Thailand Development Research Institute

# TDRI Quarterly Review

*Contents*



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Photo on front cover: *A construction site on Soi Asoke. Photograph by Anne Johnson.*

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# Thailand's Strategy for Coping with the Gulf Crisis and New Oil Prices*

Narongchai Akrasanee

In response to favorable world economic situations, the Thai economy started to grow rapidly in 1986, reaching the unprecedented growth rate of 13.4 percent in 1988. Although the growth rate was lower in 1989, it was still estimated to be as high as 12.2 percent. Manufactured exports, foreign investment, and to a lesser extent, domestic investment and consumption have all been responsible for this unprecedented economic boom. During the first half of 1990, results of the economic boom were still evident throughout the country. The share prices kept breaking new high records. Construction confusion and communications congestion were the order of the day. The consensus was that for 1990 and beyond, moderately high economic growth rates would prevail. Even on August 6 – when the full Cabinet and the country's top planners met to map out the strategy for the Seventh Five-Year Plan covering the period of 1992-1996 – it was agreed that the targeted average annual growth rate should be set at 9 percent.

The events subsequent to the August 2 invasion into Kuwait by the Iraqi army have prompted all economic forecasters to revise their growth rates downward for the short- and medium-terms. The Thailand Development Research Institute is also predicting lower growth rates for the Thai economy. But the Institute is confident of Thailand's financial strength and believes that through proper measures designed to deal with the impact of the Gulf crisis and higher oil prices, the Thai economy will be able to grow at moderate rates, which should not be lower than those of most countries in the world.

TDRI's pre-Gulf crisis mid-year forecast confirmed the high-growth scenarios of the Thai economy, albeit at lower rates than in previous years. The 1990 growth rate was expected to be 9.6 percent, with the inflation rate stabilizing at 6.2 percent. The lower growth rate was due to slower export growth in 1990, which was slightly more than half the export growth achieved in 1989. However, financially the Thai economy has become stronger. The government is expected to have a treasury surplus of more than ฿100 billion. The country's foreign exchange reserve will pass US$13 billion, and the debt service ratio will remain at about 12 percent.

The Gulf crisis and the new higher oil prices will adversely affect the prospects of the Thai economy – as they would affect most other economies of the world that are trade-oriented and net oil importers – through their impact on economic growth and inflation. The impact will be minimal for 1990 because only the country's performance during the last quarter of the year will be affected. If the average oil cost to Thailand during the last quarter is about US$23-US$25 per barrel, the annual growth rate and the inflation rate will be about 9.3 percent and 6.5 percent, respectively.

The impact of the Gulf crisis on the Thai economy in 1991 is expected to be more severe. If the average growth rate of the OECD countries declines to one-half of what was originally expected – about 1.5 percent – and if the annual average cost of oil to Thailand is US$25 per barrel, then Thailand's growth rate is expected to be 5.3 percent, with a 7.8 percent inflation rate. An average oil cost of US$23 per barrel will improve the economic growth rate and the inflation rate to 6 percent and 7.3 percent, respectively. In summary, if the Gulf crisis cuts OECD growth by half and results in an average crude oil price of US$25 per barrel and if the government does not take any other action apart from adjusting the retail oil prices, then the Thai economy is expected to grow at about 5 to 6 percent in 1991. TDRI does not offer forecasts for the years beyond 1991 under this Gulf crisis scenario.

The impact of the Gulf crisis on the Thai economy in 1991 is strong because the Thai economy has been growing rapidly only for a few years. This growth has been strongly export-oriented. The domestic demand growth is about to become the major driving force, as the per capita income is reaching US$1,400. Without the Gulf crisis, Thailand's economy could be self-sustaining within the next few years. Nevertheless, the domestic demand growth is expected to help sustain the overall growth of the economy in 1991, which otherwise would be growing at even lower rates.

One factor in Thailand's favor during the expected world economic crisis of 1991 is its financial strength. As pointed out earlier, the country's fiscal, foreign exchange reserve, and foreign debt positions are strong and sound. Thus, the government could help sustain the growth rate by accelerating the implementation of infrastructure projects, all of which are long overdue. By doing so, the government could help the economy to grow at about 7 percent, a rate that few countries in the world could expect to achieve should the stalemate in the Middle East be prolonged through the first half of 1991.

* *Speech presented at the Australian-Thai Chamber of Commerce Luncheon October, 1990.*

# An Estimate of Cropping Production and Value in Thailand's Forest Reserves from the 1988 Village Census

Songkram Grachangnetara

The 1988 survey of Thailand's rural villages was undertaken in accordance with the Cabinet decision in September 1987. The Cabinet took the occasion also to endorse the recommendation of the Committee of Economic Ministers (The Economic Cabinet) for a biannual survey of all villages outside urban areas. Although there had been two such previous surveys in 1984 and 1986, the decision meant that such comprehensive socioeconomic surveys of rural Thailand would continue to be conducted on a permanent basis every other year. The rural area is defined as all villages situated outside the urbanized enclosures of sanitary (*suka-piban*) and municipal districts. For the year 1988 such villages (*muban*) numbered 56,296. These rural entities, the lowest-level local administrative units, form part of the higher administrative units of 6,361 subdistricts (*tambon*), attached to 731 districts (*amphoe*) and 72 provinces (*changwad*).

The survey questionnaire is known as the NRDC 2C Form, the acronym NRDC standing for the National Rural Development Committee. The first NRDC 2C survey undertaken in 1984 was an attempt to identify a class of "poor" rural villages as a target group to which all efforts of the government's anti-poverty program were to be directed exclusively. Later, the program's aim was modified; the target group became all rural villages, in response to whose revealed needs the government would implement a differentiated program of rural support and development.

There are a maximum of 493 variables pertinent to the socioeconomic profile of each village contained in the 1988 NRDC questionnaire. The data constitute the single largest set of information that depicts Thailand's contemporary rural profile.

### The Rural Profile

Nearly all of Thailand's farmers, and most of the poor, live in rural areas. The NRDC 2C census presents a composite picture of Thailand's agricultural production, income, and social conditions: the data define the degree and incidence of Thailand's rural poverty, log the current changes in rural socioeconomic parameters, and depict the country's current rural profile.

The 1988 survey's demographic data showed that Thailand's rural population totaled 34.2 million, consisting of 6.6 million households in basic communities of 56,296 villages. A rural household averaged 5.2 persons, and a village averaged 600 persons, or 120 households.

The Thai rural community is not isolated. There were 38 television sets for every 100 households, 74 percent of which had electricity. It is mobile. Less than 2,000 villages, or only 3 percent of the total number, had no direct road connection to the local district town or amphoe from which access to the country's highways network is assured; 52 percent of all the villages had regular or scheduled passenger buses, minibuses, or motorcycle services throughout the year; and a further 30 percent had such services on an irregular and occasional basis for part of the year during the rainy season. For every 100 rural households, there were 56 bicycles, 26 motorcycles, two converted farm transport vehicles (*e-tan*), and four pick-up trucks.

Occupation and livelihood indicators showed that 4.3 million, or 66 percent of the rural households, owned the land on which they worked; 11 percent rented supplementary land, and 9 percent worked on wholly rented land. Two-thirds of the total number of households (not necessarily the same set that worked their own land) owed part or all of their subsistence to rice farming. The overwhelming majority of them (3.9 million, or over 90 percent) produced a single rice crop per year, the rest either occasionally or regularly harvested two crops. Nineteen percent of the villages cited the lack of water as the reason for the farmers' frustrated second cropping. One-half of the total number of rice farming households harvested paddy from over 6 rai of land, 35 percent of them from 6-20 rai. Of all the rural households, 13 percent regularly engaged in dry season cash cropping. Fifty-two percent used fertilizers, and 42 percent used insecticides. Thirty percent of the households owned draft animals, and 6 percent rented them either exclusively or to supplement their own animals. Eleven percent owned small tractors or mechanized hoes with tracks, while 19 percent rented them. Less than one percent owned farm tractors, while 22 percent rented them. The rural labor force is comprised of 18.5 million persons belonging to the 14 to 50

year old age group, with 23 percent, or 1.5 million rural households, having members who migrated for all or part of the year to work outside their subdistrict or tambon area.

The public education and health infrastructures that had been extended and developed over the years were very much in evidence and were shown to have delivered effective basic services to the rural community. Education indicators showed that 63 percent of the total current rural population of all age groups had passed through the four-year compulsory education system. Although primary school enrollment is universal, only 4.4 percent had received a secondary-level education. On the other hand, only 0.87 million, or 4.7 percent of the 14 to 50 year age group, were illiterate. Fifty-six percent of all the villages had primary schools within the village grounds, and 97 percent of all the subdistricts in which the villages were the subordinate parts had a primary school.

Health indicators showed that the rural infant mortality rate averaged 12 per thousand live births up to one year old; maternal deaths averaged 6 per one thousand live births. Seventy-five percent of rural families practiced some form of birth control. Ninety-seven percent of the villages had had over 75 percent of the children in the compulsory schooling age group vaccinated under the government's primary health care program. Of all the rural households, 61 percent had septic tank toilets, while 32 percent still had no toilets of any kind. Of all the subdistricts in which the villages were the subordinate parts, 94 percent had a government health center. Of all the rural children up to five years old, 17 percent were classified as malnourished, mostly of the level 1 (the least severe) standard. The government ran official day-care centers in 8 percent of the villages; 16 percent had nursery schools for children of preschool age.

The above summary picks out rather arbitrarily some of the more salient features of Thailand's rural profile, a composite picture that covers two-thirds of the country's total population of mostly farming householders, for almost all the agricultural land in use. The NRDC 2C village census is uniquely comprehensive in both coverage and design. The questionnaire data take stock of the prevailing socioeconomic situation and the public service infrastructure, the rural householders' occupations, and their predominantly agricultural production and income. The very broad spectrum of indicators within the scope of the census may overlap or duplicate parts of other surveys that are more narrowly focused and more narrowly based in terms of the underlying sample population size and the area covered. However, parts of the NRDC survey are census data that cover practically all households and all of the population engaged in certain types of activities or livelihoods. And because the census is repeated every two years, the NRDC 2C data also provide useful dynamic information on such groups or subclasses of the population making their living in geographically well-defined areas. The farming population, and the various subgroups of rural householders engaged in different cropping activities are cases in point. In this respect, the NRDC survey is an agricultural census.

### Cropping Income

Section 2 of the NRDC questionnaire dealing with occupational and livelihood indicators depicts in detail and in depth the production and income derived from agricultural activities. The section covers the number of households, the cropping area, the yield, the farmgate price or the market value, and a host of other variables (the uses and types of fertilzers, for example) relating to the production of all major and some minor crops. Since agricultural activities take place and farming households live almost exclusively in the rural areas – defined by the questionnaire as non-urban – the NRDC 2C survey in this section approximates a national census of agricultural production and income. However, because the agricultural variables can also be cross-tabulated with other village-level socioeconomic data, the census can point out some unexpected and surprising perspectives that could drastically revise our perception of certain issues. For example, the 1988 NRDC survey data revealed that 12,360 villages, or 22 per cent of the total number of 56,296 rural villages, were situated in areas that are still legally parts of Thailand's National Forest Reserves. Some 1.6 million households in these villages, which constitute 24.3 per cent of the total 6.6 million Thai rural households, are living in and working on encroached forest lands.

The NRDC 2C questionnaire covers the production quantities and the value of gross income derived from 20 listed categories of rural household occupational activities (except cottage industries) relating to the agriculture sector. The respondent village indicates the number of its households deriving income under each of the 20 categories. Because a household may be involved in more than one category of activities, the total number of households listed for all the categories of occupational activities may exceed the number of actual households in the village. Following the first category of rice cropping, short-term and long-term upland cropping are classified as two separate categories; the respondent village can list up to three common types of upland crops grown under each category, in terms of the number of farming households involved.

Production quantities and the unit price – the "typical" farmgate or market value per unit received by the producer – are assessed on the basis of the mode value (the most frequently occurring one) for the respective crop. Short-term upland crops are defined as those with a planting cycle time of less than four months to harvesting, such as maize (for cattle feed), mung bean and soya bean, but not including vegetables. Long-term upland

crops are those with more than a four-month planting cycle time, such as sugarcane, tapioca, jute, castor, cotton, pineapple, etc.

The production and income derived from upland crops listed under short-term and long-term croppings exclude all the other crops appearing under other listed categories. Dry season cropping – a separate category on its own – is defined as the cropping of all short-term crops and vegetables grown for sale only during the dry season. "Other tree crops" include coconuts, conifers, oil palm, coffee, cocoa, and cashew. "Other crops" are those not in the short- and long-term crop varieties nor appearing elsewhere in any other given category of activities; they include such miscellaneous crops as bamboo, mushrooms, and mulberries for silkworm rearing.

The subsequent sections of this article attempt to present an approximation of the extent – in terms of relative and absolute areas – and the production value of upland crops in encroached areas of Thailand's forest reserves. The 1988 NRDC 2C village census data permit estimates to be made which differentiate between types of crops and between local administrative areas. The income derived from upland cropping constitutes an important part of the total rural income derived from all categories of agricultural activities, and it is perceived a priori to be the single most dominant category of income derived from working on encroached forest reserve lands, which cannot be legally owned nor, strictly speaking, legally farmed. Such lands are presumed to have been initially encroached and subsequently remained in use largely for upland cropping, which required relatively little investment outlays of a permanent or intensive nature.

## The Data

The sections of the NDRC 2C data pertinent to the analysis are those dealing with short-term and long-term upland cropping. In the processing of the raw census data, named upland crops were assigned codes from a total list of 41 short-term crops and 11 long-term crops to cover any combination of the top three most common crops under each category identified by the respondent villages.

The data evidently needed to be either corrected or discarded in parts: obviously implausible ranges of values occurring in isolation and too far removed from the group mean, median, or mode statistics – which would otherwise affect the estimate of production quantities or their value in the aggregate – had to be rejected as uncorrected errors. Generally, the farmgate or market prices for the major crops reportedly received by households which exceeded by 2.5 times or more the overall median unit value for the respective crop were considered unacceptable and were rejected offhand as data entry errors. By contrast, the low end of the price spectrum was left unmodified except for four major crops: the reported low price relative to the median value would be given the benefit of the doubt due to possible cases of poor quality and unfavorable and uncompetitive local conditions. To estimate more realistic values of production from the given data in the cases where the given price was considered obviously in error, either the respective provincial mode or the overall mode value was used in cases where the number of cropping villages was fewer than five for the entire province. The substituted range of pricing is shown in the 1988 Crop Price Table, which indicates the accepted range of the maximum and minimum reported price for various crops on the list of the twenty most commonly grown in terms of the number of reported cropping villages. Overall, the possible bias as a result of price substitution on the crops' estimated value of production would probably be on the side of underestimation, since the cases of reported extremely low prices for most crops were generally left unsubstituted.

There also appeared to be some confusion on the part of the respondent villages about whether to define some crops as short-term or long-term. Many crops appeared in both categories. Consequently, the observations bearing on all listed and unlisted short-term and long-term crops in the relevant sections of the questionnaire returns were consolidated into a single data file. Accordingly, the descriptive statistics were determined irrespective of a particular crop's identification (by the respondent villages) or its classification (by the census manual) as short-term or long-term. The analysis does not differentiate between the two categories.

In cases where the reported number of households engaging in any one cropping activity exceeded the total number of households for the village, the latter value from the general demographic section of the questionnaire was substituted instead as the possible maximum. And all cases were disregarded and excluded from the determination of all group statistics that implied an income level per household in excess of one million baht.

## The Analysis

Altogether 32,667 villages indicated that they had households growing upland crops; of these, 9,833 villages, or 30 percent, were identified as being villages situated in national forest reserves. Of the 15,736 villages responding that they were growing more than one type of upland crops, 5,951, or 38 percent, were situated in forest reserves. And of the 3,472 villages responding that they were growing three types of upland crops, 1,485, or 42 percent, were in forest reserves. The data showed the proportion of forest reserves villages grew as the varieties of upland crops being grown in the villages increased. The greatest number of villages reported growing tapioca (15,570 villages), followed by maize (10,226 villages), mung bean (4,722 villages), groundnut (4,659 villages), jute (4,325 villages), and sugarcane

(4,263 villages). The proportion of forest reserves villages was 34 percent for tapioca, 43 percent for maize, 32 percent for mung bean, 29 percent for groundnut, 35 percent for jute, and 25 percent for sugarcane.

For the listed 55 varieties of upland crops, there were 2,979 million cropping households, of which 1,222 million, or 41 percent, were residents of forest reserves villages. Tapioca cropping engaged the biggest group of 811,000 households, of which 331,100 were in forest reserves. Of the next largest group of 637,643 maize cropping households, over one-half, or 322,249, were from the forest reserves villages. The households of forest reserves villages growing these major two crops accounted for 53 percent of the total cropping by all households in all the forest reserves areas.

The gross income per household derived from an identified crop is first found from the census data on price, productivity, cropping area, and intensity reported for that particular crop for individual villages. The production value for the village is then determined from the number of cropping households. Differentiating between those villages which according to NRDC census data are situated within national forest reserves and others which are not, the village upland cropping data are then aggregated for all crops to show the total cash cropping income by province and by crop type. The 1988 Cropping Value by Provinces Table aggregates all data from the consolidated cash cropping file. The 1988 Cropping Value by Type Table aggregates the data limited to the classified varieties of upland crops. Not all the 55 classified short- and long-term upland crops had reported production value. The difference in the sum totals of production value of the two tables is marginal. The tables showing upland cropping in terms of land use – 1988 Cropping Areas by Province and 1988 Cropping Areas by Crops – include data only for the 55 listed upland crops. Total cropping by volume is shown in the 1988 Crop Production in Tons Table.

The value of cash crops grown in encroached national forest reserves areas was found to be 42 percent of the total gross rural income derived from all upland cash cropping, amounting in 1988 to 20.7 billion baht. The provinces of Nakhon Ratchasima, Phetchabun, Udon Thani, Kamphaeng Phet, and Prachin Buri recorded the highest production value of upland cash cropping on encroached forest reserves land, each over one billion baht, amounting to 6.6 billion baht. The sum represents 54 percent of the total gross income derived from all upland cropping done in the five provinces, and over 13 percent of the value of all upland cropping in 1988. The same five provinces also topped the list in the area of forest reserves land encroached; together they accounted for 26.5 percent of the total encroachment, with Phetchabun and Nakhon Ratchasima each having over one million rai of forest reserves under crops. Of the total 29.7 million rai in use for upland cropping, 13.7 million rai, or 46 percent were in national forest reserves areas. Of the major crops, more maize and cotton were grown and more income was derived in forest reserves lands than from outside; in the case of upland rice, over three-fourths of the total rice planted took place in encroached forest areas. In absolute terms, the greatest use of national forest reserves for growing any single upland crop was for tapioca, amounting to 4.2 million rai, or over 30 percent of the total encroached areas of the national forest reserves under upland crops.

No discernible pattern was found in the differences in productivity within and outside the forest reserves. Forest reserves land was less productive by 9 percent and 5 percent, respectively for maize and sugarcane but more productive (6%) for tapioca, relative to non-forest reserve areas. The only single marked difference was for tobacco – which must be considered a special case since the questionnaire data and coding made no distinction between varieties, some of which are intensively cultivated under contract farming for specialized markets. The productivity differences for various crops between overall areas and forest reserves are shown for the more commonly grown crops in the 1988 Mean Productivity of Cropping Table.

The extent of the encroachment of national forest reserves areas as indicated in the foregoing analysis is by no means the full picture. There are other agricultural activities and other crops besides upland crops that must have also contributed to the total encroachment. If almost a quarter of all the rural households are already farming on forest reserves land, there can be no credibility in any attempt to maintain the reserves' present legal but fictitious boundaries. The extent to which other crops have added to the encroachment of the land within those boundaries will have to be further studied. What has been demonstrated sufficiently clearly and quantitatively from the 1988 rural village census data in the case of the upland crops was that over 40 percent of their entire annual output and almost one-half of the total land area needed to grow them were supported by the largely illegal use of Thailand's national forest reserves.

## Table 1 1988 Crop Price: Baht per Kilo

| Code | Crop | Group Statistics | | | Permitted Range | |
|---|---|---|---|---|---|---|
| | | Mean | Median | Mode | Maximum | Minimum |
| 102 | maize | 2.80 | 2.20 | 2.00 | 50.00 | ..... |
| 104 | sorghum | 2.47 | 2.10 | 2.00 | ..... | ..... |
| 110 | sesame | 11.21 | 10.00 | 10.00 | ..... | ..... |
| 113 | mung bean | 7.80 | 7.30 | 8.00 | 20.00 | ..... |
| 114 | black matpe bean | 7.43 | 7.00 | 7.00 | 27.00 | ..... |
| 115 | groundnut | 7.22 | 6.00 | 5.00 | 50.00 | 0.50 |
| 116 | black bean | 5.95 | 6.00 | 6.00 | ..... | ..... |
| 117 | red bean | 5.51 | 5.00 | 5.00 | ..... | ..... |
| 125 | soya bean | 7.90 | 8.00 | 8.00 | 17.00 | ..... |
| 128 | jute | 4.71 | 4.50 | 5.00 | ..... | ..... |
| 129 | kenaf | 4.71 | 4.50 | 5.00 | 12.00 | ..... |
| 131 | cotton | 11.72 | 12.00 | 12.00 | 28.00 | 0.50 |
| 134 | tapioca | 1.17 | 0.60 | 0.50 | 5.00 | 0.10 |
| 136 | tobacco | 22.29 | 22.00 | 2.00 | ..... | ..... |
| 140 | castor | 5.70 | 6.00 | 5.00 | ..... | ..... |
| 144 | sugarcane | 2.84 | 0.42 | 0.40 | 15.00 | 0.20 |
| 148 | upland rice | 3.33 | 3.00 | 3.00 | 8.00 | ..... |
| 149 | garlic | 9.39 | 6.00 | 5.00 | ..... | ..... |
| 276 | sweet potato | 2.20 | 2.00 | 2.00 | ..... | ..... |
| 279 | pineapple | 2.57 | 1.60 | 2.00 | ..... | ..... |

## Table 2 1988 Mean Productivity of Cropping: Kilos per Rai[1]

| Code | Crop | All Areas | | Forest Reserves | |
|---|---|---|---|---|---|
| | | Mean | Villages | Mean | Villages |
| 102 | maize | 416.1 | 10138 | 395.2 | 4423 |
| 104 | sorghum | 262.4 | 940 | 270.1 | 262 |
| 110 | sesame | 77.3 | 625 | 78.2 | 191 |
| 113 | mung bean | 131.4 | 4692 | 130.0 | 1495 |
| 114 | black matpe bean | 183.1 | 1048 | 189.5 | 364 |
| 115 | groundnut | 231.3 | 4633 | 222.9 | 1346 |
| 116 | black bean | 138.8 | 177 | 129.0 | 87 |
| 117 | red bean | 182.3 | 411 | 174.9 | 287 |
| 125 | soya bean | 218.6 | 3943 | 207.0 | 1613 |
| 128 | jute | 236.6 | 4307 | 246.8 | 1502 |
| 129 | kenaf | 210.7 | 2217 | 202.3 | 688 |
| 131 | cotton | 193.3 | 1666 | 185.8 | 899 |
| 134 | tapioca | 1925.2 | 15500 | 2000.3 | 5293 |
| 136 | tobacco | 836.5 | 1329 | 1391.1 | 184 |
| 140 | castor | 198.2 | 289 | 144.2 | 167 |
| 143 | mulberry | 692.6 | 63 | 461.5 | 22 |
| 144 | sugarcane | 7280.9 | 4089 | 7014.5 | 1016 |
| 146 | unclassified beans | 439.6 | 403 | 340.6 | 118 |
| 148 | upland rice | 287.3 | 1090 | 274.1 | 755 |
| 149 | garlic | 991.1 | 249 | 903.1 | 65 |
| 276 | sweet potato | 1672.8 | 319 | 1489.8 | 47 |
| 279 | pineapple | 3980.1 | 897 | 3965.8 | 305 |

1 Mean values are determined from reported production per rai obtained by cropping households for each of the villages. The number of villages reporting cropping households represents the number of observations.

## Table 3 1988 Cropping Values by Province: In Million Baht[1]

| | | All Areas | | Forest Reserves | | % |
|---|---|---|---|---|---|---|
| Code | Province | Value | Villages | Value | Villages | Forest |
| 1 | KRABI | 22.335 | 89 | 16.356 | 52 | 73.2% |
| 2 | KANCHANABURI | 2,999.180 | 1,474 | 726.946 | 500 | 24.2% |
| 3 | KALASIN | 1,007.719 | 1,585 | 114.616 | 121 | 11.4% |
| 4 | KAMPHAENG PHET | 1,988.017 | 1,252 | 1,110.557 | 730 | 55.9% |
| 5 | KHON KAEN | 1,453.999 | 2,336 | 539.548 | 453 | 37.1% |
| 6 | CHANTHABURI | 780.797 | 469 | 474.077 | 179 | 60.7% |
| 7 | CHACHOENGSAO | 850.106 | 300 | 447.775 | 99 | 52.7% |
| 8 | CHON BURI | 1,370.164 | 549 | 624.783 | 148 | 45.6% |
| 9 | CHAI NAT | 143.635 | 189 | 25.794 | 29 | 18.0% |
| 10 | CHAIYAPHUM | 1,817.866 | 2,520 | 757.550 | 807 | 41.7% |
| 11 | CHUMPHON | 104.639 | 247 | 85.423 | 143 | 81.6% |
| 12 | CHIANG RAI | 889.217 | 1,735 | 436.281 | 836 | 49.1% |
| 13 | CHIANG MAI | 955.761 | 1,666 | 475.276 | 647 | 49.7% |
| 14 | TRANG | 14.394 | 78 | 7.469 | 19 | 51.9% |
| 15 | TRAT | 155.556 | 233 | 107.013 | 131 | 68.8% |
| 16 | TAK | 545.940 | 761 | 252.105 | 333 | 46.2% |
| 17 | YASOTHON | 213.031 | 725 | 93.249 | 251 | 43.8% |
| 18 | NAKHON NAYOK | 15.069 | 94 | 1.084 | 8 | 7.2% |
| 19 | NAKHON PATHOM | 487.551 | 341 | | | |
| 20 | NAKHON PHANOM | 174.155 | 672 | 25.638 | 99 | 14.7% |
| 21 | NAKHON RATCHASIMA | 3,801.608 | 3,890 | 1,617.657 | 1,360 | 42.6% |
| 22 | NAKHON SRI THAMMARAT | 182.668 | 473 | 67.411 | 119 | 36.9% |
| 23 | NAKHON SAWAN | 1,769.058 | 1,409 | 509.470 | 249 | 28.8% |
| 24 | NONTHABURI | 2.744 | 4 | | | |
| 25 | NARATHIWAT | 22.410 | 226 | 1.483 | 18 | 6.6% |
| 26 | NAN | 431.628 | 1,615 | 137.642 | 766 | 31.9% |
| 27 | BURI RAM | 624.876 | 1,676 | 250.484 | 343 | 40.1% |
| 28 | PATHUM THANI | 22.034 | 46 | | | |
| 29 | PRACHUAP KHIRIKHAN | 1,790.785 | 587 | 309.508 | 223 | 17.3% |
| 30 | PRACHIN BURI | 1,511.709 | 1,359 | 1,100.487 | 886 | 72.8% |
| 31 | PATTANI | 35.546 | 469 | 4.066 | 40 | 11.4% |
| 33 | AYUTTHAYA | 31.605 | 218 | | | |
| 34 | PHANGNGA | 28.270 | 59 | 9.448 | 36 | 33.4% |
| 35 | PHATTHALUNG | 47.546 | 261 | 8.002 | 68 | 16.8% |
| 36 | PICHIT | 237.092 | 488 | 13.452 | 55 | 5.7% |
| 37 | PHITSANULOK | 1,133.105 | 1,401 | 713.818 | 631 | 63.0% |
| 38 | PHETCHABURI | 603.082 | 534 | 307.292 | 173 | 51.0% |
| 39 | PHETCHABUN | 2,735.680 | 2,326 | 1,530.070 | 976 | 55.9% |
| 40 | PHRAE | 391.705 | 924 | 142.213 | 356 | 36.3% |
| 41 | PHUKET | 25.775 | 64 | 8.718 | 32 | 33.8% |
| 42 | MAHA SARAKHAM | 389.815 | 1,161 | 30.559 | 75 | 7.8% |
| 43 | MAE HONG SON | 88.733 | 360 | 57.258 | 286 | 64.5% |
| 44 | YALA | 185.184 | 122 | 3.474 | 16 | 1.9% |
| 45 | ROI ET | 382.049 | 1,297 | 67.535 | 187 | 17.7% |
| 46 | RANONG | 15.747 | 74 | 12.601 | 44 | 80.0% |
| 47 | RAYONG | 1,084.898 | 497 | 378.836 | 153 | 34.9% |
| 48 | RATCHABURI | 1,016.466 | 832 | 371.323 | 235 | 36.5% |
| 49 | LOP BURI | 2,065.746 | 1,483 | 905.548 | 567 | 43.8% |
| 50 | LAMPANG | 524.040 | 1,042 | 106.583 | 357 | 20.3% |
| 51 | LAMPHUN | 117.124 | 318 | 21.284 | 89 | 18.2% |
| 52 | LOEI | 1,838.332 | 2,162 | 962.297 | 1,105 | 52.3% |
| 53 | SI SA KET | 449.355 | 1,335 | 175.471 | 498 | 39.0% |
| 54 | SAKON NAKHON | 531.001 | 1,438 | 258.623 | 471 | 48.7% |
| 55 | SONGKHLA | 51.141 | 333 | 9.685 | 51 | 18.9% |
| 56 | SATUN | 12.431 | 52 | 3.116 | 10 | 25.1% |
| 57 | SAMUT PRAKAN | 0.061 | 2 | | | |
| 59 | SAMUT SAKHON | 0.344 | 4 | | | |
| 60 | SARABURI | 721.797 | 689 | 236.088 | 188 | 32.7% |
| 61 | SING BURI | 121.731 | 146 | 0.037 | 1 | 0.0% |
| 62 | SUKHOTHAI | 1,385.579 | 1,056 | 439.961 | 311 | 31.8% |
| 63 | SUPHAN BURI | 1,443.109 | 724 | 566.579 | 230 | 39.3% |
| 64 | SURAT THANI | 121.350 | 368 | 79.930 | 177 | 65.9% |
| 65 | SURIN | 149.520 | 1,274 | 71.978 | 487 | 48.1% |
| 66 | NONG KHAI | 877.643 | 1,395 | 369.641 | 585 | 42.1% |
| 67 | ANG THONG | 35.882 | 148 | | | |
| 68 | UDON THANI | 2,193.106 | 3,013 | 1,217.371 | 1,456 | 55.5% |
| 69 | UTTARADIT | 663.327 | 950 | 180.319 | 317 | 27.2% |
| 70 | UTHAI THANI | 1,009.833 | 634 | 696.621 | 328 | 69.0% |
| 71 | UBON RATCHATHANI | 390.455 | 1,616 | 185.465 | 673 | 47.5% |
| 72 | PHAYAO | 362.484 | 954 | 147.346 | 351 | 40.6% |
| 73 | MUKDAHARN | 199.240 | 851 | 94.994 | 384 | 47.7% |
| | Total | 49,845.579 | 61,674 | 20,703.283 | 21,548 | 41.5% |

1 Cropping values are determined from the reported production, price, the number of cropping households, cropping area and intensity (the number of cropping seasons per year) for each of the villages in the province which report short-term and long-term cropping. The values are estimated for all crops, whether or not listed as short- or long-term crops, regardless of crop codes pertinent to the sections of the questionnaire on short-term and long-term cropping engaged by the households. The number of villages reporting cropping households represents the number of observations. Since respondent villages are permitted to list up to three each of the most common short-term and long-term crops,

## Table 4 1988 Cropping Values by Crop: in Million Baht[1]

| | | All Areas | | Forest Reserves | | % |
|---|---|---|---|---|---|---|
| Code | Crop | Value | Villages | Value | Villages | Forest |
| 134 | tapioca | 12,652.000 | 15,029 | 5,937.681 | 5,146 | 46.9% |
| 102 | maize | 9,957.077 | 10,052 | 5,332.986 | 4,379 | 53.6% |
| 144 | sugarcane | 9,942.862 | 3,976 | 2,982.617 | 997 | 30.0% |
| 125 | soya bean | 3,567.175 | 3,917 | 1,720.699 | 1,602 | 48.2% |
| 279 | pineapple | 2,643.132 | 870 | 663.385 | 295 | 25.1% |
| 113 | mung bean | 1,993.660 | 4,665 | 864.663 | 1,486 | 43.4% |
| 147 | other short-term crops | 1,732.801 | 3,084 | 692.387 | 755 | 40.0% |
| 136 | tobacco | 1,192.139 | 1,321 | 111.876 | 183 | 9.4% |
| 115 | groundnut | 955.297 | 4,574 | 287.851 | 1,327 | 30.1% |
| 128 | jute | 798.307 | 4,210 | 358.411 | 1,478 | 44.9% |
| 114 | black matpe bean | 769.686 | 1,040 | 349.645 | 361 | 45.4% |
| 104 | sorghum | 608.151 | 936 | 159.203 | 261 | 26.2% |
| 131 | cotton | 593.782 | 1,624 | 362.642 | 875 | 61.1% |
| 129 | kenaf | 350.909 | 2,172 | 125.751 | 676 | 35.8% |
| 146 | unclassified beans | 221.247 | 394 | 113.507 | 114 | 51.3% |
| 148 | upland rice | 203.260 | 672 | 143.432 | 459 | 70.6% |
| 117 | red bean | 186.627 | 405 | 105.188 | 282 | 56.4% |
| 149 | garlic | 180.366 | 237 | 49.867 | 59 | 27.6% |
| 110 | sesame | 175.061 | 620 | 56.562 | 189 | 32.3% |
| 276 | sweet potato | 164.224 | 312 | 16.568 | 45 | 10.1% |
| 143 | mulberry | 72.390 | 50 | 22.817 | 17 | 31.5% |
| 116 | black bean | 60.962 | 177 | 25.220 | 87 | 41.4% |
| 277 | potatoes | 41.513 | 15 | 32.322 | 9 | 77.9% |
| 132 | yam bean | 33.208 | 47 | 0.648 | 6 | 1.9% |
| 140 | castor | 31.096 | 278 | 17.117 | 160 | 55.0% |
| 142 | truffle | 17.409 | 3 | 0.000 | | |
| 135 | mint | 11.070 | 8 | 9.064 | 4 | 81.9% |
| 112 | white bean | 6.828 | 10 | 5.776 | 6 | 84.6% |
| 280 | roselle | 6.740 | 2 | | | |
| 101 | horse tamarind | 6.527 | 33 | 0.121 | 1 | 1.9% |
| 124 | lima bean | 4.943 | 12 | 0.417 | 3 | 8.4% |
| 105 | rye | 4.845 | 18 | 3.580 | 13 | 73.9% |
| 111 | pearl barley | 3.746 | 11 | 0.479 | 1 | 12.8% |
| 130 | lamie grass/sisal | 2.422 | 7 | 0.528 | 3 | 21.8% |
| 126 | bambara groundnut | 1.743 | 5 | 0.576 | 2 | 33.0% |
| 133 | yam | 0.865 | 6 | 0.293 | 1 | 33.8% |
| 123 | duffin bean | 0.838 | 6 | 0.643 | 4 | 76.7% |
| 106 | wheat | 0.775 | 2 | 0.033 | 1 | 4.2% |
| 145 | cattle grass | 0.661 | 4 | 0.240 | 1 | 36.3% |
| 120 | hyacinthe bean | 0.391 | 2 | 0.367 | 1 | 93.9% |
| 127 | sunflower | 0.231 | 6 | 0.210 | 4 | 91.1% |
| 118 | golden gram | 0.182 | 2 | | | |
| 122 | cow pea | 0.134 | 25 | 0.027 | 3 | 20.1% |
| 103 | barley | 0.007 | 1 | | | |
| | Total | 49,197.290 | 60,840 | 20,555.399 | 21,296 | 41.8% |

1 Cropping values are determined from reported production, price, the number of cropping households, and the cropping area and intensity (the number of croppings per year) for each of the villages. The number of villages reporting cropping households represents the number of observations. Since respondent villages are permitted to list up to three each of the most common short-term and long-term crops, the total represents units of village/crops rather than the total number of villages.

## Table 5 1988 Cropping Areas by Province: In Rai[1]

| Code | Province | All Areas Rai | All Areas Villages | Forest Reserves Rai | Forest Reserves Villages | % Forest |
|---|---|---|---|---|---|---|
| 39 | PHETCHABUN | 2,428,046 | 2,347 | 1,386,319 | 998 | 57.1% |
| 21 | NAKHON RATCHASIMA | 2,530,995 | 3,897 | 1,093,158 | 1,356 | 43.2% |
| 30 | PRACHIN BURI | 1,264,357 | 1,356 | 968,266 | 888 | 76.6% |
| 68 | UDON THANI | 1,300,607 | 3,019 | 772,525 | 1,453 | 59.4% |
| 4 | KAMPHAENG PHET | 1,088,742 | 1,220 | 709,709 | 711 | 65.2% |
| 52 | LOEI | 1,328,002 | 2,220 | 708,230 | 1,143 | 53.3% |
| 49 | LOP BURI | 1,731,863 | 1,475 | 701,118 | 564 | 40.5% |
| 10 | CHAIYAPHUM | 1,379,620 | 2,527 | 603,622 | 808 | 43.8% |
| 23 | NAKHON SAWAN | 1,533,180 | 1,416 | 515,663 | 250 | 33.6% |
| 37 | PHITSANULOK | 777,946 | 1,405 | 462,561 | 642 | 59.5% |
| 70 | UTHAI THANI | 587,559 | 636 | 397,175 | 328 | 67.6% |
| 2 | KANCHANABURI | 1,122,913 | 1,464 | 391,735 | 496 | 34.9% |
| 5 | KHON KAEN | 977,176 | 2,343 | 323,117 | 454 | 33.1% |
| 6 | CHANTHABURI | 485,669 | 465 | 309,518 | 177 | 63.7% |
| 66 | NONG KHAI | 555,447 | 1,400 | 299,564 | 590 | 53.9% |
| 62 | SUKHOTHAI | 679,264 | 1,039 | 277,997 | 300 | 40.9% |
| 7 | CHACHOENGSAO | 455,114 | 306 | 250,823 | 99 | 55.1% |
| 12 | CHIANG RAI | 436,778 | 1,736 | 234,063 | 841 | 53.6% |
| 8 | CHON BURI | 562,549 | 551 | 227,865 | 148 | 40.5% |
| 63 | SUPHAN BURI | 474,406 | 712 | 221,370 | 229 | 46.7% |
| 48 | RATCHABURI | 462,953 | 832 | 210,814 | 237 | 45.5% |
| 16 | TAK | 395,022 | 778 | 204,666 | 383 | 51.8% |
| 26 | NAN | 464,027 | 1,733 | 191,633 | 854 | 41.3% |
| 54 | SAKON NAKHON | 329,987 | 1,441 | 188,554 | 475 | 57.1% |
| 60 | SARABURI | 486,000 | 690 | 166,428 | 189 | 34.2% |
| 69 | UTTARADIT | 421,920 | 948 | 160,525 | 317 | 38.0% |
| 27 | BURI RAM | 425,387 | 1,669 | 156,222 | 349 | 36.7% |
| 71 | UBON RATCHATHANI | 291,402 | 1,617 | 148,747 | 677 | 51.0% |
| 53 | SI SA KET | 322,401 | 1,334 | 139,306 | 498 | 43.2% |
| 47 | RAYONG | 395,164 | 502 | 134,066 | 154 | 33.9% |
| 13 | CHIANG MAI | 290,779 | 1,700 | 110,949 | 676 | 38.2% |
| 40 | PHRAE | 249,086 | 925 | 99,473 | 355 | 39.9% |
| 38 | PHETCHABURI | 160,187 | 443 | 95,526 | 157 | 59.6% |
| 29 | PRACHUAP KHIRIKHAN | 370,328 | 553 | 88,885 | 203 | 24.0% |
| 72 | PHAYAO | 232,536 | 952 | 77,084 | 351 | 33.1% |
| 3 | KALASIN | 684,526 | 1,582 | 75,716 | 122 | 11.1% |
| 73 | MUKDAHARN | 143,949 | 850 | 75,684 | 380 | 52.6% |
| 17 | YASOTHON | 147,221 | 712 | 65,063 | 249 | 44.2% |
| 65 | SURIN | 123,517 | 1,269 | 56,119 | 486 | 45.4% |
| 45 | ROI ET | 217,556 | 1,286 | 52,808 | 186 | 24.3% |
| 43 | MAE HONG SON | 63,808 | 395 | 51,979 | 315 | 81.5% |
| 50 | LAMPANG | 177,391 | 1,061 | 46,023 | 366 | 25.9% |
| 11 | CHUMPHON | 46,159 | 258 | 38,217 | 149 | 82.8% |
| 64 | SURAT THANI | 63,625 | 406 | 37,533 | 197 | 59.0% |
| 15 | TRAT | 39,484 | 233 | 27,662 | 131 | 70.1% |
| 42 | MAHA SARAKHAM | 259,718 | 1,158 | 23,436 | 75 | 9.0% |
| 9 | CHAI NAT | 124,175 | 190 | 22,225 | 29 | 17.9% |
| 36 | PICHIT | 179,430 | 489 | 20,290 | 55 | 11.3% |
| 22 | NAKHON SRI THAMMARAT | 49,026 | 464 | 18,005 | 121 | 36.7% |
| 20 | NAKHON PHANOM | 99,547 | 678 | 17,162 | 99 | 17.2% |
| 51 | LAMPHUN | 42,412 | 325 | 8,925 | 91 | 21.0% |
| 46 | RANONG | 10,368 | 74 | 8,740 | 44 | 84.3% |
| 1 | KRABI | 12,316 | 106 | 7,760 | 61 | 63.0% |
| 55 | SONGKHLA | 21,492 | 363 | 4,902 | 61 | 22.8% |
| 35 | PHATTHALUNG | 21,962 | 257 | 4,286 | 65 | 19.5% |
| 34 | PHANGNGA | 3,984 | 57 | 1,842 | 34 | 46.2% |
| 14 | TRANG | 4,282 | 82 | 1,833 | 22 | 42.8% |
| 31 | PATTANI | 15,284 | 478 | 1,088 | 39 | 7.1% |
| 41 | PHUKET | 2,469 | 54 | 942 | 23 | 38.1% |
| 18 | NAKHON NAYOK | 4,460 | 93 | 734 | 8 | 16.4% |
| 44 | YALA | 4,409 | 120 | 641 | 15 | 14.5% |
| 56 | SATUN | 1,750 | 50 | 399 | 10 | 22.8% |
| 25 | NARATHIWAT | 5,865 | 222 | 250 | 17 | 4.3% |
| 61 | SING BURI | 15,748 | 147 | 35 | 1 | 0.2% |
| 59 | SAMUT SAKHON | 61 | 3 | | | |
| 33 | AYUTTHAYA | 15,945 | 220 | | | |
| 28 | PATHUM THANI | 1,738 | 41 | | | |
| 67 | ANG THONG | 17,278 | 151 | | | |
| 24 | NONTHABURI | 185 | 5 | | | |
| 19 | NAKHON PATHOM | 119,153 | 335 | | | |
| | Total | 29,737,695 | 61,865 | 13,697,567 | 21,801 | 46.1% |

1 Cropping areas are determined from reported cropping area per household and the number of cropping households for each of the villages. The number of villages reporting cropping households represents the number of observations. Since respondent villages are permitted to list up to three each of the most common short-term and long-term crops, the sum total therefore represents units of village/crops and exceeds the actual number of reporting villages.

## Table 6 1988 Cropping Areas by Crop: In Rai[1]

| | | All Areas | | Forest Reserves | | % |
|---|---|---|---|---|---|---|
| Code | Crop | Rai | Villages | Rai | Villages | Forest |
| 134 | tapioca | 9,218,099 | 15,113 | 4,159,497 | 5,169 | 45.1% |
| 102 | maize | 8,864,170 | 10,166 | 4,816,441 | 4,426 | 54.3% |
| 144 | sugarcane | 2,553,809 | 4,018 | 827,751 | 1,013 | 32.4% |
| 113 | mung bean | 1,856,624 | 4,697 | 853,827 | 1,494 | 46.0% |
| 125 | soya bean | 1,559,763 | 3,947 | 772,701 | 1,616 | 49.5% |
| 104 | sorghum | 944,316 | 939 | 237,312 | 262 | 25.1% |
| 114 | black matpe bean | 820,737 | 1,046 | 383,757 | 363 | 46.8% |
| 128 | jute | 710,546 | 4,237 | 300,550 | 1,492 | 42.3% |
| 115 | groundnut | 512,564 | 4,629 | 154,104 | 1,339 | 30.1% |
| 147 | other short-term crops | 386,134 | 3,165 | 132,582 | 770 | 34.3% |
| 279 | pineapple | 382,802 | 904 | 108,080 | 305 | 28.2% |
| 129 | kenaf | 354,944 | 2,186 | 136,195 | 681 | 38.4% |
| 148 | upland rice | 338,126 | 1,077 | 254,601 | 750 | 75.3% |
| 131 | cotton | 282,450 | 1,641 | 180,348 | 883 | 63.9% |
| 110 | sesame | 218,156 | 621 | 68,800 | 189 | 31.5% |
| 136 | tobacco | 178,387 | 1,327 | 18,994 | 185 | 10.6% |
| 146 | unclassified beans | 177,643 | 405 | 119,391 | 116 | 67.2% |
| 117 | red bean | 171,971 | 409 | 92,434 | 285 | 53.7% |
| 116 | black bean | 48,927 | 177 | 24,660 | 87 | 50.4% |
| 276 | sweet potato | 34,648 | 315 | 6,188 | 47 | 17.9% |
| 140 | castor | 32,145 | 290 | 15,700 | 164 | 48.8% |
| 149 | garlic | 21,338 | 248 | 7,237 | 65 | 33.9% |
| 280 | roselle | 8,600 | 2 | | | |
| 105 | rye | 8,305 | 33 | 5,908 | 25 | 71.1% |
| 135 | mint | 8,083 | 8 | 6,000 | 4 | 74.2% |
| 132 | yam bean | 7,594 | 47 | 242 | 6 | 3.2% |
| 101 | horse tamarind | 7,308 | 34 | 96 | 1 | 1.3% |
| 112 | white bean | 6,903 | 10 | 6,066 | 6 | 87.9% |
| 143 | mulberry | 6,668 | 64 | 2,634 | 24 | 39.5% |
| 111 | pearl barley | 4,282 | 11 | 515 | 1 | 12.0% |
| 124 | lima bean | 3,000 | 12 | 414 | 3 | 13.8% |
| 277 | potatoes | 2,246 | 15 | 1,424 | 9 | 63.4% |
| 130 | lamie grass/sisal | 1,962 | 8 | 1,122 | 4 | 57.2% |
| 142 | truffle | 884 | 3 | | | |
| 126 | bambara groundnut | 792 | 5 | 560 | 2 | 70.7% |
| 145 | cattle grass | 754 | 4 | 600 | 1 | 79.6% |
| 106 | wheat | 505 | 2 | 10 | 1 | 2.0% |
| 133 | yam | 448 | 7 | 195 | 1 | 43.6% |
| 123 | duffin bean | 318 | 6 | 258 | 4 | 81.1% |
| 127 | sunflower | 294 | 6 | 268 | 4 | 91.0% |
| 122 | cow pea | 236 | 26 | 19 | 3 | 8.2% |
| 120 | hyacinthe bean | 132 | 2 | 92 | 1 | 69.7% |
| 118 | golden gram | 84 | 2 | | | |
| 103 | barley | 5 | 1 | | | |
| | Total | 29,737,695 | 61,865 | 13,697,567 | 21,801 | 46.1% |

1 Cropping areas are determined from reported cropping per household and the number of cropping households for each of the villages. An acre is 2.5 rais.The number of villages reporting cropping households represents the number of observations. Since respondent villages are permitted to list up to three each of the most common short-term and long-term crops, the sum total therefore represents units of village/crops and exceeds the actual number of reporting villages.

## Table 7 1988 Crop Production in Tons[1]

| Code | Crop | All Areas Tons | All Areas Villages | Forest Areas Tons | Forest Areas Villages | % Forest |
|---|---|---|---|---|---|---|
| 101 | horse tamarind | 6,712 | 33 | 115 | 1 | 1.7% |
| 102 | maize | 4,384,867 | 10,102 | 2,390,462 | 4,407 | 54.5% |
| 103 | barley | 2 | 1 | | | |
| 104 | sorghum | 267,537 | 936 | 74,336 | 261 | 27.8% |
| 105 | rye | 2,272 | 33 | 1,759 | 25 | 77.5% |
| 106 | wheat | 252 | 2 | 5 | 1 | 1.9% |
| 110 | sesame | 18,004 | 620 | 5,995 | 189 | 33.3% |
| 111 | pearl barley | 1,249 | 11 | 160 | 1 | 12.8% |
| 112 | white bean | 1,187 | 10 | 1,034 | 6 | 87.1% |
| 113 | mung bean | 270,188 | 4,670 | 118,187 | 1,488 | 43.7% |
| 114 | black matpe bean | 118,839 | 1,041 | 51,607 | 361 | 43.4% |
| 115 | groundnut | 159,573 | 4,606 | 48,328 | 1,336 | 30.3% |
| 116 | black bean | 9,728 | 177 | 4,086 | 87 | 42.0% |
| 117 | red bean | 36,426 | 407 | 19,651 | 284 | 53.9% |
| 118 | golden gram | 17 | 2 | | | |
| 120 | hyacinthe bean | 64 | 2 | 52 | 1 | 81.4% |
| 122 | cow pea | 28 | 26 | 4 | 3 | 14.1% |
| 123 | duffin bean | 122 | 6 | 100 | 4 | 82.3% |
| 124 | lima bean | 2,870 | 12 | 476 | 3 | 16.6% |
| 125 | soya bean | 452,443 | 3,923 | 215,249 | 1,607 | 47.6% |
| 126 | bambara groundnut | 677 | 5 | 107 | 2 | 15.8% |
| 127 | sunflower | 55 | 6 | 51 | 4 | 92.5% |
| 128 | jute | 182,368 | 4,229 | 80,386 | 1,488 | 44.1% |
| 129 | kenaf | 77,861 | 2,183 | 27,333 | 681 | 35.1% |
| 130 | lamie grass/sisal | 5,340 | 7 | 252 | 3 | 4.7% |
| 131 | cotton | 53,049 | 1,638 | 32,309 | 882 | 60.9% |
| 132 | yam bean | 41,826 | 47 | 375 | 6 | 0.9% |
| 133 | yam | 577 | 7 | 488 | 1 | 84.5% |
| 134 | tapioca | 19,013,000 | 15,063 | 8,798,333 | 5,153 | 46.3% |
| 135 | mint | 16,191 | 8 | 12,466 | 4 | 77.0% |
| 136 | tobacco | 148,274 | 1,323 | 30,790 | 183 | 20.8% |
| 140 | castor | 5,538 | 285 | 2,899 | 163 | 52.4% |
| 142 | truffle | 4,938 | 3 | | | |
| 143 | mulberry | 18,767 | 62 | 1,751 | 22 | 9.3% |
| 144 | sugarcane | 18,729,000 | 3,992 | 5,856,531 | 1,002 | 31.3% |
| 145 | cattle grass | 205 | 4 | 60 | 1 | 29.2% |
| 146 | unclassified beans | 37,462 | 397 | 18,925 | 114 | 50.5% |
| 147 | other short-term crops | 515,652 | 3,121 | 170,521 | 762 | 33.1% |
| 148 | upland rice | 98,033 | 1,074 | 72,087 | 748 | 73.5% |
| 149 | garlic | 27,730 | 245 | 7,693 | 65 | 27.7% |
| 276 | sweet potato | 81,976 | 315 | 13,285 | 47 | 16.2% |
| 277 | potatoes | 8,252 | 15 | 6,495 | 9 | 78.7% |
| 279 | pineapple | 1,823,116 | 876 | 451,744 | 297 | 24.8% |
| 280 | roselle | 1,520 | 2 | | | |
| | Total Tons | 46,623,787 | 61,527 | 18,516,487 | 21,702 | 39.7% |

1 Production in metric tons (1000 kgs.) is estimated from the normal productivity per rai, area planted, the number of croppings per year and the number of cropping households reported for each village. The number of the villages reporting cropping represents the number of observations.

# The Trends of Income Inequality and Poverty and a Profile of the Urban Poor in Thailand

Suganya Hutaserani

## I. THAILAND'S DEVELOPMENT EXPERIENCE: A PRELUDE TO THE PROBLEM

Although Thailand has achieved unprecedented economic growth, the country's income inequality worsened between the 1960s and the mid-1980s. By contrast, the trend in poverty during the same period has markedly improved, except during the recession in the mid-1980s.

Despite the increase in overall poverty during the mid-1980s, poverty in the Bangkok Metropolitan Region (BMR) and in all other urban (municipal) areas except those in the Northeast has decreased. Based on data from the Socioeconomic Surveys (SES) collected by the National Statistical Office (NSO), the overall poverty incidence as measured by the headcount ratio declined from 39 percent in 1968/69, to 30 percent in 1975/76, and to 23 percent in 1980/81. However, it rose to 29.5 in 1985/86.[1] By contrast, poverty in the BMR decreased from 7.8 percent in 1975/76, to 3.9 percent in 1980/81, and 3.5 percent in 1985/86. At the same time, the poverty incidence in all other urban areas, excluding those in the Northeast, decreased from 12.5 percent to 7.5 and 5.9 percent within the same three periods.

The increase in the overall poverty incidence in the mid-1980s was thus concentrated in rural areas, which were the most severely affected by the recession (which resulted mainly from the second oil shock and its consequent impacts, such as the deterioration of crop prices). The directions of change in the overall, rural, and urban poverty incidences during the late 1980s are a matter of empirical research, which will be undertaken in this paper.

Regardless of whether or not the poverty incidence actually improved in the late 1980s, poverty, especially in urban areas, is an important policy issue. This is because urban poverty manifests itself not only in terms of low income levels but also in terms of inadequate working skills and productivity in relation to the rapidly flourishing urban sector. Moreover, the urban poor are also faced with a lower quality of life compared to the rural poor in some ways. This is due to the urban poor's minimal access to basic social welfare services (education, low-cost or decent housing, tenure security, health and nutritional care, family planning, electricity, water supply, etc.) amidst a poorer living environment and greater stress, both of which are intrinsic to urban life.

Sections III and IV of this paper analyze the trend of urban poverty and provide a profile of the urban poor in Thailand using the most recent SES data collected by the NSO in 1988/89. Regional differences are identified as well. The trend of income inequality, together with the trends of rural and overall poverty, is also examined.[2] A general economic background is outlined in section II, and Section V concludes.

## II. GENERAL ECONOMIC BACKGROUND

Thailand's average annual GDP growth rate has been high since the 1970s. However, it experienced low growth rates in the mid-1980s, when the worldwide recession resulting primarily from the second oil shock reduced the prices of major crops and their outputs. The resulting growth rate was then as low as 2.3 percent, while the agricultural growth rate became negative

The situation improved substantially in the late 1980s, and Thailand achieved the high average growth rate of 7.1 percent, the major part of which was due to high growth in the industrial and services sectors. Much of this high industrial growth has resulted from the rapid expansion of manufactured exports, which have recently been growing at the rate of 35-40 percent per annum.

The economic improvement in the late 1980s has contributed to higher crop prices—both external and domestic. Coupled with recoveries from the two internal droughts experienced in the mid-1980s, major agricultural products (except cassava) expanded dramatically. GDP in the agricultural sector rose sharply, from the negative rate of -2.5 percent in 1987 to 10.1 percent the following year. During this period the GDP growth rate in the industrial sector not only remained high but increased as well, from 10.3 to 12.0 percent due to the rapid expansion of manufactured exports. Thus, the average growth rate of 10.3 percent was achieved in 1988.

## III. ANALYSES OF INCOME INEQUALITY AND POVERTY TRENDS

### Income Inequality Trend

Although there has been a slight decline in income inequality during the late 1980s, the trend of income inequality steadily increased from the 1960s until the

mid-1980s. Table 1 classifies the population according to per capita household income into five quintiles. During the period between the mid-1970s and mid-1980s, the income share of the richest 20 percent increased from 49.3 to 55.6 percent. Most of this increase was concentrated in the quintile comprising the richest 10 percent. The income shares of the remaining four lower-income quintiles decreased. The trend of worsening income distribution that existed until the mid-1980s is confirmed by the increasing values of the Gini coefficient and the variance of the logarithm of income, which are the indices measuring income inequality. The former increased from 0.43 to 0.50 and the latter from 0.53 to 0.74.

The economic recovery in the late 1980s has slightly reduced income inequality. That is, while the income share of the top quintile has decreased, the income shares of the lower quintiles have increased—with the exception of the bottom income group, whose income share continued to decrease. The Gini coefficient and the variance of the logarithm of income also declined from the mid-1980s level.

### The Poverty Trend and a Comparison of Poverty by Rural-Urban Location

Table 2 indicates a declining trend in the overall poverty incidence as measured by the headcount ratio, except during the mid-1980s.[3] When broken down by location, comprising rural (villages and sanitary districts) and urban (municipal) areas, declining poverty trends were also observed, except during the mid-1980s in the rural areas and in the late 1980s in the urban areas.

The exception in the mid-1980s, during which the overall poverty incidence increased to 29.5 percent from the 1980/81 level of 23 percent, was caused by the worldwide recession and two internal droughts. Major crop prices and farmers' economic status deteriorated, thus exacerbating poverty in the rural areas. Since the overall poverty increase during the mid-1980s was concentrated in rural areas, the poverty incidence in urban areas during this period decreased to 5.9 percent from the 1980/81 level of 7.5 percent.

Along with the recent rapid economic growth driven by the export boom, the overall poverty incidence in Thailand during the late 1980s decreased compared to the mid-1980s level, from 29.5 to 23.7 percent. This overall reduction in poverty has been accompanied by a reduction in rural poverty due to the increases in major crop prices.

Vastly more noteworthy, however, is the recent increase in urban poverty in contrast to the declines in both overall and rural poverty. Table 2 shows that the urban poverty incidence has recently increased to 6.7 percent from the mid-1980s level of 5.9 percent. This might be attributed to the increasing number of new migrants moving into urban areas in order to take advantage of the recent economic boom. Due to their inadequate labor skills and the inadequate provision of basic social services, the urban poverty situation has been aggravated. The associated higher urban consumer price index has also contributed to this increase in urban poverty.

Another noteworthy aspect of poverty is its severity as measured by the relative income shortfall index.[4] As shown in Table 3, except for the BMR, the Bangkok Metropolitan Area (BMA), and the North, the changes in this index between the mid-1980s and late 1980s were in the same directions as the changes in the poverty

**Table 1 Income Shares by Quintile Group of Population**

(% of Total Income)

| Quintile | 1975/76 | 1980/81 | 1985/86 | 1988/89 |
|---|---|---|---|---|
| 1st | 49.26 | 51.47 | 55.63 | 54.98 |
| highest top 10% | 33.40 | 35.44 | 39.15 | 37.85 |
| second top 10% | 15.86 | 16.04 | 16.48 | 17.12 |
| 2nd | 20.96 | 20.64 | 19.86 | 20.30 |
| 3rd | 14.00 | 13.38 | 12.09 | 12.20 |
| 4th | 9.73 | 9.10 | 7.87 | 7.98 |
| 5th | 6.05 | 5.41 | 4.55 | 4.51 |
| second bottom 10% | 3.62 | 3.28 | 2.75 | 2.74 |
| lowest bottom 10% | 2.43 | 2.13 | 1.80 | 1.76 |
| Total Share | 100.00 | 100.00 | 100.00 | 100.00 |
| Gini Coefficient | 0.426 | 0.453 | 0.500 | 0.478 |
| Variance of Logarithm of Income | 0.530 | 0.602 | 0.737 | 0.689 |

*Source:* Reproduced from Hutaserani and Tapwong (1990).

**Table 2 Poverty Incidence between 1975/76 and 1988/89**

| Region | 1975/76 | 1980/81 | 1985/86 | 1988/89 |
|---|---|---|---|---|
| Whole Kingdom | 30.02 | 23.04 | 29.51 | 23.67 |
| NORTH | 33.20 | 21.50 | 25.54 | 23.23 |
| Villages | 36.37 | 23.32 | 27.74 | 25.13 |
| Sanitary districts | 19.23 | 16.16 | 20.19 | 18.74 |
| Municipal areas | 17.84 | 8.03 | 6.87 | 11.31 |
| NORTHEAST | 44.92 | 35.93 | 48.17 | 37.45 |
| Villages | 48.54 | 37.92 | 50.49 | 39.87 |
| Sanitary districts | 24.66 | 20.81 | 33.25 | 20.12 |
| Municipal areas | 20.90 | 17.99 | 18.67 | 18.97 |
| CENTRAL | 12.99 | 13.55 | 15.63 | 15.97 |
| Villages | 14.26 | 14.16 | 17.37 | 18.97 |
| Sanitary districts | 7.99 | 11.62 | 11.36 | 6.41 |
| Municipal areas | 11.45 | 11.74 | 8.87 | 8.36 |
| SOUTH | 30.71 | 20.37 | 27.17 | 21.49 |
| Villages | 33.84 | 22.16 | 31.17 | 23.99 |
| Sanitary districts | 18.14 | 6.75 | 8.07 | 11.46 |
| Municipal areas | 21.69 | 15.20 | 8.61 | 11.80 |
| BMR | 7.75 | 3.89 | 3.54 | 3.41 |
| - City core | 6.90 | 3.70 | 3.11 | 3.26 |
| - Five Vicinity Provinces | | | | 4.30 |
| Villages | | | | 4.10 |
| Sanitary districts | | | | 3.03 |
| Municipal areas | | | 6.08 | 10.75 |
| All villages | 36.16 | 27.34 | 35.75 | 29.43 |
| All sanitary districts | 14.76 | 13.47 | 18.55 | 13.18 |
| All municipal areas | 12.53 | 7.51 | 5.90 | 6.74 |

Poverty Line: Per Capita Household Income /Year in baht

| | RURAL (Villages and Sanitary Districts) in baht | URBAN (Municipal Areas) in baht |
|---|---|---|
| 1975/76 | 1,981 | 2,961 |
| 1980/81 | 3,454 | 5,151 |
| 1985/86 | 3,823 | 5,834 |
| 1888/89 | 4,141 | 6,324 |

Source : Reproduced from Hutaserani and Tapwong (1990).

incidence as measured by the headcount ratio. The index for the urban areas of the whole kingdom increased from 0.27 to 0.28. This implies that the income of the average urban poor households in Thailand must be increased by 28 percent of the poverty level income in order to rise above the poverty level.

### Comparison of Poverty by Region

As expected, the poverty incidence presented in Table 2 was highest in the Northeast and lowest in the BMR in 1988/89, at 37.5 and 3.4 percent, respectively. These percentages were much different from the national average, which was 23.7 percent in the same year. The North's, which was similar to the national average, was the second highest, followed by the South and the Central regions, respectively. Between the mid- and late 1980s, urban poverty was on the rise in almost all regions, except in the Central region and the BMR. However, the poverty incidence in the BMR's city core also increased.

Surprisingly enough, poverty appeared to be the least severe in the Northeast compared to other regions during the mid- and late 1980s. This is shown in Table 3 by its lowest relative income shortfall index for both periods (.24 and .27, respectively). This indicates that the Northeast's average urban poor households needed a smaller percentage of the necessary income in order to get out of poverty despite the fact that the Northeast has a much higher percentage of urban poor households than do the other regions. On the other hand, poverty was found to be the most severe in the North, followed by the BMA.

The percentage distribution of the urban poor across regions in Table 3 shows that the majority of the urban poor lived in the BMR – the BMA in particular – during both the mid- and late 1980s, though the percentage declined slightly, from 32.9 to 31.4. This is not surprising, since the BMR is composed of huge urban areas offering ample job opportunities, including lower-paid jobs. The Northeast has been the second largest home to the urban poor.

## IV. ANALYSES OF THE PROFILE OF THE URBAN POOR AND NON-POOR AND A COMPARISON BY REGION

Both the demographic and socioeconomic characteristics of the urban poor and non-poor are analyzed and compared in this section. Differences across regions are also examined. However, since quite a few characteristics are considered, they cannot be tabulated here due to space limitations. However, some important figures representing these characteristics can be extracted without tabulation.

The findings reveal that on average, the poor have a larger family size than the non-poor (4.7 vs. 3.5 persons). This is true in all regions. The largest average family size for the non-poor was found in the five BMR vicinity provinces (4 persons) and in the South for the poor families (5.4 persons). Since most people in the South are Muslim, their fertility rate and their average family size are expected to be higher than those in other regions. Due to the successful family planning programs in the North, the average family size there appeared to be lowest for both the poor and the non-poor (4.1 and 3.2 persons, respectively) compared to the rest of the regions.

As a result of the larger family size, the poor's dependency ratio – which measures the number of dependents that an average earner in a household has to

**Table 3 Urban Poverty Incidence as Measured by Headcount Ratio and Relative Income Shortfall Index and Percentage Distribution of Urban Poor Households by Region**

| Region | 1980/81 | | 1985/86 | | | 1988/89 | | |
|---|---|---|---|---|---|---|---|---|
| | Urban Poverty Incidence | | Urban Poverty Incidence | | % Distribution of Urban Poor Households | Urban Poverty Incidence | | % Distribution of Urban Poor Households |
| | Headcount Ratio | Relative Income Shortfall Index | Headcount Ratio | Relative Income Shortfall Index | | Headcount Ratio | Relative Income Shortfall Index | |
| Whole Kingdom | 7.51 | 0.2750 | 5.90 | 0.2710 | 100.00 | 6.74 | 0.2795 | 100.00 |
| North | 8.03 | 0.2478 | 6.87 | 0.3098 | 11.2 | 11.31 | 0.2868 | 17.3 |
| Northeast | 17.99 | 0.3342 | 18.67 | 0.2386 | 25.8 | 18.97 | 0.2673 | 23.4 |
| Central | 11.74 | 0.2942 | 8.87 | 0.3169 | 16.8 | 8.36 | 0.2744 | 13.8 |
| South | 15.20 | 0.2282 | 8.61 | 0.2720 | 13.3 | 11.80 | 0.2823 | 14.0 |
| BMR | 3.89 | 0.2580 | 3.54 | 0.2623 | 32.9 | 3.41 | 0.2857 | 31.4 |
| - BMA | 3.70 | 0.2531 | 3.11 | 0.3122 | 29.8 | 3.26 | 0.2865 | 29.6 |
| - Five Vicinity Provinces | | 0.3288 | 6.08 | 0.2710 | 3.1 | 10.75 | 0.2744 | 1.8 |

*Source:* Reproduced from Hutaserani and Tapwong (1990).

take care of—was higher than that for the non-poor (1.8 vs. 1.2). Again, this is true in all regions. For the poor, the South was more burdened with dependents (2.3) than all other regions. For the non-poor, the region with the highest number of dependents was in the BMR's five vicinity provinces (1.3). As expected, the North had the lowest dependency ratios for both the poor and non-poor (1.4 vs. 1.1). Nevertheless, the poor had a greater number of earners than the non-poor (1.9 vs. 1.7 persons) despite their having a higher dependency ratio. This implies that the poor must have had a larger number of dependents associated with higher fertility than the non-poor. Comparison by region indicates that the average number of earners for both the poor and non-poor were higher in the regions with more ample job opportunities, i.e., the five BMR vicinity provinces, the BMA and the Central region.

Female-headed households have become a more common phenomenon among the poor than among the non-poor; 28.9 percent of the poor were headed by females compared to 26.9 percent of the non-poor. This is because a greater proportion of female-headed households has been observed over time and because the resulting number of earners is inevitably smaller in such households. These findings are true in all regions except the BMA, where females are more independent due to better economic opportunities compared with other regions. This explains why a much higher percentage of non-poor compared to poor households in the BMA were headed by females (17.6 vs. 8.4 percent)

When classified into different age groups, the poor had a smaller percentage of household heads aged less than twenty compared to the non-poor (1.8 vs. 2.8 percent). The poor have a much higher percentage of household heads aged 60 and over than the non-poor (18.9 vs. 13.9 percent) which was consistent with their having a much higher dependency ratio as explained earlier. Similar findings emerged for almost all regions.

It is no surprise that a much greater percentage of poor household heads had no education or had only a primary education compared to non-poor household heads (16 vs. 7.1 and 70.1 vs. 52.3 percent, respectively). In the remaining higher levels of education, higher percentages were found among the non-poor. Comparison by region also reveals more or less the same results. The non-poor heads having a secondary education tended to concentrate in the BMA, thus comprising a much greater percentage than the poor household heads living there with the same educational level (10.9 vs. 4.5 percent).

Poor households were found to be engaged more often in agriculture and other lower-class occupations (e.g., laboring and trading) than the non-poor. The poor's percentages of lessee farmers, owner-operator farmers, laborers, and traders were all much higher than the non-poor's. On the other hand, non-poor workers were more often employed as other kinds of employees and professionals than were poor workers (31.2 vs. 15.9 percent and 13.5 vs. 0.9 percent, respectively). A higher percentage of the non-poor were inactive compared to the poor. This may reflect greater unemployment (especially in certain educational levels) among the non-poor, who tend to be more selective about jobs.

A comparison by region indicates a higher concentration of all occupations in the BMA, where greater employment opportunities have been available for both

the poor and the non-poor. The exception emerged among poor household heads who were owner-operator farmers and traders. The majority of them were located in the poorest regions, namely the Northeast. By contrast, lessee farmers seemed to concentrate in regions other than the Northeast.

When different types of tenure status are considered, the poor had much lower tenure status than the non-poor. A much higher percentage of the poor than the non-poor owned neither a house nor land (43.4 vs. 29.3 percent). Greater percentages of the non-poor either owned both a house and land, owned a house on rented land, or lived rent free (31.7 vs. 30.1 percent, 12.8 vs. 11.1 percent, and 26.2 vs. 15.3 percent, respectively)

A regional comparison indicates that the majority of non-poor household heads with all types of tenure status were located in the BMA. For the poor, however, only those with lower tenure status (i.e., those who owned neither a house nor land and those who owned a house only) were found to be concentrated in the BMA. These results are consistent with the fact that the BMR has as many as 1,682 slums, the majority of which are located in the BMA. Moreover, about 20-25 percent of the BMA population are slum dwellers.

## V. CONCLUSIONS AND POLICY IMPLICATIONS

In contrast to the trend of income inequality, which has worsened over time (except in the late 1980s), the poverty trend is decreasing. Overall poverty conditions, especially in urban areas, have improved significantly since the 1960s. Even during the recession in the mid-1980s, when both overall and rural poverty increased, urban poverty proved to be more resilient. However, while the economic boom in the late 1980s contributed to declines in income inequality as well as in both overall and rural poverty, it also triggered an increase in the incidence of urban poverty. Since the economic boom was accompanied by greater urban employment opportunities, larger numbers of migrants moved into urban areas. Inadequate labor skills and inadequate provision of basic social services, together with the associated higher urban consumer price index, inevitably led to an increased poverty incidence.

That the urban poor lacked adequate labor skills and adequate basic social services was reflected in their having lower-status jobs, a lower level of education, and a lower tenure status compared to the non-poor. Moreover, the poor also possessed less favorable demographic characteristics, which led to a lower economic status relative to the non-poor. These characteristics included a larger family size, a higher dependency ratio, and the greater possibility of having female household heads.

Thus, any attempt to attack urban poverty should recognize the interrelationship between non-welfare and welfare policies. The non-welfare policies emphasize the role of the urban poor as an important factor of production, which should be well integrated into the process of economic development. These policies thus aim at promoting the productive use of the poor's human capital assets through skill development or vocational training programs. In order for the poor to take full advantage of economic opportunities, welfare policies are needed to improve their quality of life by providing them with basic social welfare services (education, low-cost housing, tenure security, family planning, health and nutritional care, etc.).

Comparison by region confirms the belief that the poverty incidence – be it overall, rural, or urban – has been highest in the Northeast and lowest in the BMR. Yet, distribution of the urban poor across regions shows that the largest percentage lived in the BMR (the BMA in particular), which is characterized by huge urban areas. These results imply that any non-welfare and welfare policies for attacking urban poverty should be concentrated in the BMA. The Northeast should also be the target, since it had the highest poverty incidence, including urban poverty, relative to other regions.

When the socioeconomic characteristics of the urban poor were compared across regions, the majority of those engaged in lower-status jobs seemed to be concentrated in the BMA, followed by the Northeast and the North. Larger proportions of urban poor who were self-employed were found in these three regions as well, particularly in the Northeast. Many of the urban poor having no more than a primary education were also located in these three regions. These findings point to the need for non-welfare policies promoting skill improvement and for welfare policies encouraging better access to education among the urban poor in these three regions, particularly the BMA and the Northeast.

Regarding demographic characteristics, the urban poor in the North had the lowest family size and dependency ratio due to the successful family planning programs there. These characteristics were highest in the South, followed by the five BMR vicinity provinces and the Northeast. Based on these results, welfare policies such as family planning should be more strongly encouraged in these regions.

In terms of tenure status, the poor had a lower tenure status than the non-poor, as expected. A regional comparison indicates that the poor who owned both a house and land as well as those who lived rent free tended to be concentrated in the Northeast and the North, where the problem of tenure status has not been as severe as in the BMR, in particular, the BMA. The BMA itself was found to contain a much larger percentage of poor people having no housing of their own. According to these findings, the BMA should be given priority in designing relevant welfare policies aimed at improving the tenure status of the urban poor, particularly among slum dwellers.

## Endnotes

1. Headcount Ratio =
$$\frac{\text{Households with Income Below the Poverty Line}}{\text{Total Number of Households}}$$
2. The 1988/89 SES data used here consist of 11,045 households. They have been weighted to adjust for differential sampling proportions.
3. The measurement of the headcount ratio is given in note 1 above. The poverty lines used in this paper for various years are based on the World Bank calculation adjusted by the consumer price indices (see the bottom part of Table 2).
4. Relative Income Shortfall Index =
$$\frac{\text{Poverty Line - Average Income of Poor Households}}{\text{Poverty Line}}$$

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# Morbidity – What Are the Determinants and What Are the Prospects?

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Morbidity reduces the quality of life and, in extreme forms, ends life itself. Morbidity may also have adverse effects on productivity in work or at school, both by reducing energy and effort and by causing absenteeism. These effects may either directly affect the person afflicted by the morbidity or indirectly affect other household members because providing care for those afflicted cuts into time normally spent on other activities. Consequently, the Thai government has a vested interest in limiting morbidity. This article summarizes the research to date on the determinants of Thai morbidity and on the prospects for Thai morbidity. This research is based on the 1985 Thai Morbidity Survey of 7,314 households (36,611 individuals), which is summarized in Prasartkul et al (1988).

## BASIC MORBIDITY PATTERNS ACCORDING TO THE 1985 SURVEY

At least one episode of illness in the month before the survey was reported by 15.4 percent of the respondents. The incidence was somewhat higher in rural (16.1%) than in urban (13.5%) areas. The reported morbidity was strongly dependent on age, with the highest incidence for adults over 60 and for infants and children under 5. There are also some suggestions of differences in morbidity incidence during the child-bearing years for women aged 15-44. Therefore, this study considers five age categories: 0-4, 5-14, 15-44, 45-60, and over 60. While there are other differences in morbidity incidence by sex, urbanization, region, and education, none are as substantial as age.

Table 1 gives the incidence of illness by disease type and by age group. For children aged 0-4, almost a quarter (24.8%) were ill, the second highest proportion among our five age groups. For those who were ill, infectious diseases accounted for almost three-fifths of the total (58%) and diseases of the respiratory system accounted for most of the remainder (29%). For children aged 5-14, less than half as high a percentage (11.3%) were ill, the lowest proportion among our five groups. Among those who were ill, infectious diseases (39%) and diseases of the respiratory system (27%) also were the two most significant disease categories, though the former was relatively less dominant for children aged 0-4 and there was more diversification among the five other disease categories. For prime-age adults aged 15-44, the proportion who were ill was 11.5 percent, basically the same as that for children aged 5-14. The diseases were more spread across type categories for prime-age adults than for children (see Table 1), with the percentages of those ill among the seven disease

**Table 1 The Incidence of Illness by Disease Type and Age**

| | Age | | | | |
|---|---|---|---|---|---|
| Diagnosis | 0-4 | 5-14 | 15-44 | 45-60 | 60+ |
| Percent | | | | | |
| Not ill | 75.2 | 88.7 | 88.5 | 77.5 | 68.6 |
| Infectious Disease | 14.4 | 4.4 | 2.7 | 4.3 | 5.5 |
| Endocrine Disturbance | 0.0 | 0.0 | 0.3 | 1.2 | 2.0 |
| Mental, Nervous | 0.1 | 0.1 | 0.4 | 0.9 | 0.8 |
| Circulatory System | 0.1 | 0.2 | 0.9 | 2.9 | 4.0 |
| Respiratory System | 7.2 | 3.0 | 1.7 | 2.4 | 4.3 |
| Digestive System | 0.3 | 0.7 | 2.1 | 3.8 | 2.9 |
| Others | 2.7 | 2.9 | 3.4 | 7.0 | 11.9 |

categories as follows: other 30 percent, infectious diseases 23 percent, diseases of the digestive system 18 percent, diseases of the respiratory system 15 percent, and diseases of the circulatory system 8 percent. For adults aged 45-60, the proportion who were ill was 22.5 percent, about twice as high as that for the 5-14 age group. The disease types were spread across categories even more for those aged 45-60 as follows: other 30 percent, infectious diseases 20 percent, diseases of the digestive system 17 percent, diseases of the circulatory system 13 percent, diseases of the respiratory system 11 percent, and endocrine disturbances 5 percent. Almost a third of those aged over 60 reported sick (31.4%). Of those sick, the distribution among the leading diseases was: other 38 percent, infectious diseases 18 percent, diseases of the respiratory system 14 percent, diseases of the circulatory system 13 percent, and endocrine disturbances 6 percent. Thus, across the age categories there is the expected U-shaped pattern of total incidence of morbidity, with a relatively high incidence reported for those under five years of age and those aged over 44. With increasing age, among those sick, there is an increasing diversification of diseases. For both child age groups, infectious diseases and diseases of the respiratory system alone accounted for over two-thirds of the total, but these two diseases accounted for a decreasing share of the total in adults aged 15-60 and accounted in only about a third of the total for elders aged over 60.

The mean ages in the five age groups reflect the changing age pyramid of the Thai population. For the three middle age groups, the within group means are significantly below the midpoint of the range, reflecting an increasing population growth rate during the period when these people were born. For children aged 0-4, in contrast, the mean is above the midpoint of the range, reflecting the recent deceleration in population growth, together with the ongoing relatively high infant and child mortality rate. Across the age groups, there is a steady increase in the number of females in the population, with the exception of the youngest age group. The mean education of adults across the age groups reflects the secular trend in Thai education, so it is inversely associated with age. For children, of course, the mean education shows that many children have not yet completed their education.

Over five out of every six Thais (84.6%) in the sample lived in intact households. The remaining 15.4 percent live in single-headed households; 10.9 percent with female heads and 4.6 percent with males. The average education of head and spouse in an intact household was 4.6 and 3.9 years, respectively. The average education of household heads in male and female single-headed households were slightly less, at 4.5 and 3.1 years, respectively. About 60 percent of the sample households reported having sanitary toilet facilities. The average wealth in terms of durables for the three adult age groups was in the range of ฿30-40,000, with some suggestion of a life-cycle financial pattern increasing to a peak for the 45-60 age group and then declining slightly with age (though the latter decline also might reflect the secular growth in per capita income over time). The means both for having sanitary toilet facilities and for wealth are lower for the two age groups of children than for adults. This pattern reflects that there is some tendency for poorer households to have more children, so the average child lives in a poorer household than does the average adult. About three-quarters of the Thai population live in rural areas. For village residents, the average time required to travel to the nearest town is about 30 minutes. About 12 percent of sample villagers live in areas where public health facilities are available in the community, and about 10 percent live in areas where private health outlets are available in the community.

## DETERMINANTS OF OVERALL MORBIDITY AND OF PARTICULAR DISEASES

We investigated both the overall morbidity determinants and the determinants of the major disease types by age group for four groups of determinants. Binomial and multinomial logit estimates of these determinants suggest the following:

**Household Wealth:** The overall morbidity estimates suggest that there is an inverse effect of wealth only for the youngest and the oldest of the five age groups. The disaggregated estimates indicate a significant effect only for other diseases for adults aged over 60, but suggest a weaker effect for circulatory and perhaps respiratory diseases for such adults and for infectious and perhaps respiratory diseases for children aged 0-4. These results imply little relationship between the distribution of wealth and reported morbidity for the middle three age groups, so income/wealth redistribution and economic growth alone would not have much effect on their reported morbidity.

**Individual Characteristics:**

- **Age:** Age has an important effect that is captured primarily by the disaggregation among the five age groups. In the overall estimates, in addition, there are within-group age effects for the youngest and the oldest age groups. For children aged 0-4 the disaggregated estimates indicate that the older the child, the lower the incidence of infectious disease. For adults over 60 the within-group age effect on total morbidity is estimated to be dominated by increasing incidence of both infectious disease and the other disease category with age. There also is some evidence of positive effects of age on the within-group incidence of digestive diseases for adults aged 15-44.

- **Sex:** The overall morbidity results indicate a higher incidence for males in the 0-4 age range and for females in the 15-44 age group. We speculate that the former is due to differences in inherent robustness and the latter due to differences associated with childbearing and infant and young child care, though there might also be some effects of differential economic rewards to health investment according to gender and differential reporting according to gender. The disaggregated results suggest that for children aged 0-4 the effect is basically on the incidence of infectious diseases. For adults 15-44 these results indicate that the effect is primarily on the other disease category (which is consistent with our conjecture, since morbidity associated with childbearing is included in that category) and (more surprising to us) circulatory diseases. Also, males in the 45-60 age group have less reported morbidity of endocrine and circulatory diseases than do females. The combination of the results across the three adult age groups implies decreasing strength in the higher incidence of reported morbidity with age, with no effect for those over age 60. This pattern suggests that biased reporting associated with gender is not the dominant factor since, if it were, it is not clear why it would decline across older age groups and become irrelevant for those over age 60. On the other hand, that the effects are strongest during the childbearing years suggests that there is a real impact on female morbidity associated with childbearing and feeding and care of infants and small children. That a somewhat weaker effect persists for the 45-60 age range suggests that part of the explanation for gender differentials in reported morbidity may be because of lesser incentives for investing in adult female health than adult male health because of lesser returns in terms of fairly immediate economic productivity during the prime work years (but not for the over age 60 or under age 15 groups).
- **Own education:** Own education has strong effects in the aggregate estimates for two age groups—negative for adults 15-44 and positive for adults over age 60. The disaggregated estimates suggest that for adults aged 15-44 the negative effect is primarily in the other disease category and secondarily on diseases of the digestive system. The disaggregate estimates suggest that for adults aged over 60 the positive effects are associated with diseases of the circulatory system, respiratory system, and the other disease category. If stress from work increases the morbidity probability for diseases related to the circulatory system, then it may be that the nature of work undertaken by more-educated persons causes higher probability of circulatory problems when such individuals are aged over 60. But for prime-age adults such negative factors apparently are outweighed by the positive effects of education on health care, though in part these associations with education may reflect greater ability and motivation, good health-care habits, and better genetic endowments.
- **Education of Head or Spouse:** We find no evidence of an impact on these variables even in the health of children. This surprising result is in contrast to frequent conjectures about the importance of women's education in improving the health of other household members.
- **General Household and Community Environments:** The availability of decent toilet facilities, representing household sanitation, does not have much effect. Nor does local availabilty of governmental or private health facilities. The aggregate results indicate that travel time to the nearest town positively affects reported morbidity for adults. Thus there may be improvements in the morbidity experience for adults from transportation improvements that make the health facilities of municipalities more available to villagers. The disaggregated estimates suggest that these effects are concentrated by disease categories: respiratory diseases for adults aged 15-44, infectious and the other disease category for adults aged 45-60, and infectious diseases for adults aged over 60. For children, however, there is no evidence that travel time affects reported moribidity. In the aggregate estimates, living in a municipality is associated only with morbidity for children aged 0-4. The disaggregated estimates suggest that this effect is a little more robust for infectious and respiratory diseases than other diseases, which suggests a better health and health-care environment for infants and small children in municipalities than in villages. However, for adults the disaggregated estimates indicate higher incidences of reported morbidity in those living in municipal areas as follows: for respiratory diseases in adults aged 15-44, for endocrine and circulatory diseases (though lower for infectious diseases) in adults aged 45-60, and for endocrine disorders in adults over aged 60. A possible explanation is that adults, particularly in their occupations (since such effects do not seem to dominate for children), are more exposed in municipalities than in villages to causes of these specific types of morbidity.

## SIMULATION OF FUTURE MORBIDITY PATTERNS

We used the foregoing estimates of morbidity determinants to simulate the number of individuals ill by disease types up to the year 2010. These simulations are partial in the sense that there can be no feedback of morbidity on the wealth, education or other deter-

**Table 2 Simulated Number of Patients by Morbidity Type 1985-2010 Given NESDB Demographic Projection for Total Population and Sex Composition**

| Diagnosis | Year | | | | | |
|---|---|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 |
| Population (Thousand) | 51,568 | 55,843 | 59,779 | 63,573 | 67,173 | 70,453 |
| Not ill | 43,603 | 47,254 | 50,522 | 53,552 | 56,349 | 58,812 |
| Infectious | 2,492 | 2,575 | 2,677 | 2,812 | 2,960 | 3,104 |
| Endocrine | 222 | 253 | 287 | 328 | 372 | 421 |
| Circulatory | 514 | 587 | 666 | 757 | 854 | 958 |
| Respiratory | 1,505 | 1,570 | 1,641 | 1,728 | 1,822 | 1,916 |
| Digestive | 933 | 1,052 | 1,171 | 1,294 | 1,415 | 1,533 |
| Other | 2,300 | 2,553 | 2,815 | 3,103 | 3,400 | 3,710 |
| Percent | | | | | | |
| Not ill | 84.55 | 84.62 | 84.51 | 84.24 | 83.89 | 83.48 |
| Infectious | 4.83 | 4.61 | 4.48 | 4.42 | 4.41 | 4.41 |
| Endocrine | 0.43 | 4.61 | 4.48 | 4.42 | 4.41 | 4.41 |
| Circulatory | 1.00 | 1.05 | 1.11 | 1.19 | 1.27 | 1.36 |
| Respiratory | 2.92 | 2.81 | 2.75 | 2.72 | 2.71 | 2.72 |
| Digestive | 1.81 | 1.88 | 1.96 | 2.04 | 2.11 | 2.18 |
| Other | 4.46 | 4.57 | 4.71 | 4.88 | 5.06 | 5.27 |

minants. They also assume that the relationships for 1985 will remain stable for the next 25 years without changes due to new health developments such as, for example, the apparent rapid spread of AIDS. Despite such limitations, the simulations should be of use in deciding the nature of possible future developments. We present two simulations, both based on recent NESDB population projections.

The first simulation is a reference simulation that assumes no change in the morbidity determinants except for the population total and age-sex composition (Table 2). Since the morbidity estimates vary by age and, to a lesser extent, by sex, these demographic changes by themselves imply changes in morbidity patterns. The total population increases from approximately 51.6 million in 1985 to 70.5 million in 2010, with an annual growth rate of 1.3 percent during this period. The number reported ill per month increases from 7.9 to 11.6 million, which implies an annual growth rate of 1.5 percent. The proportion of the population reported ill increases from 15.5 percent to 16.5 percent. The increase in the proportion of population with reported morbidity is primarily a reflection of the growing number of old people with relatively high morbidity, more than offsetting the reduction in the share of high morbidity for infants and children aged 0-4.

The age-sex compositional changes in the reference simulation also imply some changes in the composition of morbidity, in addition to an increase in the total morbidity rate. Not surprisingly, from the discussion of the incidence of diseases by age group above, this involves a shift from the infectious and respiratory diseases that dominate among children towards circulatory, endocrine, digestive and other diseases that have relatively greater incidence with age. The annual percentage growth rates of the numbers reported by disease categories in decreasing order of growth over the 1985-2010 simulation period are endocrine disorders 2.6 percent, diseases of the circulatory system 2.5 percent, diseases of the digestive system 2.0 percent, other disease 1.9 percent, diseases of the respiratory system 1.0 percent and infectious disease 0.9 percent. However, it should be noted that although the proportion of population who report morbidity due to infectious disease is declining over time, this category remains the disease group that afflicts more people than any other single specific disease group (though the residual other disease category overtakes infectious diseases in terms of total numbers after 1995.

The second simulation (Table 3) assumes that the educational attainment of adults increases by 1 percent, the proportion living in municipalities grows by 3 percent, and household wealth grows by 5 percent annually, all in addition to the age-sex changes in the reference simulation. This is a scenario assuming continuing social and economic development. In this case, in comparison with the reference simulation, the proportion of the population that reports morbidity within a one-month period is 14.1 percent in 2010. This rate of overall morbidity is 2.4 percent lower than in the reference simulation. This is equivalent to a reduction in those with reported morbidity of approximately 1.7 million

**Table 3 Simulated Number of Patients by Morbidity Type 1985-2010 (Assuming Changing Levels of Education, Municipality, Wealth, and Travelling Time Required to Nearest Town)**

| Diagnosis | Year | | | | | |
|---|---|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 |
| Population (Thousand) | 51,568 | 55,843 | 59,779 | 63,573 | 67,173 | 70,453 |
| Not ill | 43,603 | 47,485 | 51,032 | 54,401 | 57,600 | 60,534 |
| Infectious | 2,492 | 2,473 | 2,451 | 2,427 | 2,379 | 2,286 |
| Endocrine | 222 | 255 | 295 | 350 | 420 | 513 |
| Circulatory | 514 | 585 | 665 | 764 | 881 | 1,020 |
| Respiratory | 1,505 | 1,559 | 1,621 | 1,696 | 1,775 | 1,846 |
| Digestive | 933 | 1,028 | 1,117 | 1,204 | 1,280 | 1,340 |
| Other | 2,300 | 2,458 | 2,597 | 2,731 | 2,838 | 2,915 |
| Percent | | | | | | |
| Not ill | 84.55 | 85.03 | 85.37 | 85.57 | 85.75 | 85.92 |
| Infectious | 4.83 | 4.43 | 4.10 | 3.82 | 3.54 | 3.24 |
| Endocrine | 0.43 | 0.46 | 0.49 | 0.55 | 0.63 | 0.73 |
| Circulatory | 1.00 | 1.05 | 1.11 | 1.20 | 1.31 | 1.45 |
| Respiratory | 2.92 | 2.79 | 2.71 | 2.67 | 2.64 | 2.62 |
| Digestive | 1.81 | 1.84 | 1.87 | 1.89 | 1.91 | 1.90 |
| Other | 4.46 | 4.40 | 4.34 | 4.30 | 4.22 | 4.14 |

Note: 1) Education = 1% change per year (except for children, which assume no change)
Municipality = 3% change per year
Wealth = 5% change per year
Travelling time required to nearest town
= -2% change per year
(2) Other diseases are distributed as in 1985 in order to reconcile for different definitions of this category across age groups.
(3) The demographic change assumptions in the reference simulation in Table 2 also are assumed here.

individuals per month as a result of better living standards. This reduction is due primarily to a decline in those who would have suffered because of infectious diseases and the other disease category (each about 0.8 million) and, to a lesser extent, diseases of the digestive and respiratory systems (0.2 million for digestive and 0.1 million for respiratory diseases). But as a projected result of social and economic development, the numbers who suffer from the diseases of the circulatory system and endocrine disturbance are simulated to be slightly higher than in the reference simulation.

## POLICY IMPLICATIONS

The policy implications of our study are several. First, unlike human resource investments in education, the pressure on resources for health investments is not likely to be reduced as a result of a lower population growth rate. In fact, the aging population that results from the lower population growth rate is likely to increase the incidence of overall morbidity and change its composition towards diseases that tend to be more difficult to prevent and more costly to contain or cure. Second, there are some determinants of morbidity that seem to have substantial effects at least for some age groups and some diseases that are amenable to direct policy influence. The most important of these policies seem to be increases in education and reductions in the time cost (and perhaps other costs) of health treatment. Income/wealth increases that reflect indirectly a myriad of policies, in contrast, have fairly limited effects. Third, socioeconomic development broadly defined, nevertheless, apparently can offset the negative impact of the changing age composition on total morbidity and reduce the cost of such morbidity for a large number of individuals. At the same time, such development is likely to lead to gradual shifts in morbidity towards diseases associated with development, such as those of the circulatory system, that are more expensive to cure and more difficult to prevent. This trend seems inevitable, and the strategy to cope with its implications should be developed accordingly. Information about the preven-

tion and detection of such diseases is not likely to be disseminated adequately from a social perspective by private entities, so there probably is an important policy role to facilitate such information dissemination for efficiency reasons. Also, there may be efficiency reasons for policy action of a preventive sort to the extent that the causes of these diseases reflect market failures, such as through pollution externalities (as opposed to individual effects such as stress associated with particular occupational choices). But such market failures are not likely to be as great for most of the diseases that will become of increasing importance as for the currently very widespread infectious diseases that are likely to become of lesser relative importance. Further, there are not likely to be efficiency arguments for public subsidies for curative measures for most of the diseases that are likely to become of increasing relative importance, though there may be distributional arguments that suggest subsidies for health insurance for the poor. Thus the change in the composition of diseases that is likely with aging of the population and with development may call for changes in the nature of a number of dimensions of health policies.

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# Prospects for Cooperation in Industrial Technology Between Thailand and the European Community*

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Joe Anderson

## INTRODUCTION

This paper was commissioned to suggest possible areas of cooperation in science and technology between Thailand and the European Community (EC). While many potential areas can be identified, we consider cooperation in the field of industrial technology to be of the most immediate need and to have the highest potential for promoting industry, investment and trade for mutual benefit. In what follows, we start by defining a conceptual framework for technology activities in industry. Next, we describe the status of industrial technology in Thailand. Finally, we identify areas for possible cooperation between Thailand and the EC.

## CONCEPTUAL FRAMEWORK FOR TECHNOLOGY ACTIVITIES IN INDUSTRY

Technology activities in industry may be divided into three levels.

### Level 1: Utilization of Existing Technology

This is the most straightforward kind of technological activity that can be undertaken by a company. It involves the deployment or utilization of technology that is available "off-the-shelf" in international markets. This is usually purchased by companies to improve production processes and is often introduced with a minimum of modification to imported machinery or other equipment. Typically, the new technology is operated by the staff in the recipient company, but vendors can have roles in purchasing, delivery, setting-up, staff training and equipment maintenance. Technology activities may involve productivity improvement, quality control, and testing in order to utilize existing equipment to its fullest extent.

### Level 2: Development of Technology

In more technologically sophisticated industries, individual companies frequently have to develop and adapt their existing products and processes to meet market demands. Here, because companies are often unable to purchase the necessary technology in a "ready-made" form, they have to undertake a certain amount of applied research to adapt and improve existing technology, thereby producing differentiated products required by the market. These development activities may be conducted in-house by the company through an informal management structure (usually the case with small companies) or in more formal R&D facilities, running along a continium up to free-standing laboratories. Level 2 activities may also be conducted in collaboration with public- sector institutions or by paying for the services of private design, engineering, or research organizations.

### Level 3: Basic and Strategic Scientific Research

Level 3 activities include the kind of scientific research typically conducted in the dedicated R&D laboratories of large companies. Such research may be fundamental in nature, and designed to advance scientific knowledge generally, but it is usually in a field relevant to the company's technology interests. Such work is often referred to as "strategic research" which can bring about new products, processes or materials. Also related to level 3 is more fundamental "curiosity oriented" scientific research conducted in universities and public research institutes. Here research is not necessarily related to industrial needs but is oriented by criteria of scientific merit and is usually known as "basic research."

Level 3 activities (basic and strategic research) thus supply the knowledge from which new technology may

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be developed. In the case of company-sponsored strategic research, the impact on technology development may be direct and obvious. But, with publicly supported basic research, scientific developments diffuse broadly through scientific publications, teaching, academic seminars and conferences, and the movement of personnel between academia and industry. The impact of academic research on technology development is therefore often much more obscure.

To further illustrate what we mean by each of the three levels of technology activity, two hypothetical examples for the electronics and biotechnology industries are outlined below.

### Hypothetical Examples of Technology Activity Levels in Two Industries.

**Electronics Industry: Television Assembly in Thailand** Television assembly started in Thailand thirty years ago. However, the majority of companies still assemble televisions from "completely knocked down kits" (CKD) with imported components comprising up to 90 percent of the cost of raw materials. Televisions produced by the larger companies often have a higher "local content," but they are manufactured to specifications from abroad. There is no design work. Technology activities in the production line involve quality control, testing, and maintenance. There is periodic review of the process to improve productivity (increase yield and reduce errors) and reduce costs by "value engineering." These are strictly level 1 activities.

Level 2 activities include, for example, development work to enable television receivers to operate in remote areas. This may require changes to the original design to increase the sensitivity of the front-end circuits. Level 2 activities do not include simple design changes – for example, changing the appearance of the television to fit local tastes. The company should thoroughly understand the technology of television receivers and be able to change the circuitry to achieve the specification required.

Level 3 would include radical changes to the television technology. Examples are the use of digital signal processing (DSP) techniques to process the signal (instead of the current analog systems) to make multiple-window viewing possible. Equally, the change of display device from the present cathode ray tube to flat screen liquid-crystal display (LCD) would constitute a Level 3 activity.

**Biotechnology Industry: Production of Industrial Enzymes** The example chosen here is in the field of enzyme technology. Consider an established chemicals company wishing to start production of industrial enzymes using modern fermentation technologies. The equipment for this – such as bioreactors, fermentors, and downstream technology – can be readily purchased in international markets. The identification, acquisition, and implementation of such equipment would constitute a level 1 activity.

Once the process is running smoothly producing, say, a starch degrading enzyme, the company may wish to examine how its fermenters could be adapted to produce other enzymes such as proteases or peroxidases. This may involve experimentation with other microorganisms, or the substrate used. This would represent level 2 activities. In contrast to the television example given above, this kind of level 2 innovation would be to develop the production technology, not the product.

At a more sophisticated level, the company may wish to understand how it can improve the substrate-specificity of the enzymes produced. This would involve level 3 activities such as basic research on protein engineering and recombinant DNA. The outcome of such research might be an improved understanding of structure/function relationships in enzymes generally and could be published in scientific papers as an advance in human knowledge. At the same time, however, a company involved in this kind of work will gain valuable proprietary information on future product design. This type of "strategic research" is of course limited to companies with high levels of intellectual and financial capital and may be conducted in the company's own research laboratory, or in collaboration with an academic center. This kind of level 3 activity is presently rare or even non-existent in Thai companies.

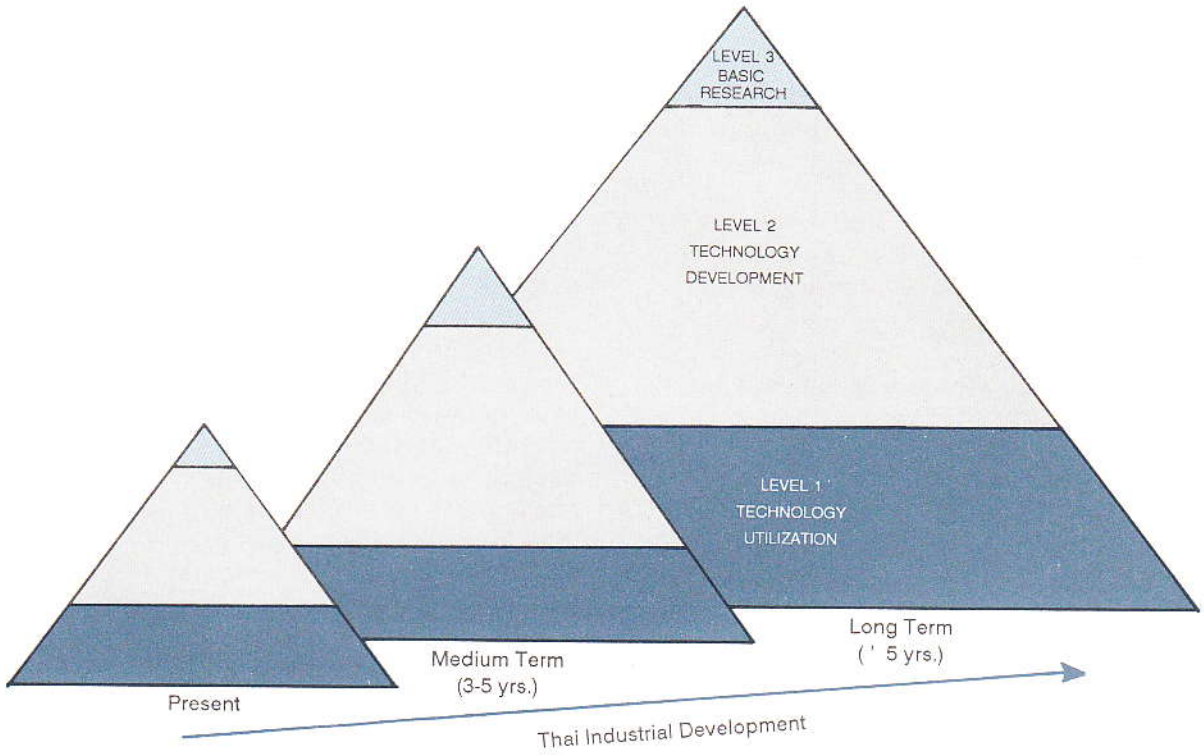
## CURRENT TECHNOLOGY ACTIVITY LEVELS OF THAI INDUSTRY

Figure 1 shows our view of the balance of technology activities in the Thai manufacturing industry and likely future trends, based on data from a series of studies at the Thailand Development Research Institute. As depicted, the majority of companies in Thailand operate at level 1, having the most basic kind of technology activity in our analytical framework. This does not necessarily mean that level 1 companies run outdated or primitive operations. In contrast, some have acquired state-of-the-art technology and operate ultra-modern plants. The point here is that level 1 companies are not necessarily technologically unsophisticated but rather that they have experienced little pressure to undertake development work or are blocked from doing so by other factors.

Companies operating at level 2 are less common – few undertake their own adaptation and development of existing technology. Companies which do undertake such work are usually driven to do so either by the nature of the local operating environment or by direct market needs.

Even rarer are level 3 activities, and these are only conducted in a few large Thai companies or foreign-owned multinationals based in Thailand. The latter

**Figure 1 Projected Levels of Technology Activities in Thai Industry**




usually conduct level 3 R&D abroad, arguing that the manpower or skills do not exist in Thailand.

Our prediction is that as the Thai economy continues to develop away from an agricultural base into manufacturing, there will be an overall increase in technological activity in the country at all three levels, as shown in Figure 1. Although, it is probable that there will also be a relative increase in level 3 and level 2 activities, it is clear that in the next five years, level 1 activities (the deployment of utilization of technology that is available "off-the-shelf" in international markets) will continue to dominate the Thai manufacturing industry. Nevertheless, we would argue that any initiatives in international cooperation should address development issues at all three levels of industrial technology in parallel.

## FACTORS LIMITING TECHNOLOGY DEVELOPMENT IN THAILAND

The most important factor limiting technology development in Thailand is the current economic and policy environment. The economy is growing at an unprecedented rate, fuelled by direct foreign investment and an export boom. Under these conditions, most manufacturers are preoccupied with rapidly scaling up output to meet excess demand, and there is little pressure for companies to differentiate products or to innovate. This is reinforced by protective trade policies that impose high import tariffs on foreign technology-intensive goods and regulate the number of companies in any given sector. Such protection lowers competitive pressures, causing a laissez-faire attitude towards product or process innovation in the local manufacturing industry. These economic and policy factors therefore create an unhealthy environment for the development of technology activities in industry. Various arguments can be made as to why it is important to promote a better environment for industrial technology and how to bring this about, but these are outside the scope of this paper.

Besides economic and policy factors, there are other more direct constraints on technology development in Thailand which may be overcome through international cooperation. These include constraints due to an inadequate business infrastructure for S&T, inadequate provision of S&T institutes, and inadequate human resources. These will now be considered in turn.

### Constraints Due to an Inadequate Business Infrastructure

Any shift from level 1 to level 2 technology activities in Thai industry will require an adequate supply of the components for technology development and an associated need for raw materials and higher value-added services. Technology components here may be as simple as plastic cases to supply a manufacturer of photographic film, or more complicated equipment,

such as technical machinery for a new production process. Services may include technology consultancy or information brokerage. Regardless of the type of product or service, it is widely argued that the network of vendors that can supply such technology components and services is currently very poor.

Most manufacturing companies with level 2 activities repeatedly argue that they need assistance with identifying quality vendors either in Thailand or abroad and that they wish to see an upgrading of the capabilities of existing vendors.

### Constraints Due to Inadequate S&T Institutions

S&T institutions are either organizations that conduct S&T activities (education, research, development), such as universities, government departments and private companies, or institutions that support these activities through providing services. Service institutions include S&T information centers, testing and calibration centers, technical consultancy services, etc. The main institutional deficiency in Thailand is in this service sector.

For example, if a Thai company has purchased technology from a foreign vendor, there is very limited after-sales service, and few local consultancy organizations to which companies can turn to for technical advice in the event of problems. Another limitation concerns the inadequacy of technical testing and calibration facilities which are necessary for ensuring that locally manufactured products meet international specifications and standards. Public-sector institutions providing services in this area have been described as inefficient and unreliable.

Consultancy and testing services mainly address the needs of companies with level 1 technology activities. Improving the institutional basis for services at level 2 is more troublesome and may not be achieved easily by improving networks of consultants. It has been argued that free-standing technology research institutes are needed to service the needs of industry. Examples of this kind of institute abroad can be found in the Hong Kong Productivitity Council and the Industrial Technology Research Institute in Taiwan. These conduct industry-related applied research and develop technologies up to the pilot production stage. We would argue that similar institutes are required in Thailand to enhance level 2 activities in industry.

Finally, it is clear that existing S&T information centers cannot adequately describe either the R&D being conducted in this country or the technical and consultancy resources that are available in universities. It is ironic that present initiatives to promote S&T information are focused on foreign technical services and R&D conducted abroad, while such details are not yet available for Thailand. There is strong evidence showing that companies would not only welcome the provision of better information on R&D conducted in the Thai public sector and the S&T services available, but that they would also appreciate increased opportunities to utilize domestic S&T facilities.

### Constraints Due to Indequate Human Resources

The shortage of S&T manpower poses the most serious bottleneck for the further industrial and economic development of Thailand. Companies continually report difficulties in recruiting suitable staff, a demand for high salaries, and rapid turnover of staff. At the same time, government agencies and universities are losing S&T staff, with little prospect of filling the vacant positions.

As technology activities in most Thai companies do not yet extend beyond level 1, the immediate need is therefore for increased numbers of engineering graduates. A production increase of 15-20 percent annually is thought to be necessary. However, as technology activities shift from level 1 to level 2, there will also be a need for a different kind of training to produce engineers and scientists better equipped to undertake industrial R&D.

## POSSIBLE AREAS FOR COOPERATION BETWEEN THAILAND AND THE EC

In conclusion, we would argue that there are two main constraints to strengthening R&D in Thailand. On the one hand, there are prevailing economic conditions and a policy environment which mitigate against industrial innovation; on the other hand, there is an inadequate national infrastructure for S&T. The economic constraints can only be properly addressed by policy initiatives from a Thai government that is committed to taking a strategic, long-term view of industrial development. There is therefore not much scope for collaboration between the EC and Thailand in this domain. By contrast, there are many initiatives that can be undertaken collaboratively which would make a direct impact on improving Thailand's S&T infrastructure in ways that would also benefit the EC. Our suggestions here fall under three categories: a) improving the business infrastructure for technology development, b) strengthening S&T institutions, and c) improving the manpower supply.

## COOPERATION TO IMPROVE THE BUSINESS INFRASTRUCTURE FOR TECHNOLOGY DEVELOPMENT

With the expansion of Thai industry, it is becoming apparent that manufacturing companies do not have enough suppliers of the raw materials, value-added services, or intermediate goods (molds, dies, precision plastic/metal parts) to support even their most basic (level 1) technology activities.

One way of overcoming this would be to first establish an EC- sponsored organization that identifies existing and potential vendors of technical supplies. Assistance for these vendors to upgrade technically could then be provided by organizations in the EC. And, where it is not possible to elevate the capabilities of existing vendors or where vendors of certain equipment/services do not exist in Thailand, European companies could be identified and assume the role of suppliers in Thailand. These could provide the necessary equipment/services through joint venture partners or by establishing Thai-based subsidiaries.

## COOPERATION TO STRENGTHEN THE INSTITUTIONAL INFRASTRUCTURE FOR S&T

As previously outlined, the institutional base for supporting technology development in Thailand is extremely poor. Technical consultancy services are badly organized and have no solid institutional base; industrial standards and testing services are scattered and ineffective, and organizations providing S&T information services are not sufficiently geared towards the needs of industry. These are all areas in which collaboration with the EC would be mutually beneficial, as suggested below.

### Industrial Extension and Technical Consultancy

Many manufacturing companies in Thailand are simply not aware of the benefits that appropriate technology can bring in improving production efficiency and diversifying products. Where these benefits are perceived, there are few places for companies to turn to for assistance in selecting, purchasing and implementing new technology. There is a clear need, therefore, to create an institutional basis for stimulating the demand and utilization of technology in Thai industry.

One option might be to establish a pro-active industrial extension service that would identify existing companies that are ready for technological intensification. The service would help these companies improve production efficiency and effectiveness, demonstrating where new technology can help solve problems or enhance production. The focus of this service should be in enhancing level 1 activities – i.e., the acquisition and implementation of existing technology – rather than in helping companies to develop new technology. The target groups needing such assistance are small- and medium-sized industries. In some cases, the problems facing the client companies may not be solely technical but could be related to ineffective technology management. The industrial extension service should therefore also provide advice and guidance on management and finance.

In essence, this organization would be a brokerage for consultants who are able to provide packaged services in engineering diagnosis, market analysis, human resource assessment, and guidance in obtaining modernization loans and equipment. In certain cases, it would clearly be appropriate to involve European consultants, thus providing business opportunities for companies in the EC.

Thailand's Science and Technology Development Board (STDB) has recently established a "Technical Service Center for Industry" (TSCI), which will fulfill many of the functions of an industrial extension service. This is a move in the right direction, but TSCI is a temporary organization that will exist for only three years. The total number of consultancy contracts that TSCI is required to undertake during this time is only 175, which is unlikely to make a large impact on the overall technological capability of Thai industry (which has tens of thousands of small- and medium-sized companies).

Our suggestion is that a more permanent industrial extension service could be established and operated on a larger scale, arranging several hundred consultancy contracts a year. It could either be established as a private company, an automonous organization under the Ministry of Science, Technology and Energy (MOSTE), or as a statutory body. Whatever the structure, it is likely that the income generated from client fees will have to be subsidized, at least in the early stages, by the Thai government or from overseas aid. The EC may consider such direct support. And, in addition to direct funding, the EC may also consider subsidizing European consultants in Thailand through the proposed industrial extension service.

### IndustriaL Standards Testing and Calibration Services

As Thailand industrializes, the need for an effective industrial standards system cannot be overemphasized. The present system is judged by many manufacturers to be inadequate, due to excessive delays in product testing and insufficient coverage of products. Of special concern are the needs of export companies that have to test products according to specifications of client countries in Europe, the United States, and Japan.

The need for a reliable and efficient industrial testing and calibration service is now recognized in some areas of the Thai public sector, and foreign aid funds have been sought and obtained from the Japanese government, which is providing over US$50 million for an appropriate organization to be established in Thailand. This new testing and calibration facility will be operated by the Thailand Institute for Science and Technology Research (TISTR) and the Thai Industrial Standards Institute (TISI). However, in order for the center to be effective, it must obtain accreditation from the technical standards authorities of major client countries. The EC could take a lead here in ensuring that the facility will receive accreditation according to standards laid down by member countries. This will

provide a valuable service to Thai industrial development and ease channels of trade with Europe.

### S&T Information

At present, there is no comprehensive directory of current scientific and technological research being undertaken in Thai public-sector institutions. Some universities produce indexes of researchers and publications, but these lists are often incomplete and out-of-date. This makes it very difficult for companies to identify local expertise or technical resources to support their level 2 activities. And as level 3 activities develop in Thailand, there are signs that local and foreign companies will increasingly wish to engage in collaborative research with universities to develop academic concepts through to new products. Again, information on the achievements and research outputs of universities is required, but at present this is relatively inaccessible and uncomprehensive.

The EC could provide assistance here by supporting the development of databases on Thai S&T. These would consist of details of all Thai scientists and technologists working in public sector research institutions (including the universities and TISTR), focusing on their expertise and the services they could provide to industry. Added to this could be information describing the outputs of Thai S&T, to include all published material (papers in journals, technical reports, conference papers, etc.) and non-published items (such as engineering designs, technical specifications, patents, software, etc.)

Together, such systematized information would permit analysis of areas of weakness and strength in Thai S&T and trends in S&T activity within individual institutes and the technology sector. As well as providing the basis for a national management information system in Thai government S&T agencies, the development of databases on S&T inputs and outputs would also provide European companies with useful intelligence on Thai R&D capabilities.

In addition, a flow of information in the reverse direction would also be mutually beneficial. Here, it would be valuable for Thai companies and universities to have better access to information on S&T training opportunities in European institutions.

## COOPERATION TO IMPROVE HUMAN RESOURCES IN S&T

Thailand urgently needs an improved supply of S&T manpower at all three levels of technological activity in industry. At level 1, it is necessary to increase the numbers of engineers graduating each year to satisfy the demand from industry for manpower able to supervise the acquisition, implementation and operation of industrial technology. At level 2, there is a need for more advanced training in engineering to enhance domestic capabilities in industrial R&D. At level 3, it will be necessary in the longer term to strengthen the capability of the academic community to undertake fundamental research in S&T. Developments at levels 2 and 3 are particularly amenable to assistance through international cooperation. These will now be considered in turn.

### Graduate Engineering Training – Level 2

One of the key deficiencies constraining industrial R&D in Thailand is the undersupply of engineers who have received the postgraduate training necessary for them to be capable of effectively initiating and undertaking research programs. One way of helping to correct this would be to establish one or more graduate engineering schools in Thailand. These could be established as joint-ventures between European universities and any Thai organization (university or otherwise) able to provide facilities and staff backup. The Sasin Graduate Institute of Business Administration, a joint program between Chulalongkorn University and two American management schools, is one example that could serve as a model.

The EC could act as a broker in establishing such schools by (a) identifying interested universities in Europe, (b) soliciting and screening applications for a joint venture from potential Thai partners, (c) sponsoring meetings and study tours of European and Thai academic institutions, and (d) providing the seed money to help establish the joint ventures. Like Sasin, the proposed graduate school could eventually be self-supporting.

The current and expected high growth of private industries should guarantee that the proposed engineering school would be economically viable in both the short- and long-terms. The school would undoubtedly make a long-lasting impact on the academic engineering community and private industry by increasing the number of highly trained engineers in the country. This would be achievable at present only through the involvement of foreign university teachers, as the number of qualified engineering lecturers in Thailand is presently inadequate to support a new graduate school.

### Training in Advanced Technology - Level 2

There is currently a high demand for in-service (level 2) training in industrial technology, and the main source of supply here is through short courses provided by the Technological Promotion Association (TPA). Some universities also run a number of extension or continuing education courses.

Not included, however, are courses that provide training in the techniques of advanced engineering, such as computer-aided design (CAD) for new products and training facilities for R&D management. It would therefore be desirable to establish an advanced training organization, possibly supported by an endowment fund or membership charges to participant companies. This or-

ganization should aim to diagnose professional technology training needs at the levels of individuals and companies, act as a broker for training services using both local and European resources and, where necessary, prepare and deliver courses. The involvement of the EC here would provide valuable access to European teaching materials and resources and help to promote business opportunities for European-based training consultants.

### Academic S&T Research - Level 3

In the longer term, improvement in the technological capabilities of Thailand will depend to an extent on the strength of the local science base. The kind of basic and strategic research undertaken in academic institutions anywhere is often driven by curiosity alone and has little direct relevance to the problems of industry. However, the benefits of such work are diffuse and profound. It supplies the knowledge base and intellectual capital necessary for participating in the international S&T community. In particular, academic science generates an endemic capability to evaluate and absorb ideas and innovations in high technology emerging from other countries. More directly, academic science can also give rise to knowledge that underpins local technological innovations and can provide high calibre training for original and innovative minds.

Despite strengths in certain areas of basic and strategic science—notably, some life sciences and biotechnology—Thailand's overall academic science base is still very weak. This could be strengthened through increased cooperation between academic institutions in Europe and Thailand. Besides conventional exchange programs for academic staff, the EC could consider funding a few key centers of excellence in Thai academic institutions to act as nucleating points for the development of research groups in areas of strategic scientific interest to both Thailand and EC member countries. These centers would require funds for senior staff (European or Thai scientists) to lead research programs and provide the structured opportunities for promotion that are necessary to attract junior scientists into a research career. Besides the obvious benefits for Thailand, such assistance from the EC could also provide a means for European scientists to tap into certain rich areas of Thai science, create new research opportunities, and strengthen cultural links between the two regions.

# NEWSBRIEF

## The Third Annual "Thailand in Transition" Photography Contest:

## "Save Our Environment"

Thailand is being transformed from an agricultural to an industrialized country and may be on the path of becoming the fifth Asian NIC. But, what is the cost of this rapid change? And can the country continue its unprecedented economic growth rate without sacrificing the quality of its environment and the quality of life of the Thai people? Indeed, the country's future economic progress is now being threatened by rapid deterioration of its rich, yet fragile, natural resources.

Thus, "Save Our Environment" was the central theme that TDRI, Kodak (Thailand), Ltd. and the Photographic Science and Printing Technology Department of Chulalongkorn University asked photographers to capture through the eye of a camera. Fourteen finalists were selected from a total of more than 240 photographs.

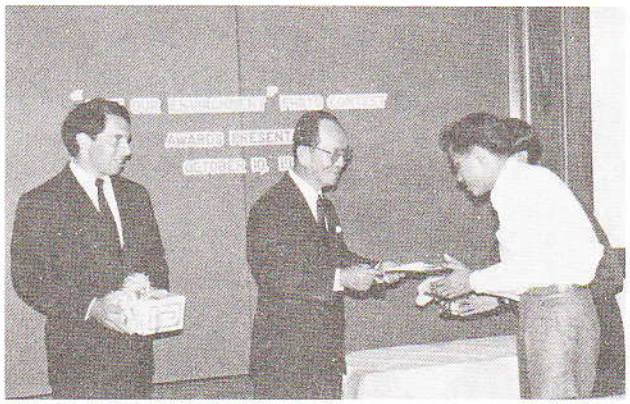
On October 10, a special awards presentation was held at TDRI's headquarters for the fourteen finalists. Cash awards of 10,000, 5,000 and 3,000 baht and a Kodak camera were presented to the first-, second-, and third-prize winners; the eleven runners-up received copies of Kodak's book, "The Joy of Photographing People."

"At the Limit," Sathip Thongnakcokgrud's first-prize-winning photo, graphically illustrates the dire consequences of water pollution. Photos by second- and third-prize winners Manit Larpluchai and Kriengkai Waiyakitland portrayed the need for stronger pollution control measures. By contrast, a reminder that more than sixty percent of Thai workers are still engaged in argicultural work is emphasized by Tanong Prajakjit's photo of terraced rice fields.

Other finalists turned their lenses toward the country's existing natural beauty – mountain peaks rising majestically from the earth; a hillside in Mae Hong Son covered with a carpet of yellow flowers; the sun's rays illuminating a small boat at dawn.

On the other hand, "Consequences" by Sarun Chailert is an eerie portrayl of the terrible effects of environmental mismanagement, while Somsak Sriboon's photo, "Garbage Road," shows the mounting waste resulting from Thailand's increasingly consumer-oriented society.

The "Save Our Environment" photography contest was organized in conjunction with the 1990 Year-End Conference, "Industrializing Thailand and Its Impact on the Environment," which was co-sponsored with the Chai Pattana Foundation, founded by His Majesty the King. A Display of fifty photographs from the contest will be on exhibit at the conference. In addition, eight prize-winning photographs from this year's contest will be published in TDRI's 1990 Annual Report.



Dr. Snoh Unakul, Chairman of TDRI, presents the first-prize award to Sathip Thongnakcokgrud for his photograph, "At the Limit," as Mr. Joseph Dilberto of Kodak (Thailand), Ltd. looks on.

## DONORS AND SPONSORS PRESENTATION CEREMONY FOR THE 1990 YEAR-END CONFERENCE HELD AT TDRI

On October 10 TDRI announced the sponsors and donors for the 1990 Year-End Conference, "Industrializing Thailand and Its Impact on the Environment," at a special ceremony held at the Institute.

The conference, which will be held at the Ambassador City, Jomtien, on December 8 and 9, will focus on the multitude of environmental constraints facing Thailand today as a result of the country's rapid industrialization. The conference's corporate sponsors include the following:

CP Group of Companies
Siam Commerical Bank, Ltd.
ESSO Standard Thailand, Ltd.
Thai Farmers Bank, Ltd.
Padaeng Industry Co., Ltd.
Unocal Thailand, Ltd.
Premier Group of Companies
Lever Brothers (Thailand) Ltd.
Saha-Union Corp., Ltd.
Shell Company of Thailand, Ltd.
Siam Cement Co., Inc.
SP International Co, Inc.

## ITR Program Holds Workshops to Develop Strategies for the 7th Plan

TDRI's ITR Program recently conducted four workshops as part of the ongoing project, "Industrial and Trade Development Strategy for the Seventh Plan (1992-1996)" as follows:

Project I - Workshop on the "Study of Selected Strategic Industries and Decentralization of Manufacturing for Thailand, National Economic & Social Development Plan, 1992-1996." The seminar was held at the Landmark Hotel, Bangkok, on November 19.

Project II - Workshop on the "Study of a Trade Development Strategy for Thailand during the Seventh Plan, 1992-1996" was held at the Novotel Hotel, Bangkok, on November 21.

Project III - Workshop on the "Study of the Trade and Industrialization Policy Incentives for Implementation through Private-Public Sector Cooperation" was held at the Regent Hotel, Bangkok, on December 3.

Project IV - Worshop on the "Study of the Development of Infrastructure and Supporting Facilities and Prevention and Controls for Pollution and Environment" was held at the Hilton Hotel, Bangkok, on December 11.

Each workshop was attended by forty to fifty participants from the NESDB and TDRI working staff, academic institutions, the private sector, and governmental agencies.

## Seminars Attended and Papers Presented Elsewhere

### P&D

Dr. Twatchai Yongkittikul attended the "Economic Cooperation Symposium" organized by the Economic Planning Agency of Japan. Thirty participants from nine countries made presentations on the problems of development and development strategies in their respective countries. November 19-20, Tokyo; November 21-23, Kochi Prefecture, Japan.

### ARD PROGRAM

Dr. Ammar Siamwalla attended and presented a paper on "Land-Abundant Agricultural Growth and Some of Its Consequences: The Case of Thailand" at the IFPRI Conference "Agriculture on the Road to Industrialization" held in Taipei between September 4 - 7.

Dr. Suthad Setboonsarng participated in the ACIAR Workshop in Manila, Philippines between October 21 - 25.

Dr. Ammar Siamwalla joined the International Policy Council Conference held in Budapest, Hungary on October 23 - 26.

Dr. Suthad Setboonsarng attended the Organization for Economic Cooperation and Development Conference in Paris, France from November 4 - 8.

Dr. Ammar Siamwalla attended the Asian Development Bank Finalization Symposium on "Priority Issues and Policy Measures to Alleviate Rural Poverty" held in Manila, Philippines on November 14 -16.

### HRS PROGRAM

"Mega-Cities Coordinators Meeting." Conference. Organized by the Mega-Cities Project. Dr. Orapin Sopchokchai presented a paper on "Thailand's Successful Innovation." Mexico City, September 24-28.

Srinakharinwirot University. Seminar. Dr. Teera Ashakul gave a seminar for students and faculty on the "Family Planning Program in Thailand: Issues and Problems in Upcoming Decades." Srinakharinwirot University, Prasarnmit Campus, September 17.

"Private Provision of Social Services." Conference. Jointly sponsored by the World Bank and the Rockefeller Foundation. This conference discussed alternative modes of private provision of social services with the aim of identifying fruitful research programs in the area. Dr. Chalongphob Sussangkarn presented a paper on "Private Provisions of Social Services: Suggested Research on Education and health in Thailand." Bellagio Study and Conference Center, Bellagio, Italy, October 22-26.

ILO ARTEP Regional Course on "Advanced Techniques of Employment and Labor Market Analysis." Workshop. Organized by ILO ARTEP and the New Delhi Institute of Applied Manpower Research. Dr. Suganya Hutaserani attended. New Delhi, India, October 4-23.

"Policy Dialogue on Gender, Economic Growth and Poverty." Conference. Organized by the Women in Development Programme, Asia and Pacific Development Center (APDC) and the Center for Women's Studies. Dr. Orapin Sopchokchai presented her joint paper with Dr. Twatchai Yongkittikul on "The Impact of the Basic Needs Approach on the Alleviation of Poverty and the Status of Women." Hanoi, Vietnam, October 13-23.

Thai Population Association Annual Meeting. Conference. Organized by the Population Association of Thailand. Dr. Mathana Phananiramai presented a paper on "The Ties Between Children and Their Mothers' Households." Bangkok, November 16.

"Urban Population Trends and Projections by Province." Dr. Teera Ashakul and Dr. Penporn Teerasawasdi presented their research as part of the NESDB's project on a National Urban Development

Policy Framework. Human Resources and Social Development Program, October 18.

"Regional Economic Performance and Outcomes." Dr. Yongyuth Chalamwong and Dr. C. Michael Douglas presented their research results as part of the NESDB's project on a National Urban Development Policy Framework. Human Resources and Social Development Program, November 5.

## MEP PROGRAM

Regional Seminar on an Interlinked Country Model System, Ninth Session. Dr. Damkirng Sawamiphakdi and Khun Chanin Kemheangpatiyooth attended and presented two papers entitled "The Economic Outlook for Thailand: 1990-1992" and "Thailand's Macroeconomy: The Impact of Imported Oil Prices." Beijing, China, October 22-24.

The AEO-Project Link Conference, "The Third Workshop on the Asian Economic Outlook." Dr. Damkirng Sawamiphakdi and Khun Pairuj Kanjanakaroon participated and gave a presentation on "The Economic Outlook for Thailand: 1990-1992." Manila, Philippines, November 5-9.

## ITR PROGRAM

On November 12, Prof. Arnold C. Harberger, who specializes in economic policies, development economics, public finances and international trade, visited TDRI and gave a lecture on "Policy Versus Change in the Process of Economic Growth."

Dr. Narongchai Akrasanee made a presentation on "ASEAN Economics and Trade" to a group of twenty ASEAN journalists, in their traveling workshop on September 11, at TDRI's conference room. The workshop was organized and sponsored by the International Institute for Journalism in Berlin.

Dr. Narongchai Akrasanee gave a lecture on "Thailand since 1987 and Its Future Economic Prospects" in the 1990 Partnership Conference held by Chesterton International Property Consultants in London during November 2-4.

Dr. Narongchai Akrasanee appeared as a panel discussant at a seminar on "Thailand and Its Economic Relations in the Next Decade," organized by the Committee of the Ministry of Foreign Affairs. His presentation focused on the Thai relationship towards the Asia-Pacific region. The seminar was held at the Imperial Hotel, Bangkok, November 13.

Dr. Paitoon Wiboonchutikula participated in the International Centre for Economic Growth's Second Regional Meeting for Asia and Middle East correspondent institutes, held in Kuala Lumpur, Malaysia, on November 14-16, 1990.

## STD PROGRAM

Dr. Chatri Sripaipan presented a paper on "Facilitators of Research and Development" at a workshop training on "Research in Natural Science," organized by the National Research Council of Thailand, Bangkok, September 11.

Dr. Chatri Sripaipan participated in and gave the closing remarks at the Thai Science Week seminar on "Keys to the Asian Renaissance of the 1990s: Science and Technology Strategies for Development," organized by Chulalongkorn University, the Science Society of Thailand, Ministry of Science, Technology and Energy, and the Science & Technology Policy Forum, at Chulalongkorn University, Bangkok, August 23.

The STD Program, in cooperation with the Science and Technology Policy Forum (STPF), invited Dr. Yongyuth Yuthavong, Director of the National Centre for Genetic Engineering and Biotechnology, Ministry of Science, Technology and Energy, to give a talk on "The Process of Science and Technology Planning in Thailand" at the TDRI conference room, October 9.

Dr. Chatri Sripaipan presented a paper on "Measuring the Science and Technology Activity in Thailand's R&D Intelligence from Published Papers," co-authored with Dr. Joe Anderson and Dr. Suchata Jinachitra, at the "16th Conference on Science and Technology of Thailand," organized by the Science Society of Thailand and King Mongkut's Institute of Technology Ladkrabang, at the Central Plaza Hotel, Bangkok, October 27.

Dr. Chatri Sripaipan participated in the Pacific Economic Cooperation Conference, Science and Technology Symposium, "Toward a New Era: Pacific

The STD Program organized a workshop on "Brain Storming to Select Key Industries," held at the Imperial Hotel, Bangkok, on October 26. Participants in the workshop included experts from the government and industrial associations.

Cooperation in Science and Technology," held in Seoul, Korea, November 4-7.

Dr. Chatri Sripaipan gave a lecture on "Demand for Information and Strategies in Information Search: Various Viewpoints" at the seminar on "Information Search Strategies: Arts and Science," organized by the Institute of Academic Resources, Chulalongkorn University and the Ministry of University Affairs, at Chulalongkorn University, Bangkok, November 26.

Dr. Chatri Sripaipan presented a paper, "Country Report," at the Regional Asian Seminar on the "Integration of Human Resources and Sociocultural and Technological Change Indicators in the Development Planning Process," jointly organized by UNESCO'S Social and Human Sciences sector and UNESCO/ROSTSEA, Kuala Lumpur, Malaysia, December 3- 7.

## News About TDRI Personnel

Dr. Bhanupong Nidhiprabha has accepted an invitation from the Australian National University to join them as a Visiting Research Fellow for two months in Canberra, Australia starting October 1, 1990. His study will focus on macroeconomic policies and long-term economic growth.

Mr. Thomas N. O'Neill III has joined the MEP team as a Visiting Research Fellow for seven months starting November 1, 1990. He will conduct a joint research project on Thai-U.S. trade and economic relations supported by the Gowen Fellowship for postgraduate legal studies through the University of Pennsylvania Law School.

## News About TDRI Publications

The Publications Department has announced that the "Fact Book on Rice" (in Thai) and the "Directory of Science and Technology Services in Thailand" have been published and are available for sale through the Publications Office.

The "Fact Book on Rice," authored by Dr. Ammar Siamwalla and Viroj Na Ranong, aims to provide necessary data and pertinent information on: rice production; marketing, pricing structure and pricing policy; government intervention in the domestic rice trade; and the impact of government policy on the international rice trade.

"The Directory of Science and Technology Services in Thailand" represents an update of the institutional resources completed in the TDRI Science and Technology Resource Data Base. The directory will prove useful to industries and private firms that are seeking the assistance of external institutions in research and development, information gathering, testing, consultation, and equipment usage.

Thailand Development Research Institute Foundation

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