Highways :
- R-2 BMA - Nakhon Ratchasima - Nong Khai - Laos
- R-304 Nakhon Ratchasima - Eastern Seaboard
- R-24 Nakhon Ratchasima - Ubon Ratchathani - Laos
- R-214 Surin - Roi Et, Surin - Cambodia
- R-217 Ubon Ratchathani - Mukdahan - Laos - Viet Nam
- R-219 Buri Ram - Mahasarakam
- R-33 Nakhon Nayok - Aranyaphrathet - Cambodia
- R-212 Ubon Ratchathani - Nong Khai - Laos

Railways :
- SRT <u>Northeastern line</u>
  BMA - Nakhon Ratchasima - Nong Khai - Laos
  BMA - Nakhon Ratchasima - Ubon Ratchathani - Laos
  <u>Eastern line</u>
  BMA - Prachin Buri - Aranyaprathet - Cambodia

Airports :
- Nakhon Ratchasima - Bangkok
- Ubon Ratchathani- Nakhon Ratchasima - Bangkok
- Ubon Ratchathani - Hong Kong (charter flight)

<u>Intra-regional links</u>

Highway :
- R-226 Nakhon Ratchasima - Buri Ram - Surin - Si Sa Ket - Ubon Ratchathani

Eight of nine provinces in the Study Area are eligible for the higher level of incentives. As discussed in sub-section 2.2.4, BOI introduced a zoning system by location of investment in order to promote decentralization of economic activities. The Study Area except for Nakhon Nayok province is designated as Zone 3. Enterprises in this zone receive the highest level of location specific incentives.

Finally on 29 June 1990, the Suranaree University Act was approved by the parliament. Major points of act were a) to establish a new provincial university stressing on the development of science and technology and, b) to emphasize cooperative relationship with public sector, private sector and the university.

The University is to have schools in social sciences and technology, and in agricultural, industrial and resource technologies. It is located on 7,000 rai of land in Nakhon Ratchasima, Muang District and has access to the R-304 and the extension road of the R-24 at Pak Thong Chai. It is expected to be opened in June, 1993 with 960 students which will be increased to 1,440 during the 7th Year. This will definatly enhance the technological infrastructure of the Study Area and will help attract industrial investments.

4.2 Development Issues

In order to promote further industrialization of the Study Area by taking the above mentioned advantages and opportunities, the following general issues have to be addressed.

<u>Infrastructure and utilities</u>

A survey of industry undertaken for this Study (Annex A) and a variety of published sources report critical shortages in infrastructure and utilities. This is particularly

serious in the case of water and telecommunications. Solid waste and sewerage pose serious health and environmental risks. These need to be improved to increase area's attraction for foreign and Thai investors.

Manpower development

One of key objectives of industrial development is to provide higher income opportunities to the people to upgrade their standards of living. Therefore, in the process of deepening industrialization, cheap labor will not become available. Those industries depending on cheap labor have to restructure into more technology oriented activities. In this sense, more opportunities have to be offered for both basic and technical education and training.

Environmental considerations

The current stage of industrialization of the Study Area has not created serious pollution problems and its natural environment is comparatively well preserved. Taking into consideration the problems faced by BMA and some areas of Samut Prakan, the industrial location in the Study Area should be carefully guided in coordination with the respective city plans.

In the Nakhon Ratchasima Muang District, there are two types of problems. One is noise from automobile repair activities located in commercial areas where the typical shops are densely located and the activities at night create noise to the surrounding communities. To avoid this kind of problems, the concerned agencies should provide technical and financial assistance to encourage them to relocate their activities to a new industrial zone rather than to regulate their working hours.

Another problem is bad smell of industrial wastewater from tapioca starch factories and drainage of the untreated wastewater. Though initial costs may be high, the investment will save energy, water and land, while maintaining good environment. Much of treated water could be recycled to save water, and energy in pumping groundwater. Bad smell will be biochemically treated and will not require much land for natural treatment ponds. Assistance is needed in technical information for treatment and concessional loans for investment. Provision of industrial estate is a way to maintain a balance between development and conservation of good environmental quality.

Social amenities

Despite traffic congestion and pollution, Bangkok continues to attract investments. One of the key factors for attraction is the availability of diversified social amenities that such mega urban agglomerations can offer. A high level of cultural, educational, medical, commercial and recreational services are available.

The second stage of industrialization of the Study Area may require initiatives by outside investors probably form Bangkok and foreign countries. This requires expatriate engineers and technicians until they successfully transfer the necessary technologies to the local resourceful counterparts. Money and materials can be easily transferred but man (engineers, managers and their families) is not easy to transfer from a social amenity rich place to a poor one. Therefore, it may be necessary to give highest priority to projected industrial areas for public investments related to

these social amenities until the municipalities grow to a size of around half a million population.

4.3 Location of Industries in the Study Area

As mentioned in Section 2.1, the Study Area is the least industrialized region in the country. Based on the statistical data from IWD/MOI on the number of manufacturing industries of the Study Area in 1987-1989, it can be reasonably estimated that the number would be in the neighborhood of 16,500 in mid-1992. The rice mills had a share of little over two third of the total in 1989.

According to the latest available data from IWD/MOI of non rice mill manufacturing industries of the Study Area as of June 1992, there are total of 4,821 establishments as shown in Table 3.4 and the respective share by provinces (changwats) is as follows:

Provinces	Number of Establishment		Population (1991) 10^3	
Nakhon Nayok	108	2.2	230	2.2
Prachin Buri	621	12.9	888	8.6
Nakhon Ratchasima	2224	46.1	2404	23.1
Buri Ram	385	8.0	1459	14.0
Surin	308	6.4	1294	12.5
Si Sa Ket	227	4.7	1358	13.1
Ubon Ratchathani	610	12.7	1932	18.6
Yasothon	196	4.1	532	5.1
Mukdahan	142	2.9	288	2.8
Total	4,818	100.0%	10,385	100.0%

As indicated, there are two provinces with a higher share of the number of industrial establishments than their corresponding population shares in the Study Area. Nakhon Ratchasima is dominant with nearly half of the total, with a population share of less than a quarter. Prachin Buri follows next and slightly exceeds Ubon Ratchathani.

The distribution of the non rice milling manufacturing establishments by districts (Amphoes) is shown in Figure 4.2. There are 126 districts but some in Buri Ram, Surin, Yasothon, and Ubon Ratchathani have no manufacturing establishments. Characteristics of industrial location by provinces are as follows.

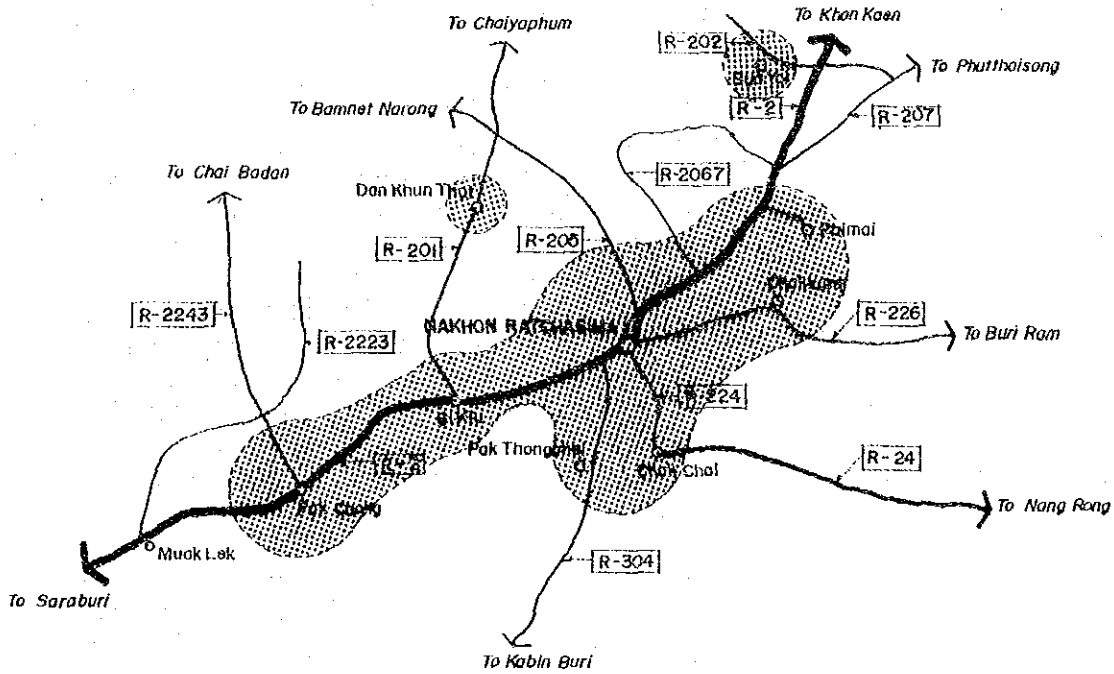
4.3.1 Nakhon Ratchasima

About 20% of the manufacturing establishments are rice mills. Approximately one out of three non rice milling establishments engage in processing cassava into chips, pellets, and starch. There are seven districts which have more than 100 establishments. Among them the Muang has the outstanding number of 729 establishments followed by Pak Chong, Pak Thong Chai, Si Khiu, Chak Karat, Bua Yai, Dan Khun Thot with 193, 138, 118, 104, and 101 respectively.

Figure 4.2 shows the major areas of industrial activities in the province. These spread along the main roads such as Mittraphap Road (R-2), R-226 to Buri Ram, R-224 to Chok Chai. There is an industrial estate called as Suranaree Industrial Zone along the R-244 which was established in 1988. The gross area is 3,000 rai and its first

phase of 530 rai was developed. Large establishments locate along the main roads but others locate near the resources, off main roads (probably due to availability of low cost, comparatively large area) and nearby customers. The shaded area shown below covers the Amphoes with large number of establishments. Though this was not prepared by actual surveys, it includes those scattered type and concentrated type (industrial estate and road sides) location.

Major Area of Industrial Activities in Nakhon Ratchasima



Industrial activities in those Amphoes are as follows:

(a) Muang

Muang is one of the most important nodal centers of the country connected through major national highways, railways and air links. It shares various functions with Khon Kaen as the regional center of the Northeast.

About one third of the non rice milling manufacturing establishments of the province have agglomerated in this district with higher degree of density than any other districts in the Study Area. Among the food processing group, cassava pellets and starch factories are large in number and are located in suburban areas along the main highways. Their scale of operations is generally larger than those in other districts of the Study Area. There are 10 cassava pellet factories with the capital ranging from 10 to 33 million baht and six tapioca starch factories with the capital ranging from 16 to 188 million baht. There are four animal feed mills with the capital ranging from 14.9 to 59.8 million baht. Other representative products of the group are noodles, meat balls, condiments, bakery products, ice, ice cream, and beverages. Most of them are located in the urban areas. There are two drinking water (carbonated and non carbonated) factories with the capital of 40 million baht. In terms of employment,

there are two tapioca starch and one drinking water factories employing 220-230 workers respectively.

The textile group covers kenaf spinning, synthetic fibers, jute yarn and ropes, knitted goods and apparel. The government-owned jute yarn and rope factory has capitalization of 267.4 million baht and is the third large of single employer in the Study Area having a little over 3,000 workers. The leather group covers bags, gloves and seatings. The three factories are capitalized at 15, 16.8 and 40.1 million baht with employment of 370, 200 and 290 respectively which are considered comparatively large operation in the province and the Study Area as well.

The wood group covers sawn lumber, building components of door and window frames and wooden furnitures. There are two sizeable factories of wood furniture having 62 and 65 workers with capitalization of 10 and 12.7 million baht. The rubber and plastic group covers retreaded tyres, reclaimed rubber products, plastic gift products, containers and sacks. The plastic gift products factory capitalized at 48 million baht has 902 workers and is also considered a large operation.

The non-metallic mineral group covers various types of building materials such as bricks, ready mixed concrete, blocks, pipes, poles and other prestressed concrete products. Since the products are heavy in weight and not economical for long hauling, the activities are widely scattered in many districts in the Study Area in a pattern similar to that of population distribution. Being the second largest city in the country, there are seven sizeable factories in this type of activity with capitalization ranging from 10 to 86 million baht having 50-60 workers on average.

The metal products group produces intermediate goods for building and engineering industries, including cast metals of ferrous and non ferrous materials, cut steel sheets and sections and steel wire ropes. Operation of this group is generally small in scale except for steel wire rope, capitalization of which is 36 million baht.

The metal working and engineering group includes, metal furniture, steel door and window frames, electroplating, parts for agricultural and transportation equipment, industrial machinery, electrical machinery, moulds and dies, bearings, assembly of bus and truck, motor vehicle bodies, measuring equipment and car repairs.

At present, the scale of business of this trade is comparatively small. There are small car repair shops with a simple lathe and welding machines. Among them there are a well established bus body builder who claims to be the oldest in the country employing about 1,000 workers including subsidiaries and the two machine parts/components manufacturers. One capitalized at 305 million baht is producing gears and shafts with about 400 workers for automobile industry in the country as well as for export to England. It is located in Tambon Kok Kruad along the Mittraphap Road and has a plan to develop an industrial estate at their adjacent lands (1,500 rai) to locate various metal working and engineering industries to support mainly the transport equipment industry in domestic as well as foreign markets. Another one capitalized at 81.5 million baht is producing parts and components for heavy equipment, some of which are exported to Malaysia. The factory is located in Suranaree Industrial Zone (SIZ) and has about 90 workers. In front of the SIZ, there is a factory for video tape recorder assembly for export employing about 1,700 workers.

Another interesting activity is the manufacturer of speciality trucks such as dump and tank trucks. The company capitalized at 14.6 million baht is located in the SIZ and has about 250 workers. Also in the SIZ, there is an export oriented engineering firm producing moulds and dies for plastic and steel forging industries, mainly related to the automotive parts and components.

The last one is a group of other products which includes joss sticks, matches, aluminum cooking utensils, sporting goods and decoration lamps. The last two items are export oriented and their factories are located in the SIZ .

(b) Pak Chong

Pak Chong is the third largest district in the Study Area in number of establishments. It is situated in the far western part of the province along the Mittraphap Road and shares border with Sara Buri. It is also served by the SRT Northeastern lines. The activities were concentrated more in processing of the local resources such as agricultural produce and non-metallic minerals.

The food group includes crop curing, poultry, dairy, ice, preserved fruits and vegetables, flour products, raw sugar and cassava products. The cassava factories occupy almost one fifth of the number of establishments of the district, excluding rice mills. There are eight cassava, two preserved fruits and vegetable and three dairy and two animal feed mills that have capitalization ranging from 10 to 73 million baht. The textile group includes cotton ginning mill, silk weaving and jute mill. The jute mill is the second largest single employer in the Study Area with around 5,200 workers and has registered capital of 170 million baht. The wood group includes door and window frames and furniture for the building.

The chemical group includes fertilizer and explosives used for quarry. The non-metallic mineral group includes bricks, lime stones, crushed stones, marble sheets and various concrete products. There are five stone crushing mills with capitalization of 19 to 52 million baht and five marble sheet with 11 to 70 million baht . The largest marble factory employs 310 workers.

Other activities are metal casting, printing, plastic sacks and bottles, retreaded tyres, general machinery and automobile repair to support the above activities of the main groups.

(c) Pak Thong Chai

Pak Thong Chai is well known as a main producing district of Thai silk in the country. It is located along the R-304 to Tambon Kabin Buri and will be served by R-24 extension connecting Chok Chai with Si Khiu at the R-2. The food group includes cassava, raw cane sugar, coconut sugar, ice and ice cream. Though the number of cassava processors are almost one third of the non rice milling establishments in the district, their scale of operations is comparatively small. The textile group includes silk yarn spinning, dyeing and weaving. There are 66 establishments engaged in this trade corresponding to about one third of the number of the establishments of the district and employing about 2,400 workers in total. There are 13 establishments which are capitalized at 10 to 141.8 million baht. The largest single employer is a spinning factory which employs 205 workers. Average size of worker per establishment is 35.

Other activities are wood products of building components, furniture, leather gloves, concrete products and automobile repair which are common to every district of the Study Area.

(d) Si Khiu

Si Khiu is located between Pak Chong and Muang along the SRT Northeastern lines and the Mittraphap Road. It is also the gateway city to Chaiyaphum to the north through the R-201. Furthermore, it will be connected with the planned extension of the R-24 leading to Ubon Ratchathani to the east.

Industrial activities of the district are characterized by the two dominant sub-sectors: food processing, and textiles. The food group includes grinding of maize and groundnuts, tapioca and cassava chips, sago pellets, noodles, ice and mineral water. There are cassava processors which account for 57% of the non rice milling establishments of the district but their scale of operations is comparatively smaller than that of Muang. The textile group includes kenaf spinning and dyeing and carpet yarn and weaving. There are four factories engaged in this trade with capital ranging from15.5 to 42.5 million baht and employing a total of about 900 workers.

Other activities include wood products, concrete products, plastic sacks, retreaded tyres and automobile repair.

(e) Chak Karat

Chak Karat is situated east of Muang along the east-west regional axis of the R-226 and south of Phimai along the R-2163. Major industrial activities are rice milling and cassava processing. Because of its proximity to Muang, there is an urban type industry of wearing apparel factory which is the single largest employer of the district with 290 workers. Other activities are wood products, concrete products, agricultural machinery and autoparts and automobile repair to meet the local needs. It is planned to have the second Nakhon Ratchasima Airport to be used exclusively for commercial flights.

(f) Bua Yai

Bua Yai is situated in the northern border of the province and has the two junctions of both the railways of Kaeng Khoi - Bua Yai line and Nakhon Ratchasima-Nong Khai line of the SRT and of the Mittraphap Road and the R-202 leading to Chaiyaphum to the west. Major activities are rice milling, cassava processing, jute and sugar milling. Other activities are almost the same as those in Chak Karat.

(g) Dan Khun Thot

Dan Khun Thot is situated in the north of Si Khiu along the R-201 and four provincial roads, the R-2146, 2217, 2164 and 2256 converging on the R-201. The activities are quite similar to those in Chak Karat and Bua Yai.

(h) Others

With a small number of non-rice milling establishments, there are three other districts which are worth mentioning as having special features. They are Sung Noen, Phimai, and Chok Chai. Sung Noen is situated in between Si Khiu and Muang along the

Mittraphap Road. Since it is close to Muang and new development of Muang tends to direct towards west along the Mittraphap Road, there are comparatively new and large scale operations. There is a meat processing plant with registered capital of 88 million baht, a synthetic fiber mill capitalized at 121.3 million baht, with 1,230 workers, and a jute mill capitalized at 593.2 million baht with 5,400 workers. This last is the single largest employer in the Study Area.

Building material industries are also active. There is one concrete products factory with 168 million baht capital and one asphalt factory with 94.1 million baht capital.

Phimai is located about 60 km from the Muang Municipality to the northeast through the Mittraphap road and the R-208. There is a resource based chemical company. The company produces two types of products. One is industrial salt as an intermediate material for their plant in Samut Prakan producing caustic soda and chlorine. Another is iodized table salt for both domestic and export markets. The company originally used sea salt made by conventional method of solar evaporation system. Faced with the problems of sea salt in quality, quantity and price, it decided to make use of abundant rock salts found in the Northeast. The Phimai was selected for mining rock salt 14 years ago.

There are two thick layer's of rock salt, one at 170 m. depth and another at 270 m. depth. Since the deeper layer contains less impurities, the company is mining the deeper layer by solution method. The original system employed was solar evaporation system but later changed to vacuum evaporation system to avoid pollution problems to the adjoining paddy fields and at the same time to produce a constant amount of salt all year around.

A 100,000 tons per year plant was made in 1989 and second phase of another 200,000 tons per year plant was made in 1991. The chlorine made in Samut Prakan is mainly used by the plastic industries in Map Ta Phut and also by the Metropolitan Water Authority. The caustic soda is used all over the country by various industries including the pulp and paper mill in Khon Kaen. Since resources are plentiful, the company can expand further to comply with demands of both domestic and export markets. However, there will be constraints in supply of water for solution mining which now requires 20,000 tons per hour. Special care is required to prevent damages on farming activities in the surrounding area.

There are three medium size tapioca starch factories capitalized at 22.5, 48.6 and 64 millions baht respectively. Other products include plastic pellets, wood furnitures and building components, and concrete products, probably for local consumption.

Chok Chai is situated 20 km. south of the Muang Municipality through the R-224, and is connected with the east-west regional artery of the R-24. It is also connected with the provincial road (R-2071) leading to the south. Aside from rice milling and cassava processing, there is a unique activity of cottage type industries producing various forms of potters in Tambon Dan Kwian. This earthen wares have a special deep brown color and have particular designs kept for many years and have become tourist attraction. The extension of the R-24 to the Mittraphap road at Si Khiu, as mentioned earlier, will enhance the industrial location potential of the district.

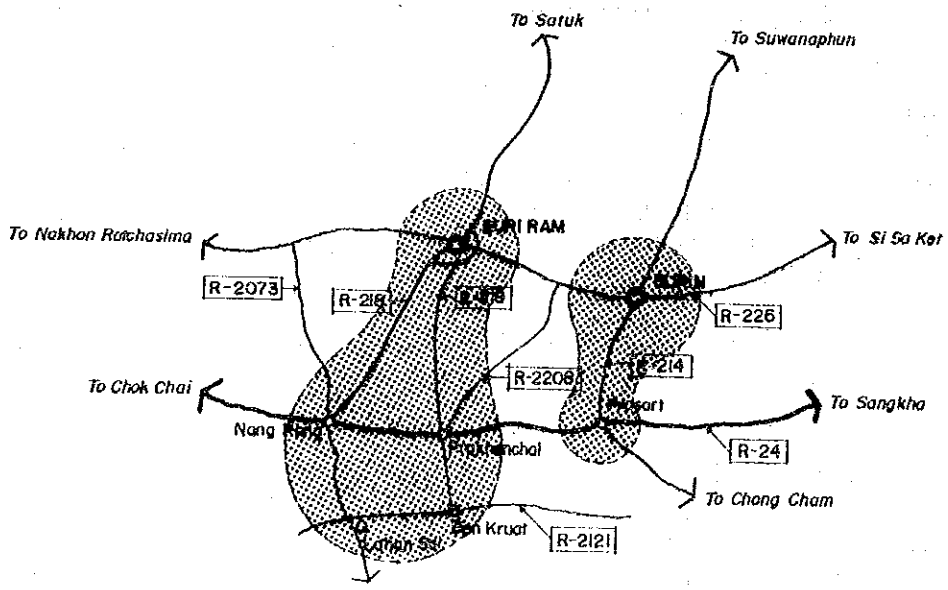
4.3.2 Buri Ram

The share of rice milling and cassava processing in number of establishments in the province is 84.4% and 9.6% respectively. The remaining 6.6% of the establishments engage in machinery repair, concrete products, automobile parts and repair, ice and so on. The single largest employer is a wig factory which was established recently and has now about 1,900 workers. This is considered the first location of labor intensive and export oriented activity in the province. Employment in the wig plant is comparable to the total number of workers employed by traditional local resource based activities: rice milling, (2,200); cassava processing, (100); concrete forming, (540); and saw milling, (320). The socioeconomic impact brought by the non-traditional wig factory is quite substantial.

There are only nine establishments, except rice mills, that have registered capital of more than 10 million baht. They are alcoholic bevarage, wig, sand excavation, rice bran oil, preserved fruits and vegetable, car engine repair, concrete products and agricultural implement. Among them the distillery is outstanding at 281.5 millions baht, followed by the wig at 53 million baht.

As shown below, industrial activities are found along the R-218, R-219, R-348 from north to south and the R-24, R-226 and R-2121 from west to east. There are no non rice milling industrial activities in three Amphoes: Plub Pla Chai, Huai Rat, and Non Suwan.

Major Area of Industrial Activities in Surin and Buri Ram



(a) Muang

Muang is situated along the R-226 and served by the R-219, R-218, R-2151 and the SRT Northeastern line. Industrial activities are diversified. The food group includes meat products, cassava, noodles, vermicelli, sugar, ice and ice cream. The textile group includes kapok, kenaf, and knitting. The wood group covers sawn lumber, building components, and furniture. The rubber and plastic group includes

retreading tyres and plastic containers. The non-metallic mineral group includes sand and concrete products.

Others are printing, roofing materials, aluminum products and automobile repair.

(b) Lahan Sai

Lahan Sai is located along the R-2121 and shares border with Cambodia to the south. The district has the second largest number of establishments in their province but major activities center on cassava and processing of fruits and vegetable.

(c) Nang Rong and Nong Ki

Both of these disctricts are located along R-24. Nang Rong has the junctions with the R-218, R-348 and R-2073, and Nong Ki has the junctions with R-2166 and R-2317. Nang Rong is a little more diversified but the basic activities are quite similar and serve the local needs.

4.3.3 Surin

Surin has about 40% more than Buri Ram in number of establishments but their number of industrial worker is about 40% less than Buri Ram. This means that the average size of employment per establishment in this province is much smaller than that of Buri Ram. Rice mills represent 94.3% of the total number of the establishments. Cassava processing is second in number but its share is only 1.1%. Therefore Surin can be called the rice province. There are only two establishments out of the non rice milling activity that have registered capital of more than 10 million baht, i.e. the jute mill with 27.5 million baht and the artificial flower with 17.0 million baht. The largest employer is the jute mill that produce gunny bags with 420 workers, followed by the artificial flower with 320 workers. Other employment number by trade is rice mills (3,256), wood and wood products (550), concrete products (246), automobile repair (239), and agricultural machinery (189).

The manufacturing of plastic based artificial flowers for export is one of the BOI promoted projects for labor intensive and export oriented type of industry. The company has been operating in Bangkok for some time but recently decided to relocate into Surin due to the fact that there was no available land for expansion. Acquisition of new land is very expensive in Bangkok and labor supply became difficult. Machinery, equipment and materials came from Taiwan in the beginning but the company has switched the source of polyester resins from Taiwan to the local made in Rayong. Some a few hundred workers are engaged in making the parts and components of the artificial flowers which are distributed to contract farmers located nearby to assemble into the final product. Later the company collects, inspects and packages the flowers for export. This non traditional activity in the province is similar to the wig discussed in Buri Ram and proves that labor intensive and export oriented type of activity can be located in a province remote from the shipping port.

The industrial activities of Surin (Figure 4.4) take a monocentric pattern at the Muang where there are 66% of the non rice milling establishments. Also there are two Amphoes i.e. Bua Chet and Samrong Thap that have no industrial activities except for rice milling.

(a) Muang

The Muang is situated along the east-west regional artery of the R-226 and is served by the R-214 and the SRT Northeastern line. Every year in November " National Elephant Round Up" is held in this city, and attract both domestic and foreign tourists. The food group includes groundnut processing, meat processing, steamed fish, bread, confection, noodles. The textile group includes gunny bags, woven silk and apparel. The wood and wood products group includes sawn lumber/building components, furnitures and crates.

The non metallic mineral group covers sand and gravel bricks, and concrete products. Metal and engineering group includes fabricated steel, roofing materials, agricultural implements, parts of machinery and automobiles. The others cover printing, artificial flowers, cooking stove, etc.

4.3.4 Si Sa Ket

Si Sa ket is similar in number of industrial establishments and employment to Surin. The share of rice milling and cassava processing establishments in the province is 90.4% and 3.3% respectively. The remaining 6.3% of the establishments engage in repair of agricultural machinery and automobiles, jute milling, wood working, concrete forming and food products for local consumption. The single largest employer is the pickling of gingers, cucumbers and egg plants for export to Japan with about 300 workers. There is no establishment whose registered capital is more than 10 million baht.

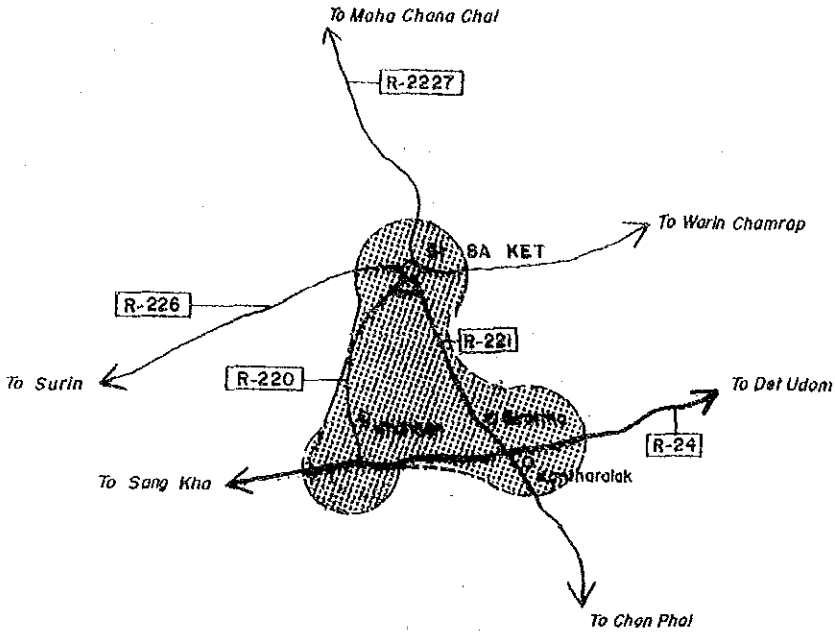
As shown, the industrial activities of Si Sa Ket take a duo-centric pattern of the Muang and Kantharalak in number of establishments. Also there are six districts with no industrial activity - except for rice milling. They are Yang Chum Noi, Bung Bun, Huai Thap Than, Nam Kliang, Wang Hin and Phu Singh.

(a) Muang and Kantharalak

The Muang is situated along the east-west regional artery of R-226 and is served by R-220, R-221, R-2083 and the SRT Northeastern line. Kantharalak is situated 60 km. south of Muang along R-221. There is the tourist spot called Khao Pra Vihan which is also a ruin of Khamer shrine.

Both have a similar number of the non-rice milling establishments. Differences in composition are that Muang has more food processors, concrete products and repair of agricultural machinery and automobiles than Kantharalak but the latter has more in cassava processing plants.

Major Area of Industrial Activities in Si Sa Ket



(b) Others

There is an interesting industrial activity in the small village of Ban Thom of Amphoe Prang Ku, located a little bit off R-2234. Accessibility to the village is not easy during rainy season. In this village more than 100 people engage in gem cutting. This activity was first introduced by a villager who was trained in Bangkok in this trade. Raw stones are procured in Bangkok and processed gem is sold back to various lapidaries in Bangkok for final setting. Another one is vegetable pickling activity as mentioned earlier which is located in Amphoe Khun Han along R-2127.

4.3.5 Ubon Ratchathani

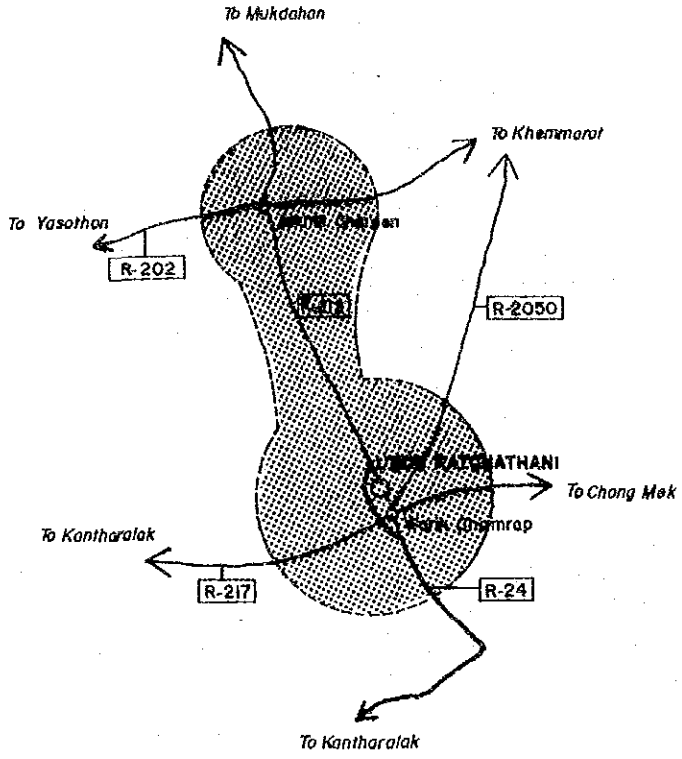
Ubon Ratchathani has a 12.7% share in the number of industrial establishments in the Study Area and ranks third after Prachin Buri with 12.9%. Rice mills represent 88.1% of the industrial establishments of the province which is higher than Nakhon Ratchasima and Buri Ram but smaller than Surin and Si Sa Ket. Unlike the eastern sub-region, cassava processing has only 0.7% share in the number of establishments.

The remaining 11.2% engage in comparatively diversified activities such as engineering and machinery, metal and concrete products with respective shares of 24.6%, 7.9%, 6.2% and 61.3%.

Among them the single largest employer is the distillery making rum from malasses that employs 348 workers. There are 10 establishments whose registered capital is more than 10 million baht. Among them the distillery is outstanding at 284.1 and others are in the range from 10.2 to 24.2 million baht in food, textile, concrete engineering and chemical.

As shown below, there are two districts that have more than 100 establishments of non rice milling in this province. They are Amphoe Muang and Warin Chamrap. The former has the outstanding share of 53.6% and the latter has 18%. There are four Amphoes i.e. Kut Khaophum, Pho Sai, Buntharik and Na Chauluai that have no industrial activities except rice milling. Figure shows the major industrial areas in the province that are formed along R-212, which connects the Muang with Mukdahan and runs further to Nong Khai along the Thai-Lao border.

Major Area of Industrial Activities in Ubon Ratchathani



(a) Muang

The Muang is situated on the north bank of the Mun river and is served by the R-23 leading to Yasothon, R-24 which is considered the east-west artery, R-2080 leading to Trakan Puetphon and an airport which just started to serve not only for domestic flights but also for international charter flights. There are 327 non-rice milling industrial establishments engaged in various trades.

The food group includes seed, chili, groundnuts, meat products, cassava, bakery products, noodles, ice cream, ice, chili sauce, alcohol and drinking water. The textile group includes kenaf, kapok, silk and garments. The wood and wood products group includes sawing mills, parquet flooring, building components and furniture. The non-metallic mineral group includes sand and gravels, pottery, brick and concrete products. The metal group includes iron roofing, metal containers, bolts,nuts and nails. The engineering and machinery group includes fabricated steel structures, repair and production of parts for agricultural machinery and automobiles. The others are printing, retreaded tyres, jewelry and industrial oxygen. Judging from

the scale of operation, most of the products seem to be supplied to the local markets within 100~150 km. radius.

(b) Warin Chamrap

Warin Chamrap is situated immediatly south of the Muang across the Mun river. It is served by R-226/227, R-24, R-2178 and the SRT Northeastern line. Though the population of Warin Chamrap is slightly bigger than that of the Muang, its industrial activities are much lower. The food group includes groundnut products, kenaf, meat products, cassava, noodles, and drinking water. The textile group includes garments. The wood and wood products include building components and furniture. The non metallic mineral group includes ceramic tiles and prestressed concrete products. The engineering and machinery group includes engine replacement parts, and automobile exhaust pipes. Others cover printing, retreaded tyres and rubber rollers for agricultural machinery.

(c) Amnat Charoen

Amnat Charoen is situated 80 km. north of the Muang along R-212 and has a junction with R-202 connecting Yasothon with Khemarat. Types of activities are quite similar to that of Warin Chamrap. The food group includes meat products, cassava, and noodles. The textile group consists mainly of garments. The wood and wood products group includes sawing mills and building components. The non metallic mineral group includes bricks and concrete products. The engineering group includes fabricated steel, and repair of agricultural implements and automobiles.

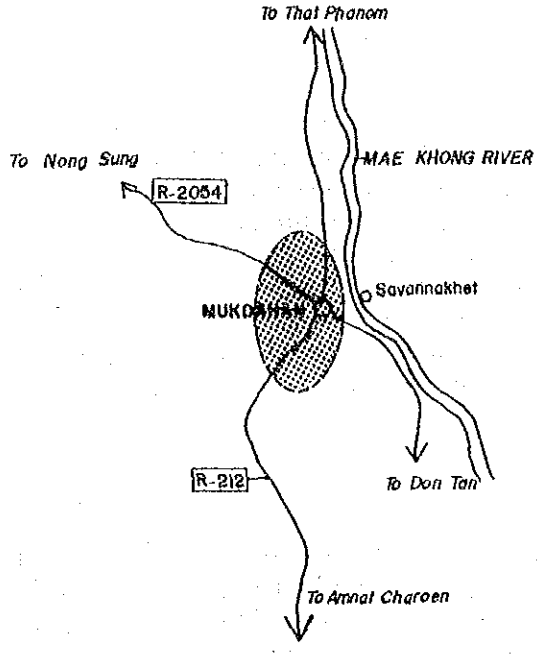
4.3.6 Mukdahan

Percentage share of rice mills is lower at 65.6%. The remaining 34.4% engage in various activities mostly for local consumption. These may include some exports to Laos due to its gateway function. Car repair, wood furniture, concrete products and cassava processing covers 42.7% of the above remaining activities. The largest single employer is a furniture factory that employs 130 workers. Other comparatively large sub-sectors in employment are wood and furniture, textile, engineering and concrete products with 306, 228, 265 and 183 workers respectively.

Out of 142 non rice milling establishments, the Muang has 128 establishment (90%). As shown below, this mono-centric industrial location pattern due to large forest areas on its western part. There are several tourist places including two national parks. Mukdahan is situated in the northeastern border of the Study Area connected with Ubon Ratchathani by R-212 and also served by the R-2034.

The food group includes sugar, meat balls, fish sauce, cassava, noodles and ice cream. The textile group includes kenaf and silk yarn and silk textile which has registered capital of 55 million baht with 98 workers. The wood group consists mostly of wood furniture. The metal group includes cast iron, aluminum products and metal roofing. The engineering and machinery includes agricultural implements, automobile parts and fabricated steel products.

Major Area of Industrial Activities in Mukdahan

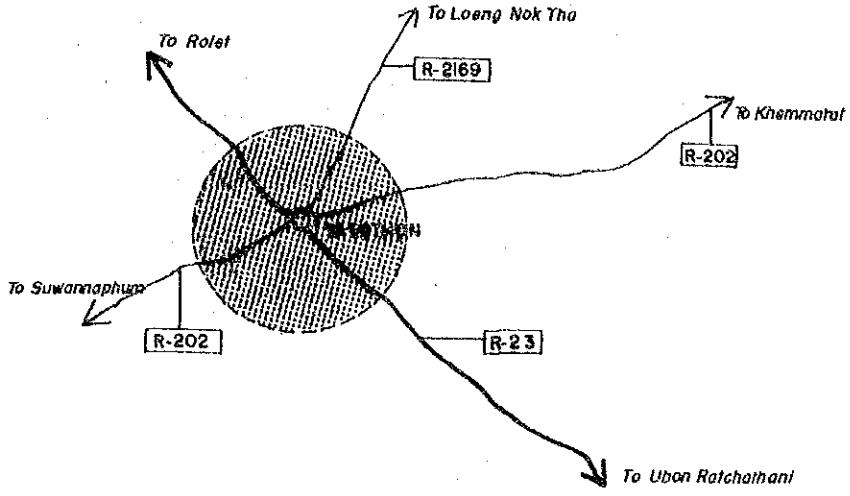


4.3.7 Yasothon

The share of rice milling and cassava processing is 74.2% and 4.3% respectively. The remaining 21.5% of the establishments engage in engineering and machinery, wood products, concrete products, car repair, food products and others. The single largest employer is the canning factory that employs 170 workers. Major employment sub-sectors are rice mills, wood products, concrete products, car repair and cassava chips with 729, 358, 232, 188 and 177 workers respectively. There are three establishments whose registered capital is more than 10 million baht. They are canning, car repair and cassava with 29,18.3 and 10 million respectively.

Out of 196 non rice milling establishments, the Muang has 121 establishments (61.7%). Its locational pattern is also of mono-centric as shown below. There is one district, Sai Mun that has no industrial activity except rice mills. The Muang is situated about 90 km. northwest of Ubon Ratchathani along R-23. It is also served by R-202 and R-2169.

Major Area of Industrial Activities in Yasothon



The food group includes cassava chips, beverage, meat products, preserved food, bakery products, noodles, ice cream and ice. The textile group includes kenaf, cotton dyeing, and triangular pillows. The non metallic mineral group includes sand and gravels, bricks, concrete products. The wood and wood products group includes sawing mills, building components and furnitures. The engineering and machinery group includes fabricated steel products, parts for general machinery and automobiles, agricultural implements and automobile repair.

4.3.8 Nakhon Nayok

Being the smallest province in the Study Area in area and population, Nakhon Nayok has the smallest number of industrial establishments. About one third of the area is under the Khao Yai National Park. Rice mills represent 47.3% of the industrial establishments and there is no cassava processing which is quite different from the structures of the LNE provinces discussed above. Because of its proximity to the BMA, the province has a more balanced urban type structure and is designated as Zone 2 under the locational incentive systems of BOI.

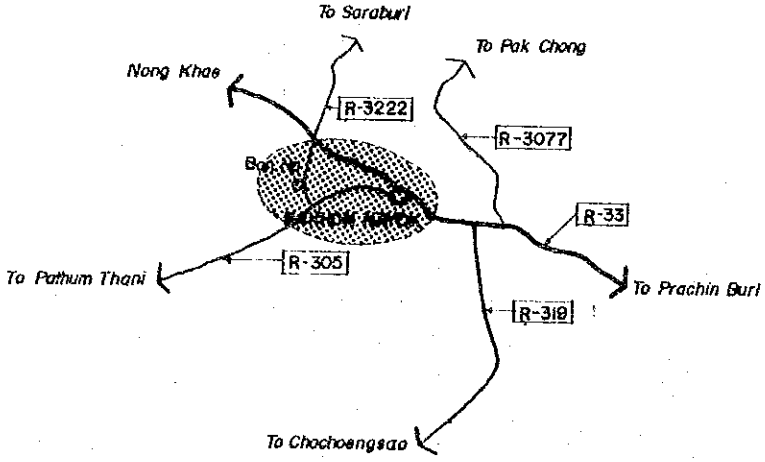
As shown, the industrial activities concentrate in the two northern districts, the Muang and Ban Na. There are four establishments that have registered capital of more than 10 millions baht. The biggest one is the activated clay factory with 46 million baht capital, followed by the coffee processing, machinery and automotive parts and crop curing with 42, 18 and 13.5 million respectively. The largest single employer is the coffee processor with 114 workers and is followed by the machinery and automotive parts with 90, and the activated clay with 73 workers.

The Muang is situated about 70 km. northeast of the Don Muang International Airport. There are two main roads of R-305 leading to Bangkok and R-33 leading to Aranyaprathet to the east. The R-3222 connects Ban Na with Kaeng Khoi, Saraburi. The SRT new line connecting Kaeng Khoi of the Northeastern line with Khlong Sip

Kao. Chachoengsao of the Eastern line is now under construction for completion by 1995 which will run in parallel with R-3222.

The food group includes noodles, syrups, soft drinks, ice cream and ice. The textile group includes knitting, and gloves. The wood group covers building components and furnitures. The chemical and non metallic mineral group includes activated clay, fertilizer, pigment, ceramic wares, sand and gravels, and concrete products. The activity of sand and gravels concentrates in the Ban Na district. The engineering and machinery group includes aluminum casting, automotive repair.

Major Area of Industrial Activities in Nakhon Nayok



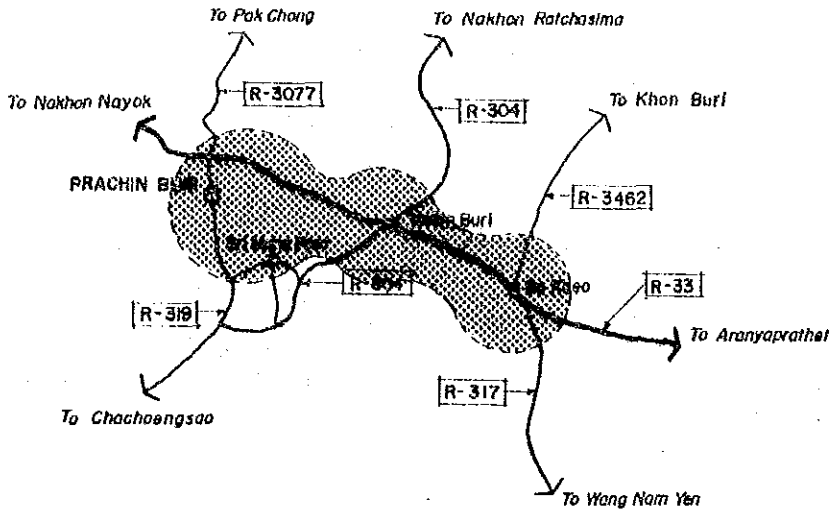
4.3.9 Prachin Buri

Prachin Buri has the second largest share of 12.9% in number of the industrial establishments in the Study Area. Rice mills represent 35.5% of industrial establishments which is the smallest percentage among the nine provinces in the Study Area. Combined with cassava processing mills of 30.9%, the share of other activities is 33.6%. Among them the major activities are engineering and machinery, canning, and concrete products.

There are 24 establishments that have registered capital of more than 10 million baht, composed of eleventh food, four textile, two non metallic mineral, two wood, two chemical and two others. Among them there are 4 establishments that have more than 100 million baht. They are the integrated textile mill of 430.8 million baht, the distillery of 199.4 million baht, the knitting mill of 155.8 million baht and the footwear of 100.8 million baht. The largest single employer is the distillery of 354 workers. Major sources of employment are cassava with 1,685, canning with 1,337, rice with 937, textile with 822, wood with 702 and wood products with 430. Those textile, canning and cassava are mainly for export markets.

Out of 621 non rice milling establishments, the Muang, Si Mahaphot, Kabin Buri and Sa Keo have 115, 88, 157, and 110 establishments respectively. As shown below, these districts are situated in the Ban Pakong Basin and locate along R-33 leading to Cambodian border.

Major Area of Industrial Activities in Prachin Buri



(a) Muang

The Muang is situated 30 km. east of the Muang Nakhon Nayok along R-319 leading to Chachoengsao and served by R-33, R-3076 and the SRT Eastern line. The activities here are local resource based mainly for local markets except for canning. The food group includes groundnuts, glucose, meat balls, bamboo shoots, baby corns, water chestnuts, noodles, ice cream,.and fish sauce. The wood and wood products group includes sawing mills, bamboo products, and furniture. The non metallic mineral group includes sand and gravels, quarries, bricks, clay and concrete products. The engineering and machinery group includes fabricated metals, agricultural implements, rice mills and car repair.

(b) Si Mahaphot

Si Mahaphot is situated next to the Muang to the east and is surrounded by R-33, R-304 and R-3281. Cassava processing is active and food group includes cashew oil extraction employing 110 workers and a distillery employing 354 workers. The wood covers sawing mills and building components. The non metallic mineral group includes sand, bricks and concrete products. The chemical group includes asphalt and plastic products. The textile covers small scale knitting. The engineering and machinery includes fabricated metals, agricultural implements and car repair. There was an announcement by the private sector to establish an industrial estate of 3000 rai but it is now said to be cancelled due to slow market.

(c) Kabin Buri

Kabin Buri situated next to Si Mahaphot to the east along R-33 and is served by the R-304 connecting Nakhon Ratchasima with Chachoengsao, R-3290 and the SRT Eastern line to Aranyaprathet.

There is a BOI promoted industrial estate "Kabin Buri Industrial Zone" of 2,500 rai, the first phase of which is now under construction. Also it is told that there is a move by another entrepreneur to develop an industrial estate of 1,500 rai in Kabin Buri but realization of this is still uncertain.

Cassava processing is very active as in Si Mahaphot. Other products under the food group are canning of bamboo shoots, fruit and vegetables, noodles, and animal feed. The textile group includes thread dyeing, clothes and knitting. The wood group includes sawing mills, building components and furniture. The non metallic mineral group includes bricks, ready made concrete, prestressed concrete products and refractory clay. The engineering and machinery includes fabricated metals, parts for general machinery and cars, agricultural implements, electroplating and automotive repair.

(c) Sa Kaeo

Sa Kaeo is situated next to Kabin Buri to the east along R-33 and is served by the R-317 leading to Chanthaburi. It is about 70 km to the Cambodian border. Cassava processing is active as in the other two districts. Other food products are canned bamboo shoots, meat balls, noodles, ice and drinking water. There are three cotton spinning mills in the textile group. The non metallic mineral group includes sand, brick and concrete products as seen everywhere. There are four saw mills, one of which has 125 workers. There is only one establishment engaged in engineering work for machinery.

4.4 Result of the Survey Conducted by the Chula Unisearch

In order to supplement the official statistical data from the governmental agencies concerning the current activities of manufacturing industry in the Study Area, the Study Team subcontracted a manufacturing survey to the Chula Unisearch, an attached research unit of the Chulalongkorn University in March, 1992. Information requested under the survey was:

1. Background of the entrepreneurs
2. Production and input utilization
3. Marketing
4. Problems encountered by the industrial plants
5. Prospects of business
6. Kind of improvement needed from the government

The survey team initially targeted about 2% of samples by type and location of factories in consultation with the provincial industrial officers. Due to the time constraints, the following three provinces, Si Sa Ket, Mukdahan, and Nakhon Nayok were excluded from the survey for there are no significant activities.

Finally 142 companies accepted interviews with the survey team which were arranged by the concerned provincial industrial officers. Breakdown of the factories interviewed by Changwat and type of industry is as follows.

		Factories	%
1.	Nakhon Ratchasima	100	70.4
2.	Ubon Ratchathani	12	8.5
3.	Surin	18	12.7
4.	Buri Rum	2	1.4
5.	Prachin Buri	9	6.3
6.	Yasothon	1	0.7
		142	100
1.	Food	87	61.3
2.	Textile	10	7.0
3.	Paper	1	0.7
4.	Plastic	1	0.7
5.	Construction materials	17	12.0
6.	Metal	6	4.2
7.	Others	20	14.1
		142	100

The detailed results of this survey are reported in Annex A. The perceptions of entrepreneurs on development constraints and prospects are largely in conformity with those of this report.

Though the samples of Nakhon Ratchasima happened to be much larger than the actual share in the number of manufacturing establishments in the Study Area, the share by activity seems to reflect the current composition. However, the sizes of company of the sample are considered to be above the average judging from the dependency on the local market of 33%. According to the study by Grandstaff,[1] those local industries with less than 20 workers and or having up to 3 million baht of invested capital, are selling 80-100% of their outputs within the provinces where they are located.

The average enterprise has invested 1-10 million baht and employs about 20 to 30 workers. The entrepreneur has higher education of either secondary or college and succeeded family business or spinned off from other business. About 40% of them started their business in the last five years. Their monthly sales is less than 1 million baht and their main inputs are agricultural products. Their views for future business prospects are mixed. The main problems they face now are availability of concessional loans, water supply, skilled labor and telecommunication facilities.

4.5 Proposed Locational Development Pattern

Based on the above development scenario, a model of long term industrial location plan was drawn as shown in Figure 4-11 Agro-industries will continue to have the most widely scattered locational pattern. Processing of rice, cassava and sugarcane will continue to take place in small urban centers near production areas.

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1) The Role of Demand in Provincial Industrialization, TDRI, 1990.

The same pattern is largely true of livestock product processing. In dairy, however, development will take place for large markets and centers of production for export to the rest of the country as well as to Indochina countries. Two such prime locations are Ubon Ratchathani and Nakhon Ratchasima.

Feed industry will locate in relation to both markets and areas of primary production. The extent to which the two coincide, there will be an agglomeration of livestock related activities.

Fruit and vegetable processing enterprises will locate primarily with reference to the production of primary commodities. Ubon Ratchathani has a clear advantage due to availability of irrigation water. Other areas, however, will also develop in product lines suited to the local ecology.

Ubon Ratchathani, Nakhon Ratchasima and the central development zone (Surin/Buri Ram) will develop fruit and vegetable processing enterprises both for the local, and the export market. During Phase I, the primary emphasis will be on further growth of proven product lines: canning of mushrooms, baby corn, asparagus and bamboo shoots for export. Gradually, the product composition will be diversified to include other vegetables, and fruits towards the end of plan period.

For non-agro industries, Nakhon Ratchasima will continue to be the regional industrial center as well as the national center of the transportation equipment industry. Primacy of Nakhon Ratchasima can be found by simple calculation of population within the physical distance from there Figure 4.1 shows the areas captured with 100 miles (160 simple comparison of population gravity. 200 miles is considered as a boundary of normal day trip on surface transport.

Nakhon Ratchasima is situated in the center of population gravity of the country as it captures about 63% of the national population within 320 km radius as against 41% of Bangkok as shown below. Nakhon Ratchasima is easily accessible either by highways, railway or air and has the various public facilities serving the region.

	Center	Population in million		Percentage captured
		100 miles	200 miles	
1.	Nakhon Ratchasima	8M	35M	63%
2.	Bangkok	16M	23M	41%
3.	Aranyaprathet	9M	29M *1	
4.	Ubon Ratchathani	7M	21M *2	

*1 assumes one million Cambodians
*2 assumes two million Laotions and one million Cambodians

The engineering and metal working industries that now have to procure their raw materials either from overseas or local suppliers in Bangkok will be able to get them from suppliers in Nakhon Ratchasima.

The local suppliers will get the basic iron and steel from the mills located in Prachuap Khiri Khan who will ship their products probably by the RO/RO boats to Laem Chabang and then switch to rail there to Nakhon Ratchasima by the SRT Eastern and Northeastern lines. The plastic and other basic chemicals will be supplied by the mills mostly located in Map Ta Phut industrial zone in Rayong to the users and traders in Nakhon Ratchasima by the rails. The traders in Nakhon Ratchasima will further redistribute them to the industries in the Study Area as well as to those in the Upper Northeast. Nakhon Ratchasima will also become the regional distribution center of these intermediate goods. In turn the engineering and metal working industries in Nakhon Ratchasima will supply the necessary parts, components and industrial machinery to the steel industries in the Southern Seaboard and chemical industries in the Eastern Seaboard.

Though it is outside the Study Area, Sara Buri is the national center of building materials of non metallic minerals centering on cement. It will continue to supply the materials and products like sanitary wares to the building and construction industries in the Study Area.

Pak Chong will continue to grow having agro-industries as its base and diversify its activities as a key industrial area. Si Khiu and Sung Noen will accommodate expansion demands from both Nakhon Ratchasima and the BMA. Their main activities will be consumer related products of both the local as well as imported resources from outer regions.

Along the R-304, the area surrounding the Suranaree University will be the location of research and development type of activities in joint efforts with the University. Further south is the Pak Thong Chai Industrial Center of the Thai Silk, which will also grow and their activities will be further deepened and widened.

Industrial activities along the R-33 will continue to grow in main lines of consumer products such as food and textile and export oriented products. Kabin Buri district will grow faster than the Muang. Activities in Sa Keo will have closer links with the Lower Northeast and Cambodia. Khao Yai is located in the middle of a triangle formed by the three industrial corridors composed of the R-2 (Sara Buri - Pak Chong - Si Khiu - Nakhon Ratchasima), the R-304 (Nakhon Ratchasima - Pak Thong Chai - Kabin Buri), the R-33 (Kabin Buri - Si Mahaphot - Muang Prachin Buri - Nakhon Nayok - Sara Buri). In this triangle, resort and research for the surrounding industries will be the main activities. Research activities will mainly deal with development of industrial software.

The central part of the Study Area, Buri Ram, Surin, Si Sa Ket, and Yasothon will basically continue their agro based activities and more of handicraft industries, and other local resource based industries. Export oriented footloose industries will be introduced. Such activities will mainly take place in the areas between the two arterial roads of the R-24 and R-226.

Ubon Ratchathani and Mukdahan share border with Laos. Their activities are based on both local and raw materials imported from Indochina. Ubon Ratchathani is the subregional center with the international airport which will attract location of airport oriented export industries and/or high technology industries.

Prachin Buri and Nakhon Nayok will play regional functions similar to those of the other three regional centers: Nakhon Ratchasima, Ubon Ratchathani and Surin/Buri

Ram. The regional market, however, will be of secondary importance. They will grow primarily as a result of industrial relocation and expansion from BMA.

CHAPTER 5

DEVELOPMENT PLAN

Industrial development of the Study Area is the only viable option for closing or reducing the income gap between the area and the national average and for creating new employment opportunities. Expansion of agricultural land has already reached its limits. There are limited water resources for expansion of area irrigated. Under these conditions, it would be extremely difficult to achieve agricultural sector growth rates of over 4% per annum.

The growth in services is largely determined by that of agriculture and industry. Border trade and tourism are targeted for rapid growth, but because of their very small share, are unlikely to substantially alter the growth rates and income levels in the Study Area. Rapid growth of industry is thus the only viable option for development of the Study Area.

Agro-industries are the backbone of the manufacturing sector and they will continue to play a key role. Their further development will also contribute to the attainment of higher rates of growth in primary agricultural production than otherwise would be the case.

The available agricultural resources in the region and the relatively slow growth in demand for agro-industry products, however, places a limit on the rate at which agro-industries would grow. There are real constraints, and development of appropriate arrangements between the farmer and processors will necessarily take time.

The demand for agro-industry products grows faster than that of primary products in response to growth of incomes, but the rate of growth is less than that of income growth. Agro-industry growth of over 5 to 6% per annum would depend on developing regional exports either to the rest of the country and/or abroad.

To attain the rate of growth needed to close the income gap between the Study Area and the Kingdom, introduction and support of high growth, national and international market oriented manufacturing is essential. This has already started. Some of this is in agro-processing, but the bulk is in labor intensive activities. These will be the high growth manufacturing sub-sectors in the Study Area.

The third type of industries will be of linkage type. They will grow in relation to that of the first two.

5.1 Projected Composition of Manufacturing Value Added

The estimated rates of growth for each type of industry and their share in manufacturing value added is summarized below. The agro-industry growth rate is derived from the detailed sub-sectoral estimates given below. The growth of other sector is derived so as to attain the manufacturing (and overall industry sector) growth rate of 11.5% per annum between 1990-2010.

	Growth Targets		
	Value Added in 1989 (Billion baht)	Average Annual Growth Rate (%)	v.a. in 2010 (Billion baht)
Agro-industry	2.4	6.5	9.0
Others	0.8	17.2	21.6
Total Manufacturing	3.2	11.5	30.6

Note: 1989 prices

The phasing of this development is discussed in detail in Section 5.8. At the end of the plan period, the agro-industry share in value added is projected to decline to 35%.

5.2 Projected Levels of Agro-Industry Growth

5.2.1 Growth by sub-sectors

The projected levels of output and employment are achievable under a set of reasonable development policies. In livestock, the target is to supply the regional market to meet the growth in local demand. The growth in feed industry derives from this. Poultry meat is mainly export oriented, and this orientation will continue in the future.

Conservative targets are adopted for fruit and vegetable sub-sector. This is primarily due to constraints in primary production. These targets can easily be exceeded if some of the projects detailed below are implemented.

An ambitious target is adopted for oilseeds. This primarily derives from requirements for the protein ingredients of the livestock feed. It will also be important for diversification of the crop output in the Study Area to reduce dependence on rice. To achieve this target, however, a major effort needs to be made to identify/develop appropriate crops and varieties to be grown in the region. The tentative list of these crops include soyabeans, sunflower, safflower, rapeseed, sesame, and nuts (cashew and peanut).

No growth is projected for rice milling. The expansion in cassava processing is confined to starch manufacture. Some growth is expected in corn milling for human consumption and some wheat milling, but this is not taken into account for projection purposes.

A modest growth of 3% per annum is assumed for bakery products and sugar based industries. The main source of demand growth for these product lines will be urbanization in the region. Income growth, in contrast, generally has limited impact on demand for these products.

5.2.2 Projection methodology

There is a strong conservative bias in the projections presented. There are two key factors that will lead to higher levels of agro-industry employment and output than those assumed in this report.

First, all incremental production is assumed to occur in factory type of units based on modern technology and minimum efficient scales. At present, such units account only for a third of agro-industry employment in the Study Area. Most of the present employment is in small cottage type units. Production in these small units is much more labor intensive than the units discussed in the following section. The estimated employment associated with a given level of output would be much higher if one were to base it on a mixture of factory-cottage type production units.

The second reason why the projections are conservative is the simple composition assumed. The projections are based on the present composition within each product group.

Substantial deeping in product composition will be expected with urbanization and income growth in the region. This will lead to a shift in consumption from commodities with limited processing to those embodying an advanced level of processing. Purchase of pre-prepared meals, canned or frozen food, and growth in consumption of specialty foods are prime examples. This change in composition of consumption, and therefore production, is not reflected in projections.

Another factor that could have an important impact on agro-industry growth in the Study Area is the inter-regional comparative advantage. This is incorporated, to some degree, in the projections. The growth is based on present production levels. This, in turn, reflects the region's position as a net importer or exporter (i.e. poultry).

Furthermore, the upper limit on the growth is the regional resource base with no inter-regional shipments of primary products. The input requirements of the projected level are expected to be met by local production while the growth in demand is also basically regional.

The growth estimates presented below start with sub-sectoral (product line) estimates of incremental production. Based on representative factory type, units of production, the employment to be created, investment requirements, and the agricultural land area needed to produce the raw materials is estimated for the year 2010.

The present employment by sub-sectors is added to the estimates of incremental employment to arrive at the future levels of employment by agro-industry in the product groups studied. Employment and output in some minor product groups not covered ("Food not Elsewhere Specified", "Coffee, Tea, spices, etc.", and "Seafood Processing") is added by assuming the same ratio within agro-industry as in the base-year (1992).

5.2.3 Investment and production units

Livestock

The likely growth parameters for livestock products in the Study Area (employment, output, agricultural land and investment) are derived on the basis of representative models of dairy units (processing and primary production), broiler and layer production and swine raising. The layer units are included in the analysis, though their output (eggs) are not presently processed and no processing is foreseen. It is included to derive the feed requirements of this sub-sector.

The dairy unit consists of a plant with a processing capacity of 100 tons raw milk/day, operating at 80% capacity utilization. The specification of product composition for the output is not necessary at this stage as the likely demand growth is based on product averages (dairy products). The plant is supplied with 80 tons a day of raw milk from 1,000 farms with an average of 10 milking cows (a dairy herd of around 20 head). These parameters are the same as those presently achieved in the Study Area by modern dairy enterprises.

Based on the data provided by BOI for projects which have received promotional privileges, the investment requirement of the plant itself (excluding village units) would be 220 million baht. Such a plant employs 150 workers in direct production.[2)]

The representative red meat production unit is a swine raising operation producing 150,000 head of pigs/year. This unit will utilize 22,500 tons of feed/year. The investment requirements for the breeding component of primary production and the processing plant will be 600 million baht, employing 400 workers. The red meat output is 10,000 tons/year. Around 100 of these workers will be employed in the slaughterhouse.

The representative broiler unit produces 20 million birds/year. The broiler meat output is 24,000 tons/year. The feed requirement (including the parent stock operation) is 65,000 tons/year. The investment requirements (excluding village broiler houses) are 600 million baht, employing 250 workers.

The layer unit's parent stock operation produces 2 million day-old-chicks for commercial layer units. It would have investment requirements of 250 million Baht, employing 150 workers. The feed requirements of commercial units and the central farm would be 80,000 tons/year.

Animal feed

The new feed mills which have received BOI promotional privileges in recent years have very large capacities (200 to 500 tons/day), while the existing mills tend to be of the standard 10 tons/hour capacity. Because of data availability, future growth of feed milling industry is analyzed on the basis of a unit producing 140,000 tons/annum of poultry and swine feed. Such a plant would cost 150 million baht and would employ 80 workers.

Canned fruits and vegetables

Small to medium scale processing in Thailand is based on a processing capacity in the order of 5,000 - 6,000 tons of fruit per year and sterilization in 3 ton batches.

A well equipped modern plant with sufficient capacity to attain economies of scale is considered. It would require a minimum of 50 tons of fresh tropical fruits a day (except pineapple) and would produce 15,000 tons/year. The plant would require an investment of 100 million baht and would employ 150 workers.

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2) The employment and investment parameters vary depending on output composition. A plant processing 75 tons of milk in 24 hours in Ubon Ratchathani with 1/3 rd of its output in cheese employed 250 workers, while one in Nakhon Ratchasima only producing fresh milk and processing 100 tons employed 101 workers.

Sugar milling

Two new sugarcane processing plants are already under construction in Nakhon Ratchasima. One will start operations at the end of 1992 and the other at the end of 1993. Both of these have a processing capacity of 18,000 tons/day. Based on a conservative estimate of 120 days operating period, each of these plants will process 2.2 million tons of cane/year. Together with the two other plants already in the Study Area, the cane processed will be 5.4 million tons. This will be 11% of all cane produced in Thailand in 1991/92.

The total cane processed in the Northeast Region in 1990/91 was 7.8 million tons in seven plants. With the two new plants in Nakhon Ratchasima, the cane processed in the Northeast region will be 12.2 million tons. This is 26% of the present production in the country.

A possible target for the year 2010 is to assume the same level of cane output in Thailand as at present. The cane production will move to the North and Northeast regions, with each of these regions producing 40% of the present national output. This would imply 19 million tons of cane production in the Northeast region. The present share of the Study Area in the Northeast is small (28%), but will increase to 54% when the two plants in Nakhon Ratchasima are in full operation. This share of the Study Area in incremental production in the Northeast would imply additional cane production of 3.5 million tons in the Study Area, corresponding to two new plants of 18,000 tons/day capacity each.

The two new plants, those being built in Nakhon Ratchasima, and the two existing plants in Buri Ram and Mukdahan (six plants) would have a combined capacity of 78,000 tons/day cane (9.4 million tons/year). At the present national average yields (7.84 tons/rai in 1991/92), this will call for a sugarcane growing area of 1.2 million rai in the Study Area (20% of present national area in sugarcane).

The two new plants in Nakhon Ratchasima and two additional ones to be build will employ around 500 permanent and 700 seasonal workers each, creating a total of 4,800 new jobs. The investment requirement of each plant will be around 1,500 million baht each.

Grain milling

No new investment appears to be needed in rice milling (Section 4.3). There would be substantial expansion in cassava processing if the exports shift from tapioca to starch. This, in turn, largely depends on the changes in the EC market.

At present Thailand produces no wheat. Wheat consumption, on the other hand, has been increasing at around 10% per annum in recent years with imports totalling 450,000 tons in 1991. This trend of increased wheat consumption is likely to continue in the future. It is, however, doubtful that the import dependent wheat flour mills would actually locate in the Study Area. Wheat flour milling tends to locate near the final consumers and the growth of the regional market may justify some milling in the region. This is likely to happen if cassava and rice starch is blended with wheat flour in production of some commodities for which the market is reported to be expanding rapidly: noodles, biscuits and bakery products.

The extent to which cassava processing will shift from tapioca pellets to starch is difficult to predict. A tentative framework assumes that half of the cassava produced is exported as tapioca (the present share of EC). The rest will be supplied to the animal feed industry to a maximum level of 20% of overall feed ingredients (up to 15% for poultry and swine feed, and up to 30% for ruminant feed). All of the rest will be processed into starch.

Two starch plants that received BOI privileges over the last three years in the Study Area had an average capacity of 5,000 tons output/annum. The average investment requirement was 20 million baht and each employed 30 workers.

Edible oil

Two projects planned for Nakhon Ratchasima are designed to extract oil from cashew nuts and rapeseed. They had an average capacity of 75 tons/day (21,000 tons/year), employed an average of 190 workers, and required an investment of 120 million baht each.

5.3 Projected Levels of Production

5.3.1 Livestock products and feed

No information is available on livestock production in the Study Area. This information is derived from the available statistics on livestock herd in the region and national production per head in the herd.

The present level of livestock production thus estimated and the growth in production expected up to the year 2010 is summarized below.

Livestock Products	Production in the Study Area in 1990 (tons)	Growth in production (% per annum)	Production in 2010 (ton)
Pork	51,000	5.0	135,000
Beef and veal	31,000	10.0	208,000
Eggs	35,000	5.0	93,000
Poultry meat	184,000	8.0	857,000
Milk	56,000	10.0	376,000
Feed (concentrate)	1,000,000	8.1	4,700,000

The projected level of beef/veal production is about the same as the national production at present (Table 10). This is considered attainable given the relatively large proportion of the national herd already in the Study Area and the Study Area's strong production base (feed and labor).

The projected level of pork production is a third of the present production in Thailand. For all other commodities, the Study Area is expected to produce close to the present level of production of the whole kingdom by the year 2010.

The total feed requirements of livestock are 1.4 million tons of maize/sorghum (or other substitute cereals), and 1.2 million tons of oilseed cakes/pastes. The amount of oilseed required depends on the oil/cake content of the seed. For seeds with oil

content similar to soybeans, the oilseed requirement would be 1.4 million tons of seed to be processed into 200,000 tons of raw edible oil and 1.2 million tons of paste/cake.

The other feed ingredients are already available in the region (700,000 tons of rice bran and one million tons of tapioca).

5.3.2 Fruit and vegetable processing

The development of this sub-sector is severely constrained by primary production of raw materials. Among the fruits, there appears to be practically no production of traditionally processed fruits such as longon, papaya and rambutan. The production of other fruits which may be processed is also very small (Table 8) and dominated by mango. There is also strong demand for fresh consumption. Nonetheless, it is assumed that half of the level of present production of 100,000 tons will be processed in 2010.

For vegetables, primary production appears to be less of a constraint as traditionally processed products are already produced in the region (peas, cucumber and chillies), and supply can respond within a matter of months to marketing opportunities. As a notional figure, it is assumed that 200,000 tons of vegetables will be processed by the year 2010.

5.3.3 Cassava products

Over a third of the total national cassava production occurs in the Study Area (Table 10). The future of cassava industry in the region, therefore, is largely determined by what happens to the national industry.

For projection purposes, it is assumed that the present level of national and regional cassava production continues at 20 and 7 million tons respectively. The equivalent of 12 million tons of cassava is exported to EC under the present quota system and the rest will be disposed of otherwise. Assuming the same export/output ratios for the Study Area as in the whole kingdom, 4.2 million tons of regional production will be exported. The remaining amount to be processed into animal feed and starch would thus be 3 million tons of cassava. Of this, two million tons (tapioca equivalent of 900,000 tons) will be utilized by the livestock industry, and the rest will be processed into starch. This corresponds to 38 starch plants given the present choices of production scale.

5.3.4 Growth in output and employment

The product lines covered above, together with rice mills, accounted for 97% of employment in the Study Area in 1992. The sectors not studied in detail (seafood processing, beverages, tobacco and the category "food not elsewhere classified") were of minor importance.

For the product lines covered, output is projected to grow by 8.5% and employment by 4.5% per annum between 1990-2010. Caution, however, is needed in applying these growth rates to total agro-industry employment in the Study Area.

The detailed sub-sectoral data provided by the Ministry of Industry on the number of enterprises and employment cover only a small subset of all enterprises and employment. The analysis in this report is based on this source as it is the only one

that provides detailed product line information. The other two sources have a wider coverage (NSO industry survey on manufacturing enterprises, and the same source for employment through the population surveys) but provide only aggregate data for the Study Area on agro-industries as a single group.

According to the Ministry of Industry, there were 8,300 agro-industry manufacturing enterprises employing 35,248 workers in the Study Area in 1992. The manufacturing enterprises covered by the NSO Survey of Industry employed 76,208 workers for the same product coverage. The NSO labor force survey reported an average of 225,000 workers for 1989 (average of rainy and dry seasons), which implies agro-industry employment of 160,000 in 1989. This last seems to be the reasonable figure in the light of total employment and its composition.

The difference between the first two and the last figure would be cottage type industries. It is, however, difficult to reconcile the first two figures as the second source's coverage is a sub-set of the first.[3)]

The base figure of 160,000 workers is adopted for agro-industries (manufacturing employment of 225,000). Two separate estimates of employment are made. The first in based on projections of output and labor productivity. The second assumes that the cottage type employment will remain at 83,792 (the difference between NSO survey of industrial enterprises and the Labor Force Survey results). The factory type employment grows at the rates indicated by the detailed analysis based on the Ministry of Industry data.

5.4 Employment and Investment by Sub-Sectors

The investment requirement of each new factory type job to be created is 1.5 million baht. This is slightly higher than the present manufacturing average of about one million baht. This is expected as agro-industries tend to be more capital intensive than other large sectors of employment such as garments and engineering industries. The detailed breakdown of these estimates is as follows:

Type of Industry	Number of		Investment Requirements
	Enterprises	Workers	(Million Baht)
Dairy enterprises	11	1,650	2,420
Red meat			
Swine raising and processing	8	3,200	4,800
Other red meat	18	4,500	4,500
Poultry			
Layer	3	450	750
Broiler	28	7,000	16,800
Animal feed	26	2,080	3,900
Fruit and vegetable processing	25	3,750	2,500
Cassava starch	30	900	600
Sugar factories	4	4,800	6,000
Total	153	28,330	42,270

Source: Table 13

3) Enterprises employing 7 workers or more are registered by the Ministry of Industry. NSO survey of industry covers enterprises with 10 workers or more.

The present and incremental employment in the product lines discussed above is given in Table 13. The projected growth in employment for the product lines covered (which includes cassava but excludes rice milling) is 4.5% per annum for the planning period (from 18,994 in 1992 to 41,925 in 2010). The much slower growth in employment than the projected output growth of 8.5% is one indication of relatively low productivity in existing enterprises compared with models on which estimates are based.

The bulk of employment, however, will be created in cottage type enterprises. The overall growth in employment would be less than 4.5% if there are structural changes in industry, some of which is unavoidable.

Many small enterprises produce processed food at present. This includes meat products, condiments, seasonings and sauces. These are distributed through traditional channels. These are priced at 10 to 20% below comparable products of large modern enterprises and, per unit of output, create more employment than large scale, capital intensive production.

With increasing recoginition of brand names, growth in incomes and strict hygiene regulations, a part of this market segment will be taken over by modern enterprises. This structural change, in turn, will lead to slower growth in employment than in output.

5.5 Impact of Projected Growth on Agriculture

The growth in livestock production, production of oil seeds, forages and sugarcane production will reduce the Study Area's dependence on paddy production. The land requirements of some of the major products are discussed below.

The forage requirement of the proposed dairy development are very modest: 150,000 rai in forages. This is based on the present requirement of 4 rai per cow milked, under rainfed conditions, and could be reduced with introduction of higher yield new forage crops. Production of feed ingredient for all livestock feed would require no expansion in area presently planted in maize with a modest improvement of around 1% per annum in maize yields.

There would be a substantial growth in the area under oil seeds if the requirements are to be met locally rather than relying on imports, both from other regions in the country and abroad. In terms of cake/oil ratios, the most favorable oilseed is soyabeans. Other oilseeds, however, are also grown in the Study Area including sesame, groundnuts and sunflower.

Based on the cake yield of soyabeans, the land requirement of protein feed ingredients would vary between 4 to 6 million rai depending on composition of feed and yield of oil seeds. This is around 15% of the total farm land of 33 million rai in the Study Area. The land requirement, however, would be as large as the total irrigated area. Most of the new oilseed area, therefore, would need to be rainfed, and most of the oilseeds referred to above can be grown on such land.

In the short run, the main component of oil seed production will continue to be soybeans. The government has major programs for promoting soybean production. Partly as a result of this, the yields have increased substantially over the last three

years. The average yields in 1988-1991 were around 200 kg/rai. These yields are comparable to those of the major soybean producing countries. The Northern and Northeast regions are targeted by the government as the major soybean growing areas.

The two plants under construction in Nakhon Ratchasima and the additional two new plants expected by the end of Master Plan period will process a total of 8.6 million tons of sugarcane. Together with the two existing plants in Buri Ram and Mukdahan, they will process 9.4 million tons/year. Based on the present average yield of 7.8 tons/rai, this would require a sugarcane growing area of 1.2 million rai, slightly over 3% of agricultural land. Up to 40,000 farm families could participate in cane production if medium sized farmers are encouraged to grow sugarcane.

5.6 Growth of Other Manufacturing Sub-Sectors

It becomes very important to develop another key industry which will work in tandem with the agro-industries to lead the industrialization of the region and transform the existing lopsided subsectoral structure to a well balanced one. Metal working and machinery industries including electrical and transportation equipment should be developed as another backbone industry of the region. These industries are supportive to those industries in the BMR and the Eastern Seaboard as well as to the local industries. The industries require higher technologies than the simple labour intensive, export oriented types of industries and tend to develop a wider spatial linkage and can also meet the requirements of the Indochina countries.

Modernization of agriculture requires further mechanized farming. More tractors, planters, harvesters, irrigation pumps, threshers, milling machine, E-tan, tools and applicancies will be demanded. More silos, elevators and hauling trucks will be required for storage and transportation. More agro-processing machinery and equipment including bottling and packaging will be needed. People require more motorcycles and cars to commute for business and other diversified daily activities. The metal working and machinery industry has to be developed to support the activities of the agriculture sector which will remain as the mainstay of the economy of the Study Area up to the year targeted.

In the short and mid term, these labour intensive, footloose industries need to be promoted specially at rural areas for absorption of both the new workforce and the one shifted from agriculture but their long term prospects will not be favorable due to possible competition with less developed countries as the NIES has experienced.

In order for the strategy to work successfully, it is quite necessary to make special efforts in the initial stage to attract outside investors who have enough management resources such as capitals, technologies and marketing to pioneer in manufacturing new products. Support to these investors from various levels is required to prove the projects as sound investments so that local investors will be convinced to follow these pioneers. Attraction of cheap labor will not last long and manpower development to meet the needs of incoming industries is of prime importance. Secondary importance is to improve urban facilities such as an international school to encourage foreign engineers and technicians to stay in the Study Area to transfer their technologies to the local workers.

The future image of the region is of much more industrialized one to an extent that the share of the manufacturing industry in value added of the region will come nearer

to the share of population. The subsectoral structure will be more balanced as if it forms a tripod comprising of the traditional agro-industry, labor intensive footloose industries cum local culture based handicraft industry and the metal working and machinery industry or linkage oriented industry.

5.7 Growth in Industrial Sector

Construction and mining are likely to grow at rates close to that of manufacturing. The utilities, however, should grow faster than the manufacturing sector. This is essential to eliminate the existing deficiencies in the physical infrastructure, particularly urban water supply, sewerage systems, and roads within the urban areas.

5.8 Proposed Development Phasing

The development will take place in phases with the following time frames and activities.

(a) Phase I (1992 - 1996)

It is aimed to achieve an overall growth rate of 11% per annum. The manufacturing GRDP in 1996 will be 6.0 billion bahts in 1972 prices.

It is assumed that agro-industries will grow at 6.5% which is about 1 point higher than the government target. Processing of dairy, fruits and vegetable will contribute to the growth.

The existing and newly coming non agro-industries will grow at 16%. Labor intensive export oriented type of industries will lead the development. Linkage oriented industries will continue to locate.

About 71,000 jobs will be created. This will require industrial lands of approximately 5,500 rai, of which Suranaree Industrial Zone, Khok Kraud Industrial Estate Northern Industrial Estate in Nakhon Ratchasima, Krabin Buri Industrial Zone in Prachin Buri will have around 60% of share. Pulp industry proposed by the Forestry industry Organization will locate in Ubon Ratchathani or Si Sa Ket and another one proposed by a private enterprise will locate in the Northern Industrial Estate which is planned to be integrated with sugar mill for utilization of baggase.

The likely sub-sector structure will be 62% agro, 24% non agro and 14% linkage.

(b) Phase II (1997 - 2001)

It is aimed to achieve an overall growth rate of 12% per annum. The manufacturing GRDP in 2001 will be 11.7 billion bahts in 1972 prices.

It is assumed that agro-industries will maintain the growth rate of 6.5%. The slower growth of conventional agro-industries such as rice milling will be offset by higher growth of non conventional agro products. Agro-industrial park in Ubon Ratchathani will be in operation.

The existing non agro-industries will grow at 16.7%. Handicraft industry will grow with continued growth of tourism industry. Footloose industries will locate widely in the region where there are enough manpower. A car and rolling stock assembly

plants newly located will lead growth of the linkage type industries at 15%. A large scale automobile test course will be introduced in the region to improve quality of the local made automobiles. Research and recreation type activities will take place in Khao Yai district to support activities at the Nakhon Ratchasima - Kabin Buri - Saraburi industrial triangle.

About 125,000 new jobs will be created. This will require industrial lands of approximately 9,600 rai. Three planned industrial estates in Nakhon Ratchasima, Prachin Buri and Ubon Ratchathani will provide around 50% of requirements. Some more industrial estates have to be developed in various locations.

A branch of the Northeast Industrial Promotion Center will be established in some where in Surin which will also provide assistance of technical training and consultancy services to Laotians and Cambodians to enhance technical and economic relation with these countries. The likely sub-sectoral structure will be 39% agro, 35% non agro and 26% inkage.

(c) Phase III (2002 - 2010)

It is aimed to achieve an overall growth rate of 11.5% per annum. GRDP manufacturing in 2001 will be 30.6 billion bahts in 1972 prices.

It is assumed that agro-industries will continue to maintain the constant growth rate of 6.5%. Thanks to the water resources developments and irrigation systems, the crops would have been well diversified and allow agro-processing industries get steady supply of inputs.

Non agro-industries and linkage industries will maintain the momentum developed in the Phase II. Manufacturing of light air crafts and helicopters used for agriculture and business would be established and would become an export industry too. Labor productivity of agriculture sector will jump to higher level to rectify the gap between the manufacturing industry.

About 500,000 new jobs will be created on the new industrial lands of about 38,000 rai. Assuming that 60% of industries will locate in industrial estates, a total of 2,000 to 3,000 rai of industrial estates will have to be developed every year. Manufacturers of intermediate goods based on both local and imported materials from the Indochina countries will locate in the Ubon Ratchathani - Mukdahan - Yasothon industrial triangle because of availability of enough industrial water. Nakhon Ratchasima will have agglomeration of engineering and machinery industries to become Detroit of Thailand.

Due to the growing industrial base of the Study Area and the number of jobs created, the manufacturing sector will grow over time despite the moderation in the growth rate. This is shown below for each development phase.

Phasing of Manufacturing Sector Growth

Phase	Period	No. of new jobs to be created	Industrial land requirements (rai)	Industrial structure (%)		
				Agro	Non-agro	Linkage
I	~ 1996	71,000	5,500	62	24	14
II	1997 ~ 2001	125,000	9,600	47	35	18
III	2002 ~ 2010	500,000	38,000	29	40	31

The maturity in industrial structure, given above, will increase the income stability in the Study Area. It will support specialized services, located in the large urban centers, and will create the industrial dynamism to insure self-sustained growth and development.

5.9 Development Projects and Support Measures

The attainment of industrial sector development targets set for the Master Plan depends both on national level macro conditions and specific local actions. Some of the specific local projects that may be implemented and other support measures are described.

Local projects

Specific projects to be implemented within one Study Area range from purely private sector investments to those of highly public nature. The latter are related mainly to skill training, research and development, and quality upgrading.

Some agro-industries are highly promissing. In particular, the following have good prospects, as livestock improvement particularly of cattle is strongly recommended by the Master Plan.

- Animal feed,
- Dairy products, and
- Meat processing.

A preliminary feasiblity analysis has been carried out as part of master planning, and results are contained in a separate volume. Outlines of the latter two are in Appendix to this sector report.

These and other agro-industries may be developed as part of the complete cycle projects (CCP's). As the first step to promote CCP's, existing guidelines for CCP's should be reviewed by NESDB as indicated in sub-section 3.3.2. Small industry districts are proposed to improve the existing small and medium industries into efficient economic units so that they can link efficiently with large industries for next stage of industrialization. A profile of this project is in Appendix. The first priority for this purpose is Nakhon Ratchasima. Therefore, the Nakhon Ratchasima industrial modernization is proposed, and its outline is also in Appendix.

Nakhon Ratchasima will be further industrialized with the development of engineering and machinery industry which will be a backbone industry of the industrialization drive at the Study Area as a whole. In particular, Nakhon Ratchasima will be specialized in automobile manufacturing as a "Detroit of

Thailand". To serve local and regional automobile industries, an automobile test course is proposed, and its profile in Appendix. Various rural industries will develop throughout the Study Area, and particularly in Buri Ram - Surin - Si Sa Ket area if the access and other infrastructure and utility are improved. To support these industries, a branch of the Northeast Industrial Promotion Center in Khon Kaen is proposed in Surin. A profile of this project is contained in Appendix.

Industrialization in the Study Area will be linked to industries in the BMA, the ESB and other areas such as Saraburi and Chachaengsao. To serve these industries for software development and information exchange an advanced technology, the Khao Yai resort and research development is proposed, and its profile is in Appendix.

Profiles of a few other projects are also included in Appendix to this sectior report.

Support measures

At the national level policy stability is a key factor. Foreign investment will play a critical role in the Study Area, particularly for export oriented investments in growth centers such as Nakhon Ratchasima, Ubon Ratchathani and the Upper East. The recent trend in decline in foreign investment, therefore, is significant and will endanger the attainment of projected growth levels if it continues.

The growth of linkage and rural industries (including some agro-based) will depend on availability of finance and technology upgrading. The first will be largely undertaken by commercial banks. IFCT should also substantially expand its lending in the Study Area. A specific project is proposed below for technology upgrading.

A key factor in sustaining the industrial growth of the Study Area will be availability of skilled labor. Fiscal incentives should be provided to companies who train their workers for skilled jobs. In addition, new vocational schools should be established in the Study Area.

At the local level, improvements in infrastructure will be critical. Given the government's commitment to increase public investment in infrastructure, a major growth in financial resources commitment should be made.

For promotion of industrial development as proposed, regular and frequent exchanges of information and coordination among the concerned agencies at the central and local level will become increasingly important. NESDB central and regional offices are better equipped to play a key role in this regard.

At the central level, NESDB should guide manufacturing and processing industries (under various State enterprises) to relocate their factories out of the BMA and maintain close coordination with Board of Investment, Department of Industrial Promotion, Department of Industrial Works, Industrial Estate Authority of Thailand, Federation of Thai Industries, Department of Local Administration etc. Relocation of these factories will induce relocation and/or new location of the supporting industries of the private sector.

At the regional level, NESDB can coordinate Northeastern Industrial Development Promotion Center in Khon Kaen, BOI in Korat, relevant changwat offices, universities, colleges and vocational schools, local industrial clubs and chamber of

commerce to help improve investment climate including social amenity of each locality, an important factor to attract both domestic and foreign investors.

CHAPTER 6

RECOMMENDATIONS TOWARDS REALIZATION

1. Inter regional transportation networks enhancement should be implemented as planned in the 6th and 7th National Plan.

2. In order not to repeat the costly experiences of Bangkok that failed to control the ways industrialization and urbanization have taken place and resulted in serious traffic congestions and pollution, it is recommended to formulate a well coordinated land use plan among agricultural, industrial and urban sectors in the main industrial areas.

3. Acceleration of urban agglomeration in Nakhon Ratchasima as the regional industrial center is proposed as a strategy for the overall development of the LNE-UE region. Therefore it is imperative to prepare the above mentioned plan for Nakhon Ratchasima and full supports will be needed by the concerned agencies to the local authorities for their implementation of the projects.

4. Though the private sector has begun to play an important role to develop industrial estates in line with the government's privatization policy, it is also necessary to encourage local authorities to take initiative when private sector developer will not come in. However, those local authorities lack qualified personnels to plan, implement and manage the project. In this connection, the Industrial Estate Authority of Thailand (IEAT) and the Industrial Finance Corporation of Thailand (IFCT) are recommended to extend training service for the staffs of those local authorities for them to.

5. Public authorities will require long process in decision making in development of industrial infrastructures which sometimes discourages potential industrial investors to come in. This is a reason why the private sector developers began to involve in development of industrial estate. Their objective is to make money out of sale of developed land and job creation is not their immediate objective. On the other hand, the immediate objective of local authority is to gain long term benefits of expanded tax base by creation of job for the local people and increased fixed assets. One approach is to create a quasi public corporation which is formed as joint venture between the local authorities and local business enterprises. The corporation has a complete autonomy and can supplement activities of the local authorities.

6. The LNE-UE region has basic constraint in water supply, it is recommend to encourage industries to expand to use recycled water in their process as much as possible. Public subsidies or soft loans to the industries for investment for this purpose are recommendable and this will contribute in conservation of better environment.

7. For promotion of meat processing industry, privatization of slaughterhouse and upgrading of facilities is recommended. A pilot of Complete Cycle Project based on livestock products should be implemented to test how it will work.

8. For implementation of the proposed project, it is recommended to conduct feasibility studies within the Phase I period.

Tables

Table 1 Gross Domestic Product by Industrial Origin at Current Prices

	1981		1986		1988		1990		1991 *	
	Billion Baht	As % of total	Billion Baht	As % of total	Billion Baht	As % of total	Billion Baht	As % of total	Billion Baht	As % of total
I Agriculture	163.0	21.4	178.1	16.3	250.4	16.6	254.5	12.4	275.9	11.8
a) Crops	105.7	13.9	107.0	9.8	160.2	10.6	150.1	7.3	166.7	7.1
b) Livestock	15.8	2.1	19.8	1.8	24.6	1.6	32.0	1.6	32.6	1.4
c) Fisheries	10.6	1.4	15.3	1.4	21.7	1.4	22.5	1.1	24.3	1.0
II Industry	229.2	30.1	349.8	31.9	505.8	33.6	755.7	36.9	885.3	38.0
a) Mining & Quarring	21.6	2.8	34.5	3.1	47.7	3.2	73.5	3.6	87.1	3.7
b) Manufacturing	169.5	22.3	258.6	23.6	373.3	24.8	535.4	26.1	619.5	26.6
c) Construction	38.1	5.0	56.6	5.2	84.8	5.6	146.8	7.2	178.7	7.7
III Services	368.0		567.4	51.8	750.8	49.8	1,040.9	50.7	1,170.6	50.2
a) Util. & Trans.	56.8		122.7	10.3	141.0	9.4	186.1	9.1	209.4	9.0
b) Trade	137.5		171.0	15.6	240.1	15.9	312.7	15.2	355.0	15.2
c) Bank, Insur. & R. Estste	22.6		37.2	3.4	65.0	4.3	124.5	6.1	150.4	6.5
Total GDP	760.2	100.0	1,095.4	100.0	1,507.0	100.0	2,051.0	100.0	2,331.8	100.0

* Provisional

Source : NESDB

Table 2 The Structure of Foreign Trade in Thailand

(Unite : million b

	Exports				
	1981	1986	1989	1990	1991
Total Exports	153,001	233,383	516,315	589,813	725,772
1 Agriculture(of which)	100,882	94,870	147,749	133,263	195,756
6 principal Exports *	73,730	75,440	135,253	116,755	125,245
2 Manufacturing	53,702	129,170	354,154	440,395	511,431
a) Integrated circuits	6,193	15,818	18,424	21,580	25,760
b) Textile products	12,570	31,268	74,027	84,472	109,563
c) Precious Stones and Jewelry	5,012	13,164	28,393	22,045	35,898
d) Processed food **		18,376	32,678	37,038	45,985
Other Manufacturing		75,626	153,522	165,135	294,225
3 Mining		6,283	8,018	7,438	7,530
4 Others		3,060	6,394	8,717	11,055
	Imports				
Total Imports	216,796	241,358	662,679	844,448	958,831
1 Food	5,966	13,087	30,001	33,563	41,915
2 Manufactured goods		43,655	152,105	298,699	352,139
3 Machinery	36,922	79,215	251,001	348,248	388,770
4 Chemicals		38,794	74,204	85,591	88,345
5 Mineral Fuels	36,922	32,354	59,819	78,347	87,662

* Rice, Rubber, Maize, Tapioca, Shrimps and Sugar

** Frozen fowl; canned pineapple, fish and crustaceans;and dried cuttlefish.

Source : Bank of Thailand

Table 3 Manufacturing GDP in Thailand and the Study Area

(million baht in 1972 pric

	1981		1986		1989	
	Whole Kingdom	Study Area	Whole Kingdom	Study Area	Whole Kingdom	Study Area
Food processing	5,885	401	7,669	574	9,849	632
Beverages	6,687	600	8,592	985	12,398	1,328
Textiles and leather	16,113	701	23,479	685	36,301	676
Wood products	2,037	36	2,516	30	2,858	25
Pulp and paper	2,344	5	3,042	7	3,842	5
Chemical products	6,343	4	8,273	5	11,142	7
Non-metalic products	1,828	11	2,349	12	4,462	19
Basic Matreial Industries	1,617	1	2,096	1	2,668	3
Machinery	550	3	643	-	865	-
Electrical Appliances	975	-	1,318	-	2,724	1
Transport Equipment	3,180	-	3,060	-	8,334	-
Other Industries	21,507	283	27,222	421	41,814	534
Total	69,066	2,045	90,259	2,720	137,257	3,230
	(Sub-sectoral Share of Manufacturing - %)					
Food processing	8.5	19.6	8.5	21.1	7.2	19.6
Beverages	9.7	29.3	9.5	36.2	9.0	41.1
Textiles and leather	23.3	34.3	26.0	25.2	26.4	20.9
Wood products	2.9	1.8	2.8	1.1	2.1	0.8
Pulp and paper	3.4	0.2	3.4	0.3	2.8	0.2
Chemical products	9.2	0.2	9.2	0.2	8.1	0.2
Non-metalic products	2.6	0.5	2.6	0.4	3.3	0.6
Basic Matreial Industries	2.3	-	2.3	-	1.9	0.1
Machinery	0.8	0.1	0.7	-	0.6	-
Electrical Appliances	1.4	-	1.5	-	2.0	-
Transport Equipment	4.6	-	3.4	-	6.1	-
Other Industries	31.1	13.8	30.2	15.5	30.5	16.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 4 BOI Approved Investment in Thailand, Northeast Region, and Study Area

	1989	1990	1991
Thailand			
No. of Projects	1,183	915	606
Total Investment (Million Baht)	286,054	474,879	277,107
Employment (No. of Workers) *	331,315	282,804	188,229
Northeast Region			
No. of Projects	57	51	64
Total Investment	15,462	6,739	8,445
Employment	14,243	10,064	31,916
Study Area			
No. of Projects	42	47	67
Total Investment	11,411	8,035	10,400
Employment	9,052	11,541	32,658
	As a % of Thailand		
Northeast			
No. of Projects	4.8	5.6	10.6
Total Investment	5.4	1.4	-
Employment	4.3	3.6	-
Study Area			
No. of Projects	3.6	5.1	11.1
Total Investment	4.0	1.7	3.7
Employment	2.7	4.1	17.4

* Excludes Expatriates

Source: Board of Investment

Table 5 Number of Manufacturing Industries Excluding Rice Mills in LNE-UE (1992)

Type of Industries	Nakhon Nayok		Prachin Buri		Nakhon Ratchasima*		Buri Ram		Surin		Si Sa Ket		Ubon Ratchathani		Yasothon		Mukdahan		Total Study Area	
	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers
1 Food Processing	22	288	386	5,023	1,037	12,256	254	2,234	96	1,047	149	1,347	120	2,111	51	468	39	491	2,154	25,270
2 Textile	4	111	6	974	102	22,080	3	507	3	455	1	45	5	417	1	10	1	98	126	24,697
3 Wood and Furniture	16	101	41	1,719	83	1,971	16	536	36	544	11	439	47	566	30	358	18	320	298	6,554
4 Paper and Pulp	-	-	4	35	24	198	4	25	4	24	-	-	7	45	2	6	1	5	46	338
5 Chemical and Petroleum, Rubber and Plastic	2	88	6	164	57	2,679	4	24	4	9	3	32	13	62	4	8	3	10	96	3,076
6 Non-Metallic	24	266	76	750	182	3,778	42	998	54	494	30	329	73	837	41	346	26	222	548	8,020
7 General Machinery, Electric and Engineering	16	165	68	331	455	4,754	35	148	62	270	23	86	215	1,243	35	167	29	213	938	7,377
8 Preaision Machinery	25	135	34	116	281	2,095	27	1,437	49	578	10	104	130	1,032	26	162	30	126	612	5,785
Total	109	1,154	621	9,112	2,221	49,811	385	5,909	308	3,421	227	2,382	610	6,313	190	1,525	147	1,485	4,818	81,112

Source : Factory Registered Statistic Section, Factory Control Division, Department of Industrial Work, Ministy of Industry

Note : * The data of Nakhon Ratchasima is discounted due to termination of operations and duplication.

Table 6 BOI Approved Projects in the Study Area (1989-91)

Province	Project Number					Investment (million)					Employment				
	1989	1990	1991	Total	%	1989	1990	1991	Total	%	1989	1990	1991	Total	%
Nakhon Nayok	2.00	3.00	3.00	8.00	5.20	218.60	173.90	132.20	524.00	1.80	313.00	204.00	529.00	1,046.00	2.00
Prachin Buri	5.00	13.00	7.00	25.00	16.00	2,530.80	3,435.30	3,198.00	9,164.10	30.70	684.00	5,366.00	2,297.00	8,347.00	15.70
Nakhon Ratchasima	30.00	26.00	37.00	93.00	59.60	3,760.90	3,950.90	4,081.30	11,793.10	39.50	6,008.00	4,819.00	23,113.00	33,940.00	63.70
Buri Ram	1.00	1.00	0.00	2.00	1.30	230.00	60.00	0.00	290.00	1.00	97.00	131.00	0.00	228.00	0.40
Surin	1.00	0.00	2.00	3.00	1.90	75.00	0.00	85.00	160.00	0.50	200.00	0.00	290.00	490.00	0.90
Si Sa Ket	1.00	0.00	2.00	3.00	1.90	65.00	0.00	74.00	139.00	0.50	75.00	0.00	192.00	267.00	0.50
Ubon Ratchathani	1.00	3.00	15.00	19.00	12.20	4,000.00	355.00	2,789.90	7,144.90	24.00	1,455.00	792.00	6,197.00	8,444.00	15.90
Yasothon	1.00	0.00	1.00	2.00	1.30	531.00	0.00	39.40	570.40	1.90	220.00	0.00	40.00	260.00	0.50
Mukdahan	0.00	1.00	0.00	1.00	0.60	0.00	41.90	0.00	41.90	0.10	0.00	229.00	0.00	229.00	0.40
Total	42.00	47.00	67.00	156.00	100.00	11,411.30	8,017.00	10,399.80	29,827.40	100.00	9,052.00	11,541.00	32,658.00	53,251.00	100.00

Source : BOI

Table 7 Number of Livestock and Slaughters (off - Take) by Provinces: 1989

Provinces	Buffalos	Cattle	Swine
Whole Kingdom (000)			
Number	5,443	5,285	4,679
Slaughter (off-take)	78	395	3,554
%	2.0%	5.6%	60.4%
Mukdahan			
Number	97	40	20
Slaughter (off-take)	1	1	7
%	2.0%	5.6%	60.4%
Yasothon			
Number	105	54	19
Slaughter (off-take)	2	7	14
%	2.0%	5.6%	60.4%
Ubon Ratchathani			
Number	389	180	81
Slaughter (off-take)	5	10	53
%	1.3%	5.6%	65.4%
Buri Ram			
Number	320	88	108
Slaughter (off-take)	4	8	47
%	1.2%	8.5%	43.9%
Si Sa Ket			
Number	286	111	85
Slaughter (off-take)	2	3	14
%	0.7%	2.6%	16.9%
Surin			
Number	318.9	104.5	91.0
Slaughter (off-take)	5.7	4.0	35.0
%	1.8%	3.8%	38.5%
Nakhon Ratchasima			
Number	294.7	287.0	197.1
Slaughter (off-take)	14.5	16.3	179.5
%	4.9%	5.7%	91.0%
Nakhoh Nayok			
Number	15.8	5.3	14.3
Slaughter (off-take)	1.9	0.2	11.9
%	12.0%	4.3%	83.2%
Prachin Buri			
Number	107.5	63.0	76.1
Slaughter (off-take)	2.8	2.8	54.0
%	2.6%	4.4%	71.0%
Total Study Area			
Number	318.9	318.9	318.9
Slaughter (off-take)	318.9	318.9	318.9
%	2.0%	5.6%	60.4%

Table 8 Fruit and Vegetable Production in the Study Area - Selected Representative Products for Processing (Tons in 1986)

Province	Peas	Chili	Cucumber	Mango	Tamarind	Guava
Nakhon Nayok	-	47	781	2,700	482	200
Prachin Buri	-	-	-	-	-	-
Nakhon Ratchasima	350	2,498	13,116	19,700	8,715	2,080
Buri Ram	47	770	4,594	19,900	6,786	2,906
Mukdahan	6	36	766	3,300	1,996	191
Si Sa Ket	25	86	3,751	6,100	1,616	996
Surin	1	32	705	11,700	923	644
Ubon Ratchathani	58	163	3,496	600	147	68
Yasothon	18	26	1,887	7,000	823	648
Study Area	**505**	**3,658**	**29,096**	**71,000**	**21,488**	**7,733**

Source: Consultant Report Submitted to Ministry of Industry; DIP (April 1988)

Table 9 Household Expenditure Elasticities for Selected Food and Agro-Industry Products (1981 - 1986) Thailand

Processed Foods	Greater Bangkok	Provincial
Rice	-0.08	-0.14
Flour (rice, wheat, etc.)	2.69	-0.99
Noodles	0.14	1.06
Bean curd	0.80	1.91
Bread	1.14	-
Cake and pastries	0.78	1.10
Other cereal products	3.27	-1.54
Prepared meat and poultry	0.13	1.56
Prepared fish and seafood	0.34	1.17
Fresh milk	1.90	4.60
Condensed milk	2.30	0.84
Chesse	3.82	6.92
Oils and fats	0.97	1.38
Canned fruits	2.27	6.58
Pickled fruits	5.99	-0.27
Pickled vegetables	-0.82	-0.93
Sugar and sweets	1.83	1.16
Coffee	4.58	4.30
Cocoa	6.66	-
Ovaltine	4.79	7.05
Non-alcoholic beverages	1.18	0.49
Alcoholic beverages	1.82	0.77
Tabacco products	0.68	-0.06

Source: Paitoon Wiboonchutika, "The Houselhod Demand for Goods Produced I Industries", TDRI, 1990 - based upon NSO Socio-Economic Surveys.

Table 10 **Production of the Main Crops and Livestock Products in the Study Area and the Whole Kingdom, 1990/91**

Products	Study Area	Thailand
Paddy	3,737,301	17,193,000
Maize	710,851	3,772,000
Cassava	7,127,788	20,701,000
Sugarcane	1,056,317	33,561,000
Groundnuts	25,010	161,000
Cotton	9,289	97,000
Kenaf	82,921	157,000
Mungbean	7,165	303,000
Sorghum	5,991	237,000
Soyabean	16,126	530,000
Shallot	69,297	143,000
Garlic	-	104,100
Beef and veal	30,811	171,800
Buffalo meat	21,723	63,300
Pig meat	51,477	337,500
Poultry meat	183,761	660,900
Milk	56,440	166,000
Eggs	35,000	127,000

Source : - Crop production data from Agricultural Statistics of Thailand, 1991
- Livestock production data for Thailand from F.A.O., Selected Indicators of Food and Agriculture
- Development in Asia-Pacific Region, 1980-1990, Bangkok, 1991.

Table 11 Returns to Crops: Nakhon Ratchasima (average 1986 -1990)

Crops	Yield (kg/rai)	Unit Cost (baht/kg)	Unit Return (baht/rai)	Prices received by farmers (baht/kg)
Rainfed rice	226	2.98	29.4	3.11
Irrigated rice	494	2.57	291	3.16
Cassava	2,346	0.38	590	0.63
Maize	324	2.08	86	2.34
Sorghum	222	1.84	98	2.28
Soyabeans	195	5.03	383	7.00
Mungbean	92	5.90	92	6.90
Groundnut	216	5.29	392	7.11
Black sesame	99	n.a.	593	14.00
Cotton	224	9.63	113	13.11
Kenaf	153	5.55	-127	4.72
Sugarcane	8,731	0.19	1,346	0.39
Kaew mango	748	n.a.	1,131	4.70
Namdokmai mango	385	n.a.	2,891	17.79
Longan	302	n.a.	745	16.00
Pomelo	1,440	-	21,600	15.00
Sour tamarind	-	-	1,000	3.00
Cashew nut	360	-	-	10.00
Lichee	-	-	10,000	-
Papaya	2,383	-	-	-
Guava (fresh, juice)	2,493	-	-	-
Melon	2,593	-	3,523	2.59
Shallot	1,834	-	1,034	4.76
Cucumber	4,379	-	5,574	2.00
Babycorn	1,296	-	1,039	2.17
Ginger	1,785	-	8,709	2.50
Sweet potato	1,173	-	1,336	2.50
Chilli	1,000	-	702	3.00
Asparagus	1,000	-	7,038	17.54

Source: Department of Agriculture, Nakhon Ratchasima

Table 12 Thailand's Structure of Agricultural and Agro-Industry Exports, 1985-1990

Exports	1985		1990	
	Volume (ton)	Value - Million Baht	Volume (ton)	Value - Million Baht
Total Exports	-	193,366	-	589,713
Tapioca products	7,088,393	14,969	-	24,465
Fresh or frozen poultry cuts	37,839	1,467	138,945	7,590
Canned fish	102,944	5,204	317,741	21,623
Sugar	1,724,377	6,247	2,307,353	17,694
Canned pineapple	192,764	3,292	398,337	5,524
Animal feed ingredients	74,791	605	203,359	3,474
Canned fruit (ex. pineapple)	-	-	72,733	1,707
Pineapple juice	17,000	300	73,680	1,592
Rice products	-	-	103,834	1,495
Jute products	-	-	-	1,428
Molasses	751,656	758	910,020	1,137
Canned vegetable (ex corn & bean)	-	-	42,298	852
Canned bamboo shoots	-	-	42,639	693
Fruit (dried, preserve in sugar)	-	-	166,624	675
Sauces & preservation	29,000	600	24,157	666
Vegetable	-	-	34,010	568
Canned baby corn	-	-	26,795	537
Fruit juices (ex. pineapple)	-	-	7,120	202

Table 13 Output and Employment in the Study Area in Agro-Industry Product Lines (1992-2010)

Product Lines	Output (Tons)			Employment (No. of Workers)		
	Output in 1990	Incremental Ouput	Output in 2010	Emp. in 1992	Incremental Emp. (1992-2010)	Emp. in 2010
Milk (Dairy)	56,440	323,560	380,000	429	2,167	2,596
Meat Processing	287,872	937,023	1,224,795	679	7,808	8,487
Swine/pork	51,477	85,023	136,500			
Beef/veal	52,534	176,000	228,534			
Poultry						
Layers/eggs	35,000	59,000	94,000			
Broilers	184,000	676,000	860,000			
Fruit and Vegetable Proc.		250,000		2,987	1,667	4,654
Concentrate Feed	642,000	4,058,000	4,700,000	367	2,686	3,053
Vegetable Oil	64,000	55,040	119,040	576	2,895	3,471
Bakery Products				1,202	480	1,682
Sugar	105,600	85,100	190,700	1,200	4,800	6,000
Cassava Starch		100,000		11,554	4,285	15,839

Table 14 Value of Present and Projected Output (Million Baht)

Product Lines	Ex-factory Price (Baht/kg)	Present Production Value (1990)	Incremental Output (1990-2010)	Output Value -2,010
Fresh milk and dairy products (milk equivalent)	16	903	5,177	6,080
Red meat	35	3,640	9,136	12,776
Poultry meat	30	5,512	20,280	25,792
Canned fruit	17	-	3,787	3,787
Animal feed	4	2,568	16,232	18,800
Vegetable oils	25	1,600	1,376	2,976
Sugar and products of sugar	10	1,056	850	1,907
Cassava starch	6	-	6,000	6,000
Total		**15,279**		**78,118**

Table 15 Ago-Industry Enterprises in the Study Area which were Registered with the Ministry of Industry (1/3) (as of June 1992)

	Nakhon Ratchasima		Prachin Buri		Nakhon Nayok		Ubon Ratchathani		Buri Ram		Si Sa Ket		Surin		Yasothon		Mukdahan		Total Study Area	
	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers
I. Livestock products processing																				
1. Slaughtering	7	80					1	12			1	5	12						21	97
2. Processing of meat	2	12					1	20					17						20	32
3. Instant products of meat & lard	34	456	3	6			12	79	2	24			7	5	1	8	7	22	66	600
4. Meat packaging			5	21															5	21
5. Others	1	7																	1	7
Sub total	**44**	**555**	**8**	**27**			**14**	**111**	**2**	**24**	**1**	**5**	**36**	**5**	**1**	**8**	**7**	**22**	**113**	**757**
II. Processing of dairy products																				
1. Pasturized or sterilized milk	6	142																	6	142
2. Milk products of powder or butter																				
3. Auromatic milk																				
4. Cream production																				
5. Liquid butter & cheese	4	34																	4	34
6. Ice cream	15	98	3	34	6	46	6	53	5	20	14	104	1	2	3	14	2	8	55	379
Sub total	**25**	**274**	**3**	**34**	**6**	**46**	**6**	**53**	**5**	**20**	**14**	**104**	**1**	**2**	**3**	**14**	**2**	**8**	**65**	**555**
III. Fruit and vegetable processing																				
1. Fruit and vegetable canning	3	305	39	1,977			1	430	2	74					1	160			46	2,946
2. Dehydrated or cooked fruits & vege	6	50			1	172			1	2			3	30			1	16	12	270
3. Others											1	300	1	5					2	305
Sub total	**9**	**355**	**39**	**1,977**	**1**	**172**	**1**	**430**	**3**	**76**	**1**	**300**	**4**	**35**	**1**	**160**	**1**	**16**	**60**	**3,521**
IV. Seafood processing																				
1. Seafood canning			1	5			1	5	1	36									3	46
2. Smoked or cooked seafood	8	109									1	45							9	154
Sub total	**8**	**109**	**1**	**5**			**1**	**5**	**1**	**36**	**1**	**45**							**12**	**200**
V. Vegetable and animal oil production																				
1. Crude vegetable & animal oil produ	1	205							1	14					2	175			4	394
2. Oil presses	2	100	1	110					1	60	1	15	1	7					6	292
3. Hydrogenation plants																				
4. Oil refining																				
5. Margarine or mixed oil for cooking																				
Sub total	**3**	**305**	**1**	**110**					**2**	**74**	**1**	**15**	**1**	**7**	**2**	**175**			**10**	**686**
VI. Grain milling products																				
1. Rice mills	1,301	2,090	235	860	58	307	532	1,409	1,133	3,064	1,524	2,539	975	1,843	337	620	184	414	6,279	13,146
2. Flour production	18	1,223	1	106							1	42							20	1,371
3. Grain milling	2	9					1	8			1	48	1	7					5	72
4. Production of grain products	4	98									1	30							5	128
5. Mixed flour or grain processing	1	30																	1	30
6. Cassava processing	746	6,508	299	2,134			49	432	210	1,180	95	634	37	371	34	177			1,470	11,436
Sub total	**2,072**	**9,958**	**535**	**3,100**	**58**	**307**	**582**	**1,849**	**1,343**	**4,244**	**1,622**	**3,293**	**1,013**	**2,221**	**371**	**797**	**184**	**414**	**7,780**	**26,183**

Table 15 Ago-Industry Enterprises in the Study Area which were Registered with the Ministry of Industry (2/3) (as of June 1992)

	Nakhon Ratchasima		Prachin Buri		Nakhon Nayok		Ubon Ratchathani		Buri Ram		Si Sa Ket		Surin		Yasothon		Mukdahan		Total Study Area	
	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers
VII. Bakery products																				
1. Cake & bread	24	259	1	9			6	58	2	21			7	24	1	5			41	376
2. Dry bread, fried bread	5	49	1	2					1	6	1	42							8	99
3. Noodles, rolls, etc.	27	460	9	33	6	33	13	80	8	97	7	34	10	66	3	66	2	30	85	899
Sub total	56	768	11	44	6	33	19	138	11	124	8	76	17	90	4	71	2	30	134	1,374
VIII Sugar products																				
1. Syrup					2	10													2	10
2. Brown sugar	8	231							5	39			2	34					15	304
3. Raw sugar	3	50							1	140							1	86	5	276
4. Refined sugar																				
5. Powder or cube sugar																				
6. Glucoze, Dextroze	1	50																	1	50
Sub total	12	331			2	10			6	179			2	34			1	86	23	640
IX. Tea, coffee & confectionaries																				
1.					1	124													1	124
2. Instant coffee	1	20															2	8	3	28
3.																				
4.																				
5.																				
6.																				
7. Chewing gum																				
8. Candy & Toffee															1	2			1	2
9.																				
10.																				
11. Toffee	16	98	3	34	6	46	6	53	5	19	14	144	1	2	3	14			54	410
Sub total	17	118	3	34	7	170	6	53	5	19	14	144	1	2	4	16	2	8	59	564
X. Food NEC																				
1. Baking powder																				
2. Flavoring extracts			1	5			1	20			1	3							3	28
3.																				
4.																				
5.																				
6.																				
7.																				
8. Sauces	2	7																	2	7
9.																				
Sub total	2	7	1	5			1	20			1	3							5	35
XI. Ice factories																				

Table 15 Ago-Industry Enterprises in the Study Area which were Registered with the Ministry of Industry (3/3) (as of June 1992)

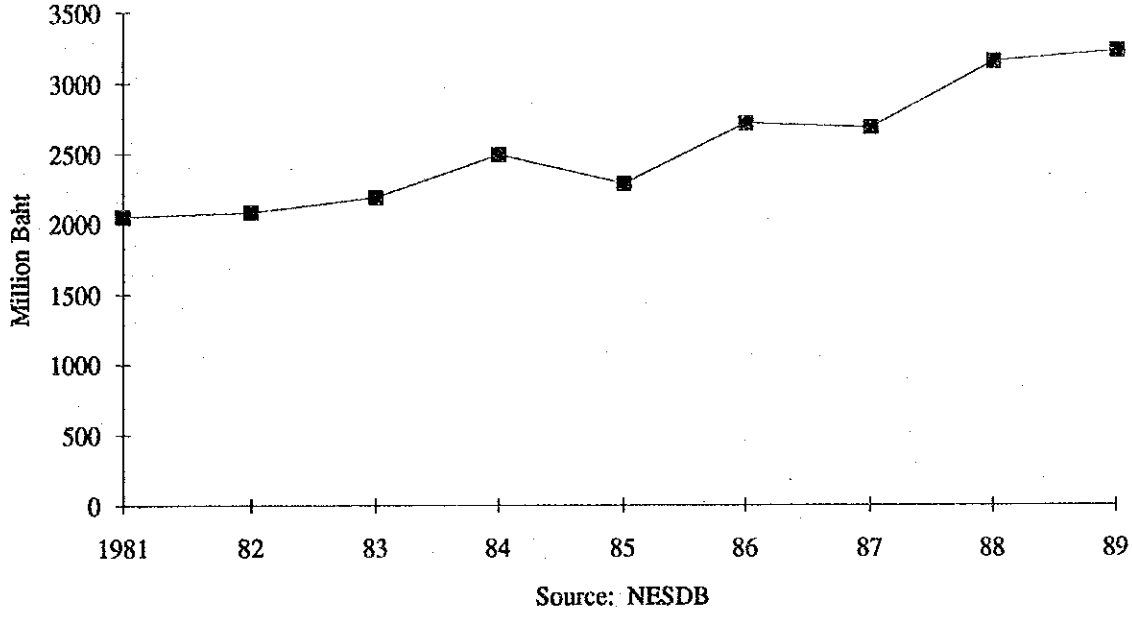
	Nakhon Ratchasima		Prachin Buri		Nakhon Nayok		Ubon Ratchathani		Buri Ram		Si Sa Ket		Surin		Yasothon		Mukdahan		Total Study Area	
	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers	Factories	Workers
XII. Animal feed																				
1. Pet & fish feed																				
2. Other concentrate feed	23	342	1	10			1	15											25	367
Sub total	23	342	1	10			1	15											25	367
XIII Non-alcoholic beverages																				
1. Water bottling	5	56					2	31			1	6	1	6					9	99
2. Soft drinks			2	15	1	8													3	23
3. Water bottling (Mineral)	1	229																	1	229
4. Others	1	15																	1	15
Sub total	7	300	2	15	1	8	2	31			1	6	1	6					14	366
OVERALL TOTAL	2,278	13,422	605	5,361	81	746	633	2,705	1,378	4,796	1,664	3,991	1,076	2,402	386	1,241	199	584	8,300	35,248

Source: Ministry of Industry, Department of Industrial Economics (June 1992). Selective information obtained from the Ministry of Interior, Ministry of Agriculture and Professional Associations have been added to the base data.

Figures

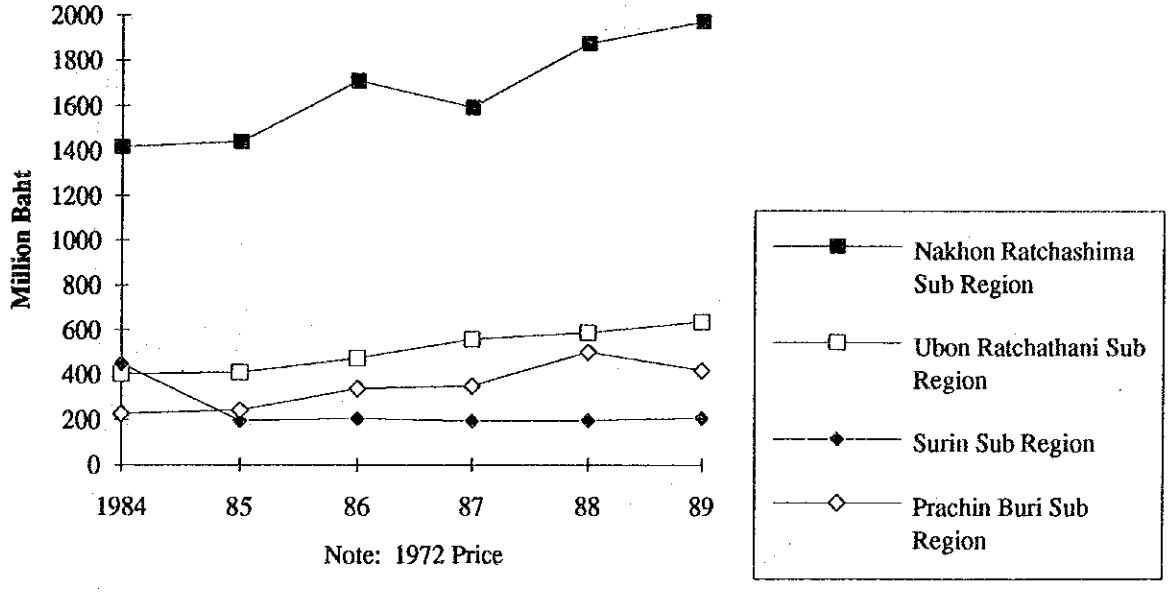
Figure 3.1 Trends of Industrial and Manufacturing Production in the Study Area

(a) Industrial Production



Source: NESDB

(b) Manufacturing Production



Note: 1972 Price

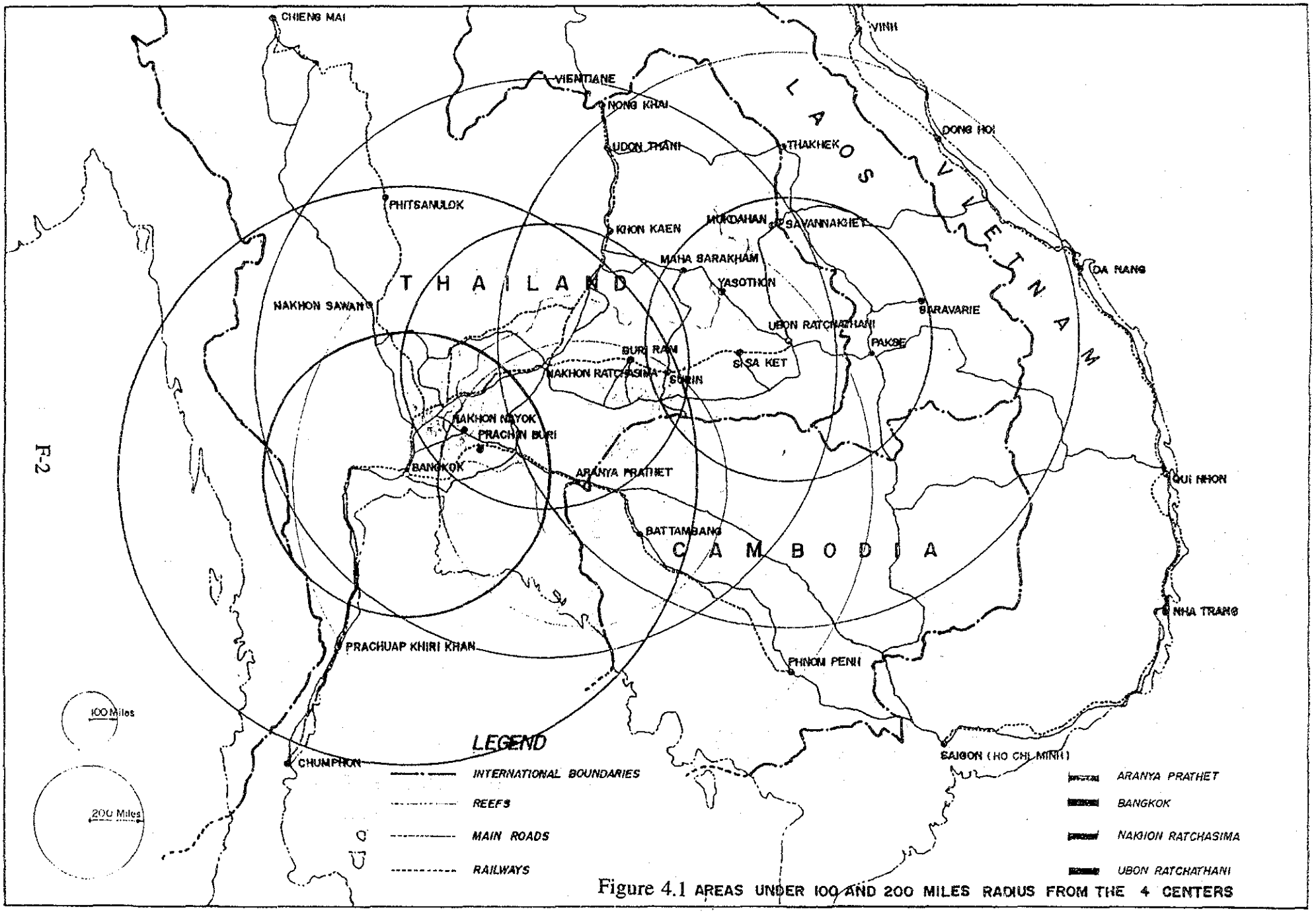


Figure 4.1 AREAS UNDER 100 AND 200 MILES RADIUS FROM THE 4 CENTERS

Amphoe Code

Nakhon Nayok

N-1	Muang
N-2	Ban Na
N-3	Ongkharak
N-4	Pagpli

Prachin Buri

P-1	Muang
P-2	Kabin Buri
P-3	Sa Kaeo
P-4	Si Mahaphot
P-5	Wang Nam Yen
P-6	Watthana Nakhon
P-7	Prachantakham
P-8	Ta Phraya
P-9	Aranyaprathet
P-10	Na Di
P-11	Khok Pip
P-12	Ban Sang
P-13	Klong Hat Sub District

Nakhon Ratchasima

NR-1	Muang
NR-2	Pak Chong
NR-3	Pak Thong Chai
NR-4	Sikhiu
NR-5	Chakkarat
NR-6	Bua Yai
NR-7	Dan Khun Thot
NR-8	Phimai
NR-9	Khon Buri
NR-10	Chok Chai
NR-11	Nong Bun Nak
NR-12	Kham Thale So
NR-13	Sung Noen
NR-14	Soeng Sang
NR-15	Chum Phuang
NR-16	Non Thai
NR-17	Huai Thalaeng
NR-18	Non Sung
NR-19	Pra Thai
NR-20	Khong
NR-21	Kham Sakae Saeng
NR-22	Kaeng Sanam Nang
NR-23	Non Daeng
NR-24	Ban Luam

Buri Ram

B-1	Muang
B-2	Lahan Sai
B-3	Nang Rong
B-4	Nong Ki
B-5	Ban Kruat
B-6	Sa Tuk
B-7	Khu Muang
B-8	Prakhon Chai
B-9	Phutthaisong
B-10	Pa Kham
B-11	Lam Plai Mat
B-12	Krasang
B-13	Nong Hong
B-14	Na Pho
B-15	Plub Pla Chai
B-16	Huai Rat
B-17	Non Suwan

Surin

SR-1	Muang
SR-2	Prasat
SR-3	Chom Pra
SR-4	Rattanaburi
SR-5	Sikhoraphum
SR-6	Sangkha
SR-7	Tha Tum
SR-8	Chumphon Buri
SR-9	Lamduan
SR-10	Sanom
SR-11	Kab Choeng
SR-12	Bua Chet
SR-13	Samrong Thap

Si Sa Ket

S-1	Muang
S-2	Kantharalak
S-3	Khun Han
S-4	Khukhan
S-5	Utumphon Phisai
S-6	Kanthararom
S-7	Sri Ratana
S-8	Phrai Bung
S-9	Phrang Ku
S-10	Rasi Salai
S-11	Non Khun
S-12	Yang Chum Noi
S-13	Bung Bun
S-14	Huai Thap Than
S-15	Nam Kliang
S-16	Wang Hin
S-17	Phu Singh

Ubon Ratchathani

U-1	Muang
U-2	Warin Chamrap
U-3	Amnat Charoen
U-4	Det Udom
U-5	Nam Yun
U-6	Chanuman
U-7	Phibun Mangsahan
U-8	Trakan Puetphon
U-9	Khemarat
U-10	Muang Samsip
U-11	Hua Taphan
U-12	Samrong
U-13	Khuang Nai
U-14	Phana
U-15	Khong Chiam
U-16	Si Muang Mai
U-17	Senangkhanikhom
U-18	Kut Khaopum
U-19	Pho Sai
U-20	Buntharik
U-21	Na Chaluai

Mukdahan

M-1	Muang
M-2	Nikhom Kham Soi
M-3	Khamcha-I
M-4	Dong Luang
M-5	Don Tan
M-6	Nong Sung Sub District
M-7	Wan Yai Sub Disctrict

Yasothon

Y-1	Muang
Y-2	Loeng Nok Tha
Y-3	Kut Chum
Y-4	Kham Khuan Kaeo
Y-5	Pa Tiu
Y-6	Kho Wang
Y-7	Maha Chana Chai
Y-8	Sai Mun

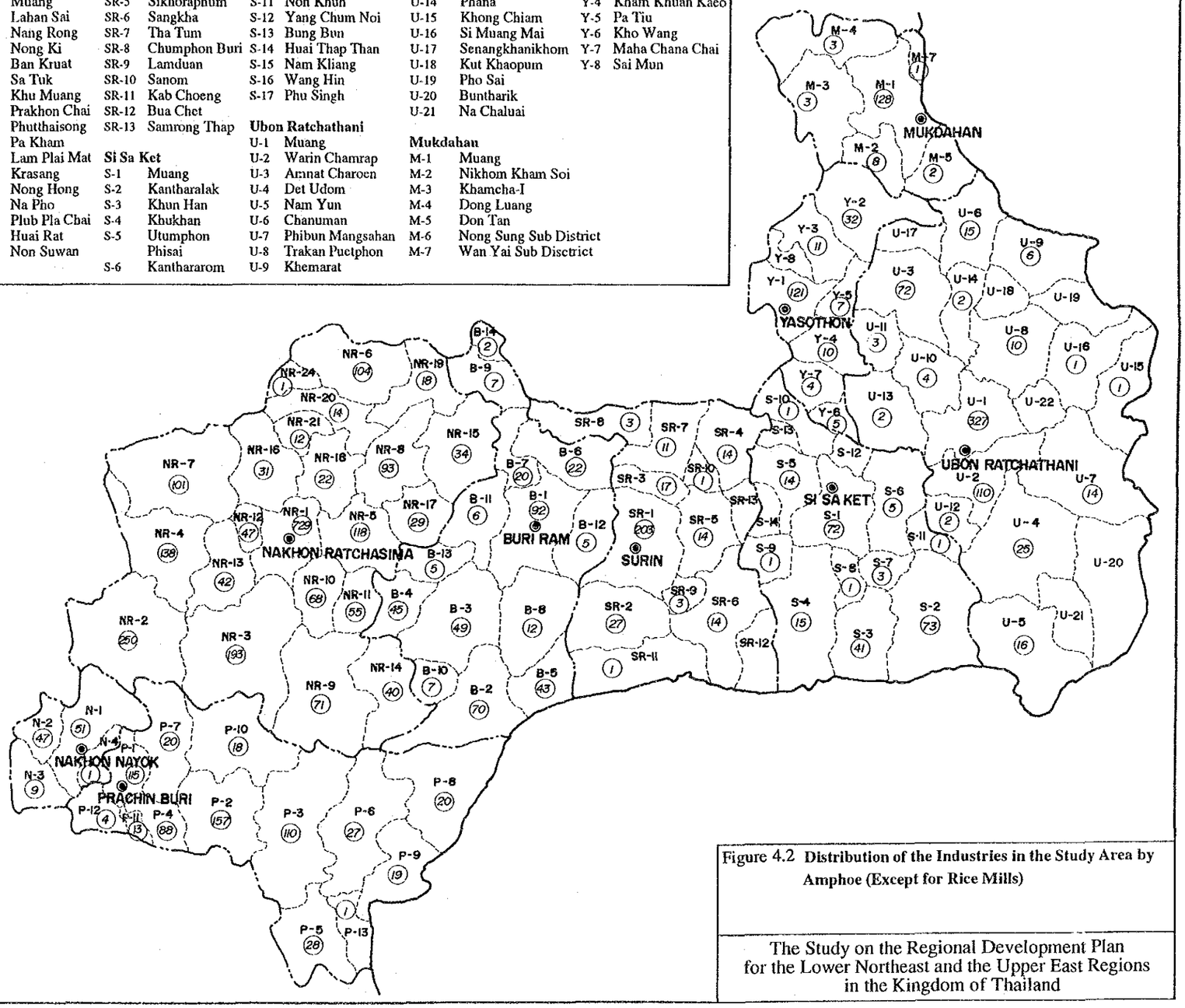


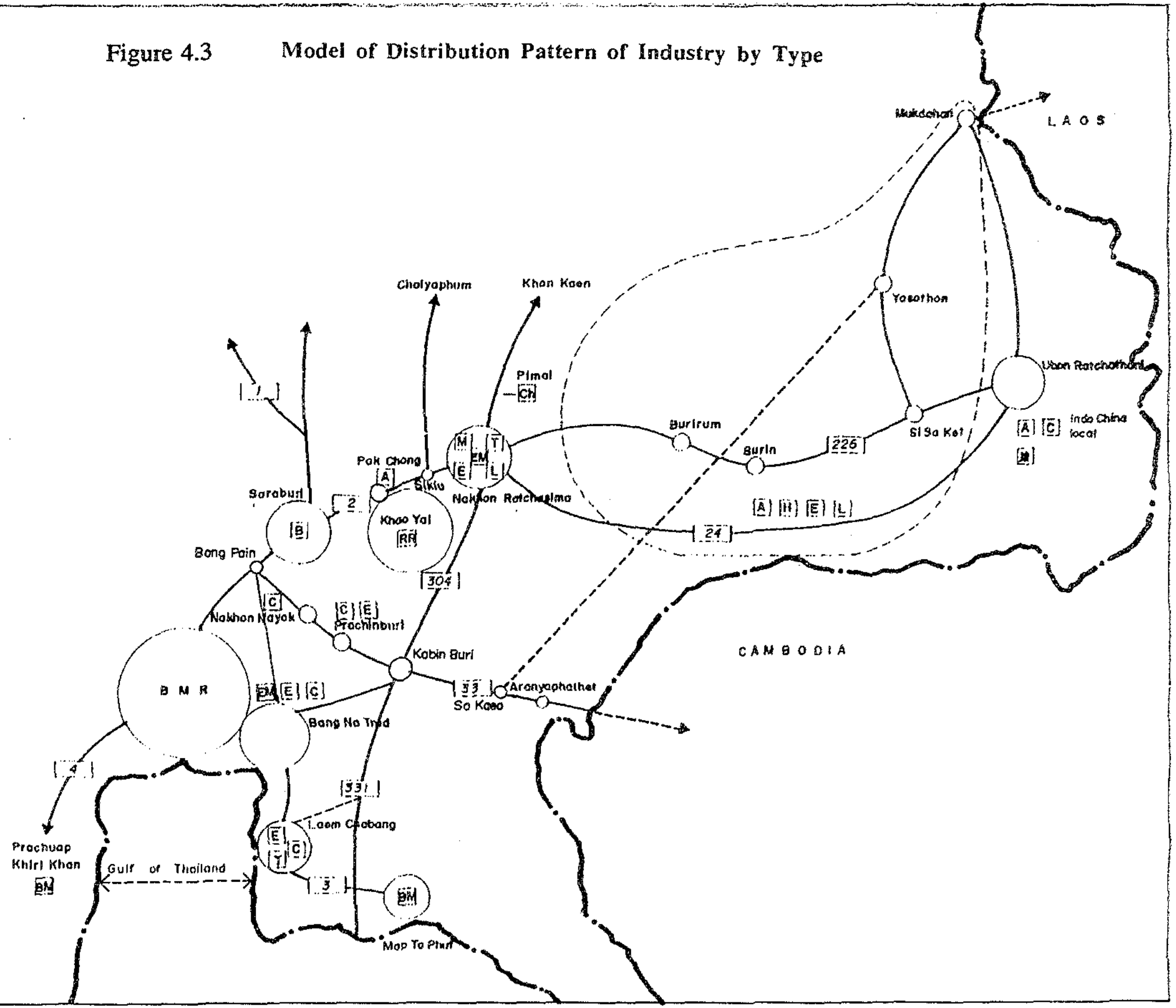
Figure 4.2 **Distribution of the Industries in the Study Area by Amphoe (Except for Rice Mills)**

The Study on the Regional Development Plan
for the Lower Northeast and the Upper East Regions
in the Kingdom of Thailand

Figure 4.3 Model of Distribution Pattern of Industry by Type

Legend

- Building materials industries	B
- Metal-working industries	M
- Transportation machinery industries	T
- Agro-industries	A
- Handicraft	H
- Consumer related industries	C
- Chemical industry	CH
- Electrical machinery	EM
- Local resources based	L
- Export oriented industries	E
- Basic materials industries	BM
- Research and recreation	RR



APPENDIX A

RESULT OF THE SURVEY CONDUCTED BY THE CHULA UNISEARCH

APPENDIX A

RESULT OF THE SURVEY CONDUCTED BY THE CHULA UNISEARCH

A.1 Introduction

In order to supplement the official statistical data from the governmental agencies concerning the current activities of manufacturing industry in the Study Area, the Study Team subcontracted a manufacturing survey to the Chula Unisearch, an attached research unit of the Chulalongkorn University in March, 1992. Information requested under the survey are as follows.

1. Background of the entrepreneurs
2. Production and input utilization
3. Marketing
4. Problems encountered by the industrial plants
5. Prospects of business
6. Kind of improvement needed from the government

The survey team initially targeted about 2% of samples by type and location of factories in consultation with the provincial industrial officers. Due to the time constraints, the following three provinces, Si Sa Ket, Mukdahan, and Nakhon Nayok were excluded from the survey for there are no significant activities.

Finally 142 companies accepted interviews with the survey team which was arranged by the concerned provincial industrial officers. Breakdown of the factories interviewed by Changwat and type of industry is as follows.

		Factories	%
1.	Nakhon Ratchasima	100	70.4
2.	Ubon Ratchathani	12	8.5
3.	Surin	18	12.7
4.	Buri Rum	2	1.4
5.	Prachin Buri	9	6.3
6.	Yasothon	1	0.7
		142	100
1.	Food	87	61.3
2.	Textile	10	7.0
3.	Paper	1	0.7
4.	Plastic	1	0.7
5.	Construction materials	17	12.0
6.	Metal	6	4.2
7.	Others	20	14.1
		142	100

A.2 General findings

Though the sample of Nakhon Ratchasima happened to be much higher than the actual share in the number of manufacturing establishment in the SA, the share by

activity seems to reflect the current composition. However, the sizes of company of the sample are considered to be above the average judging from the dependency on the local market of 33%. According to the study by Grandstaff,[1] those local industries with less than 20 workers and or having up to 3 million baht of invested capital, are selling 80-100% of their outputs within the provinces where they are located.

The average enterprise has invested 1-10 million baht and employs about 20 to 30 workers. The entrepreneur has higher education of either secondary or college and succeeded family business or spinned off from other business. About 40% of them started their business in the last 5 years. Their monthly sales is less than 1 million baht and their main inputs are agricultural products. Their views for future business prospects are of mixed. The main problems they face now are concessional loan, water supply, skilled labor and telecommunication facilities.

A.3 Results of survey

(1) Registered capital, investment, number of technicians and workers

As shown in Table 3.5 and 3.6, approximately 65% of the industrial firms in the survey have registered capital of less than 10 million baht and 60.5% of the firm have invested 1 - 10 million baht. Though the definition of technicians varies among the firms, 56.3% or 80 firms have no more than 3, of which 23 firms do no have technicians. As to the number of workers, 61.2% or 87 firms have no more than 30 persons.

1) The Role of Demand in Provincial Industrialization, TDRI, 1990.

Table A.1 Registered Capital and Total Investment in the Surveyed Firms

Registered Capital & Total Investment	Nakhon Ratchasima		Ubon Ratchathani + Yasothon + Buri Ram		Surin		Prachinburi		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Registered Capital										
1. less than 1 M.B.	21	21.0	2	13.3	5	27.8	1	11.1	29	13.4
2. between 1-10 M.B.	50	50.0	8	53.3	11	61.1	4	44.4	73	51.4
3. between 11-50 M.B.	21	21.0	4	26.7	-	-	4	44.4	29	20.4
4. more than 50 M.B.	4	4.0	-	-	2	11.1	-	-	6	4.2
5. not available	4	4.0	1	6.7	-	-	-	-	5	3.5
Total	100	100.0	15	100.0	18	100.0	9	100.0	142	100.0
2) Total Investment										
1. less than 1 M.B.	6	6.0	1	6.7	4	22.2	-	-	11	7.7
2. between 1-10 M.B.	57	57.0	9	60.0	6	33.3	3	33.3	75	52.8
3. between 11-50 M.B.	26	26.0	2	13.3	6	33.3	5	55.6	39	27.5
4. more than 50 M.B.	10	10.0	1	6.7	2	11.1	1	11.1	14	9.9
5. not available	1	1.0	2	13.3	-	-	-	-	3	2.1
Total	100	100.0	15	100.0	18	100.0	9	100.0	142	100.0

Source: Survey

Table A.2 Number of Technicians and General Workers in the Industrial Firms

Technicians/ General Workers	Nakhon Ratchasima		Ubon Ratchathani + Yasothon + Buri Ram		Surin		Prachinburi		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Technicians										
1.1 none	12	12.0	6	40.0	4	22.2	1	11.1	23	16.3
1.2 between 1-3 persons	39	39.0	6	40.0	10	55.6	2	22.2	57	40.0
1.3 between 4-5 persons	7	7.0	2	13.3	2	11.1	-	-	11	7.7
1.4 more than 5 persons	24	24.0	1	6.7	2	11.1	6	66.7	33	23.3
1.5 not available	18	10.0	-	-	-	-	-	-	18	12.7
Total	100	100.0	15	100.0	18	100.0	9	100.0	142	100.0
2) Workers										
2.1 between 1-10 persons	25	25.0	2	13.3	7	38.9	1	11.1	35	24.6
2.2 between 11-30 persons	37	37.0	8	53.3	6	33.3	1	11.1	52	36.6
2.3 between 31-50 persons	11	11.0	-	-	1	5.6	2	22.3	14	9.9
2.4 between 51-100 persons	5	5.0	1	6.7	1	5.6	-	-	7	4.9
2.5 more than 100 persons	16	16.0	4	26.7	2	11.1	4	44.4	26	18.3
2.6 not available	6	6.0	-	-	1	5.6	1	11.1	8	5.6
Total	100	100.0	15	100.0	18	100.0	9	100.0	142	100.0

Source: Survey

(2) Educational and career background of the entrepreneurs

A 56.3% or 76 entrepreneurs have educational background at secondary educational level and lower. Most of them were once employees in the same line of industries and have developed skillfulness in production process. It is interesting that 45.1% of entrepreneurs engaged in other business before turning to the existing business and whose educational backgrounds are generally higher in level than the category of entrepreneurs mentioned in the first place.

Table A.5 Educational Background

	Educational Background	No.	%
1)	Non-formal eduction	12	8.5
2)	Primary education	25	17.6
3)	Secondary education	39	27.5
4)	Bachelor degree	42	29.6
5)	Master degree	5	3.5
6)	Vocational/technicians	11	7.7
7)	Others (such as diploma)	5	3.5
8)	Not available	3	2.1
	Total 142	100.0	

Source: Survey

Table A.4 Career Background

	Career Background	No.	%
1)	Employee in the same industry	10	7.0
2)	Employee in the other different industry	5	3.5
3)	Employee in the related industries	12	8.5
4)	Work in the family-owned industries	32	22.5
5)	Engaged in other business	64	45.1
6)	Other		
	a. government	2	1.4
	b. farmers	1	.7
	c. trader	9	6.3
7)	Not available	7	4.9
	Total 142	100.0	

Source: Survey

(3) Factors for choosing the present location of the factory

There are several factors considered by the entrepreneurs for location of their factories. Table 3.9 shows that accessibility to the supply sources of raw materials is counted as the most important factors. The second is availability of their own land

and the third is accessibility to labor supply. These three reasons represent 70% of the answers.

Table A.5 Location Factors Considered

	Location Factors	No.	%
1)	Accessibility to the sources of raw materials	71	36.5
2)	Availability of own land	39	20.1
3)	Accessibility to labor supply	26	13.4
4)	Sufficient infrastructure	17	8.8
5)	Accessibility to the markets	14	7.2
6)	Wish to locate in industrial estate	10	5.2
7)	Unspecified reasons	10	5.2
8)	Cheap land price	7	3.6
	Total	194	100.0

Source: Survey
Note: Due to multiple answers, the tally is more than 142

(4) Years started operation

Approximately 40% of the factories started their operation during the last five (5) years. Those firms established before 1968 are mainly rice millers, tapioca processors and small metal working plants. Details are shown in Table 3.10.

(5) Reasons for investing in the existing industries

Majority (54%) of the firms invested in the existing industries as they have experiences in those particular industries. However 18% of the entrepreneurs entered into the existing business from the different business background. Most of them were motivated by higher potential of business which were either found by themselves or recommended or persuaded by someone else. Details are shown in Table 3.11.

(6) Sales

As shown in Table 3.12, 52% or 75 firms fall on the category of monthly sales of less than one (1) million baht.

Table A.6 Years of Started Operation of the Industrial Plants in the Survey

Year of Started Operation	Nakhon Ratchasima		Ubon Ratchathani + Yasothon + Buri Ram		Surin		Prachinburi		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Before 1957	-	-	-	-	-	-	-	-	-	-
2) 1957 - 1967	15	15.0	2	13.3	1	5.6	-	-	18	12.7
3) 1968 - 1977	13	13.0	3	20.0	4	22.2	-	-	20	14.1
4) 1978 - 1986	31	31.0	2	13.3	7	38.9	1	11.3	41	28.9
5) 1987 - 1992	34	34.0	8	53.4	6	33.3	8	88.9	56	39.4
6) Not Available	7	7.0	-	-	-	-	-	-	7	4.9
Total	100	100.0	15	100.0	18	100.0	9	100.0	142	100.0

Source: Survey

Table A.7 Reasons for Investing in the Present Industries

Reasons for Investing in the Present Business (Industries)	Nakhon Ratchasima		Ubon Ratchathani + Yasothon + Buri Ram		Surin		Prachinburi		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) High profitability	9	8.3	1	6.7	-	-	-	-	10	6.7
2) Have background experience in the business	57	52.8	7	46.7	10	55.6	7	77.8	81	54.0
3) Have been pursuaded by those in the industry	21	19.4	3	2.0	2	11.1	1	11.1	27	18.0
4) Few manufacturers are engaged in the business	13	12.0	2	13.4	3	16.7	1	11.1	19	12.7
5) Have been challenged by the business	1	0.9	-	-	2	11.1	-	-	3	2.0
6) Desire to manufacture new product	1	0.9	1	6.7	-	-	-	-	2	1.3
7) Have been granted a concessionaire	1	0.9	1	6.7	-	-	-	-	2	1.3
8) Desire to expand the project	3	2.8	-	-	-	-	-	-	3	2.0
9) Have already acquired land	2	1.8	-	-	1	5.5	-	-	3	2.0
Total	108	100.0	15	100.0	18	100.0	9	100.0	150	100.0

Source: Survey

Table A.8 Sales per Month of the Industrial Firms in the Survey

Sale/Month (M.B.)	Nakhon Ratchasima		Ubon Ratchathani + Yasothon + Buri Ram		Surin		Prachinburi		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Less than 500,000 Baht	28	28.0	7	46.7	8	44.4	1	11.1	44	31.0
2) Between 500,000 - 1,000,000 Baht	20	20.0	3	20.0	5	27.8	3	33.3	31	21.8
3) Between 1,000,000 - 3,000,000 Baht	20	20.0	1	6.7	1	5.6	5	55.6	27	19.0
4) Between 3,000,000 - 5,000,000 Baht	9	9.0	-	-	3	16.7	-	-	12	8.4
5) Between 5,000,000 - 10,000,000 Baht	1	1.0	1	6.7	-	-	-	-	2	1.4
6) More than 10,000,000 Baht	2	2.0	2	13.4	-	-	-	-	4	2.8
7) Not available	20	20.0	1	6.7	1	5.6	-	-	22	15.6
Total	100	100.0	15	100.0	18	100.0	9	100.0	142	100.0
Average (M.B.)	1.80		9.64		0.67		1.48		3.10	

Source: Survey

(7) Market

A 33% or 47 firms' activities are oriented to the local market. 19 firms sell their products to exporters. Details are discussed under the Sector Report of Trade and Distribution.

(8) Raw materials supply

Agricultural products constitute the highest percentage of 57.7% of total raw materials used in the production of industrial firms in the survey. They comprise rice, tapioca, jute, etc. These materials are supplied by local producers. Parts, components and semifinished materials mainly used by the labor intensive industries and export oriented industries are supplied by traders in Bangkok and or foreign joint venture partners. Details are also discussed under the Sector Report of Trade and Distribution.

(9) Problems encountered by the industrial plants

As Table 3.12 shows, there are 15 kinds of problems pointed out by the firms. Since the number of industrial firms in Nakhon Ratchasima is the largest, their problems encountered by them dominate the overall problems. The first priority problems in Nakhon Ratchasima is shortage of capital funds. This is attributed to the facts that many industrial plants are willing to expand their business or switch to other business as they see opportunities exist. The most serious problem pointed out by the firms in Ubon Ratchathani, Yasothon, Surin and Buri Rum is shortage of labor. This is attributed to continued out migration of younger work forces to other provinces such as Bangkok and their nearby provinces owing to scarcity of job opportunities in their home provinces and more over to the lower wage levels. The minimum wages ruled out by the government for the Study Area is ranging from 80% to 70% of the level of Bangkok but it seems that actual level in practice is lower than the official ones.

Other serious problems are inefficiency of infrastructural facilities, lacks of government supports and quality of labor. Lower level of services in utilities and relatively higher costs of services, inefficient government officials in working as the coordinators between the governments and private enterprises for solution of various problems and scarcity of skilled workers are considered as key issues.

(10) Prospect of business

As shown in Table 3.14, one fourth of the firms have confidence in their future business and they believe that liberalization of industries will encourage the efficiency of Thai industries. A little less than one fourth of the firms have either negative prospects or no idea for their future prospects. Most of them operate in small scale and are afraid of competition with those in the central region. This group needs special attention by the government.

Table A.9 Problems Encountered by Industrial Plants in the Surveyed Area

Problems Encountered by Firms	Nakhon Ratchasima (100 firms)	Ubon Ratchathani + Yasothon + Buri Ram (15 firms)	Surin (9 firms)	Prachinburi (15 firms)	Overall (142 firms)	Ranking
1) Insuffiiency of utility facilities	179	26	18	69	292	2
2) Poor conditions of road for transportation	62	9	10	17	98	7
3) Labour shortages	148	37	30	47	262	4
4) Firm's locations have created problems	39	7	-	19	65	10
5) Rising cost of land	47	5	6	-	58	10
6) Low skills of labour force	187	31	15	10	243	5
7) Shortage of fund	224	27	19	37	307	1
8) Lacks of Government's supports	206	26	15	33	280	3
9) Problems related to marketing	166	13	6	19	204	6
10) Shortages of raw materials	53	12	12	5	82	9
11) Quality of raw materials	68	12	1	15	96	8
12) Technical know-how	31	4	-	4	39	12
13) Bureaucratic red-tape	19	-	3	-	22	13
14) Wage rates are too high	48	-	-	-	48	11
15) Others (unspecified)	11	-	-	-	11	14

Source: Point calculated from the weighted score, according to priorities

Table A.10 Prospects of Business

Prospects of Business	Nakhon Ratchasima		Ubon Ratchathani + Yasothon + Buri Ram		Surin		Prachin Buri		Overall	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Good Prospects	27	27.0	4	26.7	2	22.2	3	16.7	36	25.3
2) Stable Prospects	53	53.0	7	46.7	3	33.3	12	66.7	75	52.8
3) Poor Prospects	12	12.0	1	6.6	1	11.2	3	16.7	17	12.0
4) No idea	8	8.0	3	20.0	3	33.3	-	-	14	9.9
Total	100	100.0	15	100.0	9	100.0	18	100.0	142	100.0

Source: Survey

(11) Kind of improvement needed from the governments

Among the various opinions, the major items emphasized by the firms are as follows.

1. Concessional (low interest) loan
   (Nakhon Ratchasima)
2. Regular supply of tap water
   (Ubon Ratchathani, Yasothon, Buri Rum, Surin)
3. Upgrading of skill
   (Prachin Buri and others)
4. Telecommunication system
   (All Changwats)

Details are shown in Table A.11.

Table A.11 Kind of Improvement Needed from the Government

Improvement Needed from the Government	Nakhon Ratchasima (100)	Ubon Ratchathani + Yasothon + Buri Ram (15)	Surin (9)	Prachin Buri (15)	Overall (142)	Ranking
1) Improvement in infrastructure and utility facilities						
1. Tap water	173	44	20	63	300	(2)
2. Road	28	-	-	14	45	(13)
3. Transportation	61	4	5	15	85	(9)
4. Electricity	73	15	12	12	112	(7)
5. Drainage system	76	-	5	3	89	(8)
6. Telecommunication	144	25	20	37	226	(5)
2) Industrial Estates	54	3	8	16	81	(10)
3) Training Centre	220	29	26	23	298	(3)
4) Sources of low-interest fund	257	31	11	27	326	(1)
5) Technical know-how in production	203	14	18	10	245	(4)
6) Provision of marketing information	118	12	3	18	151	(6)
7) Provision of low-prices raw materials	48	11	-	11	70	(11)
8) Provide incentives to keep labour in the provinces	9	30	7	21	67	(12)
9) Improve efficiencies of government's offices	37	-	5	-	42	(13)

Source: Survey