 Table 10.3

Table 2 Technical assumptions for Table 10

Gerneral Assumptions

(1) Raw material: 100% contton; staple length 17/16"

(2) Final product: unbleached yarn 20s (English count)

(3) Depreciation: 10 years

(4) Personnel in reserve: 10 per cent

(5) Output: 290 kg. per hour

Technical Assumptions for Semi-advanced Technology

Ring spinning frame (10,000 spindles): RPM 13,000; effiiency 92%

Speed frame: RPM 1,200; efficiency 82%

Drawing frame: RPM 250; efficiency 73.5%

High production card: output 27 kg/hr, efficiency 97%

Direct Labour Requirements (persons per hour)

	Intermediate	Semi-advanced
Skilled workers	1.38	1.38
Unskilled workers	1.00	1.00
Machine tenders	22.50	16.10

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