

2) Managerial Policy for the Future (Table 4.5.8-13, Fig. 4.5.8-51)

A table given below excellently shows the important items for the heat treatment industry.

Table 4.5.8-13

Q73-01 Managerial policy for the future

Ranking	Item	%	Number of company
1	Research & Development of Technology	58.8	10/17
1	Expansion of Market Share	58.8	10/17
2	Quality Control	41.2	7/17
2	Training of Workers	41.2	7/17
3	Production Control	35.3	6/17
3	Cost Control	35.3	6/17
4	Productivity	29.4	5/17
5	Research & Development of Product	23.5	4/17

The ranking given above is considered to naturally define the direction in which the heat treatment industry is oriented from now on.

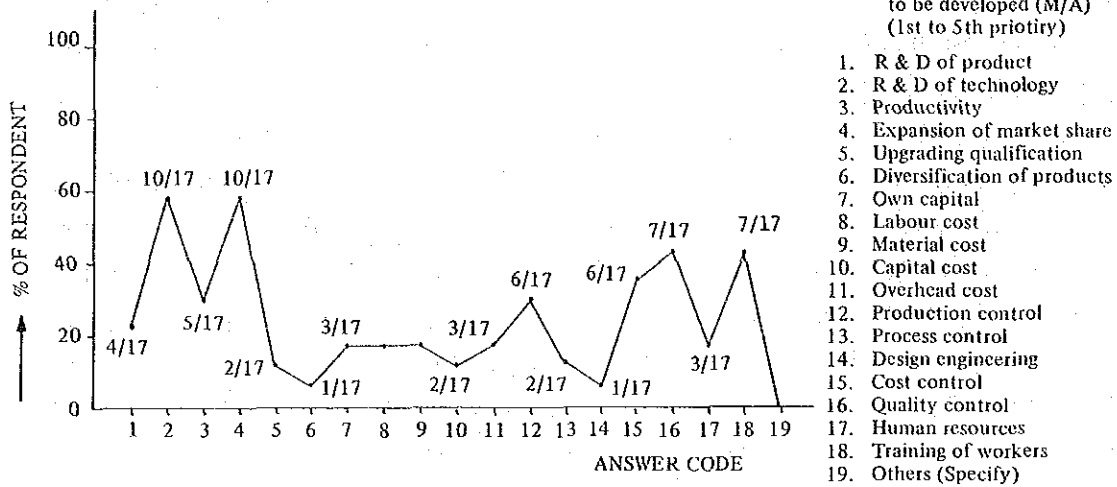
For technology R&D, remarkable progress has been being recently made in heat treatment processes all over the world. Atmosphere heat treatment and vacuum heat treatment, for example, are deemed as those technologies on which the interest of enterprise managers has been concentrated.

The market share will be naturally expanded because the heat treatment industry is part of the production process in the material industry. Coupled with the progressive development of related industries, such as automotive parts, farming machinery parts, mining equipment parts and machine tool parts, the demand is also expected to increase from now on.

Considering that the heat treatment industrial is selling the so-called technical software, it is naturally necessary to attach important to the quality control and to the education and training of employees. Since the heat treatment industry has turned out as an equipment industry, attention should be paid to the newal of equipment from the viewpoints of cost and productivity.

The managerial measures mentioned above could not be taken by a small enterprise independently but would essentially require the guidance and assistance by a public organization.

Fig. 4.5.8-51



Q73 Main management policy to be developed (M/A) (1st to 5th priority)

1. R & D of product
2. R & D of technology
3. Productivity
4. Expansion of market share
5. Upgrading qualification
6. Diversification of products
7. Own capital
8. Labour cost
9. Material cost
10. Capital cost
11. Overhead cost
12. Production control
13. Process control
14. Design engineering
15. Cost control
16. Quality control
17. Human resources
18. Training of workers
19. Others (Specify)

3) Governmental Support and Measures Desired:

a) Measures for Promotion of Heat Treatment Industry in Thailand

To promote the heat treatment industry in Thailand, all of the measures shown in Table 4.5.8-14 will be effective while the Government should positively support the enterprises concerned.

Table 4.5.8-14 (Q74)

Preferable government assistances and assessment of existing ones (M/A) (1st to 5th priority)				1	2	3
				Not useful	Useful	Very useful
Development of infrastructure						
1.	Access road	2/5	2/5	1/5		
2.	Telecommunication		7/9	2/9		
3.	Electric supply		4/7	3/7		
4.	Water supply		7/9	2/9		
5.	Central sewerage treating		3/4	1/4		
6.	Pollution control		5/6	1/6		
Technical/information services by public organization						
11.	Training services	1/10	7/10	2/10		
12.	Consultancy services		3/5	2/5		
13.	Information services	1/12	6/12	5/12		
14.	Testing services	1/8	5/8	2/8		
15.	Laboratory		5/7	2/7		
16.	Standardization National		5/6	1/6		
17.	Quality control		4/7	3/7		
18.	Seminar/symposium		4/5	1/5		
Financial/Marketing support						
Encouraging investment						
21.	Tax rebate and tax exemption			6/11	5/11	
22.	Credit assistance			3/6	3/6	
23.	Subsidy			2/6	4/6	
24.	Marketing			5/7	2/7	
Protection of domestic products						
31.	Import surcharge			5/6		
32.	Import restriction				3/4	
33.	Export promotion				7/7	

Table 4.5.8-15

Q60-1 Have you ever been funded for governmental credit assistance program, i.e. industrial/Finance Corporation? (S)

1. Yes	2. No
Yes 3/17 company	No 14/17 company

b) Examples of Machinery Industry Promotion Measures in Japan

The governmental promotion policy has been significantly contributing to the progress of industries in Japan since 1956. In other words, the measures effectively taken since then are the Provisional Measure Act for Machinery Industry (Machinery Promotion Act) (1956), Provisional Measure Act for Designated Electronics and Machinery Industries (Electromechanical Act, 1971) and Provisional Measure Act for Promotion of Designated Machinery/Information Industries (Machinery/Information Act, 1978). These measures had the objectives of promoting the modernization of industrial equipment, the increase of efficiency and the improvement of industrial engineering and arranging in order the production fields and standards in which small enterprises had been competing disorderly. As a result, Japan could keep up with those countries which had been then developed in such technologies as parts design, industrial engineering, etc. Especially the dispersion of quality and performance and the poor durability of products were improved. In addition, those parts which had been higher than those prevailing in the international market were improved too, resulting in an increase in productivity. Besides, the response to social problems such as safety, pollution, etc. could be intensified.

In the Japanese heat treatment industry, more concretely, heating furnaces were converted (coal-fired furnace → oil-fired furnace and electric or gas heating furnace). Energies were saved. Burners began to be employed. And a conversion to the atmosphere furnace and to the vacuum heat treatment furnace was tried. Moreover, the Governmental measures encouraged Japanese enterprises concerned to employ a variety of material carriers. In terms of manpower, on the other hand, the Japanese Government has established a skill certification system to qualify engineers by job (qualifications through national examinations) in the efforts to raise the level of engineerings while popularizing the system.

For public organizations and institutions, region regional industrial technology centers and occupational training centers have been organized at every part of the nation while striving to improve regional technologies. In addition, managerial centers have been organized on a national level to promote various industries all over the nation.

Examples of these are the Elementary Shape Material Center, Machinery Promotion Association, Automotive Promotion Association, etc.

(7) Environments and Others (Fig. 4.5.8- 52 Fig. 4.5.8- 53and Fig. 4.5.8- 54

Most of the companies (9/17) are located in an industrial area. Nevertheless, as many as three of the seventeen are located in a residential area, too. This should be duly borne in mind. Five of the 17 companies have received complaints in terms of pollution and the remaining twelve have received none. The complaints may be broken down into noise in 2 of the five companies, water in 2 of the five and air in 2 of the five (smoke 1/5 and smell 1/5).

The heating furnace should be changed over to the natural gas furnace in the future from a cost point of view in addition to the electric one.

The Thailand's enterprises scarcely have a plan to move their works. (14/15 companies)

Fig. 4.5.8- 52

Q90-0 What district is your firm situated in? (S)

1. Industrial district
2. Industrial district (customs free zone/free export zone)
3. Commercial area
4. Residential area
5. Not defined

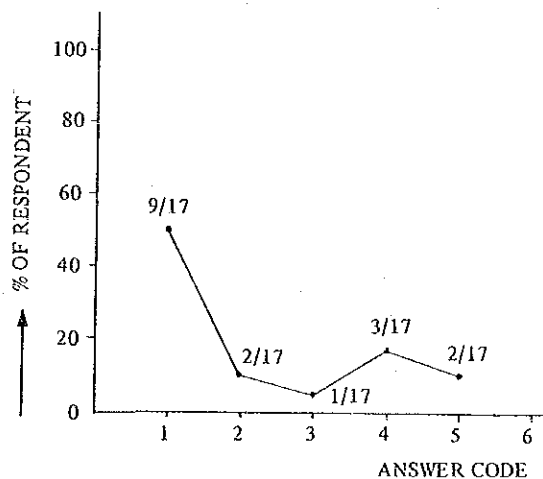


Fig. 4.5.8- 53

Q-90-1 Have you ever got claims of industrial pollution? (S) and What kinds of claims are they? (M)

1. Yes
2. No

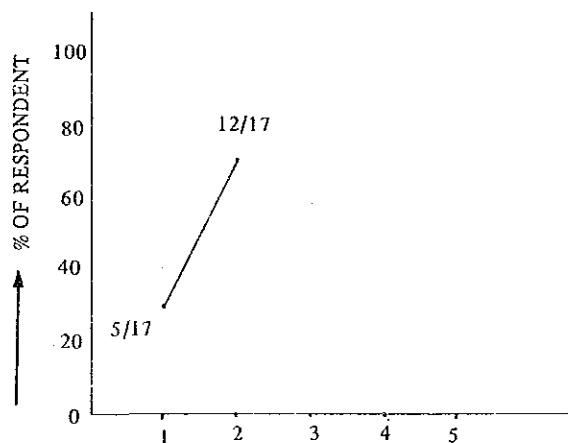
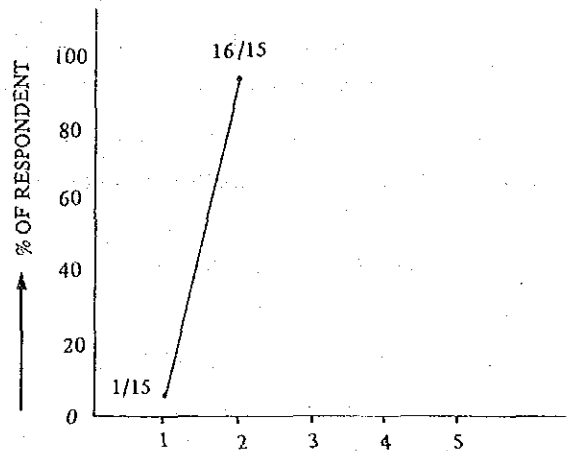


Fig. 4.5.8- 54

Q94-1 Do you have relocation program of your factory? (S)

1. Yes
2. No



(8) Current state of things and promotion of the heat treatment industry

- 1) Current state of affairs of the heat treatment industry of Thailand
 - a. The most popular heat treatment methods in the heat treatment industry of Thailand are annealing, normalizing, hardening and quenching, but other types of heat treatment such as carburizing, nitriding, salt bath treatment, flame hardening, etc., are carried out as well.
 - b. Most of the heat treatment industries of Thailand are engaged in other occupations as well. There are firms dedicated exclusively to heat treatment and also firms whose principal occupation is heat treatment in terms of share.
 - c. The capital is relatively large. Approximately 20% of the firms exceed 16000×10^3 B/Y.
 - d. The turnover is small compared with the capital, but approximately 35% of the firms exceed 16000×10^3 B/Y.
 - e. The plant and equipment have small scale compared with the capital, and they are presumed to be quite primitive.
 - f. Approximately 50% of the firms have more than 50 employees, but it is presumed that approximately 5 to 20 workers are engaged in the heat treatment job.
 - g. The number of years of experience of the workers, the wage, education level and training system are poor but the number of years of experience is relatively long.
 - h. As for the products submitted to heat treatment, automotive parts account for the largest number, and the heat treatment industry of Thailand has the tinge of related industry of the automotive parts industry. Other kinds of products submitted to heat treatment are agricultural parts, mold dies, tools and gears.

- i. As for the equipment of the heat treatment industry, the electric furnace for hardening and quenching and the oil-burning heating furnace are the most popular ones, but the induction heating furnaces, carburizing furnaces, nitriding furnaces and salt bath are used as well. Obsolete facilities such as coke ovens and charcoal ovens of small capacity are also used in some cases.

However, the heat treatment industries are not fitted with finishing equipment.

Approximately 50% of the firms are fitted with simple test and inspection equipment.

- j. As for the production, most of the firms turn out more than 1500 pcs/M. In terms of weight, most of the firms turn out from 100 kg to 2500 kg/M.
The production of carburized products is unexpectedly large.
- k. The possession of measuring, inspection and chemical composition analysis equipment is generally rare. Thermometers are also rare. Furthermore, there are few workers engaged in the heat treatment job.
- l. The sums invested in research & development are small.
- m. There are insufficiencies regarding the quality control system, heat treatment records are rare and the rate of defects after the shipment is high.
- n. Electricity, oil, coke, charcoal, etc., are used as forms of energy for heating. It is advisable to consider the development of heating furnaces using natural gas as fuel, because this is a domestic energy resource available in Thailand.
- o. There are firms whose technical level has already reached the international one.
- p. The domestic market accounts for most of the sales, but there are some exports semi-industrialized countries and industrialized countries.
- q. Cost control and market survey are carried out in a general way but they lack a detailed follow-up.
- r. As for the environment, most of the heat treatment industries of Thailand are located in industrial areas and complaints about pollution are rare but in reality there are some problems regarding pollution of air, water, noise, etc. There is practically no factory removal plan.

2) Promotion of the heat treatment industry

- a. Expansion of the market and increase of the demand

The government and public institutions should consider powerful countermeasures in this connection.

The increase of the demand is the most pressing necessity.

b. Improvement of the production technique

There are some firms of the heat treatment industry of Thailand that succeeded at reaching the international level in terms of production technique, but in reality it is difficult to say that the level of the production technique as a whole is high. The level of the production technique itself is related with the plant and equipment, and it is desirable to consider measures to upgrade the productivity and the quality. For example, firms equipped with thermometer are rare, heat treatment records are insufficient and the percentage of defective products after the shipment is high.

The following countermeasures should be considered in order to solve the said problems.

- ① In the first place the government and public institutions should provide appropriate guidance and aid.
- ② The re-education and training of executives, management people and workers engaged in the heat treatment job is badly needed.

c. Increase and modernization of the production facilities

As a heat treatment industry working principally with automotive parts, its plants and equipment are poor and the production capacity is small. Under the circumstances, it is necessary to select appropriate equipment in conformity with the importance of the parts, and to consider preferential treatment measures related to institutional, financing and tax aspects in order to promote the modernization of this industry.

For example, the adoption of such equipment as electric furnaces (resistance type, inductive heating type), ambient control heat treatment furnaces, vacuum heat treatment furnaces, thermometers, shot blasting equipment, inspection equipment, etc., should be considered in this connection.

Aggressive modernization measures should be considered in order to cope with the development of the automotive parts industry, agricultural machinery, mining machinery and ordinary industrial machinery.

d. Diffusion of control techniques

- ① The diffusion of quality control is not sufficient. The quality control system as a whole must be revised. As things now stand it is difficult to turn out products with stable quality.
- ② In connection with the process control it is indispensable to implement countermeasures to cope with delays in the terms of delivery, and to improve the schedule control.

③ Control of parts and fuel

In the heat treatment industry the correct identification of the quality of the material and the mass of the parts as well as the peculiarities of the fuel exerts decisive influence on the quality. The temperature control is particularly important in this industry, and the heat treatment should be carried out with utmost care in order to prevent fuel from being wasted. In connection with the fuel, it is desirable to consider the development and utilization of natural gas in view of its merits regarding energy saving and cleanliness.

Guide and aid of the government and public institutions are required in connection of the definition and implementation of the basic concepts related to the learning of the aforementioned control techniques, and the re-education and training of the workers should be carried out in conformity with them.

e. Equipment and improvement of the education and training system

It is necessary to re-educate executives, management people and engineers with regard to a wide range of techniques ranging from basic aspects to practical application, focusing principally on modern heat treatment methods, production techniques and control techniques, and it is desirable to have powerful guidance and aid of the government and public institutions in this connection. An example of curriculum to be implemented in the said education and training scheme is shown in the Table (Training Curriculum).

Supervisors and workers should be submitted to training consisting principally of practical techniques.

As for the institutions to take charge of the said training programs, it is desirable to select appropriate national or regional training centers for this purpose.

Furthermore, it is desirable to create a technical skill qualification system at national level for each type of occupation in order to make the technical skill of the workers more authoritative.

Table 4.5.8-16 Example of training curriculum

Item	Class	Training item	Implementation method
1.	Engineer	Heat treatment method Heat treatment plant and equipment Heat treatment design Material and the properties to be submitted to heat treatment Quality control and inspection technique	Training in institutes Training in seminars
2.	Supervisor	Heat treatment design Equipment for heat treatment Metallic materials Heat treatment technology Finishing technique Inspection technique	Training in institutes Travelling seminar and guidance
3.	Worker	Heat treatment work Material heating work Finishing work Inspection work	Training in training center Travelling guidance and in-house training

f. Promotion of standardization

It is necessary to promote the standardization of the parts and metallic materials in order to stabilize and improve the quality and cost.

Powerful guidance of the government and public institutions are indispensable for the success of the said goals.

Standardization is required also in connection with the work, and work standards should be defined for each process. Public institutions should provide guidance and consider measures to encourage the standardization.

g. Diffusion and examination of measuring, test and inspection equipment

Public institutions should provide powerful guidance to complete the heat treatment industries to fit themselves with simple measuring, test and inspection equipment (e.g. thermometer, recorders, color check equipment, hardness meter, etc.). The following alternatives are proposed in connection with more expensive equipment (e.g. material test equipment, chemical composition analysis equipment, non-destructive test equipment, etc.).

- ① To equip them in public institutions and to allow their use by private firms.
- ② To equip them in each region for collective use by the private firms.

Furthermore, the accuracy of the equipment should be inspected and approved periodically by the government or public institutions.

h. Supply of information of various kinds

The government and public institutions should supply domestic and overseas information about technical matters, marketing, etc., to the private firms. This is an important part to be played by the government and public institutions, and a powerful and aggressive attitude is required in this connection. Powerful support of the government and public institutions is required particularly in connection with marketing, because otherwise the promotion of the heat treatment industry will be impossible.

i. Encouragement of R&D activities

The government and public institutions should carry out powerful R&D in connection with processes, in order to provide appropriate guidance and aid to the private firms. On the other hand, R&D activities of the private sector should be encouraged by considering the creation of a system to reward inventions and other kinds of appropriate measures. A plausible alternative in this connection is the acceptance of suggestions of the private sector by public institutions for commissioned research and test. The use of natural gas as fuel of heating furnances of the heat treatment industry is an issue to be considered with priority by the government and public institutions, because it will contribute to reduce the consumption of imported fuel, making it possible to use domestic energy resources, and contributing furthermore to the control of pollution and improvement of the environment thanks to its peculiarities as clean fuel.

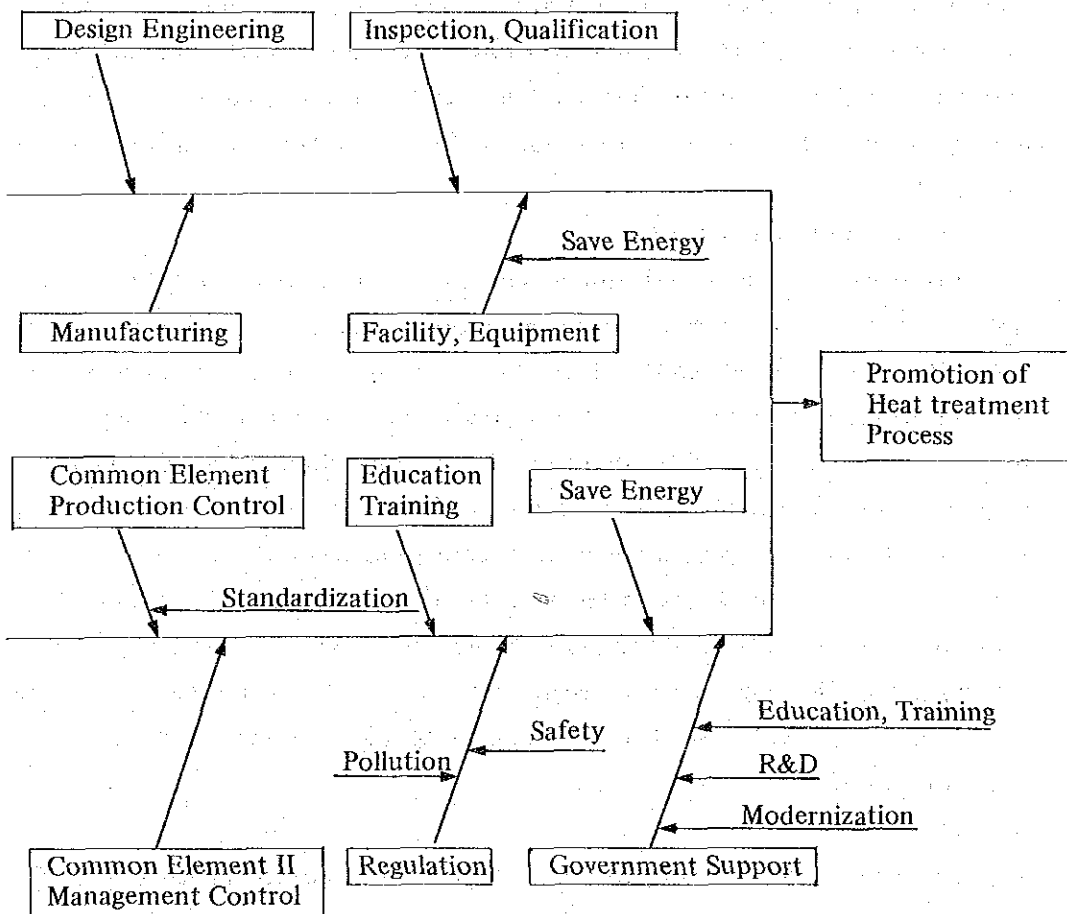
j. Recapitulation

Considerations about measures to promote the heat treatment industry were described in the foregoing. The stabilization and improvement of the quality of automotive parts, agricultural machinery parts and other products is an urgent need, and the technical improvement and stabilization of the heat treatment industry is indispensable in order to reach the international level in terms of quality and cost of these products. Such being the case, the government and public institutions should join forces to implement powerful policies, measures and guidance required in this connection.

The heat treatment industry is a technology- and software-intensive industry and at the same time an equipment-intensive industry. Such being the case, powerful guidance policy of the government and public institutions is particularly important in this connection.

The aforesaid considerations are summarized in the following diagram.

Fig. 4.5.8-55 Diagram of promotion of heat-treatment process (Total System)



4.6 Present State of Industrial Sites and Environmental Problems

In section 4.4 and 4.5, small and medium scale factories in metalworking industries were analyzed, mainly regarding problems in production technology and industrial organization. In this section, problems related to the factory sites of these small and medium scale factories are analyzed on the basis of the questionnaire survey conducted for this study.

The methodology used in this analysis compares the site characteristics of the factories in the B.M.A. and those within metropolitan Tokyo in the late 1960's.

During these years, environmental pollution generated from the factories became many problems resulting in the vigorous relocation or redistribution of the factories from urban areas. Because of similarities in the general situation in the two metropolitan areas, it may be effective to judge the magnitude of problems related to industrial sites in the B.M.A. at present and possibly avoid future problems.

Data and information on industrial sites in Tokyo were obtained from Basic Study concerning control measures against industrial pollution in Metropolitan Tokyo (abbreviated as "Tokyo Study") conducted by the Metropolitan Tokyo Government in 1969. This study was conducted to collect basic data and information on factories located in the 23 wards of Metropolitan Tokyo, and was intended to seek control measures against the increasingly serious industrial pollution.

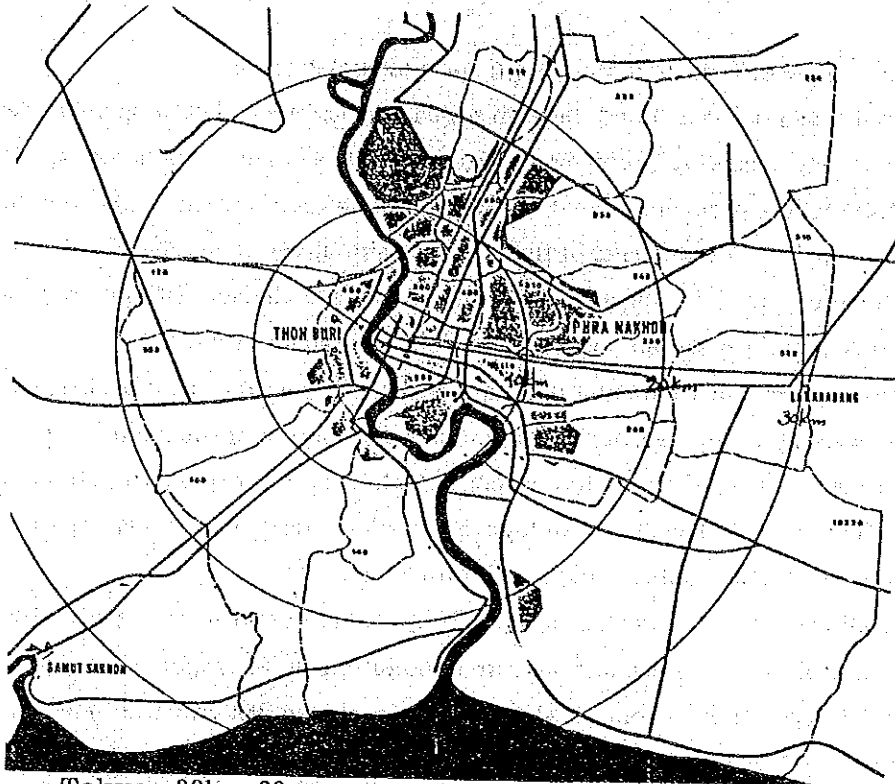
4.6.1 Site Characteristics

(1) Industrial distribution in general

The distribution of large and small/medium scale factories, the subject of this questionnaire survey, is shown in Fig. 4.6.1-2. According to this figure, roughly half of the surveyed factories are located within a 10 km radius of central Bangkok, and slightly less than 90% within a 20 km radius. When looking at the distribution of large and small/medium scale factories separately, a higher percentage of small/medium scale factories are located in the central area. (Table 4.6.1-1)

In the next step, the study area was divided into 12 districts using geographical features such as factory concentration, roads, railroads, and rivers. The factory distribution in these districts is shown in Table 4.6.1-3.

Bangkok 30km 30ne



Tokyo 30km 30ne

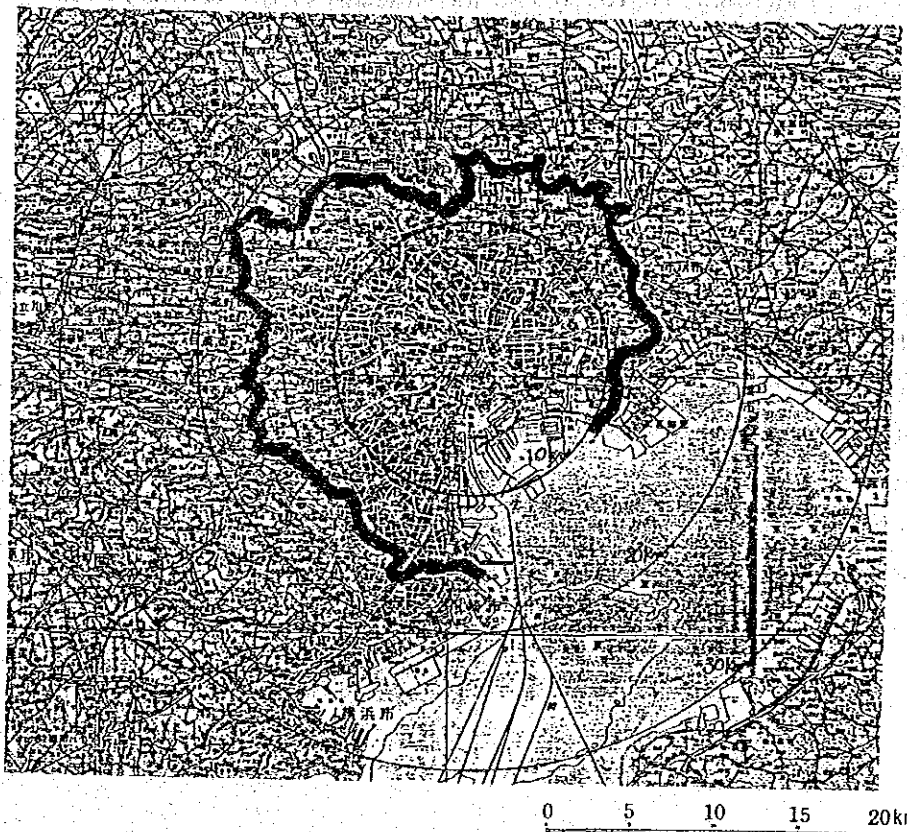


Fig. 4.6.1-1 Urban areas in Bangkok Metropolitan Area

Table 4.6.1-1 Factory distribution by zone

Upper figure: No. of respondents
Lower figure: Composition (%)

	0 – 10 km	10 – 20 km	20 – 30 km	Others	Total	Not known
Large scale factries	43 (45.3)	29 (30.5)	12 (12.6)	11 (11.6)	95 (100.0)	
Small/medium scale factries	95 (47.3)	87 (43.3)	14 (7.0)	5 (2.5)	201 (100.0)	26
Total	138 (46.6)	116 (39.2)	26 (8.8)	16 (5.4)	296 (100.0)	

Table 4.6.1-2 District Classification

A	district
B	East Samutprakarn district
C	Rajbrana · Bangkokhuentien district
D	Paseichareen district
E	Yannawa district
F	Phubprachai · Rajdamern · Rongmuang district
G	Phrakanong district
H	Bang Chan I.E. district
I	Onnuj · Bangna · Lardkrabang district
J	West Samutprakarn district
K	Samrea district
L	Dusit · Samsennai · Bangkhen district
M	Klongjun · Lardprad district
	Patumtani · Nonthabur district

Table 4.6.1-3 Factories Distribution by District

	A	B	C	D	E	F	G	H	I	J	K	L	M	Total
Large scale factories	21 (22.1) (28.0)	26 (27.4) (54.2)	1 (1.1) (3.0)	8 (8.4) (25.8)	1 (1.1) (5.6)	3 (3.2) (17.6)	7 (7.4) (50.0)	2 (2.1) (20.0)	7 (7.4) (87.5)	0 (0.0) (0.0)	6 (6.3) (42.9)	2 (2.1) (28.6)	11 (11.6) (68.8)	95 (100.0) (32.1)
Small/medium scale factories	54 (26.9) (72.0)	22 (10.9) (45.8)	32 (15.9) (97.0)	23 (11.4) (74.2)	17 (8.5) (94.4)	14 (7.0) (82.4)	7 (3.5) (50.0)	8 (4.0) (80.0)	1 (0.5) (12.5)	5 (2.5) (100.0)	8 (4.0) (57.1)	5 (2.5) (71.4)	5 (2.5) (31.3)	201 (100.0) (67.9)
Total	75 (25.3) (100.0)	48 (16.2) (100.0)	33 (11.1) (100.0)	31 (10.5) (100.0)	18 (6.1) (100.0)	17 (5.7) (100.0)	14 (4.7) (100.0)	10 (3.4) (100.0)	8 (2.7) (100.0)	5 (1.7) (100.0)	14 (4.7) (100.0)	7 (2.4) (100.0)	16 (5.4) (100.0)	296 (100.0) (100.0)

Upper figure: No. of respondents
Middle figure: Composition A (%)
Lower figure: Composition B (%)

Note: Composition A by district
Composition B by scale of factory

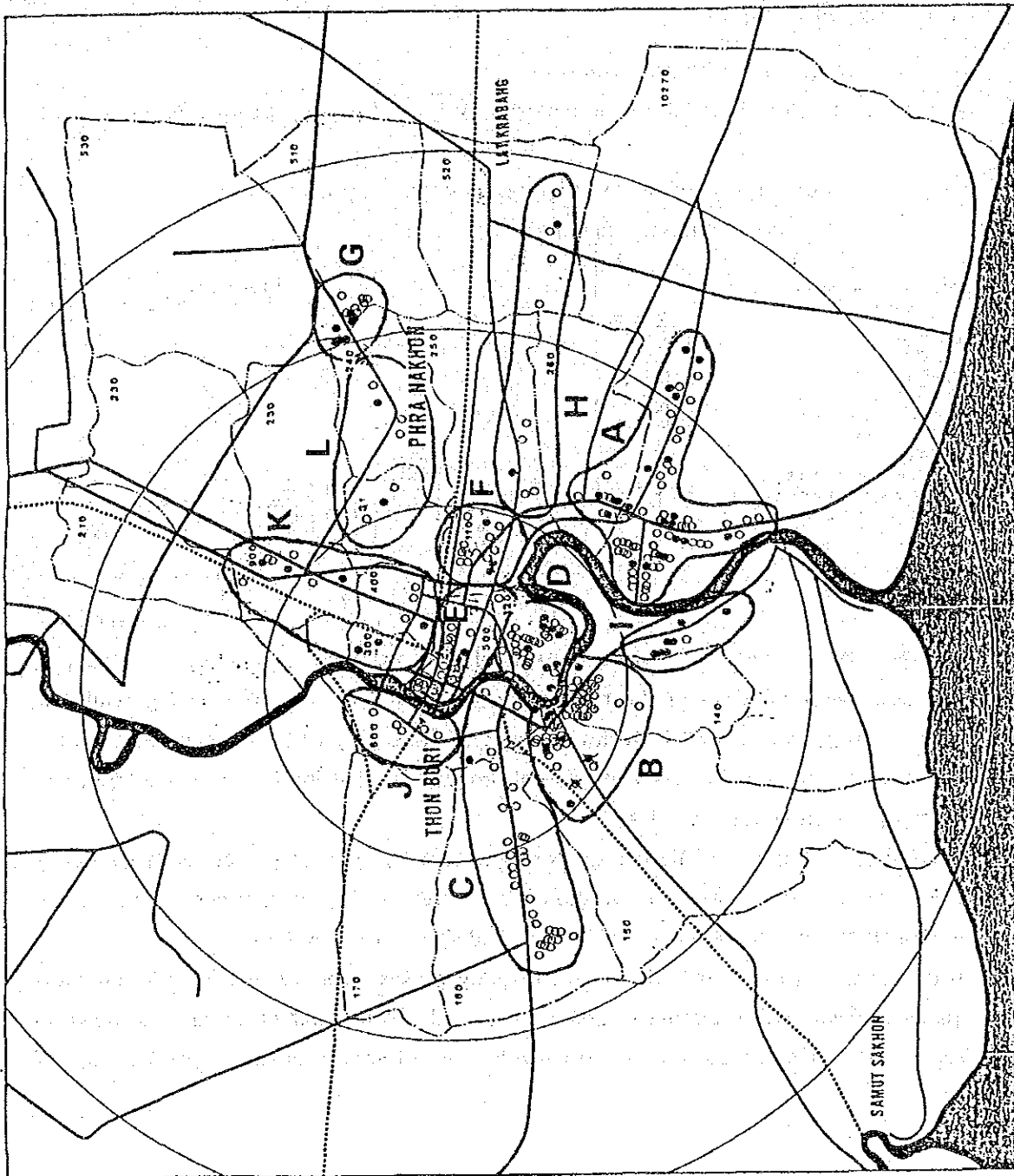
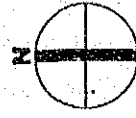
Fig. 4.6.1 - 2

Distribution of factories surveyed

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

- Large scale factories
- Small/medium scale factories



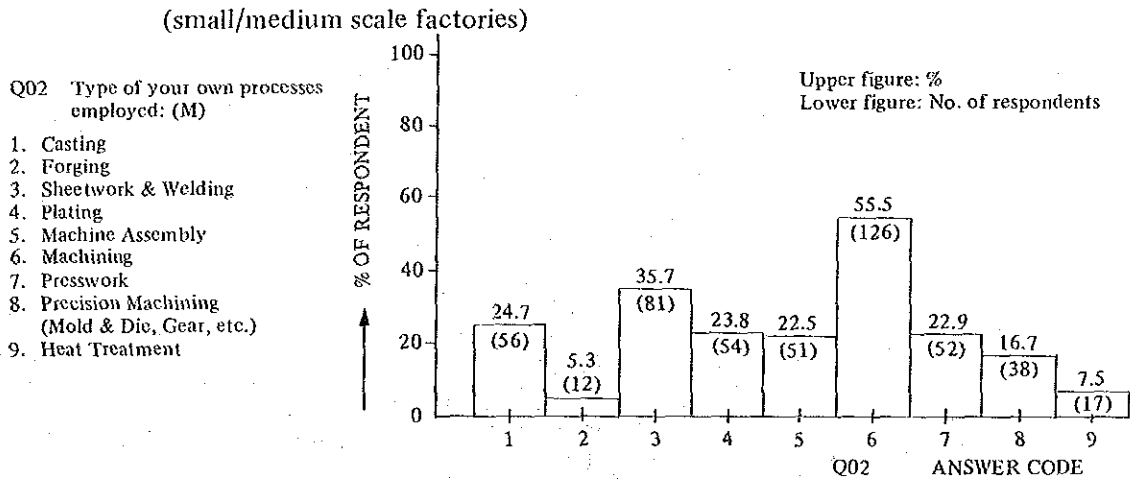
From this table, districts A through D appear to have a high concentration of metal-working industries in the B.M.A. District A, in particular, has the highest concentration, representing 25% of all factories surveyed.

When looking at the distribution of large scale factories, they are highly concentrated in districts A and B, followed by districts M, D, G, I, and K. On the other hand, central areas such as districts D, E and F contain a relatively high share of small/medium scale factories. (Table 4.6.1-3)

(2) Site characteristics by type of process

Composition of small/medium scale factories by type of process is shown in Fig. 4.6.1-3.

Fig. 4.6.1-3 Composition of surveyed factories by type of process



As shown in this figure, 126 factories specialize in machining, the largest of all types, followed by 81 factories in sheetwork & welding and 56 factories in casting, while the smallest proportion was 12 factories in forging, followed by 17 factories in heat treating, indicating a considerable variety of types of process. The distribution by process type and district is shown in Table 4.6.1-4.

According to this table, the highest concentration by type of process is in district A where the highest factory concentration is observed for all process types except casting, more specifically precision machine, forging and sheetwork & welding.

When looking at the distribution of factories by process type, casting factories are most highly concentrated in district C, and are confined to the geographical area as shown in Fig. 4.6.1-4. Plating factories are most highly concentrated in district E, which is one of

the central urban areas, followed by the adjacent district D. (Fig. 4.6.1-7)

Factories specializing in sheetwork and welding, machine assembly, machining and press work are most highly concentrated in district A, but are also widely distributed in other districts. (Fig. 4.6.1-6, 8, 9, 10)

Table 4.6.1-4 Distribution of Small/Medium Scale Factories by District and Process Type

Upper figure: No. of respondents
Lower figure: Composition (%)

	1. Casting	2. Forging	3. Sheet-work & Welding	4. Plating	5. Machine assembly	6. Machining	7. Press-work	8. Precision machine	9. Heat treatment	10. Total
A	6 (12.5)	6 (54.5)	30 (44.1)	11 (21.2)	14 (35.0)	41 (39.4)	18 (40.0)	20 (57.1)	4 (28.5)	54
B	9 (18.8)	3 (27.3)	4 (5.9)	4 (7.7)	2 (5.0)	10 (9.6)	2 (4.4)	3 (8.6)	-	22
C	17 (35.4)	-	8 (11.8)	6 (11.5)	3 (7.5)	14 (13.5)	4 (8.9)	3 (8.6)	2 (14.3)	32
D	6 (12.5)	-	3 (4.4)	8 (15.4)	4 (10.0)	12 (11.5)	2 (4.4)	1 (2.9)	2 (14.3)	23
E	-	-	1 (1.5)	11 (21.2)	1 (2.5)	3 (2.9)	2 (4.4)	1 (2.9)	-	17
F	6 (12.5)	-	4 (5.9)	3 (5.8)	5 (12.5)	6 (5.8)	3 (6.7)	2 (5.7)	1 (7.1)	14
G	2 (4.2)	-	2 (2.9)	3 (5.8)	1 (2.5)	5 (4.8)	3 (6.7)	1 (2.9)	2 (14.3)	7
H	-	-	6 (8.8)	-	5 (12.5)	4 (3.8)	2 (4.4)	3 (8.6)	1 (7.1)	8
I	1 (2.1)	-	-	-	-	-	-	-	-	1
J	-	-	1 (1.5)	3 (5.8)	1 (2.5)	1 (1.0)	1 (2.2)	-	-	5
K	1 (2.1)	-	2 (2.9)	2 (3.8)	3 (7.5)	5 (4.8)	3 (6.7)	-	1 (7.1)	8
L	-	-	3 (4.4)	1 (1.9)	1 (2.5)	2 (1.9)	3 (6.7)	-	-	5
M	-	2 (18.2)	4 (5.9)	-	-	1 (1.0)	2 (4.4)	1 (2.9)	1 (7.1)	5
Total	48 (100.0)	11 (100.0)	68 (100.0)	52 (100.0)	40 (100.0)	104 (100.0)	45 (100.0)	35 (100.0)	14 (100.0)	201 (100.0)
Not known	8	1	13	2	11	22	7	3	3	

Fig. 4.6.1 - 4
 Factory distribution by type
 of process - Casting

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

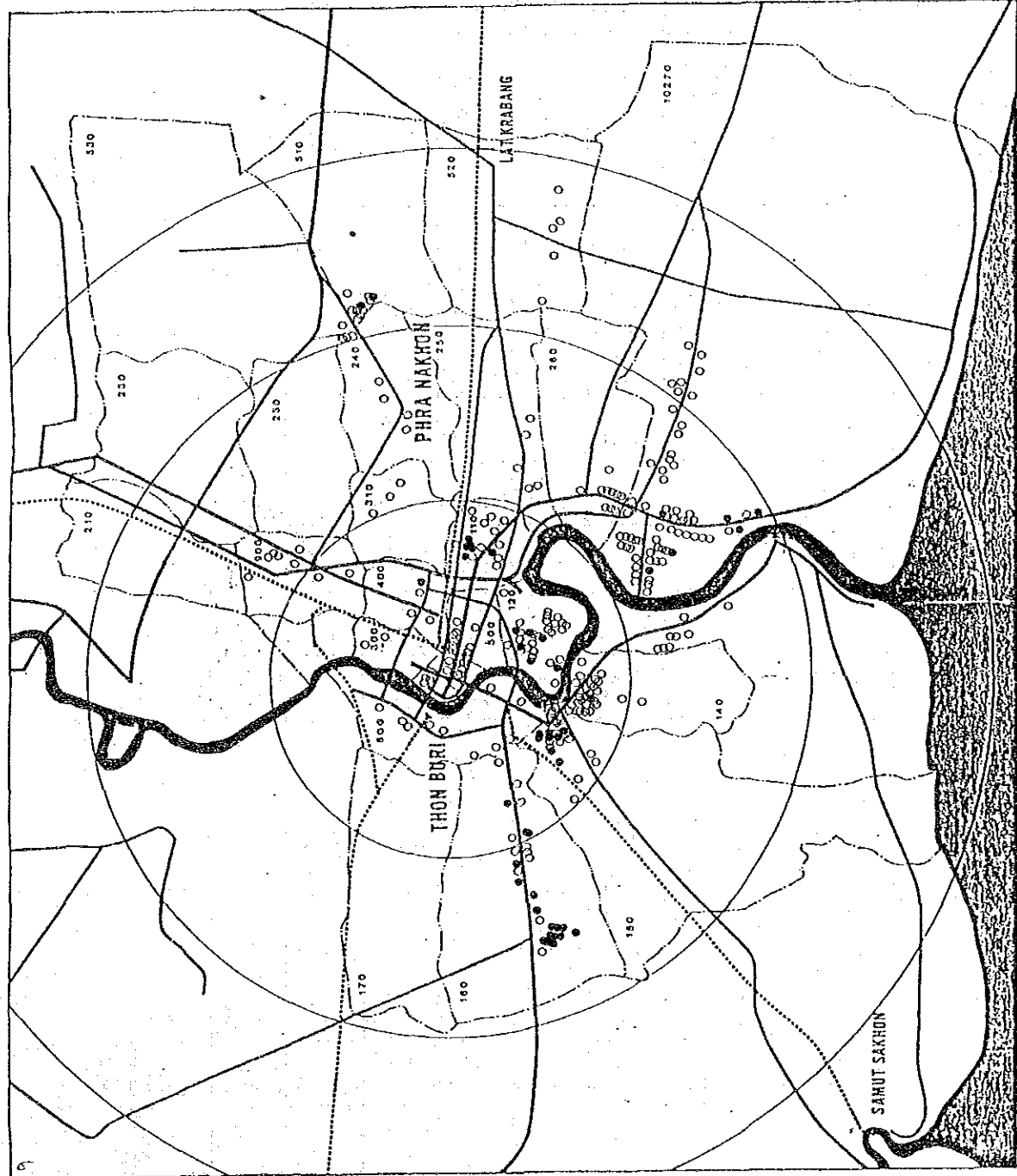
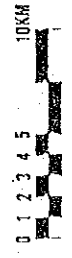
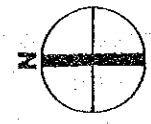
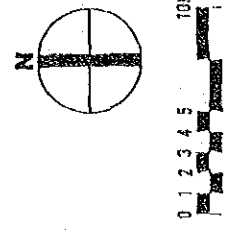


Fig. 4.6.1 - 5
 Factory distribution by type
 of process - Forging

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad



N

0 1 2 3 4 5 10KM



Fig. 4.6.1 - 6
 Factory distribution by type
 of process - Sheet work and
 welding

LEGEND

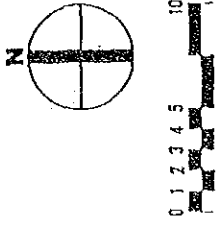
- Primary road
- Secondary road
- Dual lane highway
- Railroad



Fig. 4.6.1 - 7
 Factory distribution by type
 of process - Platings

LEGEND

- Primary road
- Secondary road
- Dual lane Highway
- Railroad



N

0 1 2 3 4 5 10KM



Fig. 4.6.1 - A
 Factory distribution by type
 of process - Machine assembly

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

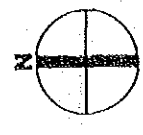


Fig. 4.6.1 - 9
 Factory distribution by type
 of process - Machining

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

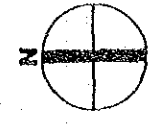
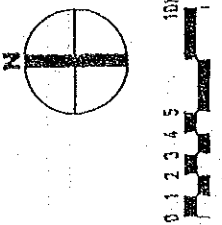


Fig. 4.6.1 - 10
 Factory distribution by type
 of process - Press work

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad



N

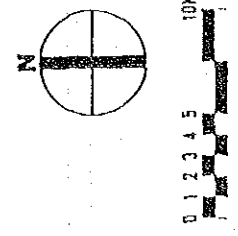
0 1 2 3 4 5 10 KM



Fig. 4.6.1 - 11
 Factor of distribution by type
 of process - Precision machine

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad



N


0 1 2 3 4 5 10KM




Fig. 4.C.1 - 12
 Factory distribution by type
 of process - heat treatment

LEGEND

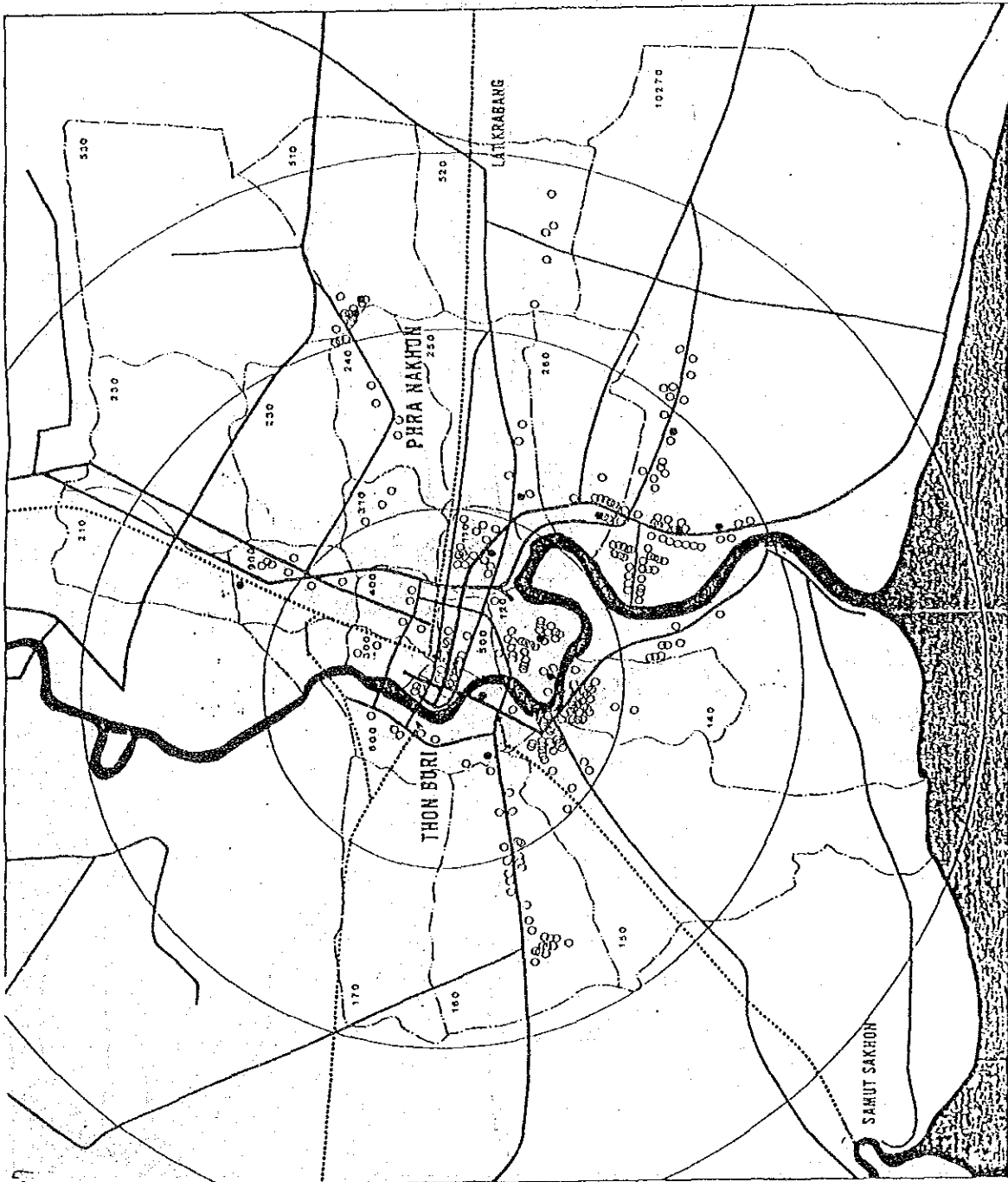
- Primary road
- Secondary road
- Dual lane highway
- Railroad



N



0 1 2 3 4 5 10KM



(3) Site characteristics by size of factory

When looking at the composition of small/medium scale factories surveyed in terms of size, most of the factories employing 10–29 persons, represent 42% of all factories surveyed, and small scale factories with less than 50 employees represent 76%.

Distribution of factories by employment size and district is shown in Table 4.6.1-5 and Fig. 4.6.1-13.

Table 4.6.1-5 Distribution of small/medium scale factories by size and district

Upper figure: No. of respondents
Lower figure: Composition (%)

	1 f 9	10 f 29	30 f 49	50 f 99	100 f 199	200 f 299	300 f 499	500 f	Not known	Total
A	2 (3.7)	25 (46.3)	12 (22.2)	6 (11.1)	6 (11.1)	1 (1.9)	—	1 (1.9)	1 (1.9)	54 (100.0)
B	4 (18.2)	12 (54.5)	1 (4.5)	4 (18.2)	1 (4.5)	—	—	—	—	22 (100.0)
C	6 (18.8)	16 (50.0)	7 (21.9)	3 (9.4)	—	—	—	—	—	32 (100.0)
D	4 (17.4)	12 (52.2)	2 (8.7)	3 (13.0)	1 (4.3)	1 (4.3)	—	—	—	23 (100.0)
E	11 (64.7)	3 (17.6)	1 (5.9)	—	1 (5.9)	—	—	—	1 (5.9)	17 (100.0)
F	2 (14.3)	5 (35.7)	4 (28.6)	3 (21.4)	—	—	—	—	—	14 (100.0)
G	2 (28.6)	—	1 (14.3)	3 (42.9)	1 (14.3)	—	—	—	—	7 (100.0)
H	—	5 (62.5)	1 (12.5)	1 (12.5)	—	1 (12.5)	—	—	—	8 (100.0)
I	—	—	—	—	—	—	—	—	1 (100.0)	1 (100.0)
J	2 (40.0)	2 (40.0)	1 (20.0)	—	—	—	—	—	—	5 (100.0)
K	2 (25.0)	2 (25.0)	—	1 (12.5)	1 (12.5)	—	—	—	2 (25.0)	8 (100.0)
L	1 (20.0)	2 (40.0)	—	1 (20.0)	—	—	—	—	1 (20.0)	5 (100.0)
M	—	1 (20.0)	1 (20.0)	1 (20.0)	—	—	—	—	2 (40.0)	5 (100.0)
Total	36 (17.9)	85 (42.3)	31 (15.4)	26 (12.9)	11 (5.5)	3 (1.5)	—	1 (0.5)	8 (4.0)	201 (100.0)

Fig. 4.6.1 - 13
 Distribution of factories
 surveyed by number of
 employees

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

- 1 - 9 persons
- 10 - 29 "
- 30 - 49 "
- 50 - 99 "
- 100 - 199 "
- ⊗ 200 - 299 "
- ⊕ 500 - "



According to this data, the smallest scale factories, with less than 10 employees, are found most frequently in district E, constituting 65% of all factories in the district. Small scale factories, with 10 – 49 employees, are found mostly in district C (72% of all factories in the district), A (69%), F (64%) and G (75%). Medium scale factories, with 50 – 199 employees, are found mostly in district A (22%), B (23%), F (21%) and G (57%). District G contains so many large scale factories because of the Bang Chan industrial estate.

(4) Site characteristics of subcontractor and subcontractee factories

As discussed in section 4.3.3, the distance between subcontractor and subcontractee factories is mostly within a range of 11 – 20 km, representing 31% of all factories surveyed; distances of less than 40 km, which represents all of urban Bangkok, include 76%. Site relationships between selected subcontractor and their subcontractee factories are shown in Fig. 4.6.1-14. This analysis indicated no particular relationship of this type, such as a concentration of subcontractee factories around subcontractor factories.


One reason for the lack of this relationship might be found in the current development level of industry in Thailand; an industrial structure consisting of systematic and close subcontract relationships with large enterprises as a core is yet to be developed, and thus, the location of subcontractee factories in relation to that of their subcontractor factories is not particularly significant.

Fig. 4.6.2 - 14
 Distribution of subcontractor
 and subcontractee factories


LEGEND

- Primary road
- - - Secondary road
- == Dual lane highway
- Rail Road
- ★ Subcontractor
- Subcontractee

N



0 1 2 3 4 5 10KM




4.6.2 Present State of Site Environment

(1) Factories mixed in various land uses

Types of land use where factories are located are shown in Table 4.6.2-1.

According to this, 42.8% of all factories surveyed are located in industrial districts, and thus, the majority are located in commercial and residential districts.

Table 4.6.2-1 Types of land use in which factories are located.

	Frequency	Percent (%)
1. Industrial	83	39.0
2. Industrial (CFZ, FEZ)	8	3.8
3. Commercial	26	12.2
4. Residential	73	34.3
5. Not defined	23	10.7
Total	213	100.0

Table 4.6.2-2 shows number of factories which are located in Tokyo wards by zone (according to zone classification in urban and land use plans) obtained from the Tokyo Study conducted in 1969. This indicates that 55.6% of all factories surveyed were located in industrial or semi-industrial areas.

This fact might lead to the conclusion that the present condition of mixed land use by factories in Bangkok is similar or exceeds that in Tokyo wards in the late 1960's when industrial pollution became prominent.

Table 4.6.2-2 Number of factories which are located in Tokyo wards by zone - 1969.

	Frequency	Percent (%)
1. Industrial	4,027	11.7
2. Semi-industrial	15,083	43.9
3. Commercial	6,345	18.4
4. Residential	8,930	26.0
Total	34,345	100.0

Source: "Tokyo Study"

As to the relationship between zoning and factories by size, small scale factories have a tendency to be located in residential or commercial districts, to indicating a strong trend of mixed land use. (Table 4.6.2-3)

When looking at the distribution of zones in which factories are located, as shown in Fig. 4.6.2-1, only districts A, B, G and C (part) are classified as industrial, and the remaining districts are classified as other land uses, indicating mixed land use by factories

Fig. 4.6.2 - 1
Type of zones in which
factories are located

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

- Industrial district
- ⊗ Industrial district
(C.F.Z. *1, F.E.Z. *2)
- ⊙ Commercial district
- ⊕ Residential district
- ⊖ Not defined

Remark:
*1: C.F.Z.
= Customs free zone
*2: F.E.Z.
= Free export zone



in most of the B.M.A.

Table 4.6.2-3 Zones and factories by size

Upper figure: No. of respondents
Lower figure: Composition (%)

No. of Employees	1 1 ~ 6	2 7 ~ 16	3 17 ~ 40	4 41 ~ 100	5 101 ~ 250	6 251 ~ 630	7 631 ~ 1600	8 1600 ~	Total
1. Industrial	7 26.9	24 36.9	28 44.4	12 40.0	10 55.6	1 16.7			82 38.7
2. Industrial (CFZ, FEZ)	1 3.8	1 1.5	3 4.8	3 10.0					8 3.8
3. Commercial	3 11.5	14 21.5	4 6.3	3 10.0		1 16.7	1 25.0		26 12.3
4. Residential	12 46.2	28 43.1	22 34.9	10 33.3	2 11.1		3 75.0		73 34.4
5. Not defined	3 11.5	2 3.1	6 9.5	2 6.7	6 33.3	4 66.7			23 10.8
Total	26 100.0	65 100.0	63 100.0	30 100.0	18 100.0	6 100.0	4 100.0		212 100.0

(2) Present situation of industrial pollution

1) Record of claims of industrial pollution

Table 4.6.2-4 shows the record of claims of industrial pollution from factories surveyed. This shows that 24.8% of all responses have experience in receiving claims.

On the other hand, the Tokyo Study indicates that there were 1,805 claims filed about industrial pollution (those received by the Metropolitan Tokyo Government) in Tokyo wards in 1967. This figure represents 2.2% of all factories in Tokyo, assuming one case per factory. Naturally, this data cannot be directly compared with the present study results. Nevertheless, the percentage of factories receiving claims was 2.5% annually assuming that they were made over a 10 year period, and this figure is found to correspond to that in Tokyo. Considering that the present study is limited to the metalworking industry which generates a relatively small amount of pollution, it appears that industrial pollution in the B.M.A. is quite a problem, and one that will become more serious in the future, taking into account the present state of the urban infrastructure in Bangkok.

Table 4.6.2-4 Experience in receiving claims of industrial pollution

	Frequency	Percent (%)
1. Yes	50	24.8
2. No	152	75.2
Total	202	100.0

Experience in receiving claims about industrial pollution based on the size of factories are shown in Table 4.6.2-5. According to this data, the number of factories receiving claims are roughly proportional to their size. This might result from the fact that the larger the scale of production, the higher the discharge of effluent, smoke, noise and vibration, making them easier to identify. Small scale factories cannot be easily identified as source of pollution because of the relatively small amount of discharge from each factory. Nevertheless, since an accumulation of small scale factories will

Table 4.6.2-5 Experience in receiving claims about industrial pollution based

on the size of factory

Upper figure: No. of respondents
Lower figure: Composition (%)

No. of Employees	1 1 ~ 6	2 7 ~ 16	3 17 ~ 40	4 41 ~ 100	5 101 ~ 250	6 251 ~ 630	7 631 ~ 1600	8 1600 ~	Total
1. Yes	4 17.4	15 24.2	12 20.7	9 30.0	6 33.3	4 66.7			50 24.9
2. No	19 82.6	47 75.8	46 79.3	21 70.0	12 66.7	2 33.3	4 100.0		151 75.1
Total	23 100.0	62 100.0	58 100.0	30 100.0	18 100.0	6 100.0	4 100.0		201 100.0


increases the amount of various discharges, and they represent a dominant portion of factories in the B.M.A., pollution control in these small scale factories will become a significant problem in the future.


As to the distribution of factories will experience in receiving claim, they are generally concentrated in districts A and C as shown in Fig. 4.6.2-2. In district C, particularly there is a local concentrations in an areas, which may require certain special measures. In other districts where no significant concentration is observed, factories with experience in receiving claims are distributed over the whole B.M.A. except the one containing the Bang Chan Industrial Estate, making it necessary to deal with industrial pollution as one problem for all of the B.M.A.

Fig. 4-6.2 - 2
 Distribution of factories
 having experience in resolving
 claims on industrial pollution

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- - - - - Railroad





 0 1 2 3 4 5 10KM



2) Type of claims about industrial pollution

Since metalworking industry is the subjected of this study, noise was the claim most frequently received. (Fig. 4.6.2-2')

When looking at the number of cases by process as well as the type of claims, many claims were received by industries generating a relatively small degree of pollution, namely mechaning (40 cases), sheetwork and welding (32 cases), machine assembly (22 cases), and presswork (22 cases). This might partly result from the factories of this type included in the surveyed factories. However, since all kinds of pollution are observed, pollution control measures need to be considered for the industry as a whole and include industries generating less pollution. (Table 4.6.2-7)

Fig. 4.6.2-2' Types of claims about industrial pollution

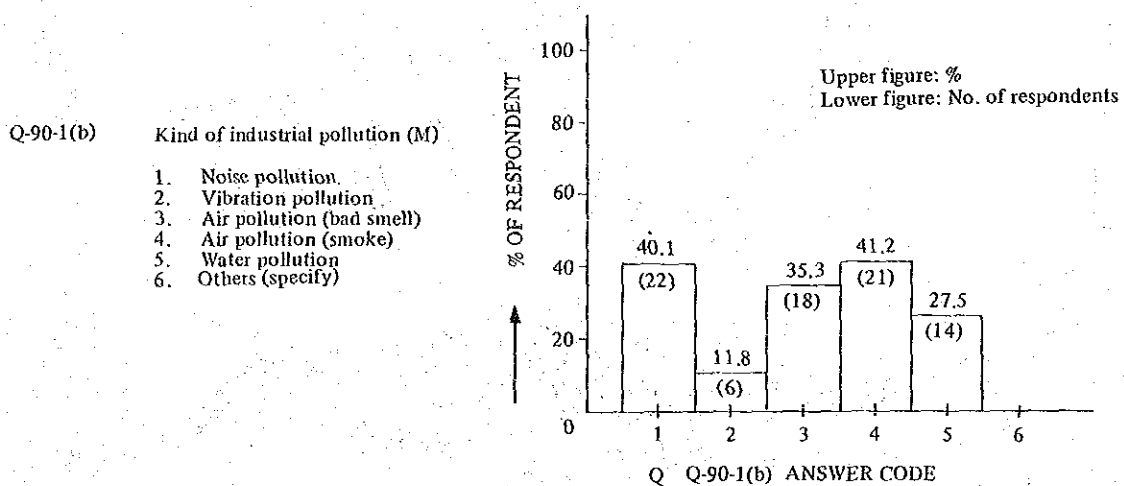


Table 4.6.2-7 Types of claims about industrial pollution by process type Upper figure: No. of respondents
Lower figure: Composition (%)

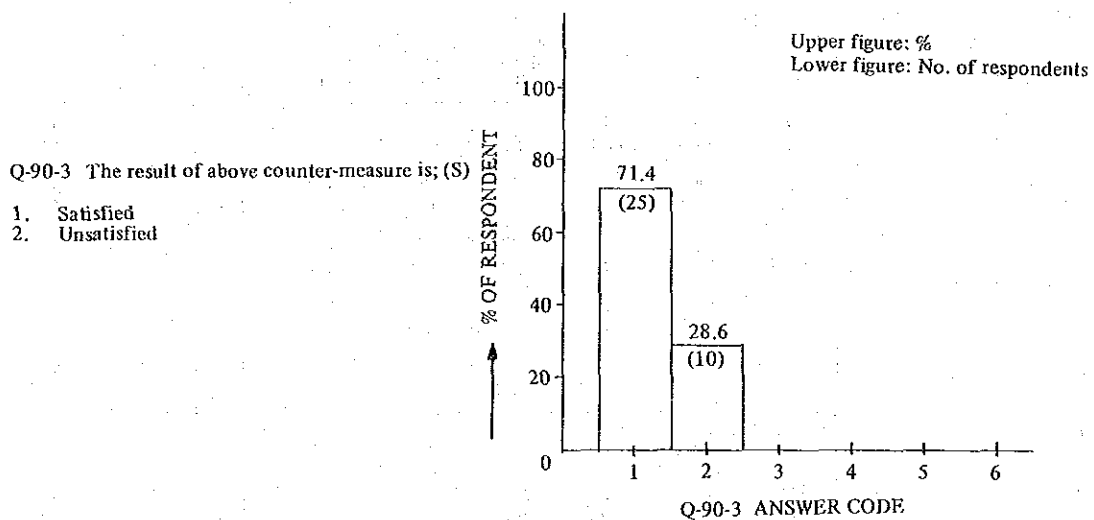
Process	1 Casting	2 Forging	3 Sheet-work & Wedding	4 Plating	5 Machine Assembly	6 Machining	7 Press-work	8 Precision Machine	9 Heat Treatment	10 Total
1	2 33.3	2 50.0	10 31.3	0	6 27.3	10 25.0	8 36.4	2 16.7	2 20.0	42 27.3
2	0	0	4 12.5		4 18.2	2 5.0	2 9.1	0	0	12 7.8
3	2 33.3	0	6 18.8	0	6 27.3	12 30.0	4 18.2	4 33.3	2 20.0	36 23.4
4	0	0	6 18.8	0	6 27.3	10 25.0	2 9.1	4 33.3	2 20.0	30 19.5
5	2 33.3	2 50.0	6 18.8	6 100.0	0	6 15.0	6 27.3	2 16.7	4 40.0	34 22.1
Total	6 100.0	4 100.0	32 100.0	6 100.0	22 100.0	40 100.0	22 100.0	12 100.0	10 100.0	154 100.0

3) Pollution control measures taken by factory and the level of satisfaction

Of 51 factories which received claims about industrial pollutions, 35 factories adopted certain control measures, and of those, 25 factories were satisfied with them.

On the other hand, 10 factories adopted certain control measures but were not satisfied, and 16 factories adopted no control measures, indicating that a majority of them had not solved problems related to industrial pollution, which represent around 10% of all factories surveyed. (Fig. 4.6.2-3)

Fig. 4.6.2-3 Level of satisfaction with pollution control measures



4) Destination of industrial effluent discharge

Water pollution is likely to become a serious problem with a wide range of repercussions because of the close relationship between the Thai people and water on a daily basis. Also, an improved public treatment system is greatly needed for small/medium scale factories because they cannot provide complete effluent treatment within their factories.

On the basis of the above understanding, industrial effluent treatment (and destination of industrial effluent discharge) were also surveyed. The results are summarized in Fig. 4.6.2-4 and Table 4.6.2-8.

Fig. 4.6.2-4 Preliminary destination of industrial effluent discharge

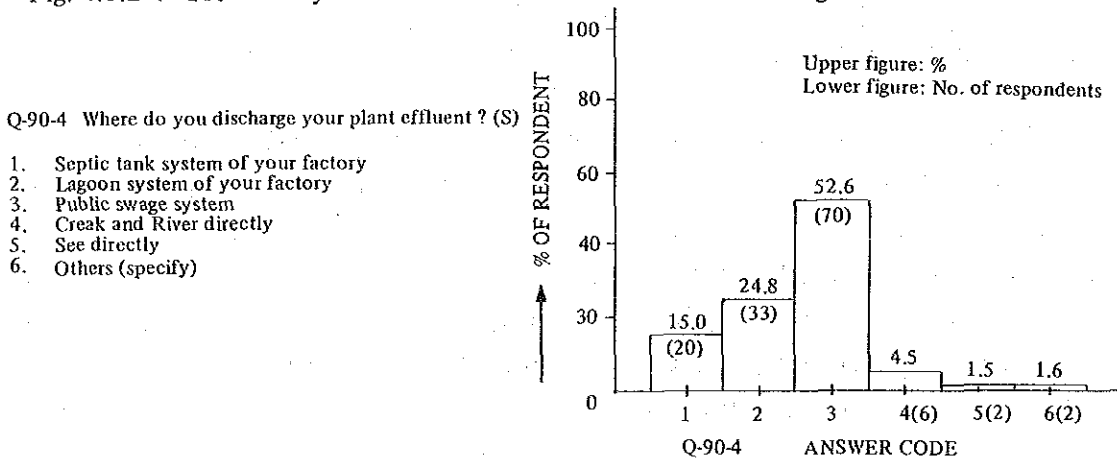


Table 4.6.2-8 Preliminary destination of industrial effluent by size of establishment

No. of Employees	Destination of Effluent								Total
	1 1 ~ 6	2 7 ~ 16	3 17 ~ 40	4 41 ~ 100	5 101 ~ 250	6 251 ~ 630	7 631 ~ 1600	8 1600 ~	
1	4 26.7	10 24.4	4 10.8	2 9.5					20 15.0
2	1 6.7	8 19.5	10 27.0	3 14.3	6 60.0	3 25.0	2 66.7		33 24.8
3	10 66.7	21 51.2	22 59.5	13 61.9	3 30.0	1 8.3			70 52.6
4			1 2.7	2 9.5	1 10.0	1 8.3	1 33.3		6 4.5
5		1 2.4		1 4.8					2 1.5
6		1 2.4				1 8.3			2 1.5
Total	15 100.0	41 100.0	37 100.0	21 100.0	10 100.0	12 100.0	3 100.0		133 100.0

Upper figure: No. of respondents
Lower figure: Composition (%)

According to this data, 52.6% of all factories surveyed discharged effluent directly into the public sewage system, while 39.8% treat it by means of a treatment system within the factory; 15.0% discharge into a septic tank system and 24.8% into a lagoon system. It should be noted, however, that only a small portion of the effluent discharged into the public sewage system is adequately treated judging from the existing quality of the sewage system of the B.M.A., so a significant amount of raw industrial effluent is considered to be discharged directly into rivers.

Only 6.0% of all factories discharged effluent directly into a canal, river or the sea. Despite this small percentage, relatively large scale factories were responsible, suggesting a relatively high level of influence.

A similar survey was conducted in the Tokyo Study, and those results are summarized in Table 4.6.2-9. According to this, 5.7% of all factories surveyed discharged effluent into 'Rivers and the like', which is more or less the same as in the present survey.

Table 4.6.2-9 Preliminary destination of industrial effluent discharge from factories in Tokyo wards

Destination of discharge	Public sewage system	Road side ditches	Rivers and like	Total
No. of factories	5,113	1,361	392	6,866
Composition (%)	74.5	19.8	5.7	100.0

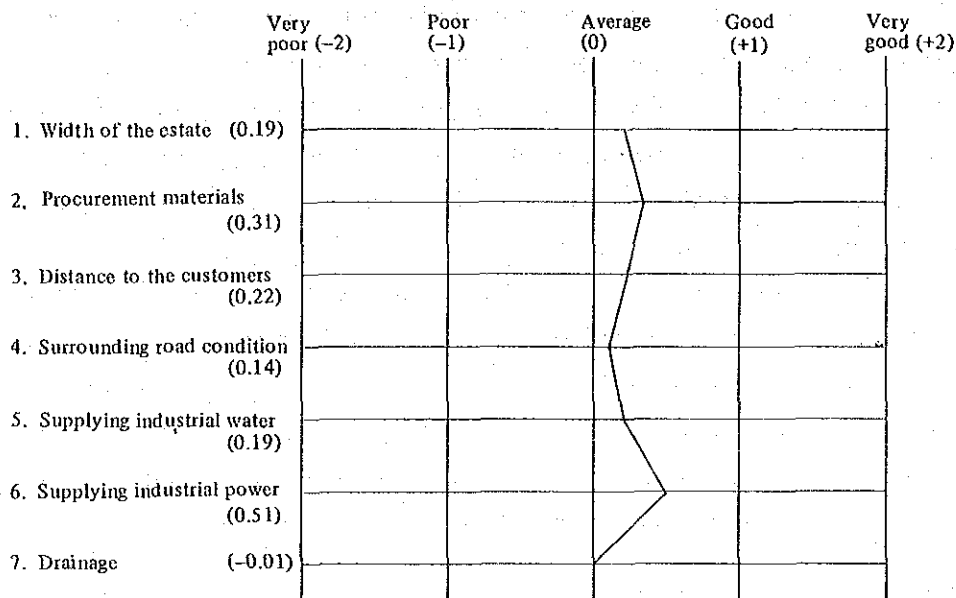
Judging from the degree of pollution in rivers in Tokyo wards as well as the present level of the public sewage system in Bangkok, pollution in rivers in the Bangkok area is thought to have progressed to a considerable degree, making it an immediate and serious problem for solution in the future.

(3) Evaluation of industrial environment

Average values of each factory's evaluation of the industrial environment are shown in Fig. 4.6.2-5.

This indicates that all items except 'drainage' were evaluated as slightly above 'average' (point '0').

Fig. 4.6.2-5 Average values of evaluation of the site environment



Evaluation results are arranged in the order of value; 6. Supplying Industrial power (0.51)-2. Procurement Materials (0.31)-3. Distance to the customers (0.22)-1. Width of the estate (0.19)-5. Supplying industrial water (0.9)-4. Surrounding road conditions (0.14)-7. Drainage (-0.01), to indicating relatively strong dissatisfaction with the urban infrastructure and facilities. Table 4.6.2-10 shows the same evaluation by size of factory. According to this, the evaluation of factories with more than 100 employees is generally higher than that of smaller factories, clearly indicating stronger dissatisfaction by smaller industries.

Table 4.6.2-10 Average values of evaluation by item and size of factories

Employment size	1 ~	7 ~	17 ~	41 ~	101 ~	251 ~	631 ~	1601 ~
	6	16	40	100	250	630	1600	
1. Width of the estate	0.04	0.05	0.13	0.15	1.00	0.80	0.5	
2. Procurement materials	0.45	0.34	0.15	0.20	0.53	0.60	0.75	
3. Distance to the customers	0.40	0.25	0.18	0.08	0.25	0.20	0.25	
4. Surrounding road conditions	0.33	0.11	0.05	0.04	0.44	0.40	0.25	
5. Supplying industrial water	0.04	0.26	0.05	0.24	0.25	0.80	0.75	
6. Supplying industrial power	0.54	0.53	0.41	0.52	0.50	1.00	0.75	
7. Drainage	0.20	-0.05	-0.06	0.24	0.43	0.00	0.50	

The distribution of factories in terms of evaluation are shown by evaluation item and district in Table 4.6.2-11 and Fig. 4.6.2-6 through 12. They indicate that the evaluation in districts D and G was lower than that in other districts. More particularly, district D was evaluated as less than 'average' for all items except 'item 6, Supplying industrial power', indicating that this district has the most urgent need for an improved infrastructure.

Table 4.6.2-11 Average values of evaluation by item and district


	1. Width of the estate	2. Procurement materials	3. Distance to the customers	4. Surrounding road condition	5. Supplying industrial water	6. Supplying electric power	7. Drainage	Total
Average	0.19	0.31	0.22	0.14	0.99	0.51	-0.01	0.22
A District	0.28	0.67	0.32	0.23	0.25	0.39	-0.10	0.29
B District	0.00	0.27	0.36	-0.05	0.26	0.82	0.00	0.23
C District	0.28	0.47	0.39	0.38	0.48	0.70	0.42	0.45
D District	-0.14	-0.05	-0.18	-0.43	-0.41	0.36	-0.55	-0.20
E District	0.29	0.41	0.41	0.06	0.38	0.81	0.13	0.36
F District	0.29	0.23	0.38	0.43	0.50	0.57	-0.07	0.33
G District	0.14	0.29	-0.50	-0.33	0.00	-0.17	-0.17	-0.11
H District	-0.14	0.14	0.83	0.17	0.13	0.33	0.00	0.13
I District	0.00	1.00	1.00	1.0	-1.0	0.00	0.00	0.29
J District	0.00	0.66	0.33	0.50	0.33	1.00	0.33	0.45
K District	-0.2	0.2	0.00	0.50	0.20	0.20	0.00	0.13
L District	0.50	0.25	0.25	0.25	0.00	0.75	0.25	0.32
M District								

Fig. 4.6.2 - 6
 Evaluation of the industrial
 environment - width of the
 - width of the estate

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

- very good (+2)
- △ good (+1)
- average (0)
- △ poor (-1)
- ⊙ very poor (-2)



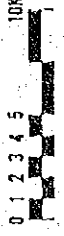


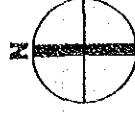


Fig. 4.6.2 - 7
 Evaluation of the industrial
 environment
 - Procurement materials

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

- very good (+2)
- △ good (+1)
- average (0)
- ▲ poor (-1)
- ⊗ very poor (-2)



0 1 2 3 4 5 10KM







FIG. 4.6.2 - 8
 Evaluation of the Infrastructural
 Development
 - Distance to the customer

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

- Very Good (+2)
- △ Good (+1)
- Average (0)
- ▲ Poor (-1)
- ⊗ Very poor (-2)




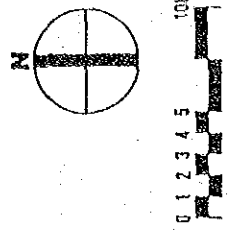




Fig. 4.6.2 - 9
 Evaluation of the industrial
 environment
 - Surrounding road condition

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad
- very good (+2)
- △ good (+1)
- average (0)
- ▲ poor (-1)
- ⊙ very poor (-2)



N

0 1 2 3 4 5 10KM



Fig. 4.6.2 - 10
 Evaluation of the industrial
 environment
 - Supplying industrial
 water

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad

□ very good (+2)
 △ good (+1)
 ○ average (0)
 ▲ poor (-1)
 ⊙ very poor (-2)



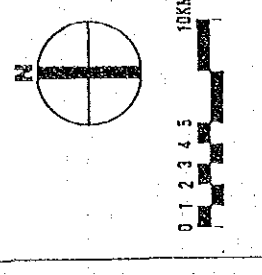
N

 0 1 2 3 4 5 10KVA




Fig. 4.6.2 - 11
Evaluation of the industrial
environment
- Supplying electric
Power

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad
- Very good (+2)
- Good (+1)
- Average (0)
- Poor (-1)
- Very poor (-2)





0 1 2 3 4 5 10KM

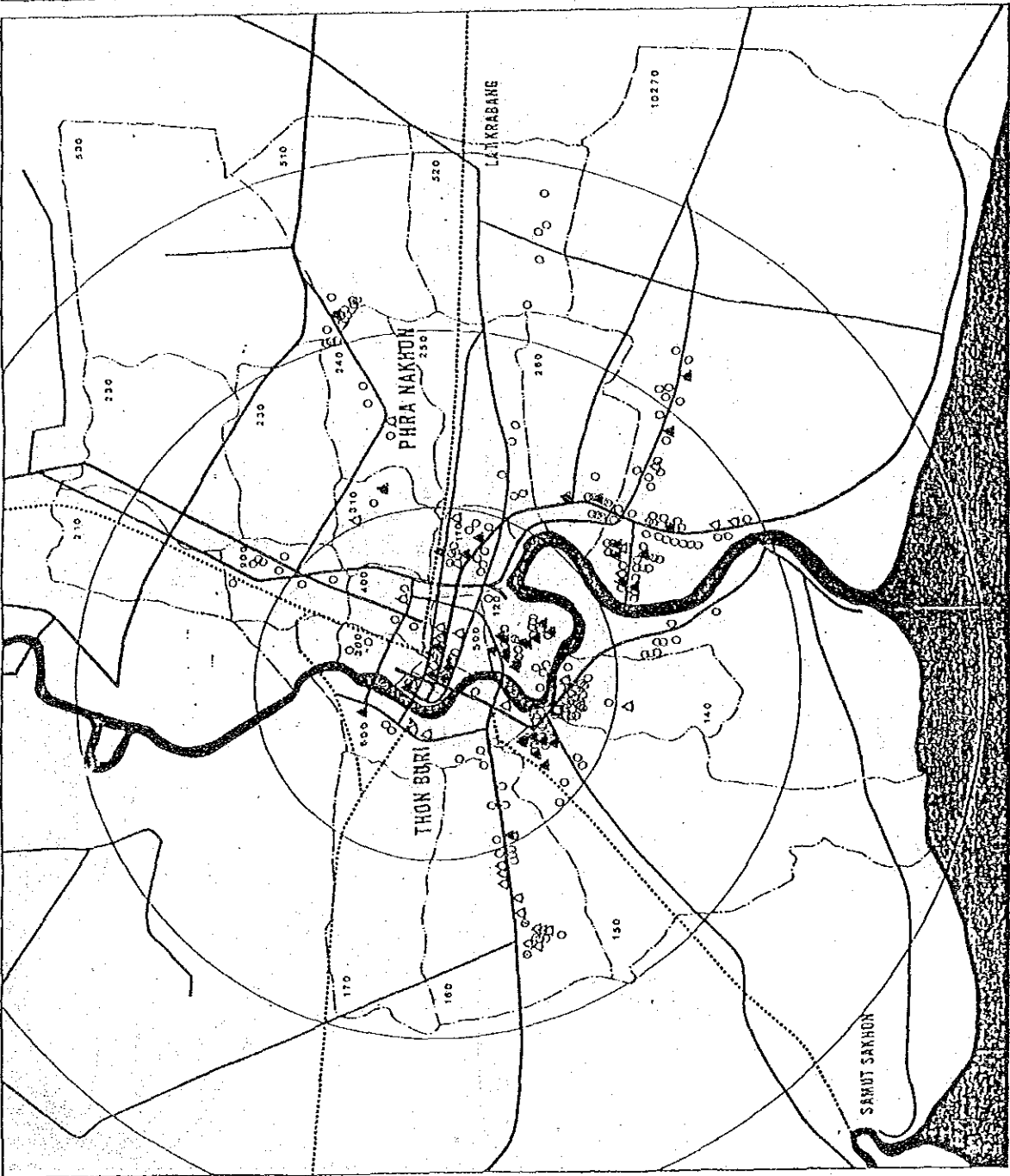


Fig. 4.6.2 - 12
 Evaluation of the industrial
 environment
 -M. Sittler

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad
- very good (+2)
- △ good (+1)
- average (0)
- ⊙ poor (-1)
- ⊖ very poor (-2)


 0 1 2 3 4 5 10KM




(4) Present commuting conditions

Employee commuting distance and commuting mode are summarized in Table 4.6.2-12 and 13. As shown in the table, commuting distance for approximately 50% of all employees is less than 1 km, and approximately 95% less than 10 km.

As to the commuting mode approximately 50% of employees walk to work, followed by bus (approximately 40%), with the remaining insignificant share by other means.

Together, most employees walk to work if the commuting distance is less than 1 km, and use bus for distances of more than 1 km.

Table 4.6.2-12. Commuting distance

Range of distance	Composition (%)
1. Less than 1 km	46.7
2. 1 km ~ 2 km	16.2
3. 2 km ~ 5 km	18.0
4. 5 km ~ 10 km	13.6
5. 10 km ~ 30 km	4.5
6. Over 30 km	1.0
Total	100.0

Table 4.6.2-13. Means of commuting

Commuting mode	Composition (%)
1. On foot	46.8
2. By bicycle	5.2
3. By motorcycle	5.7
4. By private car	3.1
5. By bus	36.3
6. By light ban	2.4
7. By tham row	0.5
8. By train	0.0
Total	100.0

(5) Present condition and plans for cooperative operation

1) Present condition of cooperative operation

Table 4.6.2-14 and 15 show the present state of cooperative operation among factories surveyed. According to this, 27.4% of the establishments are engaged to some degree in cooperative operation. In terms of size of factory, more larger factory are practising cooperative operation, in contrast to a relatively low rate of cooperative operation by small seale factory which are considered to need such activity.

Table 4.6.2-14. Practice of cooperative operation

	Frequence	Percent (%)
1. Yes	54	27.4
2. No	143	72.6
Total	197	100.0

Table 4.6.2-15 Practice of cooperative operation by size of factory

Upper figure: No. of respondents
Lower figure: Composition (%)

No. of Employees	1	2	3	4	5	6	7	8	Total
	1 ~ 6	7 ~ 16	17 ~ 40	41 ~ 100	101 ~ 250	251 ~ 630	631 ~ 1600	1600 ~	
1. Yes	2 8.7	12 19.4	17 29.8	8 28.6	10 58.8	3 50.0	2 66.7		54 27.6
2. No	21 91.3	50 80.6	40 70.2	20 71.4	7 41.2	3 50.0	1 33.3		142 72.4
Total	23 100.0	62 100.0	57 100.0	28 100.0	17 100.0	6 100.0	3 100.0		196 100.0

2) Type of cooperative operation

The types of cooperative operation practiced by factories is summarized in Table 4.6.2-16. As shown in the table, the most frequent type of cooperative operation is 'getting production order', representing 55.8% of all establishments practicing cooperative operation, followed by 'procurement of materials' and 'development of new goods and manufacturing technique', each representing 30.8%.

In contrast, the least frequent type of cooperative cooperation is 'Employees training', representing 9.6%.

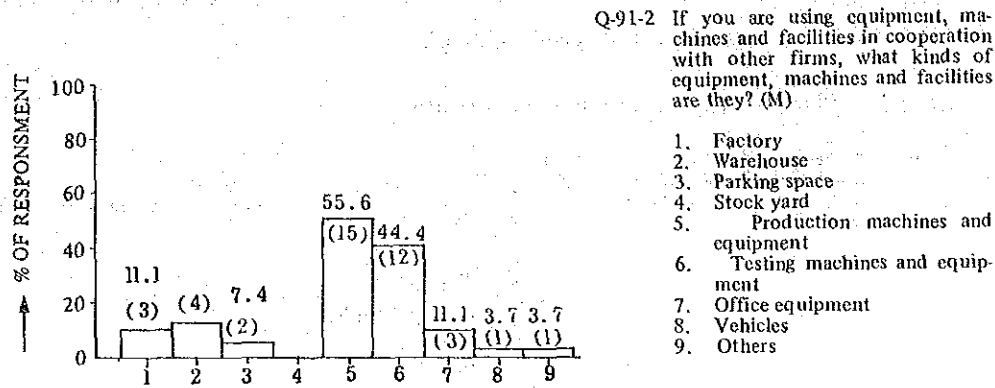
Table 4.6.2-16 Type of cooperative operation

	Frequency	Percent (%)
1. Getting production order	29	55.8
2. Procurement of materials	16	30.8
3. Employees training	5	9.6
4. Development of new goods and manufacturing technique	16	30.8
5. Using equipment, machines, and facilities	13	25.0
6. Others	4	7.7
Total	52	159.7

3) Type of equipment, machines and facilities jointly used

25% of the factories engaged in cooperative operation practice 'Using equipment, machines and facilities'. As shown in Fig. 4.6.2-13, the most frequent type of joint use is related to machines and equipment directly used in production, such as 'Production machines and equipment' and 'Testing machines and equipment', with limited frequency with other types of jointly used equipment.

Fig. 4.6.2-13 Equipment, machines and facilities jointly used



4) Distance between cooperating factories

As shown in Table 4.6.2-17, only 20.9% of all factories engaged in cooperative operation are located less than 1 km from cooperating factories, and almost half of them are located at least 10 km apart, showing a low degree of proximity.

Table 4.6.2-17 Distance between cooperating factories

	Frequency	Percent (%)
1. Basical your factory	6	9.7
2. Less than 100 m	3	4.8
3. 10 m - 500 m	3	4.8
4. 500 - 1 km	1	1.6
5. 1 km - 5 km	9	14.5
6. 5 km - 10 km	11	17.7
7. Over 10 km	29	46.9
Total	62	100.0

5) Plans for future cooperative operation

Fig. 4.6.2-14 summarizes the plans of factories for future cooperative operation. According to this, a majority of factories, have an intention to initiate cooperative operation, almost twice the current rate. When looking at this from size of factory, the intent is more prevalent in relatively large, similar to the size of establishments currently engaged in the practice. (Table 4.6.2-18)

Types of cooperative operation planned by factories are shown in Table 4.6.2-19. This shows roughly same the tendency as in actual practice; a strong tendency toward 'Getting production order' (75.5%) and 'Development of new goods and manufacturing technique' (46.9%), but weaker toward 'Employees training'.

Fig. 4.6.2-14 Plans for future cooperative operation

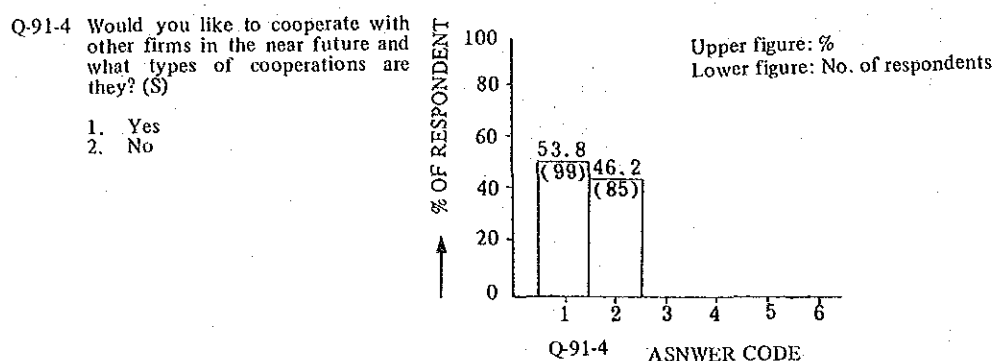


Table 4.6.2-18 Plans for future cooperative operation by size of factory

Upper figure: %
Lower figure: No. of respondents

No. of Employees	1	2	3	4	5	6	7	8	Total
	1 ~ 6	7 ~ 16	17 ~ 40	41 ~ 100	101 ~ 250	251 ~ 630	631 ~ 1600	1600 ~	
1. Yes	10 52.6	30 52.6	29 51.8	13 48.1	11 68.8	3 60.0	3 100.0		99 54.1
2. No	9 47.4	27 47.4	27 48.2	14 51.9	5 31.3	2 40.0			84 45.9
Total	19	57 100.0	56 100.0	27 100.0	16 100.0	5 100.0	3 100.0		183 100.0

There are some points of difference, however, than in actual practice; 'Procurement of materials' show a high percentage in actual practice but is low in plans for the future, being replaced by 'Using equipment machines and facilities'. In any case, a majority of the factories surveyed showed a positive attitude toward cooperative operation, and thus, it is important to take some measures to encourage small/medium scale factories in this respect.

Table 4.6.2-19 Types of cooperative operation planned

	Frequence	Percent (%)
1. Getting production order	74	75.5
2. Procurement of materials	15	15.3
3. Employees training	9	9.2
4. Development of new goods and manufacturing technique	46	46.9
5. Using equipment, machines and facilities	23	23.5
6. Others	5	5.1
Total	98	175.5

4.6.3 Relocation Program

(1) Relocation Program of Factories

The survey on relocation program of each factory is summarized in Table 4.6.3-1 through 3. According to this, 21.1% of the surveyed responded as currently having relocation program. In terms of size of factory and type of process, the highest percentage is found in factories with 41 - 99 employees and specializing in machine assembly.

On the other hand, in the Tokyo Study, only 7.9% of the factories surveyed were considered to have relocation program, far below the present study results. This implies that a significant amount of demand for industrial land will be generated in the B.M.A. by the relocation. (Table 4.6.3-4).

Table 4.6.3-1 Existence of relocation plan

	Frequency	Percent (%)
1. Yes	38	21.2
2. No	141	78.8
Total	179	100.0

Table 4.6.3-2 Existence of relocation plans by size of factory

Upper figure: No. of respondents
Lower figure: Composition (%)

No. of Employees	1 1 ~ 6	2 7 ~ 16	3 17 ~ 40	4 41 ~ 100	5 101 ~ 250	6 251 ~ 630	7 631 ~ 1600	8 1600 ~	Total
1. Yes	3 13.6	11 19.3	11 22.0	10 40.0	2 13.3	1 20.0			38 21.3
2. No	19 86.4	46 80.7	39 78.0	15 60.0	13 86.7	4 80.0	4 100.0		140 78.7
Total	22 100.0	57 100.0	50 100.0	25 100.0	15 100.0	5 100.0	4 100.0		178 100.0

Table 4.6.3-3 Existence of relocation plan by type of process

Upper figure: No. of respondents
Lower figure: Composition (%)

Process	1 Casting	2 Forging	3 Sheet- work & Welding	4 Plating	5 Machine Assembly	6 Machin- ing	7 Press work	8 Precision Machine	9 Heat Treat- ment	10 Total
1. Yes	1 12.5		10 28.6		8 47.1	9 23.7	3 21.4	3 23.1		34 24.5
2. No	7 87.5	1 100.0	25 71.4	5 100.0	9 52.9	29 76.3	11 78.6	10 76.9	8 100.0	105 75.5
Total	8 100.0	1 100.0	35 100.0	5 100.0	17 100.0	38 100.0	14 100.0	13 100.0	8 100.0	139 100.0

Table 4.6.3-4 Results of Tokyo Study

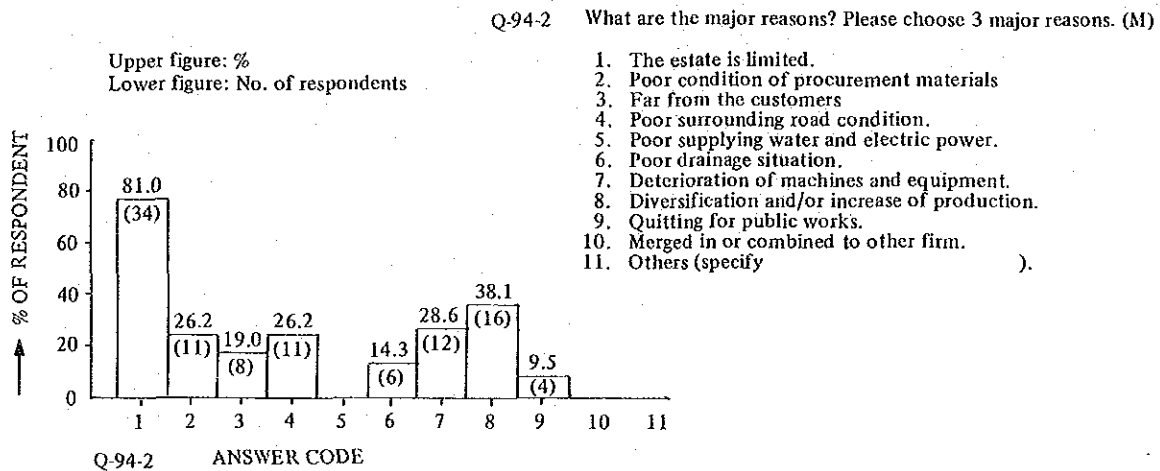
	Percent (%)
1. Relocation planned	2.5
2. Relocation desired	5.4
3. Relocation planned under certain conditions	24.7
4. No relocation planned	67.4

(2) Reasons for relocation

Reasons for relocation are summarized in Fig. 4.6.3-1.

According to this data, the most frequent reason is 'The estate is limited', representing 81.0% of all responses, followed by 'Diversification and/or increase of production', representing 38.1%, and 'Deterioration of machines and equipment', representing 28.1%, indicating that the major reasons for relocation were due a desire for expansion.

Fig. 4.6.3-1 Reasons for relocation



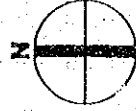
(3) Distribution of factories having relocation program

The distribution of factories having relocation program is shown in Fig. 4.6.3-2. This shows a general distribution pattern which covers the whole B.M.A. A particular concentration is observed in districts A, B and D, indicating a need for implementing redistribution programs in these districts. On the other hand, in districts E and F, which are in central Bangkok, there are fewer factories having relocation program than expected, partly because many of these small factories have insufficient financial resources for relocation. Nevertheless, it appears to be necessary to promote re-distribution of factories in these districts in order to improve their production environment and develop areas in the central urban districts. For this purpose, an industrial redistribution program such as setting up a financing system for small factories along with the development of new industrial zones are new priorities.

Fig. 4.6.3 - 2
 Distribution of factories
 having relocation program

LEGEND

- Primary road
- Secondary road
- Dual lane highway
- Railroad



4.6.4 Problems and Tasks for Future Development

(1) Promoting Industrial Redistribution

Mixed land use by various urban functions, including factories, houses and commercial/business facilities is believed to constitute a major cause of deteriorating production environment on the one hand, and deteriorating living and commercial/business environment on the other. Thus, for improvement of both environment, it is most important to separate these functions by providing environment suitable for each.

According to the survey results, urban areas recognized as industrial districts are only a small portion of B.M.A., and a majority of factories are located in residential or commercial/business districts. Thus, to improve production environment and further to facilitate urban environment in B.M.A., appropriate redistribution of factories is thought to be the most important and immediate task.

As indicated in the survey, more than a fifth of the factories have relocation programs, to clearly suggest their positive attitude for improving production environment by relocation. It should be noted, however, that such attitude is mostly found in medium scale factories of more than 40 employees, but less in smaller scale factories. Since small scale factories are predominantly located in the form of mixed land use, to encourage relocation of such factories is the most important part of industrial redistribution.

When turning to the present state of industrial land development to accommodate relocating factories, development of industrial estates is progressed by IEAT in 30–50 km radius from center in B.M.A. However, these estates are designed for medium or large scale factories and require movement over the distance of 30–50 km, therefore they are not appropriate for small scale factories.

On the basis of the present state of industrial estate development, redistribution programs for small scale factories will be an important task in the future.

(2) Industrial pollution control measures

According to the survey results, around a quarter of all the factories have experience in receiving claims on industrial pollution, including industry types which are considered to generate relatively small degree of pollution. At the same time, incidence of claims on industrial pollution is widely distributed throughout the whole part of B.M.A., to demand comprehensive measures.

Two major pollution control measures can be contemplated; 1) pollution control at source, and 2) improvement of urban infrastructure as an areal program.

Pollution control at source will consist of provision of pollution control facilities and

equipment. But it is difficult for small and medium scale factories to provide facilities and equipment particularly in effluent treatment because of the weak financial bases and small amount of discharge. To deal with these obstacles, it is desirable to provide finance system for small scale factories to afford their own facilities and equipment, and to develop programs to encourage the provision of collective facilities. Particularly, collective facilities should be actively promoted for plating industries which generate hazardous effluent, consist of small scale factories, and are concentrated in the central area.

Among urban infrastructure to be provided, sewage system forms an integral part of pollution control measures.

According to the survey results, demand for the public sewage system is so strong that more than half of all the factories surveyed discharge industrial effluent directly into the public sewage system, implying that there is a great demand for the public sewage system. However, it is reasonable to surmise that most public sewage systems in Bangkok do not provide final treatment. In light of serious situation in river pollution by such industrial effluent, the improvement of these systems is believed to be the most urgent and important project to be carried out.

(3) Promoting cooperative operation

Due to weak financial bases, small/medium scale factories generally face difficulty in improving production and working environment, in upgrading technologies and in developing markets on an individual basis. Under these circumstances, an effective alternative approach is to carry out the improvement plans with cooperative efforts of these factories.

According to the survey results, around a quarter of the factories practice a certain form of cooperative operation, and more than half of them have intention to practice some cooperative operation in the future, to clearly indicate their positive attitude toward it. Thus, it is desirable to develop programs reflecting their intention.

In addition, the existing industrial organizations, such as associations and clubs, are not very active in Thailand, and their revitalization is called for.

And promoting cooperative operation among small/medium scale factories seems to be important in improving such industrial organizations.

Cooperative operation can be carried out between industries of similar types of process, within the same area and of similar sizes of establishment. In addition, cooperative operation among subcontractees under the same subcontractors can be feasible, and

this is expected to expedite formation of industrial structure consisting of large and small/medium scale industries, which are yet to be organized in a systematic way. And this forms an effective strategy for the further industrial development in Thailand.

(4) Formulating development programs for small scale factories

Various problems are accumulated with small scale factories which have the largest number of factories.

At the same time, development programs for them have been left behind those for larger factories, in terms of industrial land development and finance system.

Therefore, it appear to be important to actively formulate such programs for small scale factories.

In B.M.A., since small scale factories are the major cause of mixed land use in the urban area, and this situation may become more serious in the future, redistribution of these factories will form an important target.

On the other hand, metalworking industries have rarely grown in local regions. In order to promote industrial development in the regions, it is necessary to foster small/medium scale industries, particularly in local cities, and lay a foundation of the industrial development.

5. THAI GOVERNMENT PROMOTION POLICIES

5. Thai government Promotion Policies

5.1 The Fifth National Economic and Social Development Plan

In order to solve the socio-economic problems, the Fifth National Development Plan is adopting a "new line" of thinking for the national development which is different from the past National Development Plans.

It has the following main characteristics.

- First : "the adjustment of economic structure" rather than "economic growth"
- Second : "equality" in national economic and social development effort
- Third : "poverty alleviation" for people in backward rural areas
- Fourth : more closer coordination between economic and social development efforts and national security management
- Fifth : implementation of the Plan into operational plans
- Sixth : role and cooperation of the private sector

Along the "new line" of thinking, the Fifth Plan formulate the following Six major objectives.

- First : restoration of countries economic and financial position
- Second : adjust economic structure and raise economic efficiency
- Third : development of social structure and distribution of social services
- Fourth : poverty alleviation in backward area
- Fifth : coordination of economic development activities with national security management
- Sixth : reformation of the national development administration system and deconcentration of the ownership pattern

As we take a view that in an effort to achieve the second objective, promotion of the metalworking industries play an important part, we look into the Second objective in more details. The structural adjustment and economic efficiency improvement programme emphasize the following strategies;

"improvement in production efficiency"

"improvement in marketing efficiency and fairer pricing policy"

"the decentralization of economic activities to provincial areas and backward rural areas"

"improvement of the management system, and review those policy measures which form obstacles as well as the proper role of public and private organs"

"the use of appropriate science and technology"

From the above economic structural adjustment and efficiency improvement programme, principal features of the restructuring production and infrastructural services are summarized as follows:

1. Restructuring of the production process

- 1) agriculture
- 2) industrial restructure
- 3) mineral resources

2. Restructuring of foreign trade

3. Restructuring energy production and consumption pattern

4. Transportation restructuring programme

As we are of the opinion that the promotion of the metalworking industries has the excessive close relation with the industrial restructures, we review the policies and measures for industrial restructuring in more details.

5.2 Policies and Measures for Industrial Restructuring and Decentralization under the Fifth Plan

--- Policy measures for specific industrial development ---

The following measures are considered to be implemented for enabling the specific industries to be competitive in foreign markets and in the domestic market.

- (1) Adjust import taxes to levels which are not excessively high
- (2) Adjust and correct business and excise taxes on imported goods and locally produced goods at the same rate
- (3) Abolish general import control
- (4) Impose price control only in a certain essential case and only for short period
- (5) The government will implement sectoral industrial development and promotional policies by sector, consisting of investment promotion privileges and financial, technological, tax and legal assistance.

The government will also promote investment in the export industry by providing incentives and facilities as well as eradicating various obstacles to export for the restructuring of specific industry.

The promotion of small scale industry and industrial development in provincial areas through the following measures is considered to be one of the key factor for the restructuring of specific industry.

- (1) Improve and expand the promotion of small scale industries in provincial areas.
- (2) Develop a credit extension system and related institution for small scale industries in outlying regions.
- (3) Improve research work, develop production technology, and improve management techniques. In addition, MOC, MOI and MOST are to cooperate in the expansion of markets for small scale industries.
- (4) Promote the production sub-contracting system between small scale industries and large scale industries.
- (5) Speed up the identification of industrial zones according to size and category in various provinces and the development of industrial zone along the Eastern Seaboard and industrial estates in outlying regions.

- (6) Discontinue investment promotion for new industrial investment in Bangkok and surrounding area except for labour intensive export industries in Bangkok's neighbouring provinces.

— The promotion of industrial employment —

The following measures will be used for the promotion of industrial employment.

Direct measures

- (1) Improve incentives in the Investment Promotion act B.E. 2520 in order to promote an increase in industrial employment by reducing or abolishing import tax exemption for industries which cater for the domestic market, and by providing other forms of employment incentives
- (2) Promote and encourage training and development of skill in order to increase the labourer's capability and quality
- (3) Supervise foreign investment and transfer of technology to the Thai labour force by promoting the transfer of technology through training in labour intensive industries.

Indirect measures

- (1) Promote investment in labour intensive export industry
- (2) Conduct research into the demand for skilled workers by manufacturing businesses and develop labour intensive production techniques.
- (3) Mobilize financial assistance from the private sector and from abroad for training workers.

— Energy conservation in industrial sector —

In order to encourage the conservation of all forms of energy in industrial production, the several strategies and measures will be implemented.

— Foreign investment promotion —

For the purpose of promoting of foreign investment to the maximum benefit to the industrial restructuring programme of Thailand, the following measures will be implemented.

- (1) There will be an agency responsible for the promotion, selection, and supervision of investment, trade, technology transfer, and registration of all foreign investment.
- (2) Promote the diversification of foreign investment sources
- (3) Encourage technology transfer to improve the skill of Thai labour force in foreign businesses.

— Development of basic industry —

The following measures will be implemented for the development of major basic industries particularly iron and steel industry.

- (1) Formulate a plan for the development of basic industries in the Eastern Seaboard area.
- (2) Establish a promotional system for basic industry by assigning the responsibility to one particular agency.
- (3) Promote existing basic industries such as the iron and steel industry and natural resource based industries, and provide protection which is not higher than the general level.
- (4) The government will only participate in the investment of basic industry in certain cases.

— Coordination of the overall industrial restructuring programme —

In order to coordinate various industrial restructuring policies, industrial restructuring committee is to be established during the Fifth Plan period.

Industrial restructuring committee was established and have been discussing on restructure of the import substitute industry like automobile industry and electrical appliances for household.

Metalworking industry is one of the industries which will be discussed for restructuring.

Table 5.2.1 is a comparison table of the industrial sector problems and the fifth plan's policies.

Table 5.2.2 shows the summary of the fifth plan in which metalworking industry is named as one of the priority industry which is expected to support other priority industries like agro-based, chemical, or heavy industries.

Table 5.2.1 Problems of Manufacturing Sector and Policies of the Fifth Economic and Social Development Plan

Problems	Policies and Measures
<p>1. The industrial structure is still very import dependent. The structure of most industries are highly dependent on imported raw materials, capital goods, machinery and energy.</p> <p>2. The export industry is not efficiently developed. The structure of the government's industrial promotion privileges is mainly biased towards the protection of import substitution industries for domestic market.</p> <p>3. Industrial activities are mostly located in and around Bangkok and not dispersed to provincial areas. Among the 67,736 registered factories in 1979, 40.9 percent were in the central region.</p> <p>4. The production process and the use of technology in manufacturing industries are still not labour intensive. The development of manufacturing industries through investment promotion privileges has encouraged to make use of a lot of machinery.</p> <p>5. Development of basic industry has not occurred. There is no agency responsible for giving assistance in the development of basic industries projects.</p>	<p>1. Restructuring of specific industries</p> <ul style="list-style-type: none"> - Adjust import taxes - Adjust and correct business and excise taxes - Abolish general import control - Sectoral industrial promotional policies by sector <p>2. Industrial export promotion measures</p> <ul style="list-style-type: none"> - Improve the export promotion plan and measures - Predetermine a fixed rate of tax rebate - Increase sources of loans for export production - Set up export processing zone <p>3. The promotion of small scale industry and industrial development in provincial areas</p> <ul style="list-style-type: none"> - Develop a credit extension system - Improve research work, production and management technique - Promote the production sub-contracting system - Speed up the identification of industrial zones <p>4. The promotion of industrial employment</p> <p>5. Energy conservation in industrial sector</p> <ul style="list-style-type: none"> - Formulate investment promotional privileges to encourage energy conservation - Encourage to substitute the use of oil - Provide financial assistance in order to conserve energy <p>6. Foreign Investment Promotion</p> <ul style="list-style-type: none"> - There will be an agency responsible for the promotion, selection and supervision of investment, trade, technology transfer - Encourage technology transfer in foreign businesses <p>7. Development of basic industry</p> <ul style="list-style-type: none"> - Formulate a plan and promotional system for basic industry - Promote existing basic industries <p>8. Coordination of the overall industrial restructuring programme</p> <ul style="list-style-type: none"> - Industrial Restructuring Committee will be established during the Fifth Plan period.

Table 5.2.2 The Summary of the Fifth Plan

Priority Industries	Industrial Policies	Major Objects	Targets	Region
Agro-based Industries	Export Oriented Restructuring Existing Industries	Poverty Alleviation in Backward Area	Export Goods Increase by 22.3% per Annum	Metropolitan
Chemical Industries	Promote New Industries	Restructuring of the Country's Economic and Financial Position	Import of Goods Growth Rate Not Exceed 18.1% per Annum	Lampang-Chaing Mai
Heavy Industries	Promotion of S.S.I. and Development in Provincial Area	Adjust Economic Structure and Raise Economic Efficiency	Reduction of Oil Import Volume by 3% per Annum	Conkehen
Metalworking Industries	Promotion of Industrial Employment Energy Conservation Foreign Investment Promotion Development of Basic Industry Coordination of the Overall, Industrial Restructuring Programme	Development Social Structure and Distribution of Social Services Coordination of Economic Development Activities Reformation of the National Development Administration	GDP Growth Rate by 6.6% per Annum Manufacturing Industry Growth Rate 7.6% per Annum Government Budget Deficit Not Exceed 22,000 M\$ per/Year Reduction of the Population Growth Rate 1.5% Illiteracy Rate to 10.5% by 1986	Songkla

6. REVIEW OF THE ORGANIZATION FOR THE PROMOTION
OF METALWORKING INDUSTRY

6. REVIEW OF ORGANIZATIONS FOR PROMOTION OF METALWORKING INDUSTRIES

Organizations related to the promotion of the metalworking industries

There are many organizations having role of their own for the promotion of metalworking industries. Fig. 6.1 shows bird's-eye view of the all organizations.

Our counter parts, ISD is under the DIP (Department of Industrial Promotion) of Ministry of Industry. So we first review the DIP briefly. DIP was established in 1941 as the government agency under the ministry of industry for the promotion and assistance of local industries in all aspects. The number of staff was increased from 875 in 1977 to 1171 in 1981.

DIP has the following ten divisions --

Office of the secretary

Planning division

Industrial service division (ISD)

Industrial service division (Northern region)

Industrial productivity division (TMDPC)

Textile industry division

Thai handicraft promotion division

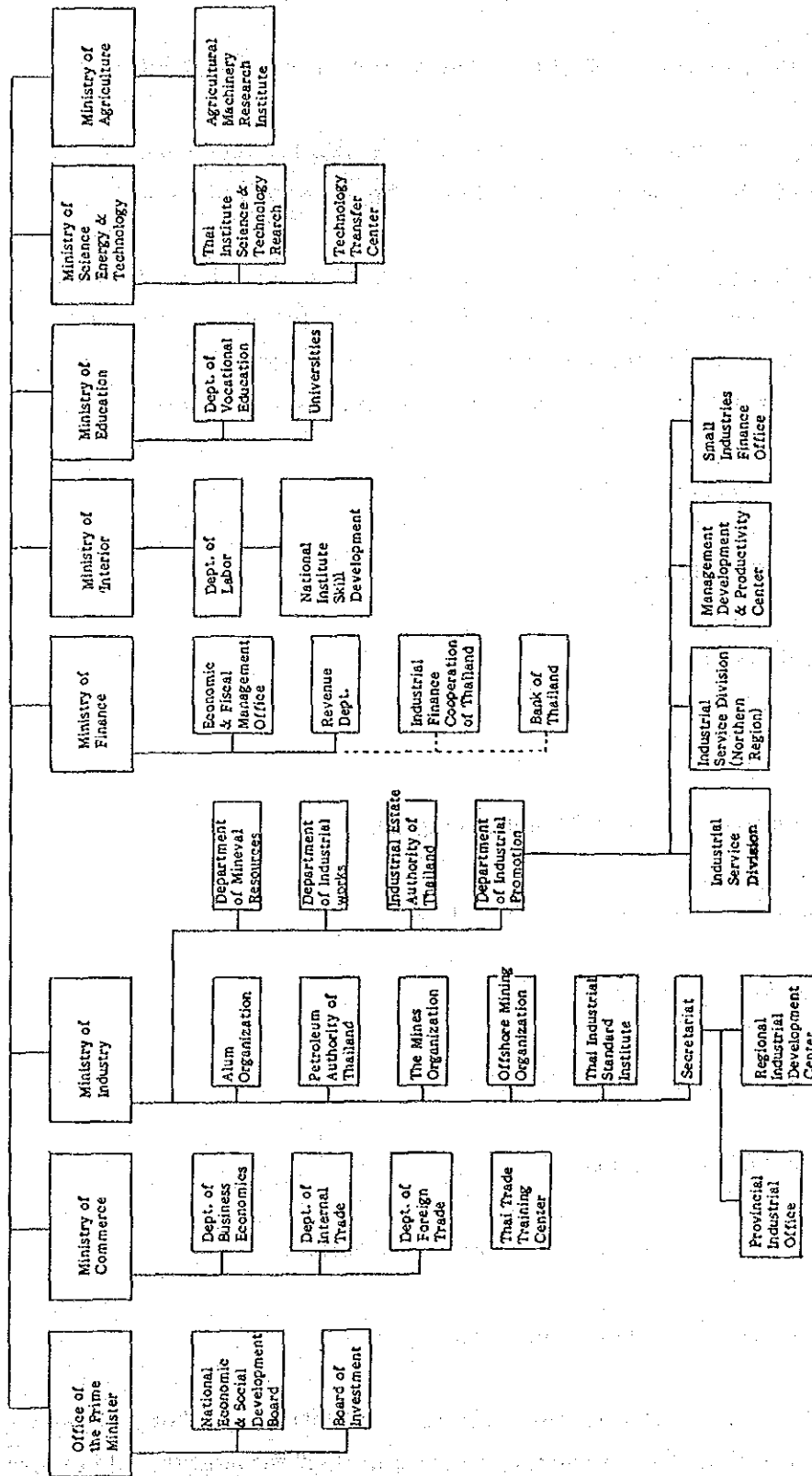
Cottage industries division

Small industries finance office ... State Enterprises

Narayama phand ... State Enterprises

Extension and training are the DIP's primary activities. In fact, six out of its eight divisions provide extension and training services in their respective field of specialization. To achieve the objects, DIP is cooperating and collaborating with the UNDP, ILO.

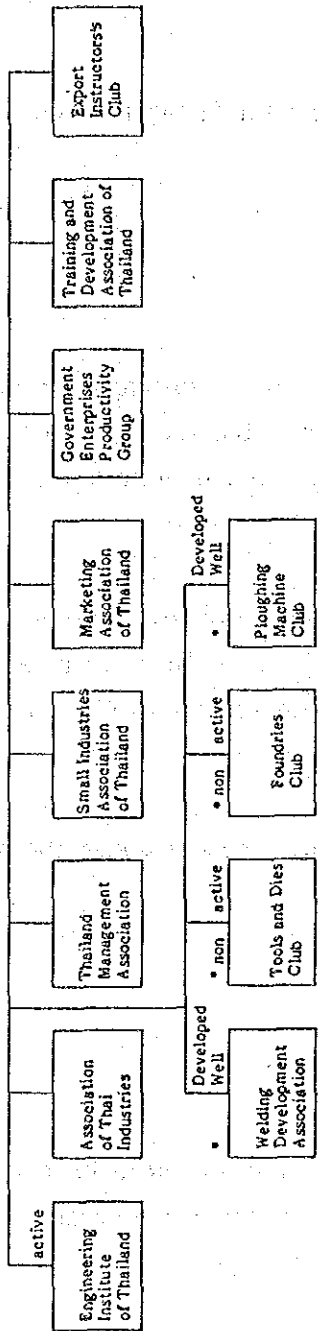
1. Governmental Organizations



(to be continued)

Fig. 6-1 Organizations Related to Promotion of Metalworking Industries

2. Private Organization



*..... ISI supported the establishment
 O..... TMDPC

3. International Organization

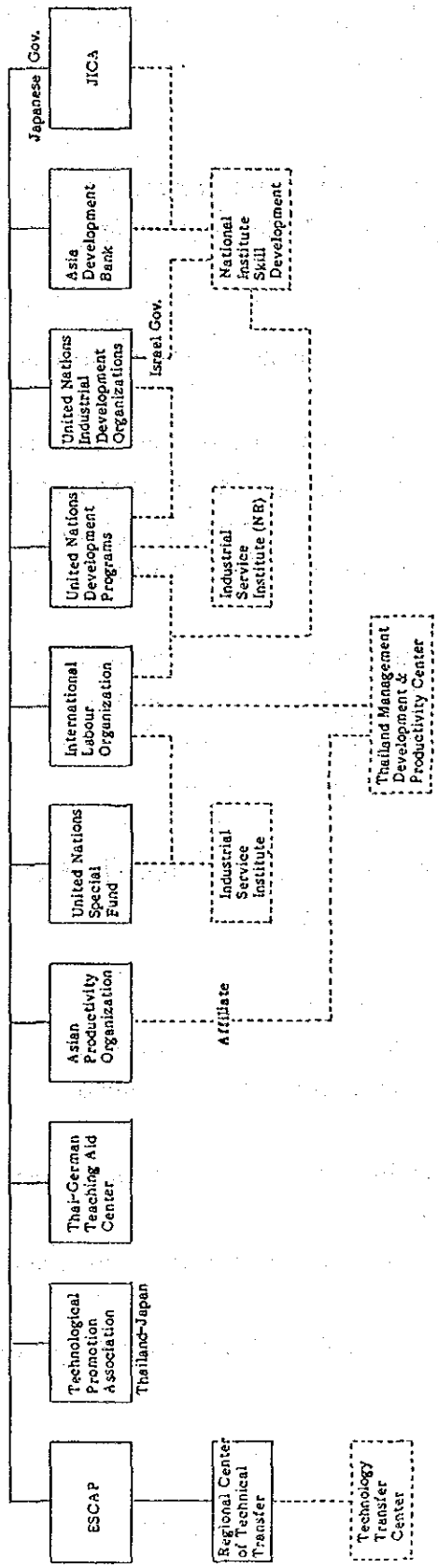


Fig: 6-1 (cont.)

DIP is also a member of TECHNUNET ASIA, an Asian network for industrial information and extension.

The present status and problems of the main organizations (including the divisions of DIP ...ISD, TMDPC, SIFO) are given under.

6.1 Educational Organizations

Thailand has many universities and various schools. Fig. 6.1.1 displays the educational system of Thailand. The period of compulsory education is the six years in the primary school. In Table 6.1.1 number of school, teaching staff and student enrolled are compared with other ASEAN countries and KOREA.

From this Table we can see that 1st and 2nd level education of Thailand can stand comparison with that of other ASEAN countries and KOREA and that 3rd level education of Thailand suffer by comparison with that of other countries and also we can guess the shortage of high level engineers.

The following shows the number of vocational & technical school under the Vocational Education Department.

Poly Technic	11
Vocational & Technical Collages	61
Vocational & Technical School	44

Thailand has universities (including private universities) and of these have department being concerned with metalworking engineering. (Industrial Engineering, Mechanical Engineering, Metallurgy Engineering, and Electrical Engineering)

Engineers are classified into the following 4 groups by educational level they received.

1	Degree Engineers	Graduates of University
2	Diploma Technicians	}... Graduates of
3	Certificates Technicians	
		King Mongkut's Institute of Technology Technical Institute (Under Department of Vocational Education) Private Colleges
4	Craftmen	Graduates of NISD Trade Schools (Belonging to Department of Vocational Education)

Table 6.1.2 give annual manpower output of Educational Institutions in engineering field. Number of engineering graduates (Bachelor Degree) in 1980 are 1,428 persons and those per million are about 32 persons as compared with approximately 640 persons of Japan. The number of graduates at Master's Degree level is still very small.

From Table 6.1.3 and 6.1.4, we can see the number of trainees graduated from the Institute for Skill Development (NISD) and number of graduates in Engineering Industry from Trade Schools of Department of Vocational Education respectively.

The production of manpower at the engineering degree level is insufficient to meet the demand. It can be also seen that the production of manpower at the diploma technician levels is insufficient. There seems to be a severe shortage of chemical and electrochemical technicians. The common defect of the degree engineers, the diploma technicians and the certificates technicians is lack of proper practical training in the educational institutes.

The government must support the more creation of the technical manpower by increasing budget. It also should take various ways to alleviate the defects of the graduates in their lack of practical skill, taking into consideration that some efficient methods doesn't need the increasing of the budget.

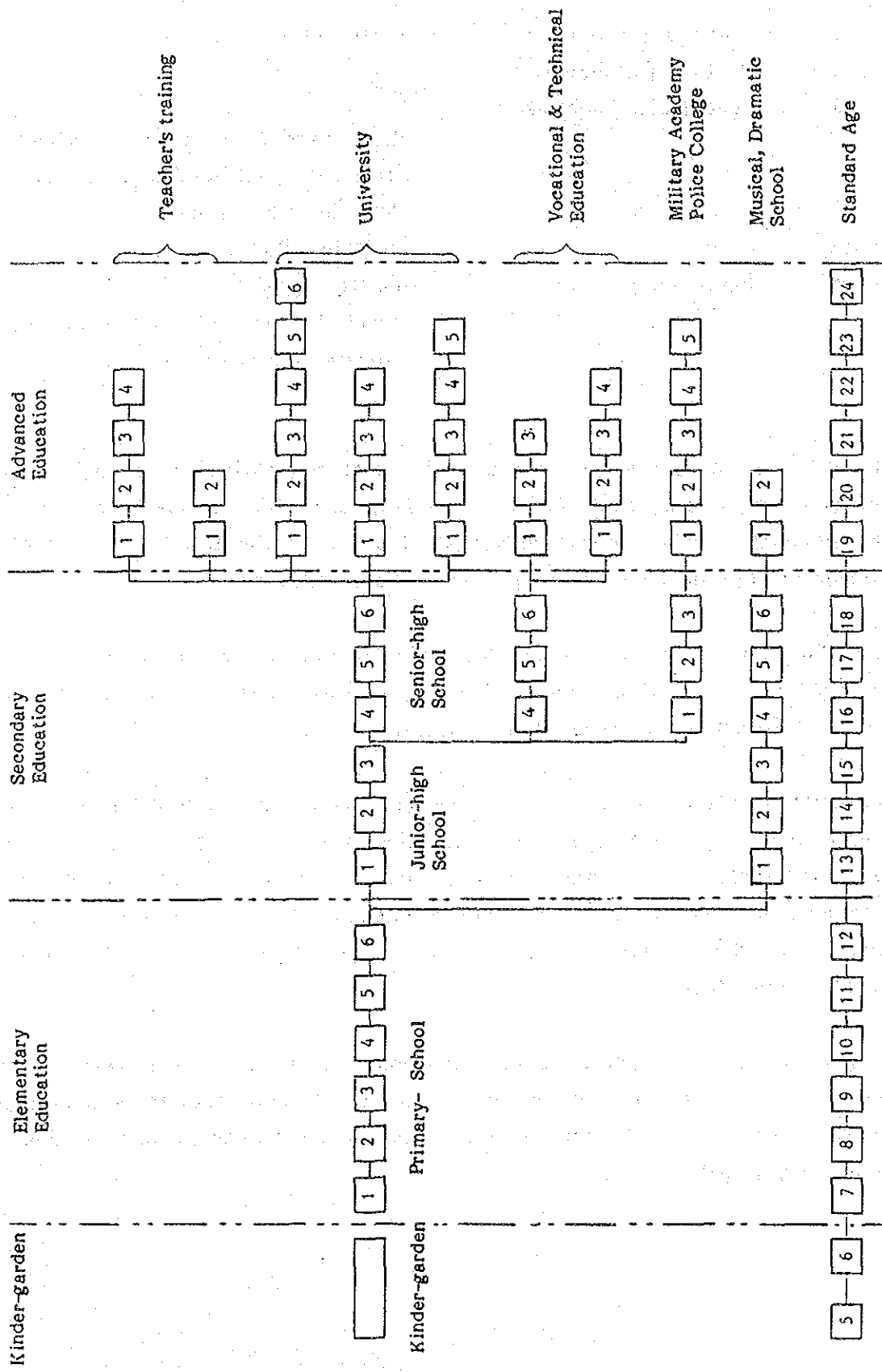


Fig. 6.1.1 School System

Table 6.1.1 Education in ASEAN Countries

	INDONESIA		PHILIPPINES		THAILAND		MALAYSIA		SINGAPORE		KOREA	
	1970	1980 g)	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
Number of School Teaching Staff Student Enrolled	116 786 e)	147 490	36 584	48 098	46 961	10 400 ^{h)}	2 250	2 391	31 435	38 723		
Population (Thousands)	64 040	98 026	22 872 ^{*1}	31 494 ^{*1}	34 758 ^{g)}	4 443	4 341	342	5 961	6 450		
Number of School	9 599	12 982 ^{e)}	30 534 ^{a)}	30 534 ^{a)}	...	887	1 023 ^{b)}	161 ^{*7}	2 671	3 470		
1st Level	5 940	10 982	3 851	5 144	...	882	943 ^{b)}	144	2 085	3 133		
2nd Level	2 756	1 892 ^{e)}	-	-	180 ^{d)}	94	66 ^{b)}	17	586	337		
General	903	586	-	-	45 ^{d)}	11	14 ^{b)}	-	-	-		
Vocational/Technical	-	-	621 ^{*2}	1 098 ^{*2}	14 ^{d)}	-	-	5	232	334		
Teacher Training	-	-	-	-	-	-	-	-	32	51		
3rd Level	514 007	676 236	234 461 ^{*1}	235 911 ^{*3}	330 965 ^{d)}	45 307	52 492 ^{f)}	11 267	101 095	117 290		
Special	146 235	251 269 ^{e)}	-	-	55 180 ^{d)}	20 952	30 464 ^{b)}	8 931 ^{*7}	52 232	103 149 ^{e)}		
Teaching Staff	87 810	206 504	49 276	48 223 ^{*3}	*4, 42 290 ^{d)}	19 775	32 149 ^{f)}	8 019	41 052	73 342 ^{d)}		
1st Level	48 780	44 765 ^{e)}	-	-	8 100 ^{d)}	870	*6 1 043 ^{d)}	912	11 180	18 761 ^{d)}		
2nd Level	9 645	13 657	25 133 ^{*2}	38 226 ^{g)}	4 790 ^{*5}	307	522 ^{b)}	-	-	-		
General	20 018	46 668 ^{c)}	-	-	18 302 ^{f)}	1 213	4 506 ^{d)}	1 158	10 435	21 863		
Vocational/Technical	670	...	-	-	...	-	-	43	394	824		
Teacher Training	14 870.2	21 123.5	6 855 ^{*1}	8 227 ^{*1}	7 272 ^{g)}	1 429.6	f) 1 637.1	296.608	5 749	5 640		
3rd Level	1 930.6	4 071.1	-	-	1 376 ^{d)}	536.5	...	150.467 ^{*7}	1 935	4 046 ^{e)}		
Special	260.9	3 517.3	1 591	2 767	1 530 ^{g)}	510.5	f) 877.8	136.782	1 634	2 991 ^{d)}		
Student Enrolled (Thousands)	544.8	553.7	-	-	148 ^{d)}	23.0	*5 f) 15.5	13.685	301	581 ^{d)}		
1st Level	124.9	216.5	-	-	115 ^{d)}	2.9	b) 6.2	-	-	-		
2nd Level	248.2	296.3	621 ^{*2}	1 182 ^{*2}	398 ^{g)}	17.0	d) 56.5	22.511	201	442		
General	3.9	-	-	-	8 ^{b)}	7	-	-	4	8		
Vocational/Technical												
Teacher Training												
3rd Level												
Special												

Source: UN Statistical Year Book the
 Asia and Pacific

Note: *1 - Including intermediate
 *2 - Including collegiate and graduate school
 *3 - Public school only
 *4 - Public school only
 *5 - Including teacher training at the third level
 *6 - Government maintained and aided school only
 *7 - Including junior college

a) 1971
 b) 1975
 c) 1976
 d) 1977
 e) Estimated
 f) 1978
 g) 1979
 h) ADB Key indicators

Table 6.1.2 Annual Manpower Output of Educational Institutions in Engineering

Level	1978					1979					1980				
	Total Engi- neering	Electri- cal Engi- neering	Indus- trial Engi- neering	Mecha- nical Engi- neering	Metal- lurgical Engi- neering	Total Engi- neering	Electri- cal Engi- neering	Indus- trial Engi- neering	Mecha- nical Engi- neering	Metal- lurgical Engi- neering	Total Engi- neering	Electri- cal Engi- neering	Indus- trial Engi- neering	Mecha- nical Engi- neering	Metal- lurgical Engi- neering
Master's Degree	69	6	7	3	-	83	20	-	10	-	86	17	6	10	-
Bachelor's Degree	1,376	373	142	254	6	1,369	327	127	222	13	1,428	363	116	219	4
Diploma Technician	6,483	1,566	389	1,975	567	6,832	1,478	467	2,015	581	7,276	1,787	494	1,874	880
Certificate Technician	18,482	4,044	4,029	5,796	-	22,206	5,236	4,657	7,212	-	24,895	5,880	3,823	9,633	-

- Source:
1. Planning Division, Department of Vocational Education, Ministry of Education.
 2. College of Technology and Vocational, Ministry of Education.
 3. Office of the Private Education Commission, Ministry of Education.
 4. Planning Division, Office of University Affairs.
 5. Private College Division, Office of University Affairs.

Table 6.1.3 Number of Trainees Graduated from the Institute for Skill Development

	1979			1980			1981			1982					
	Total Electrical Engineering	Industrial Engineering	Mechanical Engineering	Total Electrical Engineering	Industrial Engineering	Mechanical Engineering	Total Electrical Engineering	Industrial Engineering	Mechanical Engineering	Total Electrical Engineering	Industrial Engineering	Mechanical Engineering			
Preparatory training (6-10 months)	408	648	783	2,303	433	732	780	2,513	481	760	944	2,882	587	920	31
Upgrading (40-70 hours)	949	416	796	2,188	773	356	589	3,017	1,253	478	930	3,493	1,341	614	919
Apprenticeship (2-3 months)	323	198	315	1,514	396	405	453	1,344	381	387	370	1,964	490	599	568
Training Promotion	-	36	606	735	-	-	-	768	-	496	109	750	-	489	96
Special Training	1,446	-	-	1,601	-	-	-	1,833	-	-	-	2,079	-	-	-
Total	7,756	1,680	1,298	2,500	8,341	1,602	1,493	1,822	9,475	2,115	2,121	2,353	11,168	2,418	2,614

Source: National Institute for Skill Development, Department of Labour

Table 6.1.4 Number of Graduates in Engineering Industry from Trade Schools of Department of Vocational Education

(persons)

	Total Engineering	Electrical Engineering	Industrial Engineering	Mechaical Engineering	Metallurgical Engineering
1978	5,285	2,223	254	2,079	212
1979	6,489	2,875	503	2,534	13
1980	6,597	3,005	758	2,282	-

Source : Department of Vocational Education, Ministry of education

Note : These are short courses of 225 hours lasting about a year

6.2 Technical Assistance

6.2.1 ISD (Industrial Service Division)

ISD, which is one of the governmental organizations under the Department of Industrial Promotion, Ministry of Industry has been giving the technical assistance to the various field of industries in the form of training, consultancy, dissemination of information and documents and support for the establishment of professional associations since ISD had been established in 1966 by the UNDP. The followings are brief activities of ISD.

The organization map as of Dec. 1983 of ISD is shown in Figure 6.2.1. As shown in this Figure, Technical Operation Sub-Division consists of two sections, that is, Metal Industry Development Section and Industrial Technology Development Section and, has 36 persons (9... Engineer 17... Technician 10... Supporter). Metal Industry Development Section is divided into four unit (Machining Unit, Welding Unit, Heat Treatment Unit and Foundry Unit)

First, we see the training activity to the metalworking industries. ISD offers more than 20 courses in 1982 in the fields of electroplating, heat treatment, foundries, low-cost automation, welding, sheet metal works and machining. The course duration varies from 1 to 12 days. Table 6.2.1 shows the number of trainees educated in ISD from 1977 to 1982. About 1,000 people had been trained in 1982. Metal working area is playing the leading role in the training course in ISD, because of magnitude of demand among the industries concerned. Although, ISD is trying to expand their activities in quantitatively as well as qualitatively, the training services provided by ISD could be developed under the certain condition which have more budget allocation, more appropriate facilities and more resource persons. It is necessary to re-train the target people concerned, one time within 5 year circle at least, because speed of technology renovation is too fast to catch up the appropriate technology, and then try to such a cycle shorten as short as possible for reducing the technology gap between nations.

Secondly, we look at activities of technical consultancy services. ISD had provided more than 120 cases of consultancy services in 1982 and extension service is also provided to 4 - 5 firms a year. ISD is trying very unique extension services that is a group of extension officers stay longer in a firm, say for one month, and make a detail survey of the factory and then formulate and recommend appropriate countermeasures to be applied. That is the reason why the number of extension services is so small. But, this system is appreciated by many applicant firms. Therefore, this system would be hopefully further developed by applying industrial engineering analysis using such as audio visual facilities.

Thirdly, ISD disseminates the information and documents. It printed about 60 technical articles and gave some lectures in 1982. But the sale of booklets ran into difficulties since the proceeds have to be returned immediately to the Ministry of Finance. Table 6.2.2 shows the number of attendants by subject matter in 1979. We can find the facts that about 36 percent of attendants is from public sector and duration of the seminar is less than 3 days. Furthermore, ISD gives the services for the establishment of professional associations. ISD supported the establishment of the Welding Development Association of Thailand, the Tools and Dies Club, the Foundry Club and the Ploughing Machine Club. Some clubs have developed well and some haven't. Other than the above-mentioned activities, ISD expands its activities to the following fields.

- Support for the promotion of the subcontracting firms.
- Material Testing Services
- Development of New Type of Products
- Economic and Technical Survey
- Marketing assistance.

Finally, we dig out the problems to which ISD is facing. Its major difficulties lies in retaining its own experienced and capable staff. Turnover of the high and middle grade engineers is very high because they leave ISD for much better-paid jobs in the private sector. Consequently, ISD has very small number of staff in comparing with scale of their actual activities. Because of the above, there are some difficulty to accumulate the engineering and technical know-how in effective way and consequently its activities is restricted within limited fields and region. There are some difficulty to give appropriate services which fit the needs of many small and medium scale firm's entrepreneur within a limited time. Consequently ISD win little confidence from them and is also little known to the general public nevertheless of ISD's full effort. Next we consider some issues apart from the problem concerning the man-power. There are many governmental organizations related to the promotion of the metalworking industries. (we can find from the Fig. 6.1). Coordination with other organizations, for example TIRTR, NISD, TISI etc, is sure to produce efficient accomplishment of its task. There may be difficulties in coordination because of absence of the mechanisms for horizontal coordination and bureaucratic organizations. For the purpose of providing integrated technical assistance and training to small and medium scale metalworking industries, new approach to the coordination could be explored. Engineering development office newly established in ISD could play the role of coordination among the other public and private organization concerned hopefully. Furthermore ISD has problem in finance management. The ISD has to manage its finance strictly in accordance with the rules laid down by the Ministry of Finance (MOF). Its only source of income is government budget.

The income from offering training courses and services has to be returned directly to the MOF. This inflexibility makes it difficult to secure sufficient training material and solicit experts from other organizations.

Though ISD has many problems to be solved, ISD has been expanding its activities, which are shown in Table 6.2.3 - Table 6.2.7.

To solve the above-mentioned problems, ISD is now going to improve all those difficulties getting support of all of organizations concerned. This movement will be appreciated and get fruitful results in near future. ISD is going to ask approval of more flexible management system to MOF and the other governmental bodies concerned.

6.2.2 T T C (Technical Transfer Center)

TTC was established within Ministry of Science Energy & Technology. Its main work is to coordinate among various technical organizations. It promotes technical transfer, contacting with the following organizations.

Ministry of Education

Ministry of Welfare

Ministry of Agriculture

Ministry of Industry

Ministry of Energy

Thai Institute of Science and Technology Research

The office of National Research Counsel

Chulalongkorn University

As an international organization, it gets various fields of technical information from the RCTT (Regional Center of Technical Transfer) and other technical transfer center in Asia.

6.2.3 T P A (Technological Promotion Association, Thailand - Japan)

TPA's main projects are unified into the following three fields and its object is to improve the technology in Thailand.

1) Seminar and training project

In this project they can acquire a broad know-how extending from the technical aspect to management aspect through short training courses (1 - to 6 days).

In 1982, fifty technical courses were given and total number of man-days reached 8,000 and nineteen management courses were held and aggregate number of man-days come to 2,681

2) Industrial technology support project.

This project started to support the manufacturing sector in 1973. Main activities are to promote the publication of the textbook on technology and to aid the survey on the manufacturing sector.

3) Industrial instrument project

For the purpose of advancement in instrument technology, education center with foreign staffs being well experienced, measuring center to give the measuring services to small scale factory and consulting center to provide the information for the efficient maintenance of the instrument were established.

6.2.4 EIT (Engineering Institute of Technology)

EIT is non-profit organization and consists of 23,000 individual members. It has the following section.

- Civil
- Mechanical
- Electrical
- Industrial
- Mining
- Chemical

EIT organizes seminars (1-3 days) and lectures on the above-mentioned fields.

It also publish some technical books, and accept consulting work.

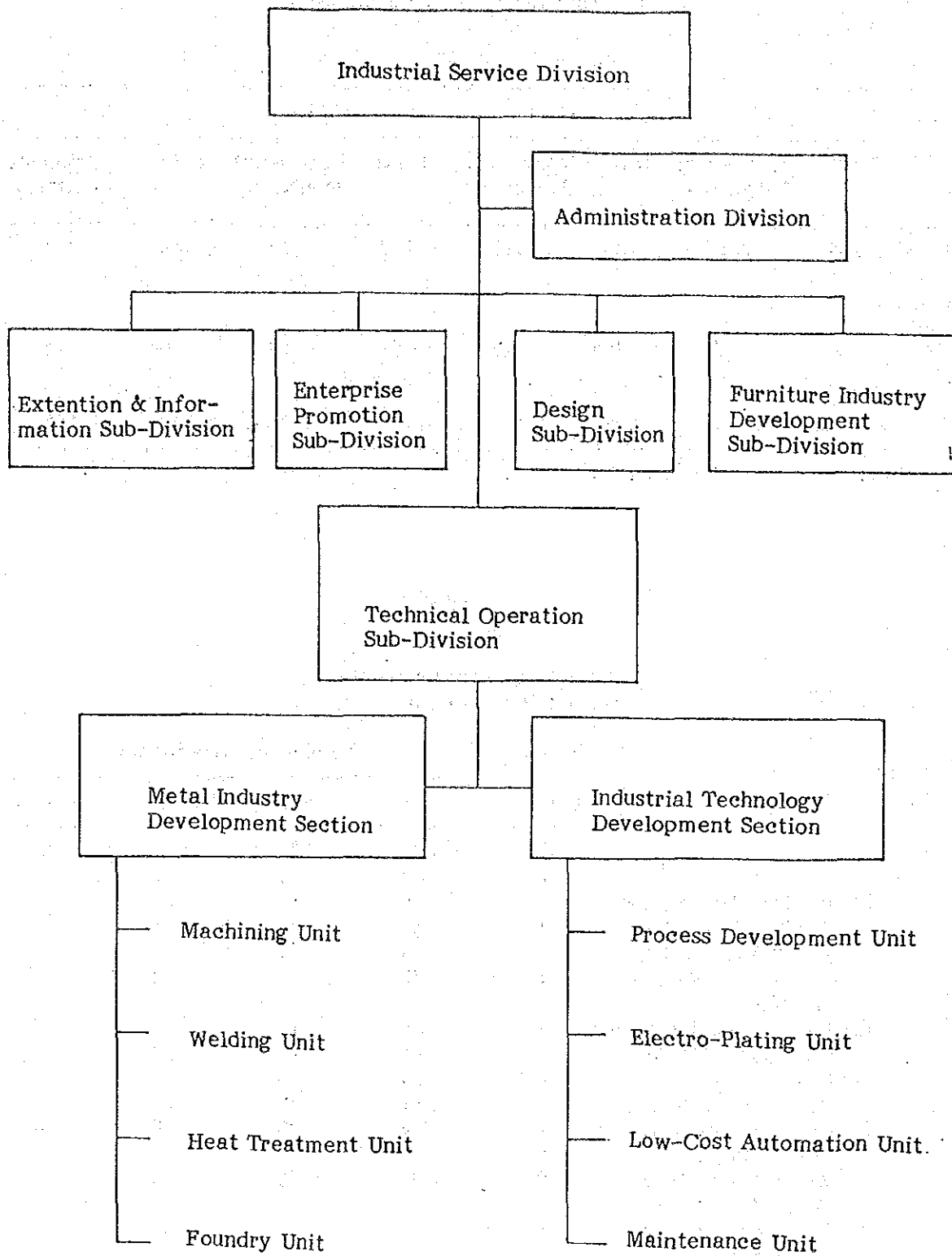


Fig. 6.2.1 Organization of ISD

Table 6.2.1

Number of Trainees Graduated from the Industrial
Service Division, Ministry of Industry

	1977		1980		1981		1982	
	Total	Engineering Industries	Total	Engineering Industries	Total	Engineering Industries	Total	Engineering Industries
Trainees	1,982	962	1,289	533	1,477	853	1,971	972
Number of course target	33	16	40	17	51	24	58	24
Man-days	8,463	2,585	10,291	2,678	8,154	2,505	10,58	2,367

Source: ISD, DIP, MOI

Table 6.2.2

Number of Attendants to
the seminar of ISI in 1979

Year	Contents	Period (days)	Number of Attendants			
			Total	Public	firm	individual
1979		21	1,091	391	611	89
	1. Packaging	1	32	5	27	-
	2. Product Advertizing	2	58	19	37	2
	3. Product Designing	3	139	88	31	20
	4. Arc & Mig Welding	2	148	51	73	24
	5. Car-body Assembly Meeting	3	102	-	102	-
	6. Water-pollution Control	1	29	12	15	2
	7. Sand-block Making	1	46	17	29	-
	8. Metal Plating	2	22	5	17	-
	9. Plastic Engineering	1	111	40	61	10
	10. Conservation Through Insulation	1	150	20	100	30
	11. Wooden Furniture Production	2	91	46	45	-
	12. Bottles and Other Containers	1	65	18	46	1
	13. Problems in Production & Marketing Products of Rattan	1	98	70	28	-

Source: ISD, DIP, MOI

Table 6.2.3

Contact with ISI (1975)

(): percent

Number of employee	Number of firms ever have made contact with ISI	Number of firms never have made contact with ISI	Total
Less than 10	29 (16.8)	144 (83.2)	173 (100.0)
10 - 49	181 (29.6)	430 (70.4)	611 (100.0)
50 - 99	53 (39.0)	83 (61.0)	136 (100.0)
100 - 199	33 (47.1)	37 (52.9)	70 (100.0)
More than 200	15 (25.3)	22 (59.1)	37 (100.0)
TOTAL	311 (30.3)	716 (69.7)	1,027 (100.0)

Source: Saeng Sanguanruang, Somsak Tambunlertchai and Nit Summabhun,
A Study of Small and Medium Scale Industries in Thailand, 1978 (in Thai)

Table 6.2.4

Factory Surveys and Extension Services by ISI (1978-83)

Year	Factories
1978	171
1979	464
1980	119
1981	483
1982	532
1983	200

Source: IDS, DIP, MOI

Table 6.2.5

Technical Information services by ISI (1978-83)

Year	Clients	Items
1978	2071	4428
1979	1503	4493
1980	2781	5162
1981	6055	7287
1982	6767	7236
1983	2902	6075

Source: ISD, DIP, MOI

Table 6.2.6

Technical Inquiry and Consultancy Services by ISI

Year	Number of Technical Inquiry and Consultancy Services
1978	495
1979	192
1980	237
1981	598
1982	470
1983	591

Source: ISD, DIP, MOI

Table 6.2.7

Training and Seminar by ISI

Year	Number of Training Course and Seminars	Number of trainees
1978	36	1461
1979	46	2181
1980	40	1289
1981	51	1477
1982	71	3119
1983	82	3631

Source: ISD, DIP, MOI

6.3 Management Assistance

6.3.1 TMDPC (Thailand Management Development and Productivity Center)

TMDPC was set up through technical cooperation of Thai government and ILO in 1962. TMDPC, a section of DIP is also an affiliate of the Asian Productivity Organization (APO). It currently employ professional staffs, most of whom are instructors.

Its activities are :

- to provide training for personnel from government and private sector, mainly management personnel.
- to provide management consultancy services.
- to arrange expert consultancy services from APO, JICA and other foreign sources.
- to run a month magazine devoted to management and productivity.

The fields of the activities are :

- marketing and products development
- production control - quality control, job methods, productivity, planning control
- personnel administration, job instruction, job relations.
- business administration - filing and record management, office organization and office resources control.
- financial management - cost control in industrial enterprises, decision making for investment.

The term of courses running 50 - 100 each year is 5 days at 3 hours. Most of the courses are conducted in the TMDPC's premises and a few are run outside.

Table 6.3.1 shows the number of trainees graduated from the TMDPC from 1979 to 1982. All figure shows the gradual increase. In 1982, 60 training courses were given to 8614 persons, totalling 31,535 man-days. The nominal limit on the number in any class is 20 persons, but classes often swell beyond this limit because of good demand.

The TMPDC also gave management consultancy service to 36 firms in 1982. It runs a bi-monthly journal "Productivity" with 2,500 copies of circulation and broadcasts an article on management productivity development on Radio Thailand once a month.

Furthermore, the support for the establishment of professional associations is one of the activities of the TMDPC.

The establishment of the Thailand Management Association (TMA), the Marketing Association of Thailand, the government Enterprises Productivity Group, the Training and Development Association of Thailand and the Export Instructors Club were supported by TMDPC.

The firms making use of these activities are mostly large firms with some medium size as well. More than half of the participants come from commercial companies rather than manufacturing companies. The charge for services is not free and TMDPC make use of the proceeds before remitting the extras to the MOF. the TMDPC has more freedom in finance management than ISD has.

The TMDPC makes considerable efforts to train its staffs by sending them abroad or to firms, and to have training courses for its own instructors. However, its effectiveness is severely limited by the fact that many of its staff are young, lacking of experience and that the size of the unit is small.

6.3.2 TMA (Thailand Management Association)

The TMA is a self-supporting non-profit organization set up in the early 1960s. The purpose of the association is to improve the quality of management in Thailand by providing training. The organization and activities of the Association are shown in the following.

Administration Department:

Providing an information services and other business services

Management Development Center:

Running training courses

The courses on production management, personnel management, financial management and marketing led by professional experts people from industries and commerce or by academics or by visiting foreign experts are held in hotels or on the company's premises. The private sector industrialist, particularly those who are running the larger companies think TMA is a good and favourable organization because :

- it provides expert training to the larger companies' middle-level managers.
- it is run by industrialists themselves
- it is not out to make a profit.
- it is more dynamic than a government agency.

However, some industrialists feel that it is becoming a bit more academic and a bit less practically oriented.

Table 6.3.1

Number of Trainees Graduated from the Thailand
Management Development and Productivity Centre

	1979		1980		1981		1982	
	Total	Engineer	Total	Engineer	Total	Engineer	Total	Engineer
Trainees	5,875	492	5,291	498	7,054	410	8,614	603
Number of course target	49	9	51	9	58	5	60	8
Man- days	14,688	1,230	13,228	1,245	17,635	1,025	212,535	1,508

Source: Thailand Management Development and Productivity Centre,
Ministry of Industry

6.4 Financial Assistance

In Thailand industrial and commercial finance is provided largely through private banking system. But to the small firms, finance is one of the most important problems and they still rely on informal sector for finding finance. The financial services given to them from formal financial institutions are insufficient. Many previous studies pointed that inadequacy of financial support is a major hindrance to development of small industries.

Finance is the most important area in which government could render assistance.

Some credit facilities are provided for industrial development on concessionary terms through the official and semi-official organization such as the SIFO, IFCT and BOT.

6.4.1 SIFO (Small Industries finance Office)

SIFO was established in 1963 as the Loan Scheme for the Small Industries Development (LSSID) to extend loans at low cost to small entrepreneur to set up new factories or expanding existing ones. The fund for lending consists of SIFO's deposit at the KTB (Krung Thai Bank) from the MOF and the contribution of KTB. Since 1969, the ratio of the KTB's contribution to SIFO's deposit has been 3 : 1. SIFO has four departments, which are called as Administration, Loan Processing, Screening & Consulting and Follow-up & Evaluation.

However, collateral appraisal, disbursement of loan proceeds and collection of loan obligation are administrated by the KTB. Table 6.4.1 and Table 6.4.2 show the lending operation by SIFO since 1977 and classification of loans by purposes respectively. Cases of application went down from 152 in 1977 to 53 in 1982. Approved cases and amount showed the more rapid decline. Only one case was approved with reference to the engineering industries.

It is estimated that SIFO's operation can satisfy only about 3-4% of the demand for capital for expansion of small manufacturing firms in the country, if we take the requirements for setting up new enterprises into consideration, distribution of parts is extremely small.

The following is the loan conditions.

Firm financed :

- o having fixed assets of B5 Million and less
- o manufacturing industries
(include the firm manufacturing metal products and machine for agriculture)
(exclude the firm financed by IFCT.)
(exclude the firm assembling automobiles)

Purpose for the loan ;

- o working capital
- o investment to fixed assets (land, machine building, etc)

Repayment period : 3 - 10 years

Collateral appraisal ; by Krung Thai Bank at 30 - 40 of market price.

Amount : Max B1 Million
 The majority B0.5 Million - B1 Million
 (80 percent)

The reason why applications can not be approved is mostly insufficiency of mortgage. The main cause of SIFO's failure have been discussed many times. From the manpower aspect high turnover of staff, shortage of staff being well acquainted with finance, and lack of labour volition have been mentioned. Strict loan conditions, taking long time and requiring many document are also explained as the reason why very few have been making use of SIFO's facility. some people criticized the part-government-owned Krung Thai Bank providing and supervising the loan for exhibiting a general lack as sympathy with the whole project. The failure seems to be caused by the original design of the institution. It was not a bank, but a government office bearing the responsibility of playing the intermediary between small firms and KTB.

As we have seen above, the reconstitution of SIFO is inevitable for the promotion of small and medium scale industries and then we should pay due regard to the following points.

- o More convenient credit than subsidized credit
- o Appraisal of creditworthiness doesn't have a need of duplication of paper and effort.

6.4.2 IFCT (Industrial Finance Corporation of Thailand)

The IFCT was established in 1959 to provide low-interest long-term and medium loans for setting up private companies, expansion and modernization of the existing plants and acceleration the progress of capital market.

It is a non-official development bank

The loan policies are :

- o Promotion of the import substitute industries
- o Fostering inland and labour intensive projects
- o Laying stress on technical transfer and environment conservation

The following is the loan conditions.

Project financed :

- o Worthwhile industrial project for the development of Thai economy

Purpose for the loan ;

- o working capital (since 1983)
- o fund for building construction, purchase of machinery and equipment

Collateral : Land, machinery, equipment, building,
guarantee by commercial bank

Interest rate : Preferential rate

Amount : More than B 1 million

Table 6.4.3 shows the loans amount by products. In 1980, the loans provided by IFC to iron, steel and metal industries totaled B 291.3 Million, representing 28.3% of the total loans.

6.4.3 IPN (Industrial Promissory Notes) by the BOT (Bank of Thailand)

A 7% discount rate is provided by the BOT for industrial promissory notes with 120 days maturity. This facility is intended to provide working capital to manufactures. The proportion of loans which can be discounted vary according to industrial category and characteristic. There have been one or two attempts to encourage the BOT to set up a guarantee scheme which would lessen the commercial bank's nervousness about lending to small and medium industries.

Table 6.4.1 Lending operation by SIFO since 1977

Amount of loans in thousands of baht

Fiscal Year	<u>Application</u>		<u>Approved</u>		<u>Denied</u>		<u>Withdraw</u>	
	Case	Amount	Case	Amount	Case	Amount	Case	Amount
1977	152	98,390	83	46,195	38	24,110	31	17,700
1978	148	104,160	85	44,880	38	28,580	28	21,500
1979	116	69,178	56	28,093	37	24,270	3	12,060
1980	76	51,740	17	5,870	-	-	-	-
1981	-	-	1	100	-	-	-	-
1982	53	38,500	5	3,010	12	9,470	16	10,900

Note : SIFO temporarily suspended lending between Feb. 1980-1982.

Source : SIFO