FEASIBILITY STUDY REPORT
ON
THE ESTABLISHMENT OF THE TESTING LABORATORY
AND QUALITY IMPROVEMENT CENTER
FOR
THE METALWORKING INDUSTRY
IN
THE REPUBLIC OF INDONESIA
(SUMMARY)

MARCH, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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E R R A T A

Section	Page	Line	Error	Correction
2.3	8	8	--capital goods (e.g.,automobiles, home electric appliances) and consumer durables.	--capital goods and consumer durables (e.g.,automobiles, home electric appliances).
5.1	21	13	--forging, heat treatment and plating, which are not sufficiently conducted in Indonesia,--	--forging, pressworking, heat treatment and plating, which are not sufficiently conducted in Indonesia, --
5.3	32	3	(Table 7.4-1 (7) Plating) 2) Concrete-made plating tanks protected by vinyle sheets are--	2) Concrete-made plating tanks protected by vinyl sheets are--
6.4(2)	45	14	--interesting in using the Center, the number of firms interesting in using the Center is obtained.	--interested in using the Center, the number of firms interested in using the Center is obtained.
7.7(1)	70	11	This area does not cover the area for the access road and it includes the area for--	This area does not cover the area for the access road but includes the area for--
9.1(3)	76	25	--Center were discussed in Chapter 8.	--Center were discussed in Chapter 6.
11.5(2)	108	5	--largely to the increase of foreign exchange earning capabilities In--	--largely to the increase of foreign exchange earning capabilities in--

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CONTENTS

ABBREVIATIONS AND SYMBOLS

Organization and Company

B4T	:	Institute for Research and Development of Industrial Materials and Technical Products
BBIK	:	Institute of Research and Development for Chemical Industry
BKI PT	:	Indonesia Classification Bureau Co., Ltd.
BKPM	:	Investment Coordinating Board
BPPI	:	Agency for Industrial Research and Development
BPS	:	Central Bureau of Statistics
CEVEST	:	Center for Vocational and Extension Service - Training
CRDI	:	Ceramic Research and Development Institute
GAMMA	:	Federation of Indonesian Metalworks & Machinery Industry
GIAMM	:	Association of Automotive Component Parts Manf.
IBRD	:	World Bank
IRDCLI	:	Institute for Research and Development of Cellulose Industries
IRDTI	:	Institute for Research and Development of Textile Industries
ITB	:	Bandung Institute of Technology
ITS	:	Surabaya Institute of Technology
JETRO	:	Japan External Trade Organization
JICA	:	Japan International Cooperation Agency
KIM-LIPI	:	Research and Development Center for Calibration Instrumentation
LIPI	:	Indonesian Institute of Science
LUK	:	Laboratory for Strength and Material Component and Structure
MIDC	:	Metal Industry Development Center
MOI	:	Ministry of Industry in Indonesia
MOPW	:	Ministry of Public Works
P.T.Askrindo	:	Indonesia Credit Insurance Co., Ltd.
PT.BBI	:	PT.Boma Bisma Indora
PTKI	:	Industrial Chemistry Technology Education Center
PUSPIPTEK	:	National Center for Research, Science and Technology

Financial and Economic Terms

C & F	:	Cost and Freight
CIF	:	Cost, Insurance and Freight
EIRR	:	Economical Internal Rate of Return
FIRR	:	Financial Internal Rate of Return
FOB	:	Free on Board
GDI	:	Gross Domestic Investment
GDS	:	Gross Domestic Savings
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
KCK	:	Working Capital Credit for Villagers
KIK	:	Investment Credit for Small Enterprises
KMKP	:	Permanent Working Capital Credit
M.	:	Thousand
M.M.	:	Million

Currency and Exchange Rate

Rp	:	Indonesia Rupiah
		(1 Japanese Yen = 12.77 Rupiah, July 29, 1988)
US$	:	U.S. Dollar
Yen	:	Japanese Yen

Technical Terms and Others

ASME	:	American Society of Mechanical Engineers
ASNT	:	American Society of Non-destructive Test
BS	:	British Standards
CNC	:	Computer Numerically Controlled
CKD	:	Complete Knock Down
CSF	:	Common Service Facility
DCI	:	Ductile Cast Iron
DIN	:	Deutsche Industrie Normen
EDM	:	Electro Discharging Machine

JIS	:	Japanese Industrial Standards
M/C	:	Machine
M/P	:	Master Plan
NC	:	Numerically Controlled
PT	:	Penetrant Test
Q.C.	:	Quality Control
R & D	:	Research and Development
RT	:	Radiography Test
SII	:	Standard Industri Indonesia
T/A	:	Technical Assistance
TR	:	Training
Univ.	:	University
UT	:	Ultrasonic Test

CHAPTER 1

BACKGROUND AND OBJECTIVE OF THE STUDY

CHAPTER 1 BACKGROUND AND OBJECTIVE OF THE STUDY

1.1 Background

The key target of the industrial development policy of the Government of the Republic of Indonesia (hereinafter called the Indonesian Government) is to accomplish the goal of the Fourth Five-year Development Plan (Repelita IV), in building the foundation of the framework for further development which will be strengthened further in the Fifth Five-year Development Plan to reach a full fledged and sustained industry after the Sixth Five-year Development Plan. In light of the above the structure of industry has to be strengthened and deepened as that implies, the linkage between different industries should be improved and well balanced development between large scale industry and small and medium scale industries should be promoted.

In line with this objective of the industrial development policy of the Indonesian Government, the Japan International Cooperation Agency (JICA) has proposed a development program for (1) the introduction of an institutionalized financing system, (2) technical cooperation and (3) the establishment of a testing laboratory and quality improvement center for the metalworking industry (hereinafter called the Center) through the "Study on Development of Linkage-type Industry in the Republic of Indonesia" (Master Plan) which was conducted as one of its fiscal 1985 projects.

In line with that proposal, the Indonesian Government has requested that JICA conducts a feasibility study (F/S) on the Center for promotion of the Indonesian metalworking industry. In response to that request, JICA dispatched a preliminary study team to Indonesia in February 1988 and reached an agreement on the scope of work (S/W) for execution of the feasibility study with the Ministry of Industry (MOI) and the Industrial Research and Development Agency (BPPI) of Indonesia.

In this study, a conceptual design for the above Center, which constitutes an integral part of the Master Plan for the Development of Linkage-type Industry in the Republic of Indonesia (hereinafter called Indonesia), has been conducted and its feasibility has been evaluated.

1.2 Technical Approach of the Study

The Study consists of two portions, namely (1) field survey in Indonesia and (2) the study in Japan. The field study in Indonesia was conducted for the period from the beginning of July, 1988 to the beginning of August, 1988, by 9 professionals. The study in Japan was carried out immediately after the field survey in Indonesia until the end of October, 1988.

The field survey in Indonesia was conducted mainly through "direct visit interview" with the firms belonging to the metalworking industries, and other related institutions including the technical institutes providing testing and inspection services, training and research and development (R & D) services to the industries. The survey on the industries focused on the understanding of the current situation of the Indonesian metalworking industries, the identification of the problems prevalent in the metalworking industries, and the location of the demand for the Center to be established from the qualitative and quantative viewpoints.

Interviews with the technical service institutes included B4T and MIDC, and other similar governmental institutes.

Table 1.2-1 Number of Interviewed Organizations in Indonesia

1. Assembly-type industries	45
2. Linkage-type industries	22
3. Similar related institutes	23
4. Other organizations	19
Total	109

In order to complement the field survey, a "Questionnaire survey" was conducted.

Table 1.2-2 Results of Questionnaire Survey

Number of firms to be surveyed	Number of effective answers	Rate of effective respondents
208	88 (total) 66 (assembly-type) 22 (linkage-type)	42.3 %

The study in Japan has included the review and analysis of the data collected during the field survey in Indonesia, and, in addition, a survey on the similar technical institutes was carried out. Results of the study have been summarized and presented in the Final Report.

The flow of the Study is summarized in Fig. 1.4.1.

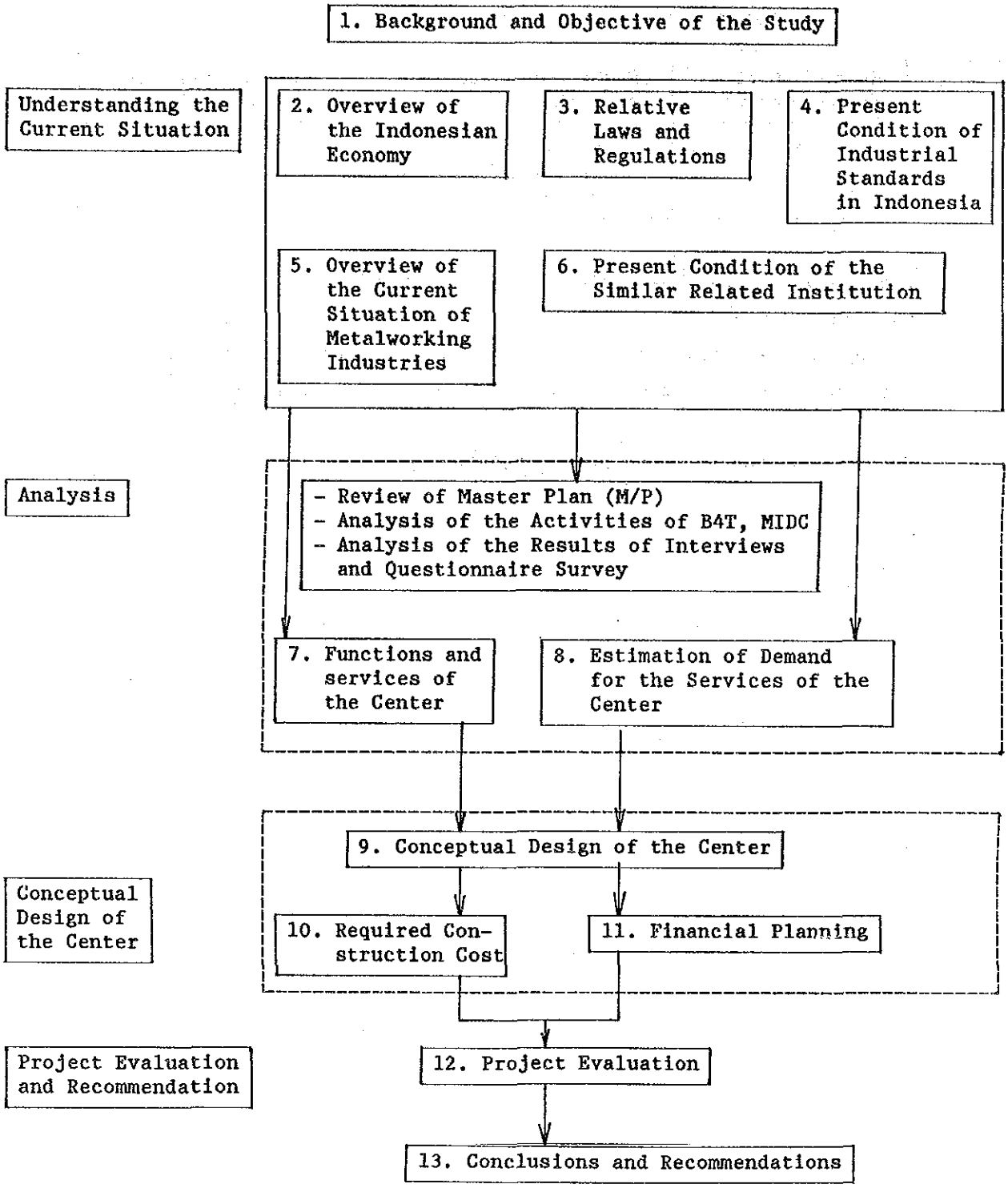


Fig. 1.4-1 Flow of the Study

CHAPTER 2

OVERVIEW OF THE INDONESIAN ECONOMY

CHAPTER 2 OVERVIEW OF THE INDONESIAN ECONOMY

2.1 General

The land area of Indonesia is 1,920,000 km^2. Indonesia is the largest archipelago in the world, and consists of about 13,000 large and small islands. The Indonesian archipelago extends 5,100 km from east to west and 1,900 km from north to south in the equatorial area. The population of Indonesia is the largest in Southeast Asia. According to the latest population census held in 1985, Indonesia's population was 170 million.

The annual average rate of per capita GNP growth in Indonesia for 21 years from 1965 to 1986 was 4.6%, and the per capita GNP amount in 1986 amounted US$490. Per capita GNP amount in the ASEAN countries except Brunei is as follows:

US$7,410 in Singapore
US$1,830 in Malaysia
US$ 810 in Thailand
US$ 560 in the Philippines

(Source: World Bank)

Although per capita income was relatively low, Indonesia's GNP in 1986 was US$75.2 billion because Indonesia has a large population. This amount was near the level of South Korea's GNP in the same year (US$98.1 billion).

2.2 Fourth Five-year Development Plan (Repelita IV)

The Fourth Five-year Development Plan was officially decided as Presidential Decree No. 21 (1984), and took effect on April 1, 1984.

It emphasizes the economic recovery policy as one of the basic policies, and the economic progress guide is set relatively low.

Target values in the following items to be accomplished in the Fourth Five-year Development Plan are as follows:

Annual rate of population growth	2%
Annual rate of GDP growth	5%
Increase in new employment opportunities	9.3 million persons
Annual inflation rate	8%
Total investment amount	Rp.145,224.5 billion
Annual increase rate of total investment	19.1%

The main purpose of the Fourth Five-year Development Plan is to improve living standards, intellectual abilities and welfare of the nation. In this Plan, Indonesia is expected to create a fundamental base for growing by itself. Top priority in this Plan is given to economic development. The Plan also focuses on foods self-sufficiency in the agricultural sector, and development of the machinery industry. The necessity of strengthening the structure of industry and linkage between up stream and down stream industries as well as between medium- and small-scale companies and large companies is emphasized. Industrial development is expected to contribute to promotion of exports as well as increase in employment opportunities. Items included in the development plan are machine tools, agricultural machinery, heavy equipment, automobiles, ships and electric machinery.

The actual Indonesian economy at the first year of the Fourth Five-year Development Plan faces a severe economic situation relative to foreign countries resulting from the lower oil prices and the increase in foreign debt, and it has become clear that it will be hard to accomplish the targeted annual growth rate of GDP, which is 5%, in the Fourth Five-year Development Plan. As far as development expenditures of the Indonesian Government's budget is concerned, the achievement rate in 1984 was 95.1%, while that in 1985 was 84.6% and that in 1986 dropped to 54.1%. This was caused by the governmental budget cut owing to the decreased oil revenue which was the main revenue sources. The development budget in 1987 was cut to 41.8% of value targeted in the Fourth Five-year Development Plan.

On the other hand, the Indonesian Government is promoting private business and consistently invites foreign investment of manufacturing industry. Priority is also given to investment with an export potential. Through continuous deregulation, a higher level of growth rate of manufacturing industry is maintained in spite of the sluggish oil sector. The growth rate of the manufacturing industry in 1983, which was 2.20%, lower than the growth rate of economy, which was 4.28% during the Fourth Five-year Development Plan, increased to 7.06%, compared to the growth rate of the economy which was 3.59% in 1987. The share of manufacturing sector in GDP, which was 12% in 1984, increased to 14% in 1987.

In terms of production value, the level was increased from Rp. 11 trillion in 1983 to Rp. 43 trillion in 1987, out of which the metal-working and machinery industries production value was increased from Rp. 1.4 trillion to Rp. 6.5 trillion. In the export of industrial products, the level increased from US$ 3.2 billion in 1983 to US$ 6.7 billion in 1987, an increase of 20.3% per annun.

Within the investment sector, the level increased year by year.

Between 1984 to 1987, the investment reached Rp. 15.9 trillion plus US$ 3.6 billion. In the employment opportunity, within the Fourth Five-year Development Plan up to the first semester of 1988, the industrial sector created more than 1.99 million new employment opportunities for the people, thus exceeding the targeted value of 1.40 million. The growth rate of manufacturing industry during Repelita IV drastically exceeds the growth rate of economy, and under recession the manufacturing industry takes the lead in the Indonesian economy.

2.3 Present Condition of Industrialization

Indonesia's industry (manufacturing industry) in 1986 accounts for 14% of the GNP. The market of petroleum and natural gas is presently sluggish, and the third largest industry behind agriculture, forestry and fishery industries (26%) and commerce (17%) is the manufacturing industry. However, the manufacturing industry is relatively behind that of other ASEAN countires, and has not created much employment opportunity. Thus, the share occupied in the national economy is not necessarily large. On

the other hand, industry has become a main pillar in the economic development policy in the new order of political regime, and is increasing its importance in the Indonesian economy.

Full-scale industrial development has started since President Soeharto assumed office in 1966, and attached importance to domestic production of daily necessaries (e.g., textiles and food processing), basic materials (fertilizer, cement, iron, steel, chemical products and the like), capital goods (e.g., automobiles, home electric appliances) and consumer durables. In other words, industrial development has been emphasized to foster industries which would manufacture import substitution products. As a result, industry has made rapid progress following the construction industry since a series of Five-year Development Plan was started in 1969, and 1981, and since the oil boom came to an end in 1981. The anticipated results were fairly well in line with the domestic production policy. Exports of light industry products such as plywood, textiles and so on during recent years show a favorable tendency. In addition, export of cement, fertilizer and iron and steel products has begun.

Since then, strategies for industrial development under the Soeharto administration have changed to emphasize exports from the initial aim of industrialization for import substitution. Policies have also been worked out to foster medium- and small-scale industry, and to realize capitalization by the Indonesian indigenous people (PRIBUMI) and development for the dispersion of industry, in consideration of solving employment problems after the 1970's.

CHAPTER 3

OVERVIEW OF THE CURRENT SITUATION OF METAL WORKING INDUSTRIES

CHAPTER 3 OVERVIEW OF THE CURRENT SITUATION OF METALWORKING INDUSTRIES

3.1 Position of Metalworking Industries among Manufacturing Industries

While the statistical data regarding the large and medium industries are available up to 1986, the data on small and household industries are very much limited, except for the data of 1974/75 and 1979.

The number of establishments of large and medium industries, which was 500 in 1974/75, increased to 1,272 in 1986. The number of persons employed also increased from 55,867 to 181,647 for the same period. The trend between 1982 - 1986 is summarized as follows:

Table 5.1-1 (1/2) Number of Establishments of Large and Medium Industries

Number of establishments of large and medium sized industries	1982	1983	1984	1985	1986
(1) Metalworking industries	839	849	823	1,283	1,272
(2) All manufacturing industries	8,020	8,027	8,006	12,909	12,765
a/b (%)	10.4	10.5	10.2	9.9	10.0

Note : The term "Metalworking" in this report includes metalworking and machinery industries.

Source: Industrial Statistics, BPS

Table 5.1-1 (2/2) Number of Employees of Large and Medium Industries

Number of persons employed (1,000)	1982	1983	1984	1985	1986
(1) Metalworking industries	139	142	136	179	181
(2) All manufacturing industries	1,067	1,119	1,197	1,684	1,691
a/b (%)	13.0	12.6	11.3	10.6	10.7

Source: Industrial Statistics, BPS

It can be observed from the above table that within five years, the number of establishments of metalworking increased by 50 percent and number of employees increased by 30 percent. However, manufacturing industries as a whole showed a 60 percent increase both in the number of establishments and in the number of employees for the same period.

The number of employees per establishment in 1986 of the metalworking industries was 142 while that for all manufacturing industries was 132.

In 1986, metalworking industries occupy about 10 percent in the number of all establishments in the manufacturing industries, and the metalworking industries employ 11 percent of all the employees engaged in the manufacturing industries.

According to the statistics of the MOI, the number of clusters of the small scale metalworking industries is 1,015 and the number of persons employed in the clusters was 50,337 in 1983/84.

3.2 Overview of the Sub-sector of the Metalworking Industries

Characteristics of each sub-sector of the metalworking are summarized as follows:

(1) The biggest subsector is "manufacture of transport equipment (No. 384), while "manufacture of fabricated metal products (No. 381) is the second biggest subsector. "Manufacture of electrical apparatus, appliances and supplies" (No. 383) is the third biggest subsector.

(2) Value added of the manufacture of transport equipment is the biggest both per establishment and per person.

(3) Value added of the manufacture of electrical apparatus, appliances and supplies is the second largest both per establishment and per person.

(4) The share of manufacture of machinery except electrical (No. 382) is relatively small.

(5) The share of manufacture of measuring, controlling and optical equipments (No. 385) is the smallest subsector.

3.3 Present Condition of Metalworking Industry from the Technical Standpoint

The present condition of linkage-type industries which were visited by the study team during the field survey is summarized as follows:

(1) Casting

The manufacturers of cast iron parts, visited by the study team, mainly use cupolas as a melting facility. Import cupolas are purchased at first and domestically produced cupolas are purchased next in their own factories.

Cupolas are maintained in a relatively good condition. Most of the companies do not have molding facilities, and use the floor type molding. The strength, permeability and moisture of molding sand are not actually measured. The quality of scrap materials and sub-materials which are melted by cupola is not controlled, and chemical composition analysis of cast iron is not conducted during the melting process. Therefore, the quality of products is not assured. Control of shapes of cast products is made only by visual inspection, and analysis of chemical composition and internal defects are not confirmed. The manufacturers seem to have a lower recognition of quality control. The aluminum and brass casting manufacturers produce products using the crucible furnace and floor molding system. The products are commercially marketed directly. The value of the products is created through the experience and knowledge of the skilled workers. The assembly-type industries produce cast iron parts by using their own casting facilities (e.g., high or low frequency induction furnaces), and automatic molding line. Some assembly-type industries conduct analyses of chemical composition, control of temperature of melted iron and molding sand, and use shot blasting machines. Some of them carry out visual and surface defect inspection. These industries have a higher

consideration of quality control and inspection while linkage-type industries have a low recognition of quality control and inspection.

(2) Forging and heat treatment

There were no companies engaged in forging and heat treatment service among the companies visited by the study team. Technologies related to forging and heat treatment should be introduced into Indonesia, because these technologies will play an important role in producing forged materials as machinery parts. Traditional blacksmiths, who manufacture farm implements, exist in Indonesia. The technical level of them, however, is yet primitive, and it cannot be regarded as the object of the study team. Some of the assembly-type companies recognize the importance of forging and heat treatment, and plan to introduce forging and heat treatment facilities.

(3) Sheetworking and welding

The companies, visited by the study team, manufacture cover plates, and exhaust pipes for agricultural machines.
These companies purchase steel plates, cut using gas cutting machines or shearing machines, bend and form using presses, and assemble, weld and perform finishing work relying on the experience of their skilled workers, although they do not use drawings and welding procedure sheets necessary for quality control. Components and parts manufactured in these companies do not require very high accuracy or strength. A technical problem is that non-destructive inspection of welded portions is not performed although the majority of these portions are manually welded, and skilled workers conduct visual inspection only.

(4) Plating

Several linkage-type plating companies are surveyed. These companies do not control plating solutions and conditions of plating, and conduct plating work according to the perception and

experience of skilled workers. Some of the assembly-type companies recognize the importance of the plating process for components and parts for machines, and plan to introduce several kinds of plating facilities including wastewater treatment facilities.

(5) Presswork

The company, visited by the study team, delivers automotive and motorcycle parts formed with presses to assembly-type companies. The control of applicable standards, drawings and products is sufficiently made, because customers' requirements are very severe. Dies for press forming are produced by this company in accordance with drawings furnished by customers. The accuracy and life of such dies and accuracy of products are unknown. This company has a higher recognition of quality control and inspection as evidenced by the fact that the defect rate is in the range of 5 to 8% and this company satisfies its customers' severe requirements. Since only one pressworking company was surveyed, the above is not necessarily representative of present conditions in this industry.

(6) Machining and machine assembly

Seven machining and assembly companies were surveyed, and these companies use lathes, radial boring machines, milling machines, planers, etc. However, they do not use special purpose machines or NC machine tools.
Most of the machines in use are old, and are not sufficiently maintained. Therefore, the accuracy of machined parts and productivity seem to be low. Raw materials that are machined are mostly casting products. However, most of the seven companies do not perform acceptance inspection of these casting parts. Casting manufacturers deliver their products without any surface treatment (e.g., using shot blasting machines) and without removing burrs, or correcting such defects as blow holes, shrinkage, and the like. Machining companies do not inspect casting parts prior to their machining. Dimensional measurement of machined products is done during the manufacturing process. Machining companies check whether or not machined products are manufactured according to drawings

furnished by customers. However, such companies do not perform the inspection of surface roughness and internal defects by using testing equipment.

CHAPTER 4

PRESENT CONDITION OF SIMILAR RELATED INSTITUTIONS

CHAPTER 4 PRESENT CONDITION OF SIMILAR RELATED INSTITUTIONS

4.1 Outline of Technical Assistance Service

Technical assistance institutions for the metalworking industry are broadly divided into the following three groups:

(1) Industrial Research and Development Institutes and Industrial Research and Development Laboratories under the Agency of Industrial Research and Development (BPPI) of MOI

(2) Common service facilities located within a mini industrial estate under the control of Directorate General of Small Industries of MOI

(3) Technical assistance institutions other than those of MOI

Bandung Institute of Technology (ITB)
Surabaya Institute of Technology (ITS)
Indonesian Institute of Science (LIPI)
National Aviation and Aerospace Institute (LAPAN)
National Atomic Agency (BATAN)
Agency for the Assessment and Application of Technology (BPDT)

These technical assistance institutions play an important role in implementing the deletion program in various fields. However, there is a shortage of technical assistance extended for medium and small industries. To some extent, medium and small industries in Bandung area, where MIDC, B4T and ITB exist and in area where common service facilities are located, make use of the service of such institutions, while in any other area they do not really utilize those institutions. Two out of nine Industrial Research and Development Laboratories are equipped with laboratory equipment for metalworking, which are not sufficiently able to extend technical assistance services in metalworking industries. The remaining of laboratories are engaged mainly in technical assistance services in the field of food processing and chemical analysis. Activities of common service facilities are not sufficient in rendering technical services and only available in limited areas in Indonesia.

Especially in Jakarta and Surabaya, governmental technical assistance institutions are limited, in spite of numerous metalworking industries.

4.2 Functions of Similar Existing Institutions

Functions of 16 laboratories for the metalworking industry out of 23 similar related institutions visited through this study, are summarized in Table 6.2-1.

Table 6.2-1 Functions of Similar Institutions Surveyed (1/2)

Areal Division	Belonging to	No.	Institution	Function
West Jawa	MOI	1	B4T	- Three types of tests and inspections of materials - Non-destructive inspection of various plant equipment, ships and machinery - Issue of inspection certificate - Engineers' training
		2	MIDC	- R & D for improvement of metal-working and machining technologies, quality and productivitiy of industrial products - Technical assistance - Training of engineers, supervisors and operators
	University	3	ITB	- Physical property test - Welding practice - Presswork practice - Mechanical property test - Test for casting - Production engineering for machining - Calibration of dimensional measuring tools
JABOTA-BEK	Other Ministries	4	CEVEST	- Training of instructors for vocational training centers in Indonesia under the control of the Ministry of Manpower Affairs
		5	KIM-LIPI	Service function in the field of instrumentation and metrology - R & D - Calibration - Instrumentation engineering - Technical advice - Training - Production of prototypes
		6	LUK	- Quality test of prototype products - Material test - Keeping in constant readiness for information on materials, parts and structures, and furnishing of technical information service - R & D related to high technology - Engineers' training related to test and quality control
		7	R & D Center for Metallurgy(LIPI)	- R & D using experimental blast furnace for pig iron - Stress analysis of bridges - Research of deletion program in the field that is not implemented by MIDC

Table 6.2-1 Functions of Similar Institutions Surveyed (2/2)

Areal Division	Belonging to	No.	Institution	Function
JABOTA-BEK	State-owned	8	BKI-PT	- Issue of test and inspection certificate - Consulting service in shipbuilding - Prototype production - Consulting service in freight car
		9	Sucofindo	- Chemical composition analysis - Cargo superintendence and inspection of various industrial machines and equipment - Non-destructive test - Issue of analysis and inspection certificate
Central Jawa	MOI	10	UPT Logam of LIK Tegal	- Casting experiment - Technical assistance related to casting by instructors sent from MIDC
		11	Unit Pelayanan Teknis (UPT), Ceper	- Machining of large casting products - Agent of B4T and MIDC to issue certificate and test reports of casting products
	University	12	Faculty of Engineering, Gadjah Mada University	Following are for practice of university students - Machining - Mechanical experiments - Instrumentally chemical analysis
East Jawa	MOI	13	Balai Penelitian dan Pengenbangan Indsiri (Surabaya)	- Analyses of industrial water, drinking water, drainage and seawater - Researches on feeds for shrimps and lobsters - Mechanical test and X-ray inspection
	University	14	ITS	- ITS has various testing equipment, but such equipment are used for students' practice
Sumatera	MOI	15	PTKI	- Chemical research - Mechanical property test - Non-destructive test
		16	Balai Penelitian Logam (Medan)	- Design and production of prototype for medium and small companies - Material test - Various inspection upon request from medium and small companies

4.3 Functional Limit of Existing Similar Institutions

Though there are many institutions and research laboratories to support the metalworking industry, they have the following functional limitations.

(1) Most of these institutions and research laboratories are located in Bandung area, and can not sufficiently provide technical service in such a way to meet requirements of local companies on a nationwide basis. Similar existing institutions in provinces have no sufficient facilities to meet local companies' requirements.

(2) An important task of the metalworking industry in Indonesia is to improve quality of casting products. MIDC is engaged in R & D of manufacturing process technology of casting products, and transfers such technology to small and medium metalworking companies. However, due to limited manpower and budget, it is not able for MIDC to transfer technology to all small companies. Further establishment of institutions with advanced capabilities, in particular in the field of metalworking, is required. Introduction of steel casting and forging technology is indispensable to promote the deletion program, which in turn could further develop Indonesia's manufacturing capablities.

(3) Precision machining and precision pressworking within metalworking industries in Indonesia are not sufficiently developed and the existing similar institution do not have sufficient facilities for technological development in this field. They should have facilities for machining and inspecting high accuracy screws and gears.

(4) Existing similar institutions do not have inspection equipment and instruments for comprehensive judgement of dynamic performance of metalworking products.

(5) Most of the institutions surveyed do not have facilities for forging, heat treatment, plating and precision machining. Therefore it is difficult for these institutions to help industries accomplish the deletion program if they do not have such facilities.

(6) Facilities' capacity of the existing similar institutions is not sufficient for quick inspection service required by the assembly-type companies.

CHAPTER 5

FUNCTIONS AND SERVICES OF THE CENTER

CHAPTER 5 FUNCTIONS AND SERVICES OF THE CENTER

5.1 Functions of the Center

For modernization of metalworking industries in Indonesia, improvement of basic technical level of the industries, especially improvement of product quality, is the most important matter. This intends to make linkage industries, that are sub-assemblers, supply assembly industries with high quality products. For the purpose, firstly, test and inspection function must be needed. Secondly, technical assistance and training of engineers are to support the development of metalworking industries to further strengthen the industrial structure, and in particular, the implementation of deletion program promoted by the Indonesian Government. Thirdly, R&D services in the fields of casting, forging, heat treatment and plating, which are not sufficiently conducted in Indonesia, are required.

Taking the above into consideration, the following three functions are required for the Center:

1) Testing and inspection
2) Technical assistance (T/A) and training
3) Research and development (R&D)

5.2 Types of services to be offered by the Center

(1) Testing and inspection

The following 13 major items are proposed as basic testings and inspections to be performed by the Center.

1) Brinell hardness test
2) Vickers hardness test
3) Tensile strength test
4) Impact test
5) Visual and microscopical inspection using projector
6) Micro structure test
7) Chemical analysis
8) Surface roughness measurement
9) Three-dimensional measurement
10) Gear tooth dimensional measurement
11) Magnetic particle inspection
12) Ultrasonic inspection
13) X-ray inspection

(2) Technical assistance (T/A), Training (TR) and R & D

As T/A is aimed at solving problems to which each company is confronted and TR is aimed at training of engineers of different companies, it is impossible to predetermine those definite items, because program should be selected according to the specific needs of the companies.
The deletion program has been used as an approach to prepare program of T/A, TR and R & D. The detailed program of R & D, T/A and TR was studied as follows:

1) 92 parts for metalworking as nominated in the deletion program for commercial car and diesel engine were selected.
2) Then, details of R & D, T/A and TR for promotion of domestic production of those parts were studied.

Major items and their details are summarized in Table 7.3-1.

Table 7.3-1 Major Items for R&D T/A and TR

	R & D	T/A	TR
Casting	- Complicated shape casting technology (e.g., engine blocks) - Special cast iron technology (e.g., ductile cast iron, malleable cast iron) - Cast steel technology technology - Alloy cast iron and alloy cast steel	- Technology in manufacturing parts as nominated in the deletion program	- Green sand mold technology - CO_2 mold technology - Shell mold - Self-hardening sand mold (Fran type resin) - Melting technology
Forging	- Die forging of connecting rods - Die forging of gears - Free forging of shafts	- T/A related to manufacturing technology of various parts as nominated in the deletion program	- Free forging technology - Die forging technology
Heat treatment	- Carburizing and nitriding of gears and shafts - Heat treatment technology of die	- Manufacturing technology of parts as nominated in the deletion program	- Heat treatment technology of die - Heat treatment technology of carbon steel
Sheet-working/ welding	- Technology for welding different metals	- Automation of thick plate welding (to be appliable to shipbuilding and pressure vessel)	- Acquisition of technology to conduct non-destructive inspection of welded portion
Press-working	- Deep drawing work technology (for automotive parts) - Die making technology	- Improvement of improper process resulting from defective parts (e.g., improvement of die)	- Working condition and maintenance of press
Plating	- Determination of plating condition for automotive parts (e.g., plating thickness and plating condition)	- Prevention of defect in plating layer (pre-treatment and plating conditions)	- Acquisition of electroplating and chemical plating, and hot dipping techniques
Machining	- It is difficult to specify this item at the present stage, because R & D themes are discovered during the promotion of the deletion program	- Finishing of high alloy steel by grinding work - Gear cutting technology (bevel gears and so on) - Jigs and fixtures making technology	- Acquisition of technology to operate NC machine - Acquisition of technology to operate grinding machine

5.3 Selection of Machinery and Equipment to be Installed in the Center

In the deletion program, 466 parts out of eight groups of industries are listed. These industries include 1 Two-wheel Motor Vehicle, 2 Commercial Car, 3 Power Tiller, 4 Mini-tractor, 5 Automobile, 6 Machine Tool, 7 Diesel Engine (2 - 25 kW), and 8 Diesel Engine (26 - 375 kW).

As the first step, manufacturing processes of the parts to satisfy requirements arising in the course of the deletion program were determined, as shown in Table 7.4-2.

Then, considering the present situation of metalworking industries, needs to the Center on technical service and training were studied. From the result of the study, selection of machinery and equipment to be installed in the Center was made both for short-term (Phase I) and long-term (Phase II). Selected machinery and equipment are listed in Table 7.4-1.

Table 7.4-1 Present Condition of Metalworking Industry and Required Equipment for the Center

(1) Casting

Present condition	1) Ordinary cast iron products except key parts such as crank cases, cylinder heads, etc., can be produced. However, the defect rate of such products is in the range of 10 to 20%, which is extremely high. 2) Technology to produce special products such as cast steel, ductile cast iron, and alloy cast iron, is insufficient. 3) There are many factories that do not conduct preliminary chemical analyses during melting, nor product chemical analyses. 4) There are many factories that do not conduct sand tests. 5) There are a few factories that examine and research the method of casting.
Phase I	
Requirements	1) Production of special cast iron such as cast steel, ductile cast iron, etc. 2) Quality control of manufacturing processes 3) Training of engineers in modern casting technology 4) Trial production of products having complicated shapes 5) Control of raw materials and sub-raw materials
Equipment to be installed	1) H.F induction furnace for iron & steel casting 2) Crucible furnace for nonferrous metals 3) Green sand molding unit 4) CO_2 sand molding unit 5) Chemical binder sand molding unit 6) Shell molding unit 7) Sand test equipment 8) Wooden pattern making equipment
Phase II	
Requirements	1) Cost reductions through improved productivity and quality. 2) Precision casting (lost wax)
Equipment to be installed	1) Finishing process equipment 2) Heat treatment furnace 3) Precision casting equipment

(2) Forging

Present condition	1) Blacksmiths making plows, hoes, etc., exist. 2) Some companies have air hammers, but do not use them. 3) Raw materials for forging are not domestically produced. 4) There is a great demand for forging steel (e.g., gears, shafts, rotating members).
Phase I Require-ments	1) Free forging and die forging technology of carbon steel and low alloy steel (e.g., shafts, gear blanks, arms and the like) 2) Method for selecting optimum materials
Equipment to be installed	1) Batch type heating furnace 2) Drop hammer 3) Temperature measuring and recording instruments 4) Trimming press
Phase II Require-ments	1) Production of high grade steel such as steel for dies, stainless steel, bearing steel, etc. 2) Cost reductions through improved productivity and quality 3) Cold forging
Equipment to be installed	1) Rotary heating furnace 2) Conveying system 3) Cold forging press

(3) Heat treatment

Present condition	1) Some foreign affiliated companies have dedicated heat treatment facilities, while most domestic factories do not have such facilities. 2) Demand for rotating parts such as gears, shafts, etc., has been increasing. 3) Because products are manufactured without heat treatment, problems such as wear, arise and such products' life shortens. 4) Demand for molds for presswork and sheetwork has been increasing, but there are very few factories that specialize in heat treating and machining the mold.
Phase I Requirements Equipment to be installed	 1) Annealing, quenching and tempering of carbon steel and low alloy steel 2) Carburizing 1) Heating furnace 2) Tempering furnace 3) Quenching oil bath 4) Quenching water bath 5) Gas atmosphere furnace
Phase II Requirements Equipment to be installed	 1) Heat treatment of molds 2) Bright quenching, and soft nitriding treatment 3) High frequency induction hardening 1) Wash cleaning bath 2) Salt bath, (high & medium) 3) Soft nitriding furnace 4) High frequency induction hardening equipment

(4) Pressworking

Present condition	1) Production of non-key parts for automobiles and motorcycles is possible. 2) Bending work is mainly done using small presses. 3) Assembling makers (in particular, foreign affiliated companies) are presently providing the technical assistance including preparation and supply of drawings.
Phase I	
Require-ments	1) Punching press technology 2) Drawing work technology of small-sized parts 3) Production technology of molds to acquire fundamental knowledge
Equipment to be installed	1) Press brake 2) Mechanical press 3) Hydraulic press 4) Shearing machine 5) Surface plate
Phase II	
Require-ments	1) Deep drawing work of large-sized parts and presswork of parts having complicated shapes 2) Automation of presswork 3) Production of molds for practical use 4) Introduction of robots for material handling
Equipment to be installed	1) Transfer press

(5) Sheetworking/welding

Present condition	1) Production of non-key parts such as engine covers, exhaust manifolds, etc., is possible. 2) Manual welding is used in many fields. 3) There are a few skilled workers, and sheetworking/welding is performed according to their personal experience. 4) Inspection is made visually only.
Phase I	
Require-ments	1) Adoption of various methods of welding - Automatic welding technology (e.g., automatic submerged arc welding and so on) - Acquisition of technology to weld alloy steel and nonferrous metal 2) Conduct of non-destructive inspection of welded portion
Equipment to be installed	1) 3-roll bending machine 2) AC arc welder 3) CO_2 gas shielded arc welder 4) Submerged arc welder 5) MIG welder 6) TIG welder 7) Arc air gauging machine 8) Band arc overlay welding machine 9) Engine welder 10) Plasma arc cutting machine 11) Manual and automatic gas cutting machine 12) Flux dryer and collector 13) Tool cabinet and rack
Phase II	
Require-ments	1) Welding of different metals 2) Welding after machining 3) Simultaneous welding on several locations of a part 4) Attempt unmanned operation (i.e., introduction of robots)
Equipment to be installed	1) Electroslag welding machine 2) Electron beam welding machine 3) Laser beam welding machine 4) Seam welding machine 5) Automatic gas cutting machine (shape) 6) Automatic gas cutting machine (flame planer)

(6) Machining and assembling

Present condition	1) Parts having simple shapes can be machined and machines with simple mechanisms can be assembled. 2) Materials parts mostly include ordinary carbon steel and cast iron. 3) Most machining and assembling facilities have deteriorated, and NC machining facilities are not used. 4) Foreign affiliated companies and Persero possess testing and inspection facilities, while most domestic private companies do not have them. 5) Most private companies do not recognize the importance of testing and inspection. 6) In particular, linkage-type industries have a strong recognition that it is sufficient for them if parts are manufactured in accordance with drawings.
Phase I	
Require-ments	1) Necessity for machining parts having complicated shapes 2) Machining and assembling of components having complicated mechanism 3) Replacement of old machines with new ones 4) Recognition of the importance of testing and inspection and conduct thereof 5) Production of dies and molds
Equipment to be installed	1) Engine lathe 2) Precision high speed lathe 3) Radial drilling machine 4) Bench drilling machine 5) Jig boring machine 6) Universal milling machine 7) Shaping machine 8) Slotting machine 9) Full broaching machine 10) Hack sawing machine 11) Band sawing machine 12) Abrasive cutoff machine 13) Universal grinding machine 14) Universal tool & cutter grinding machine 15) Gear hobbing machine 16) Cylindrical gear grinding machine 17) Gear horning machine 18) Thread chasing machine 19) Bench tapping machine 20) Universal machine 21) Copy milling machine 22) Horning machine 23) Superfinishing machine 24) Rock cutting machine 25) Straight bevel gear cutting machine 26) Straight bevel gear grinding machine 27) CNC machining center

(cont'd)

Phase II	
Require-ments	1) Machining of precision parts 2) Automation of machining 3) Machining of alloy steel and special steel 4) Improved precision of testing and inspection 5) Production of precision dies and molds
Equipment to be installed	1) Electric discharging machine 2) Electro-chemical machine 3) Electrolytic grinding machine 4) Ultrasonic machine 5) CNC lathe 6) CNC milling machine 7) CNC gear cutting machine 8) Computer aided design (CAD) system

(7) Plating

Present condition	1) Plating of small parts is possible. 2) Concrete-made plating tanks protected by vinyle sheets are used. 3) There are a limited number of skilled workers, and plating work is conducted according to their personal experience. 4) Wastewater treatment facilities are not installed.
Phase I	
Requirements	1) Plating technology of various metals such as Ni, Cr, Zn, Sn, Cd, Pb, etc. (establishment of plating conditions and inspection methods) 2) Higher efficiency of plating work 3) Conduct of wastewater treatment
Facilities to be installed	1) Electroplating facility 2) Chemical plating facility 3) Chromium coating facility 4) Hot dipping facility 5) Sand & shot blast machine 6) Polishing machine 7) Ultrasonic washing machine 8) Wastewater treatment system 9) Ion deioniser 10) Hull cell tester 11) PH meter, thickness measuring equipment, and pinhole tester 12) BOD tester and COD tester
Phase II	
Requirements	1) Local coating (plasma spraying, etc.) 2) Application of surface treatment (hardening, anti-corrosion, etc.) of parts to plating 3) Unmanned operation (introduction of robots)
Equipment to be installed	1) Plasma spraying equipment

(8) Testing and inspection

Present condition	1) Tests such as chemical composition and mechanical properties of materials are mostly not conducted. 2) Dimensional measurement of parts after they are machined is not sufficiently performed. 3) Non-destructive tests of parts after they are machined are not sufficiently performed. 4) Failure analysis of broken parts is not conducted.
Phase I	
Require-ments	1) Expansion of capabilities for analyzing chemical composition and mechanical properties of materials 2) Conduct of non-destructive tests 3) Service of precision measurement 4) Service of environmental test 5) Service of failure analysis of broken parts
Equipment to be provided	1) Material test 1 Universal tester 2) Chemical analysis 1 Direct reading spectrqmeter 3) Non-destructive test 1 X-ray radiography 4) Measuring equipment 1 Hob tester 2 Universal gear tester 3 Three dimensional measuring device 5) Environmental test 1 Industrial wastewater analysis 2 Vibrometer 3 Sound level meter 6) Performance test of machinery and equipment
Phase II	
Require-ments	1) Alignment measurement of assembled large structures 2) Dynamic balancing test of assembled large structures 3) Large structure testing 4) Drawability test of steel plate 5) Special tests of alloy steel 6) Ultra thin surface layer analysis of metal and non-metal during the conduct of failure analysis
Equipment to be provided	1) Dynamic balancing machine 2) Micro alignment telescope 3) Universal tester (capacity 300T, horizontal type) 4) Universal tester (conical cup, reduction, etc.) 5) Hardenability tester 6) Corrosion tester 7) Electron probe micro analyzer 8) Electron microscope 9) Auger electron microscope

Table 7.4-2 Kind of manufacturing processes of main parts and facilities required based on deletion program (1/3)

Kind of Manufacturing Processes	Year	1983			1984			1985			1986			1987
	* Contents	Diesel Engine, 2-25 kW	Diesel Engine, 26-375 kW	Machine Tool	Diesel Engine, 2-25 kW	Diesel Engine, 26-375 kW	Machine Tool	Diesel Engine, 2-25 kW	Diesel Engine, 26-375 kW	Machine Tool	Diesel Engine, 2-25 kW	Diesel Engine, 26-375 kW	Machine Tool	Machine Tool
Casting	Green sand mould	Cylinder head Fly wheel				Fly wheel		Crank case Cylinder liner Gear case	Fly wheel housing Counter weight Cylinder head	Cabinet leg Rear leg Front leg		Crank case	Bed Frame Table	Case Saddle Cross slide
	CO_2 mould	Fly wheel				Fly wheel				Cabinet leg Rear leg Front leg			Bed Frame Table	Case Saddle Cross slide
	Self-hardening mould	Cylinder head						Crank case Cylinder liner Gear case	Fly wheel housing Counter weight Cylinder head			Crank case		
	Shell mould	Cylinder head (Core)						Crank case (Core)	Cylinder head (Core)					
Forging					Crank gear	Connecting rod		Connecting rod Crank shaft Cam shaft	Cam shaft			Crank shaft Cam shaft gear Crank shaft gear	Lead screw Feed rod Packs	Speed gear Reverser gear
Machining	Precision high speed lathe	Crank shaft patty fly wheels				Fly wheel patty				Legs of lathe			Screw shaft lead screw	
	Jig boring machine	Crack case stud				Connecting rod		Gear case connecting rod		Frein base tables		Crank case	Knee guide off frein	Guide slide of frein
	Gear hobbing machine				Crank gear shaft gear							Gears		Gears
	Universal Grinding M/C	Piston ring piston				Piston piston ring		Crank shaft				Crank shaft	Cross guide/ guide slide	
	Super finishing machine							Cylinder liner	Cylinder liner					Bearings
	CNC machining counter							Cylinder head cam shaft	Cylinder head					
Sheetwork/ welding		Oil filter cap upper cover Breather cover oil return pipe Oil filter cap upper cover	Brocket waterpipe Fuel pipe Waterpipe			Intakes exhaust pipe Intakes exhaust pipe			Cover cooling pipe Cover cooling pipe	Chip pan sheet cover Coolant tank panel box Chip pan sheet cover			Column case Column case	Cooling system Cooling system
Presswork		Breather cover oil return pipe	Fuel pipe							Coolant tank panel box				

Note : *Contents may comprise of materials, methods and equipment

Table 7.4-2 Kind of manufacturing processes of main parts and facilities required based on deletion program (2/3)

Kind of Manufacturing Processes	Year	1987		1988		1989		1990	
	* Contents	Commercial Car	Two-wheel Motor Vehicles	Commercial Car	Two-wheel Motor Vehicles	Commercial Car	Two-wheel Motor Vehicles	Commercial Car	Two-wheel Motor Vehicles
Casting	Green sand mould	Disc plate Caliper Brake drum		Exhaust manifold	Cylinder head Cylinder block Fly wheel		Cylinder sleeve		Disc brake Caliper
	CO_2 mould								
	Self-hardening mould	Disc plate Caliper Drake drum Fly wheel			Cylinder head Cylinder block		Cylinder sleeve		Disc brake Caliper
	Shell mould	Disc plate Caliper (Core) (core)		Exhaust manifold		Cylinder head (Core) Cylinder block (Core)			
Forging			Bearing Spring Sprocket rear				Cam shaft Sprocket drive		Crank shaft Connecting rod Main gear
Machining	Precision high speed lathe	Intake/exhaust manifold cylinder head cover	Bearing	Steering shaft, rear axle shaft pinion shaft, gear shaft	Fly wheel piston	Cam shaft holder, sleeve yoke tie rod end, cylinder wheel	Piston pin	Connecting rod main shaft	connecting rod
	Universal grinding M/C	Drake sleeve, guide pin backing plate, brake disc	Spring	Clutch-dies plate, brake lining spindle hub brake shoe		Differential case	Cam shaft	Synchronizer hub	Crank shaft
	Universal milling machine				Cylinder head Cylinder block Crank case	Cylinder head	Cylinder sleeve	Differential drive pinion	Clutch
	Gear hobbing M/C	Speedmeter gear		Steering gear Reverse gear				Speed gear Input shaft counter gear Differential gear	Gear
	Super-finishing M/C					Piston		Differential drive pinion counter gear	Gears
Sheetwork/ welding		Backing plate Cover strap	Cover Cover	Disc plate Spined hub				Synchronizer hub Synchronizer sleeve	Name plate Name plate
Presswork				Friction plate washer				Synchronizer ring	

Note : *Contents may comprise of materials, methods and equipment

Table 7.4-2 Kind of manufacturing processes of main parts and facilities required based on deletion program (3/3)

Kind of Manufacturing Processes	Year	1987				1988				1989			
				Automobile				Automobile				Automobile	
	* Contents	Power Tillers	Mini Tractor	Shock Absorber	Radiator & Plug	Power Tillers	Mini Tractor	Shock Absorber	Radiator & Plug	Power Tillers	Mini Tractor	Shock Absorber	Radiator & Plug
Casting	Green sand mould	Cylinder head Gear case				Crank case Transmission case	Transmission case Cylinder liner				Crank case Cylinder head		
	CO_2 mould												
	Self-hardening mould	Cylinder head Gear case				Crank case Transmission case	Cylinder liner				Crank case Cylinder Head		
	Shell mould	Cylinder head (Core) Gear case (Core)				Crank case (Core) Transmission case (Core)	Transmission case (Core)				Crank case (Core) Cylinder head (Core)		
Forging		Connecting rod Crank shaft Cam shaft				Cam shaft gear Ring gear	Crank shaft gear				Crank shaft		
Machining	Precision high speed lathe	Sprocket	Sprocket shaft					Piston rod					
	Jig boring machine	Fork	Fork	Damper cover	Frame blacket								
	Universal milling machine	Arm	Arm				Transmission case						
Machining	Gear hobbing M/C					Staged gear	Shaft gear						
	Universal machining counter	Cylinder liner/ head									Cylinder head		
	Universal grinding M/C	Crank shaft									Crank shaft		
Sheetwork/ welding		Forks Arm Forks	Forks Arm Forks	Damper case & damper cap Cylinder tube & upper cap Damper cap upper cap	Filler pipe Inlet pipe Overflow pipe				Upper tank Upper tank				
Presswork				Outer cover	Outlet pipe								

Note : *Contents may comprise of materials, methods and equipment

CHAPTER 6

ESTIMATION OF DEMAND FOR THE SERVICES OF THE CENTER

CHAPTER 6 ESTIMATION OF DEMAND FOR THE SERVICES OF THE CENTER

6.1 Overview of the Estimation

The Center is designed to provide three kinds of services to metal-working firms in Indonesia. These are 1 Testing & Inspections, 2 Research & Development (R & D), and 3 Technical Assistance and Training. The volume of the three services of the Center was estimated in this chapter so that (i) Size of the Center, (ii) Location of the Center, and (iii) Financial analysis of the Center can be determined in the following chapters.

The estimation was made mainly by analyzing the following data and information:

(1) Forecasting of volume of metalworking by type of work in Indonesia shown in the M/P,
(2) Regional distribution of metalworking industries in Indonesia compiled by the study team from governmental production license statistics,
(3) Activity records of B4T and MIDC, and
(4) Information obtained through interviews and the questionnaire survey

It was made clear through the past activities of B4T that there is considerable difference in demand for tests and inspections (one of the three services of the Center) among regions. The questionnaire survey showed similar results: many firms are not willing to use an outside testing/inspection center, which is located far from them, unless the tests/inspections are mandatory. Aggregate demand for tests and inspections in Indonesia was estimated taking this regional factor into consideration.

For the other two services of the Center, which are R & D, and technical assistance and training, the past activities of MIDC show similar regional characteristics as those of B4T. Approximate estimation of demand for the services of the Center was made through quantitative analysis of the questionnaire survey and macro data related to metalworking industries.

6.2 Aggregate Demand for Tests and Inspections

The outline of the technical approach, which was used to estimate total volume of potential needs for tests and inspection services, is shown in Fig. 8.2-1.

(1) Forecasting of metalworking industries in Indonesia

M/P, on which this project is based, has forecast the volume of metalworking in terms of tonnage in the years 1985, 1990 and 1995 for 10 industries, such as machine tool and agriculture machines. The estimation mainly has its base on the progress of localization of metal industries in Indonesia, which was guided by the Indonesian Government. The progress, however, has not been achieved as planned, as can be exemplified by the three year postponent of the localization program for automobiles. In consideration of that situation, two of the upcoming standard years of the M/P have been changed to 1993 and 1998, from 1990 and 1995, respectively.

(2) Estimation of the number of recommendable tests and inspections

The number of recommendable tests and inspections per ton or unit was considered for each of 13 tests and inspections by type of work. The estimation was mad for each of 10 metal relating industries. These recommendable numbers of tests and inspections were multiplied by the forecast volume of metalworking, which is made by sub-assemblers, to obtain the volume of recommendable tests and inspections in 1985, 1993 and 1998.

(3) Regional distribution of metalworking industries

The regional distribution of metalworking industries was estimated through two steps. As the first step, representative commodities were chosen for each of 9 metalworking industries. As the second step, production quotas given to the manufacturers of these commodities by the Indonesian Government were summed up in each of the 6 regions in Indonesia. Comparing aggregate production quotas in each region, a regional distribution of the industries was determined. For the purpose of the Study, Indonesia was devided into 6 regions from economic point of view rather than geographical one. These are JABOTABEK (Jakarta, Bogor, Tangerang, Bekasi) Jawa Barat (except BOTABEK), Jawa Tengah (including Yogyakarta), Jawa Timur, Sumatera and all other regions combined.

(4) Recommendable number of tests and inspections by region

By multiplying the recommendable number of tests and inspections in Indonesia, calculated in section (2)-2), by the regional distribution of industries, the recommendable number of tests and inspections by region in the years 1985, 1993 and 1998 was calculated. The flow of the tests and inspections between 1985 and 1993 was then calculated assuming that the rate of annual increase of the tests and inspections is equal for each year of the period.

(5) Activities of B4T by region, 1987

The total number of tests and inspections conducted by the B4T was 6,467 in 1987. The cover ratio of B4T services in each region was calculated by dividing the regional distribution of the B4T activities by the recommendable number of tests and inspections. It was revealed that Jawa Barat, where the B4T is located, shows by far the highest cover ratio, 0.393, followed by the neighboring region, JABOTABEK, with a cover ratio of 0.145.

The direct distance between Bandung, where B4T is located, and Jakarta, the center of JABOTABEK, is about 180 km, and it was observed that the number of tests and inspections brought to the B4T from JABOTABEK was bigger than that from the other regions except Jawa Barat due to the shorter distance. The distances from Bandung to Semaran, the center of Jawa Tengah, Surabaya, the center of Jawa Timur, and Medan, the center of north Sumatera, are 290, 540 and 1,500 km, respectively. No significant differences in cover ratio among these regions was observed. It is assumed that, for distances beyond at least 290 km, distance does not affect the volume of the tests and inspections brought to the B4T.

(6) Estimation of potential needs for testing and inspections in Indonesia

It is necessary to eliminate the bias coming from distance when the aggregate potential needs for tests and inspections in Indonesia is estimated. For this purpose, the cover ratio of B4T activities to Jawa Barat, which is 0.393, was applied to all the regions assuming the ratio to be a neutral one with no bias toward distance. The flow of potential needs for tests and inspections was so estimated for the period between 1985 and 2002, and combining all the regions together, Table 8.2-8 shows the flow of the potential needs for testing and inspections in the whole of Indonesia.

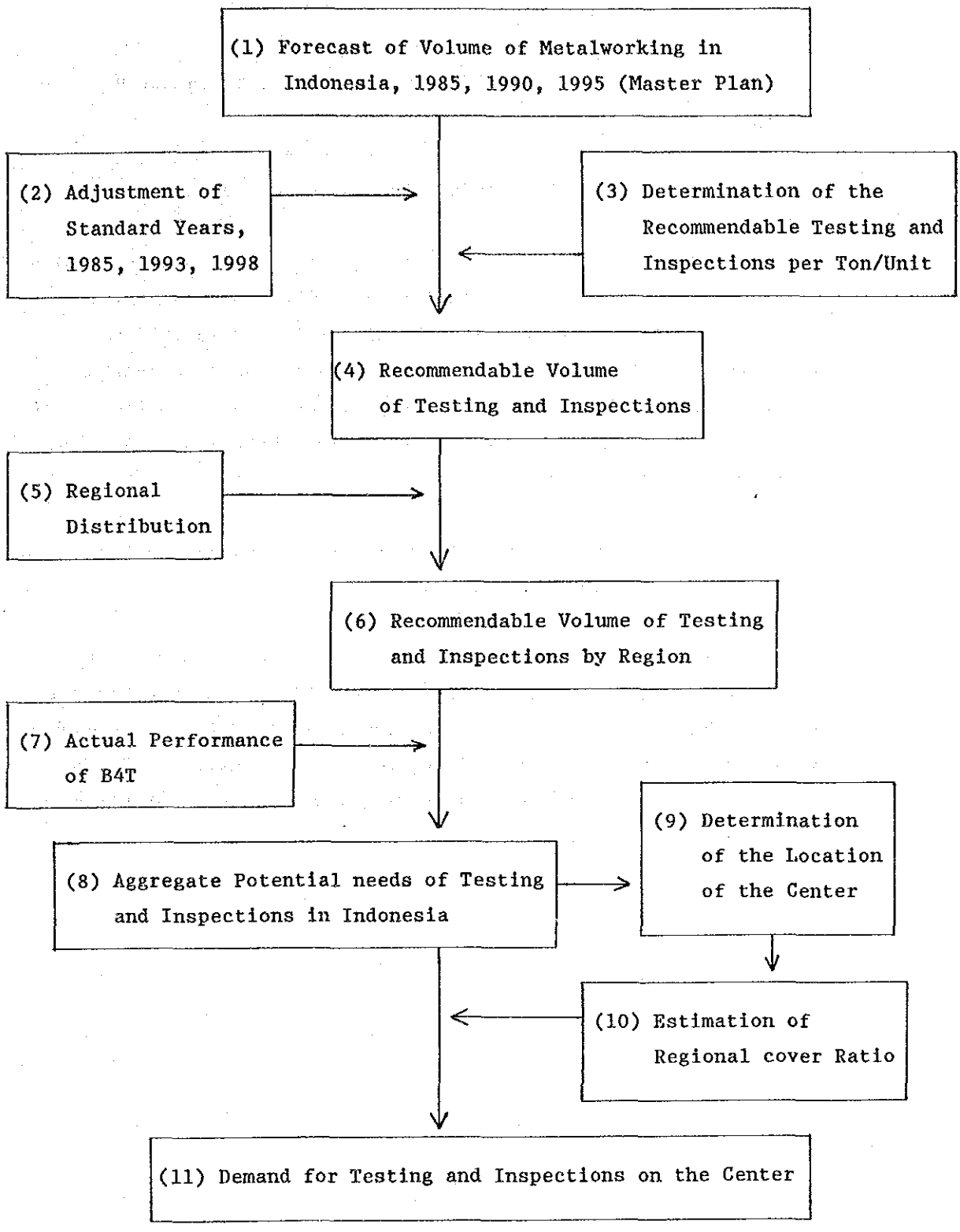


Fig. 8.2-1 Estimation of Flow of Demand for Testing and Inspection on the Center

6.3 Demand for R & D

The technical approach used to estimate the potential needs for R & D is shown in Fig. 8.3-1.

(1) Forecasting of metalworking industries in Indonesia

The numbers of establishments in the metalworking industries, which include the industries categorized in commodity numbers 381, 382, 383 and 384, were drawn from industrial statistics in 1980 and 1986. Assuming the same annual increase ratio for each industry between 1980 and 1986 to last till the year of 2002, the flow of the number of establishments of metalworking industries in Indonesia between 1986 and 2002 was calculated.

(2) Estimation of the number of establishments in Indonesia which intend to use the R & D services of the Center

From the questionnaire survey, 18 out of 30 firms showed their intention to use the Center if it were established within the region where the firm is located, as described in Table 8.3-2. The number of establishments which are willing to use the Center for R & D activities was estimated by multiplying the number of establishments in Indonesia by the ratio, 18/30.

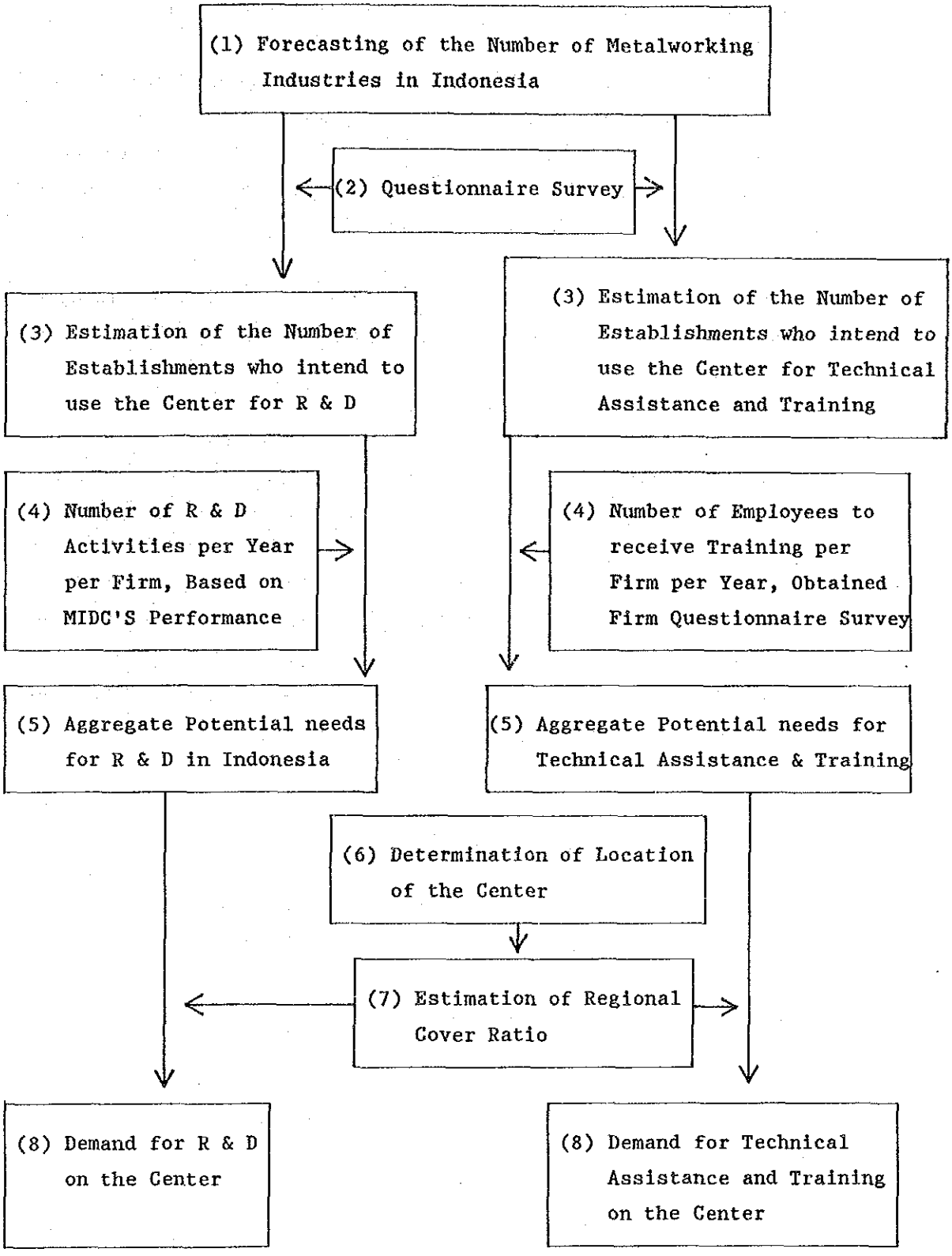


Fig. 8.3-1 Estimation of Flow of Demand for R & D, Technical Assistance and Training on the Center

(3) Estimation of total volume of potential needs for R & D per year

The estimation of total volume of potential needs in Indonesia for R & D per year was made by multiplying the number of firms by the frequency of R & D activities (the number of R & D activities per year per firm). To find the frequency of R & D activities, the past record of MIDC activities was reviewed.

The total number of R & D activities entrusted to MIDC out of Jawa Barat (excluding Bogor, Tanggerang and Bekasi) between 1984 and 1986 was 37. On the other hand, from Table 8.2-8, the volume of potential needs for tests and inspections in Jawa Barat accounted for 19 percent of the total demand in Indonesia in 1985. The activities of MIDC show similar regional characteristics as those of B4T where a substantial portion of the activities is dependent on the Jawa Barat area. Assuming that the activities of MIDC have the same regional cover ratio as those of B4T, the total potential needs for R & D in Indonesia was estimated as 195 R & D activities between 1984 and 1986. It is assumed that 65 potential needs for R & D existed in 737 firms in 1986. The same ratio (65/737) was applied to forecast the flow of the number of potential needs for R & D activities in Indonesia up to the year 2002.

6.4 Demand for Technical Assistance and Training

Table 8.3-1 shows the technical approach used to estimate the aggregate demand for technical assistance and training in Indonesia.

(1) Forecasting of metalworking industries in Indonesia

Forecasting of the number of firms engaged in metalworking industries shown in Table 8.3-1 was used here as one of the data bases.

(2) Estimation of the potential needs for technical assistance and training in Indonesia

From the questionnaire survey, it was revealed that 71 percent of the firms (32 out of 45 firms) showed an interest in using the Center for technical assistance and training purposes, as shown in Table 8.3-2. The number of employees sent to outside training institutions per firm is, from interviews with them, approximately estimated as two persons for a large-size firm, 100 or more employees, and one person for a medium-size firm, with fewer than 100 employees. The average number of employees to be sent to outside institutions is, therefore, calculated as 1.53 (= (14 x 1 + 16 x 2) ÷ 30). By multiplying the total number of establishments engaged in metalworking in Indonesia by the ratio of firms interesting in using the Center, the number of firms interesting in using the Center is obtained. Then, the aggregate potential needs for technical assistance and training provided by the Center is estimated by multiplying the number of firms interested in the services by the average number of employees sent to the Center. (see Table 8.4-2)

6.5 Determination of the Location of the Center

It is assumed that the Center would start operation in 1992. Table 8.2-8 shows that more than 75 percent of the total potential needs for tests and inspections, which amounts to 70,889, in Indonesia in 1992 will be created out of the JABOTABEK area, followed by Jawa Timur, which accounts for 14 percent of the total Indonesian needs. The two regions together account for 90 percent of total Indonesian potential needs in 1992. In 1995, the degree of concentration in the JABOTABEK area is estimated to increase to 79 percent of the total Indonesian needs. Although the degree of concentration is forecast to decline in 1998, it will still account for 75% of the total Indonesian needs. This may stem from the fact that the area is by far the most industrialized area in Indonesia. Especially, most of the automotive and electric machine/appliance manufacturers, who are assumed to create more tests/inspections than any other industries, have their production facilities there.

On the other hand, the share of Jawa Timur, which would account for 14 percent of total Indonesian potential needs in 1992, will decrease to 13 percent in 1993 and 11 percent in 1998. In terms of the number of needs, that of Jawa Timur in 1992 will be 9,816, which would amount to less than 2/3 of the total number of tests and inspections including those in non-metal-related fields which B4T conducted in 1986. Also, analysis of the past performance of B4T reveals that only about 40 percent of the potential needs in Jawa Barat, where B4T is located, were brought to B4T, while the other regions showed a much smaller rate. This limited percentage would also hold true for Jawa Timur. Accordingly, it is reasonably assumed that Jawa Timur would not be a good site for the Center to secure sufficient demand until the region lures more metalworking industries. From the viewpoint of the macro demand forecasting on tests & inspections, technical assistance, training and R & D, which have been discussed in this chapter, it would be said that there is no better place than JABOTABEK for the Center to be established.

6.6 Role sharing of the Center with B4T and MIDC

It is foreseen that a part of the services which would be conducted by B4T or MIDC, especially for those of advanced technology, will be brought to the Center. The effect of the decrease in service demand on the existing institutions would be, however, marginal, if the rapid increase of the potential needs of the services in Indonesia, specially in the Jawa Barat and JABOTABEK areas, is taken into account. For instance, the volume of the potential needs for tests and inspections in JABOTABEK alone in 1992 is 53,781, which is about 8 times the service performed by B4T in 1987. Since the demand for services is expected to increase annually which would well surpass the capacity of the existing institutions even if they were reinforced, the establishment of the Center in the JABOTABEK area is regarded as necessary.

6.7 Estimation of Demand on the Center

Regional cover ratios of the services of the Center are calculated applying the same correlation as with B4T between distance and the number of services coming from the region. The calculated regional cover ratios are further adjusted by reducing the part of the services to be handled

by B4T. The summarized regional cover ratios of the Center and B4T are shown in Table 8.6-1. The next step in estimating the demand for tests and inspections on the Center is to multiply the regional potential needs shown in Table 8.2-8 by the regional cover ratios. Table 8.6-2 shows the flow of the tests and inspections expected to be brought to the Center between 1990 and 2002.

Services provided by B4T show similar regional distribution as those of MIDC, stemming from the distance between the institutions and each region as well as from the industrial concentration of each region. Table 8.6-3 shows the ratio of the tests and inspections expected to be brought to the Center over the aggregate potential needs in Indonesia. Assuming that the same ratio is applied to R & D, and technical assistance and training, the demand for R & D, and technical assistance and training on the Center is estimated by multiplying the aggregate demand for R & D, and technical assistance and training by the ratios. The estimated demand for each service which is expected to be brought to the Center is shown in Tables 8.6-4 and 8.6-5.

Table 8.2-8 Flow of Potentail Needs for Tests and Inspections in Indonesia, 1985 - 2002

Region \ Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
JABOTABEK	4,260	5,707	7,832	11,008	15,835	23,295	35,021	53,781	84,352	99,255	116,818	137,519	161,924	190,701	224,641	264,677	311,915	367,660
Jawa Barat Ex. JABOTABEK	1,688	1,901	2,143	2,421	2,741	3,114	3,554	4,085	4,748	5,773	7,078	8,767	11,003	14,035	18,260	24,317	33,253	46,797
Jawa Tengah	653	760	887	1,037	1,215	1,426	1,679	1,980	2,342	2,926	3,666	4,607	5,807	7,342	9,312	11,848	15,123	19,367
Jawa Timur	1,722	2,112	2,623	3,300	4,210	5,459	7,225	9,816	13,816	16,015	18,570	21,537	24,983	28,988	33,641	39,049	45,334	52,641
Sumatera	537	593	656	725	801	886	981	1,087	1,205	1,377	1,575	1,804	2,067	2,372	2,724	3,133	3,608	4,162
Others	70	77	85	94	103	114	126	140	155	171	189	209	231	255	283	312	346	382
Total	8,930	11,150	14,226	18,585	24,905	34,294	48,586	70,889	106,618	125,517	147,896	174,443	206,015	243,693	288,861	343,336	409,579	491,009

Source: ANX IV-8-46 - 51

Table 8.3-1 Flow of Metalworking Industries (Number of Establishments), 1980, 1986 - 2002

ISIC Nbr \ Year	1980	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
381	363	556	597	641	688	739	793	852	914	982	1,054	1,132	1,215	1,304	1,400	1,504	1,614	1,733
382	132	180	190	200	210	221	233	245	258	272	287	302	318	335	352	371	391	412
383	113	186	202	220	239	259	282	306	333	361	393	427	464	504	548	595	647	703
384	178	307	336	368	403	442	484	529	580	635	695	761	834	913	1,000	1,095	1,199	1,313
TOTAL	786	1,229	1,325	1,428	1,540	1,661	1,792	1,933	2,085	2,250	2,429	2,622	2,830	3,056	3,301	3,565	3,851	4,161

Source: BPS

Table 8.3-2 Intention to use the Center for R & D, Training and Technical Assistance

	Yes		No		
	Number	%	Number	%	Total
R & D	18	60	12	40	30
TR. T/A	32	71	13	29	45

Source: ANX II (Questionnaire Survey)

Table 8.3-3 Flow of Potential Establishments for Tests and Inspections in Indonesia, 1980, 1986 - 2002

Year / ISIC Nbr	1980	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
381	363	556	597	641	688	739	793	852	914	982	1,054	1,132	1,215	1,304	1,400	1,504	1,614	1,733
382	132	180	190	200	210	221	233	245	258	272	287	302	318	335	352	371	391	412
383	113	186	202	220	239	259	282	306	333	361	393	427	464	504	548	595	647	703
384	178	307	336	368	403	442	484	529	580	635	695	761	834	913	1,000	1,095	1,199	1,313
Total Establishment	786	1,229	1,325	1,428	1,540	1,661	1,792	1,933	2,085	2,250	2,429	2,622	2,830	3,056	3,301	3,565	3,851	4,161
Potent. Establishment	472	737	795	857	924	997	1,075	1,160	1,251	1,350	1,457	1,573	1,698	1,834	1,980	2,139	2,311	2,496

Source: Tables 8.3-1 and 8.3-2

Table 8.3-4 Flow of Potential Needs for Tests and Inspectonns in Indonesia, 1980, 1986 - 2002

Year / ISIC Nbr	1980	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
381	363	556	597	641	688	739	793	852	914	982	1,054	1,132	1,215	1,304	1,400	1,504	1,614	1,733
382	132	180	190	200	210	221	233	245	258	272	287	302	318	335	352	371	391	412
383	113	186	202	220	239	259	282	306	333	361	393	427	464	504	548	595	647	703
384	178	307	336	368	403	442	484	529	580	635	695	761	834	913	1,000	1,095	1,199	1,313
Total	786	1,229	1,325	1,428	1,540	1,661	1,792	1,933	2,085	2,250	2,429	2,622	2,830	3,056	3,301	3,565	3,851	4,161
Potent. Establishment	472	737	795	857	924	997	1,075	1,160	1,251	1,350	1,457	1,573	1,698	1,834	1,980	2,139	2,311	2,496
Potent. Needs	42	65	70	76	81	88	95	102	110	119	129	139	150	162	175	189	204	220

Source: Tables 8.3-3

Table 8.4-2 Flow of Potential Needs for Technical Assistance and Training in Indonesia, 1980, 1986 - 2002

Year / ISIC Nbr	1980	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
381	363	556	597	641	688	739	793	852	914	982	1,054	1,132	1,215	1,304	1,400	1,504	1,614	1,733
382	132	180	190	200	210	221	233	245	258	272	287	302	318	335	352	371	391	412
383	113	186	202	220	239	259	282	306	333	361	393	427	464	504	548	595	647	703
384	178	307	336	368	403	442	484	529	580	635	695	761	834	913	1,000	1,095	1,199	1,313
Total	786	1,229	1,325	1,428	1,540	1,661	1,792	1,933	2,085	2,250	2,429	2,622	2,830	3,056	3,301	3,565	3,851	4,161
Potential Firms	559	874	942	1,016	1,095	1,181	1,274	1,374	1,483	1,600	1,727	1,864	2,013	2,173	2,347	2,535	2,739	2,959
T/A.TR per Firm	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53	1.53
Potential Needs	885	1,337	1,441	1,554	1,676	1,807	1,949	2,103	2,269	2,448	2,642	2,852	3,080	3,325	3,591	3,879	4,190	4,527

Source: Tables 8.3-1 and 8.4-1

Table 8.6-1 Regional Cover Ratios of the Center and B4T for Tests and Inspections

Regional	JABOTABEK	Jawa Barat (Ex. BOTABEK)	Jawa Tengah	Jawa Timur	Sumatera	Others
The Center	0.287	0.104	0.068	0.064	0.066	0.067
B4T	0.106	0.289	0.066	0.068	0.066	0.067
Total	0.393	0.393	0.134	0.132	0.132	0.134

Source: ANX IV-8-45

Table 8.6-2 Flow of Tests and Inspections Expected to be Brought to the Center, 1990 - 2002

Tests & Inspections \ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
[Category A]													
1) Brinnel Hardness	477	718	1,085	1,645	1,924	2,251	2,632	3,080	3,604	4,217	4,936	5,777	6,762
2) Vickers Hardness	244	368	556	844	1,015	1,224	1,475	1,778	2,144	2,588	3,127	3,778	4,566
3) Tensile	4,776	7,185	10,854	16,441	19,236	22,503	28,329	30,805	36,046	42,182	49,366	57,780	67,631
4) Impact	1,433	2,155	3,255	4,932	5,770	6,752	7,898	9,241	10,812	12,654	14,809	17,331	20,289
5) Projector	1,433	2,155	3,255	4,932	5,770	6,752	7,898	9,241	10,812	12,654	14,809	17,331	20,289
6) Micro Structure	1,638	3,304	6,668	13,468	16,204	19,511	23,516	28,381	34,318	41,607	50,628	61,907	76,214
7) Chemical Analysis	4,776	7,185	10,854	16,441	19,236	22,503	26,329	30,805	36,046	42,182	49,366	57,780	67,631
[Category B]													
8) Surface Roughness	1,324	1,536	1,783	2,070	2,442	2,882	3,404	4,020	4,747	5,606	6,622	7,823	9,241
9) 3-Dim. Measurement	408	549	737	991	1,213	1,484	1,817	2,225	2,726	3,339	4,092	5,015	6,150
10) Gear Tooth Dim.	1,324	1,536	1,783	2,070	2,442	2,882	3,404	4,020	4,747	5,606	6,622	7,823	9,241
[Category C1]													
11) Magnetic Particle	322	404	506	633	744	876	1,029	1,211	1,423	1,674	1,970	2,316	2,726
[Category C2]													
12) Ultrasonic	480	518	559	601	655	714	776	852	921	1,003	1,092	1,190	1,294
13) X-ray	504	548	597	651	711	778	850	900	1,018	1,113	1,218	1,332	1,456
Total	19,139	28,161	42,492	65,719	77,362	91,112	107,357	126,559	149,364	176,425	208,657	247,183	293,490

Source: Tables 8.2-8 and 8.6-1

Table 8.6-3 Ratio of Tests and Inspections on the Center over the Total Potential Needs, 1990 - 2002

Item \ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Demand to the Center	19,139	28,161	42,492	65,719	77,362	91,112	107,357	126,559	149,364	176,425	208,657	247,183	293,490
Potential Needs	34,294	48,586	70,889	106,618	125,517	147,896	174,443	206,015	243,693	288,861	343,336	409,579	491,009
Ratio to the Center	0.56	0.58	0.60	0.62	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.60	0.60

Source: Tables 8.2-8 and 8.6-2

Table 8.6-4 Estimated Demand for Technical Assistance and Training on the Center, 1990 - 2002

Item \ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Potential Needs	1,807	1,949	2,103	2,269	2,448	2,642	2,852	3,080	3,325	3,591	3,879	4,190	4,527
Ratio to the Center	0.56	0.58	0.6	0.62	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.6	0.6
DEMAND TO THE CENTER	1,012	1,131	1,262	1,407	1,518	1,638	1,769	1,879	2,028	2,191	2,366	2,514	2,716

Source: Tables 8.4-2 and 8.6-3

Table 8.6-5 Estimated Demand for R & D on the Center, 1990 - 2002

Item \ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Potential Needs	88	95	102	110	119	129	139	150	162	175	189	204	220
Ratio to the Center	0.56	0.58	0.6	0.62	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.6	0.6
Demand to the Center	49	55	61	68	74	80	86	92	99	107	115	122	132

Source: Tables 8.4-2 and 8.6-3

CHAPTER 7

CONCEPTUAL DESIGN OF THE CENTER

CHAPTER 7 CONCEPTUAL DESIGN OF THE CENTER

7.1 Objective and Functions of the Center

(1) Objective

The objective of the Center is to support the metalworking industries owned both by private sector and by the public sector in the improvement of the basic technology and the quality of the products, thus contributing to the modernization of the metalworking industries as a whole.

(2) Function

The major functions of the Center are as follows:

1) Testing and inspection to identify the quality of the products made by the linkage type industries to determine if they meet the requirements of the assembly type industries.
2) Implementing technical assistance services to the linkage-type industries in the manufacturing process and operation and maintenance of the equipment in order to most effectively achieve the localization program of the fabricated metal components demanded by the Indonesian Government. Training of the workforce in the acquisition of the necessary technical skills is also conducted.
3) Implementing R & D activities in the technological areas which are not yet completely practiced in Indonesia. Such areas include:
   - improvement of casting technology to produce metallic material for fabricated metal products.
   - improvement of forging and pressworking technologies to attain better forming.
   - improvement of plating, sheetworking, welding and machining technologies to attain good quality and reduction of the manufacturing cost of the products.

4) Providing technical assistance and training of manufacturing process by using facilities in the Center and holding seminars.
5) Providing technical advisory services including visits to factories.
6) Providing market and technical information to the industries, and exchanging necessary information between assembly-type and linkage-type industries.

7.2 Major Activities of the Center

(1) Testing and inspection

The Center will conduct entrusted tests of items numbered (1) and (13) below at all times for quality assurance of industrial materials and issue inspection record. There are following items from (14) to (26) to be performed, as required, as a part of T/A or R & D.

1) Brinell hardness test
2) Vickers hardness test
3) Tensile strength test
4) Impact test
5) Visual and microscopical inspection using projector
6) Micro structure test
7) Chemical analysis
8) Surface roughness measurement
9) Three-dimensional measurement
10) Gear tooth dimensional measurement
11) Magnetic particle inspection
12) Ultrasonic inspection
13) X-Ray inspection
14) Micro vickers test
15) Fatigue test
16) Scanning electron microscope test
17) Sulphur print test
18) Penetrant rest
19) Fluorescent magnetic particle test
20) Sand test for iron cast mold

21) Plating film test
22) Pressure test (air tightness and water meter)
23) Length measurement
24) Angle measurement
25) Gear rolling test
26) X-ray diffractor analysis

(2) R & D, T/A and T/R

R & D of new products and new manufacturing process will be carried out using facilities to be installed in the Center under instructions of engineers. Each technology thus developed will be transferred to companies in Indonesia. Engineers will give instructions of R & D until Indonesian companies could manufacture new products by themselves.
Technical assistance (T/A) will be divided into long-term T/A to be provided within the Center and short-term T/A to be performed in factories.

1) Long-term T/A (within the Center)
   - Quality improvement of products and suggestion thereof
   - Improvement of productivity and suggestion thereof
   - Improvement for shortening delivery time and suggestion therefor
2) Short-term T/A (in factories)
   - Solution of present problems and suggestion thereof
   - Suggestion for factory layout improvement

Regarding TR, practical training related to handling and maintenance method of machinery and equipment will be conducted using machinery and equipment to be installed in the Center. Expected effects from R & D, T/A and TR are summarized in Table 9.1-1.

Table 9.1-1 Expected Effects from R & D, T/A and TR (1/2)

	Expected effects	R & D				T/A			TR			
		Item	Duration (months)	Times per year	Number of engineers	Item (Duration)	Times per year	Number of engineers	Course (Duration)	Times per year	Number of trainees	Number of engineers
Casting	1) Transfer of technology related to manufacturing process of cast steel and special cast iron (ductile and malleable cast cast iron) 2) Transfer of technology related to complicated shape casting 3) Transfer of technology related to forging (die and free forging) 4) Transfer of heat treatment technology	- Manufacturing process of complicated shape casting (e.g., engine blocks) - Manufacturing process of special cast iron (e.g., ductile and malleable cast iron) - Manufacturing process of cast steel - Manufacturing process of alloy cast iron and cast steel - Five other items	6-8 3 3 3	9	3	- Manufacturing technology of various parts nominated in the deletion program (1 day)	300	1 (4 assistant engineers)	- Manufacturing process technology (6 days) - CO_2 mold technology (6 days) - Shell mold (6 days) - Self-hardening sand mold (Fran type resin) (6 days) - Melting technology (6 days) Breakdown of Course: Lecture for 2 days Test and inspection for 1 day Practice for 3 days	12	5-25	1
Forging		- Die forging of connecting rods - Die forging of gears - Free forging of shafts	3 3 3	3	3	- Manufacturing technology of various parts nominated in the deletion program (1 day)	20	1	- Free forging technology (6 days) - Die forging technology (6 days) Breakdown of Course: Lecture for 2 days Practice for 3 days Test and inspection for 1 day	4	5-25	1
Heat treatment		- Carburizing and nitriding of gears and shafts - Heat treatment of dies - One other item	3 3	3	1	- Manufacturing technology of various parts nominated in the deletion program (1 day)	50	1	- Heat treatment technology of die (6 days) - Heat treatment technology of carbon steel (6 days) Breakdown of Course: Lecture for 2 days Practice for 3 days Test and inspection for 1 day	4	5-25	1

Table 9.1-1 Expected Effects from R & D, T/A and TR (2/2)

	Expected effects	R & D				T/A			TR			
		Item	Duration (months)	Times per year	Number of engineers	Item (Duration)	Times per year	Number of engineers	Course (Duration)	Times per year	Number of trainees	Number of engineers
Sheet-working / welding	1) Acquisition of manufacutring process technology and transfer of technology - Increased quality - Increased productivity - Reduced manufacturing cost 2) Acquisition and transfer of technology to conduct non-destructive inspection	- Welding technology of different metals - One other item	6	2	2	- Automation of thick plate welding (to be applicable to shipbuilding and pressure vessels) (1 month/item) - Seven other items	8	1	- Acquisition of technology to conduct non-destructive inspection of welded portions (2.5 months/course) - Four other courses	5	8-10	3
Press-work		- Deep drawing work technology (for automotive parts) - One other item	6	2	1	- Improvement of improper process resulting from defective parts (e.g., improvement of dies) (1 month/item) - Seven other items	8	1	- Working conditions and maintenance of process (1 month/course) - Seven other courses	8	3-5	2
Plating	3) Acquisition and transfer of machining technology - Acquisition of precision machining and inspection of dimensional accuracy	- Determination of plating condition for automotive parts (e.g., plating thickness, plating condition) - Two other items	3	3	1	- Prevention of defect in plating layer (pre-treatment and plating condition) (1 month/item) - Seven other items	8	1	- Acquisition of electroplating and chemical plating, and hot dipping techniques (2 months/course) - Three other courses	4	4-6	1
Machining		It is difficult to specify this item at the present stage, because R & D themes are discovered during the promotion of the deletion program				- Finishing of high alloy steel by grinding work (1 month/item) - Seven other items	8	2	- Acquisition of technology to operate NC machine (3 months/course) - Two other courses	3	3-5	2
						- Gear cutting technology (bevel gears and so on) (1 month/item) - Seven other items	8		- Acquisition of technology to operate grinding machine (1 month/course) - Seven other courses	8	3-5	

7.3 Organization and Personnel of the Center

(1) Organization of the center

1) Basic concepts in formulating the organizational structure of the Center

The Center could be established as a governmental organization or semi-governmental organization jointly funded by the Indonesian Government and private sector. The supervising agency of the Center could be either BPPI or the other governmental agency. In the course of the field survey, industrial federation such as KADIN, expressed a strong interest in establishment of the high-level testing institute for export products, and its readiness for the capital contribution. However, the basic character of such institute does not necessarily coincide with that of the Center, because the Center intended to be established in the JABOTABEK area, aims to comply with the needs of metalworking industries which have not been fully covered by the existing governmental institutes such as B4T, and MIDC. Primary objectives of the Center are to enhance the technological level of the linkage type industries, thus contributing to the effective and urgent materialization of the deletion program. This means that the role of the Center is to compliment and extend the roles of B4T and MIDC for the metalworking industries. In view of these functions of the Center, it is expected that the organization of the Center should be flexible enough to allow frequent exchange of the information and staff personnel with B4T and MIDC, in order to avoid unnecessary duplication of activities.

Furthermore, it is generally considered that the establishment of the new governmental organization under totally new concept takes long time, which does not contribute to the solution of the current issues such as the materialization of the deletion programs.

On the other hand, it is absolutely necessary that the Center should be so managed to comply with the requirements of the industries, and be open to the opinions of the universities and specialists engaged in the metalworking field. Above are the basic conceptual framework in formulating the organizational structures of the Center as mentioned below.

2) The organization of the Center

As proposed, the Center to be established is to be an organization under the control of BPPI of the MOI, and to have the following organization as is described in Chart 9.1-1.

(i) Director

The Director is the top executive of the Center, whose power would be:

- formulation and decision of the implementation plan of the Center.
- management of personnel affairs and activities.
- evaluation of the activities.

(ii) Communication forum with industries and scientist.

As the relationship with the industries is very important, communication between the Center and the industries (includes the Association of Producers), scientists and specialists should be conducted regularly.

A forum for communication is necessary to be established in order to supply the Center with inputs on current requirements of the metalworking industries and the opinions of the scientists and specialists in the mechanical engineering field. The candidates of the industry representatives could be selected from the member firms belonging to:

- GAMMA
- GIANM
- GAIKINDO

The candidates for the scientist and specialist representatives could be appointed from the following universities and organizations:

- Mechanical Engineering Department, ITB
- Mechanical Engineering Department, ITS
- Directorate of other similar institutes in the metalworking field such as LUK.

(iii) Implementating organ

For the implementation of the function of the Center, three departments consisting of a Testing & Inspection Department, Technical Service Department and Administration Department under the control of the Director of the Center are to be organized.

a) Testing & Inspection Department

This department consists of three sections:

- mechanical testing section
- nondestructive inspection section
- metallurgical testing section

Total number of staff members is 36 including the manager of the department. The role of the department is to perform testing and inspection and its related activities.

b) Technical Service Department

This department consists of six sections:

- casting section
- forging and heating treatment section
- pressworking section
- welding section
- plating section
- machining section

The total size of the staff is 70 including the manager. The role of the department is to provide technical assistance to the industries and governmental organization through counseling, training and direct visits to the factories. The department also undertakes contract research projects as well as voluntary research projects.

c) Administration Department

This department consists of seven sections:

- general affairs section
- personnel affairs section
- finance and accounting section
- information management section
- promotion and public relations section
- technical coordination section
- maintenance of equipment section

The total number of staff persons is 30 including the manager. The role of each section is as follows:

- the general affairs section is to take care of keeping official documents, of maintaining the property, of managing the canteen, and of other affairs which do not belong to the other section.

- the personnel section handles personnel affairs.
- the finance and accounting section is engaged in book keeping, accounting and financing work.
- the information management section is engaged in the maintenance of the library and related information materials, and also is responsible for keeping the reports of the research work of the Center.
- the promotion and public relations section is mainly responsible for the publicity of the Center through the publication of brochures and other materials to arouse the awareness of the industries of the activities of the Center.
- the technical coordination section is engaged in the coordination of inter-divisional technical matters.
- the maintenance of equipment section is responsible for the maintenance of the machinery and equipment of the Center.

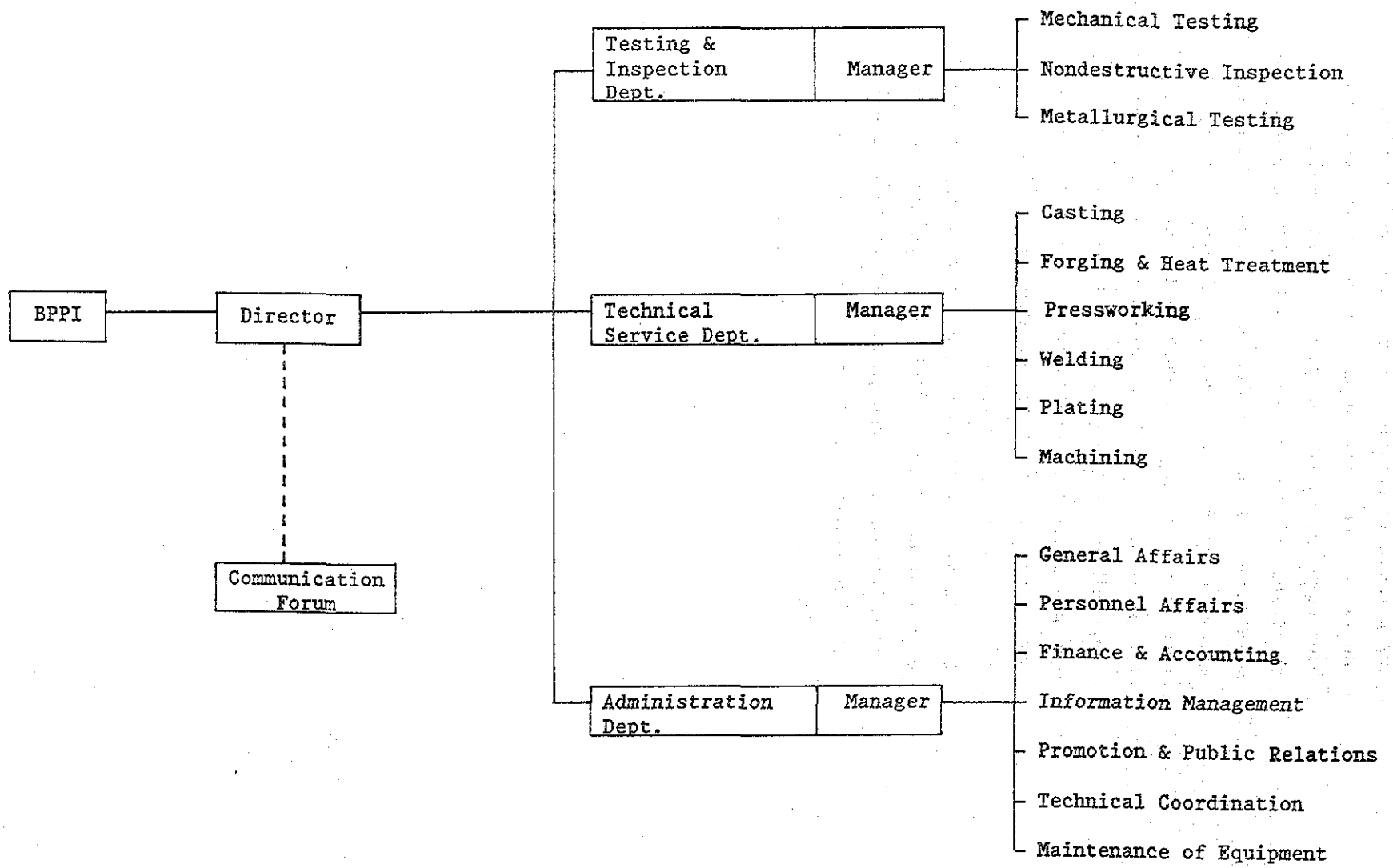


Fig. 9.1-1 Organization Chart

(2) The personnel staffing plan of the Center

The personnel structure at first year is proposed as follows:

- Director 1
- Managers of the departments 3
- Staff persons of each department 133

Table 9.1-4 Number of Personnel Staff

	Number of Engineers		Assistant	Total
	University graduate (S1)	University graduate (D3)	Engineers graduates of senior high school or more	
Testing & Inspection Department				
- Mechanical testing	1	1	7	9
- Nondestructive inspection	1	2	6	9
- Metallurgical testing	1	5	6	12
- Work force				5
Total (excl. manager)				35
Technical service Department				
- Casting	1	3	8	12
- Forging & Heating treatment	1	2	6	9
- Pressworking	1	2	6	9
- Welding	1	2	3	6
- Plating	1	1	4	6
- Machining	1	5	6	12
- Workforce				15
Total (excl. manager)				69

General Affairs Department	University graduate (S1) or (D3)	Graduates of senior high school	Total
General Affairs	2	4	6
Personnel Affairs	1	1	2
Finance & Accounting	1	1	2
Information Management	1	2	3
Promotion & Public relations	1	1	2
Technical coordination	1	1	2
Maintenance of equipment	1	1	2
Workforce			10
Total (excl. manager)			29
Grand Total			133

The details of the personnel structure of the Center classified by educational background are summarized as follows:

	Number of persons
- University graduate, S1	13
- University graduate, D3	31
- Graduates of senior high school	63
- Others	30
Total	137

(3) Personnel Training

During the establishment of the Center, training such overseas countries as Japan for five (5) engineers per year would be required for testing and inspection, R&D and training instructor in metal working.

(4) Foreign experts

For the purpose of providing supervisory and advisory services to Indonesian personnel, it is required that foreign experts specializing in the various branches of metalworking technologies be stationed at the Center. While the number of such experts needed would decline year by year, more experts are required especially at the start-up of the center in order to implement the technology transfer to Indonesian personnel smoothly and intensively. The numbers of foreign experts by branches are described in the following table.

Table 9.1-5 Number of Foreign Experts

Area of expertise	First year after start-up of the Center	Second year	Third year	Fourth year
Casting	2	1	1	1
Forging Heat treatment	1	1	1	1
Sheetwork Presswork	1	1	1	1
Welding	1	1	1	
Plating	1	1		
Machining	2	1	1	
Mechanical testing Metallurgical testing	1	1		
Nondestructive testing	1	1		
Total	10	8	5	3

(5) Alternative organization structure of the Center

The Center is proposed to be operated as a Governmental organization in the interests of financial viability. However, the establishment of a new institute with a relatively similar character as such existing organizations as MIDC or B4T would possibly not welcomed by the Indonesian Government.

In light of the above, the following alternative organization structure of the Center is suggested:

1) MIDC would be reorganized as an organization which controls two major centers, one located in Bandung and the other in the JABOTABEK area;
2) Through the establishment of a close information network among the two major centers of MIDC and local R & D laboratories related to metalworking industries such as those located in Surabaya, Medan or Semarang, and by transferring a part of the authorized testing and inspection function related to metalworking from B4T, MIDC would become a concentrated national center for the metalworking industry in Indonesia;
3) The reorganized MIDC would be managed by a director and two vice-directors. One vice-director would be in charge of the daily operations of the Bandong center and the other would be in charge of the daily operation of the new Center in the JABOTABEK area; and
4) Most of the functions and organization sections proposed in the original organization plan for the Center would be realized with the organization of the new Center of MIDC in the JABOTABEK area including the proposed communication forum. However, a part of such key functions as personnel management or annual operation planning would be transferred to the central administration section which would control both of the two major centers of the new MIDC.

Because the alternative organization structure involves the reorganization of an existing one, the suggestion of any more concrete picture of the new organizaion would be beyond the scope of this study. However, a tentatively suggested alternative organization structure is summarized and shown in Fig 9.1-2.

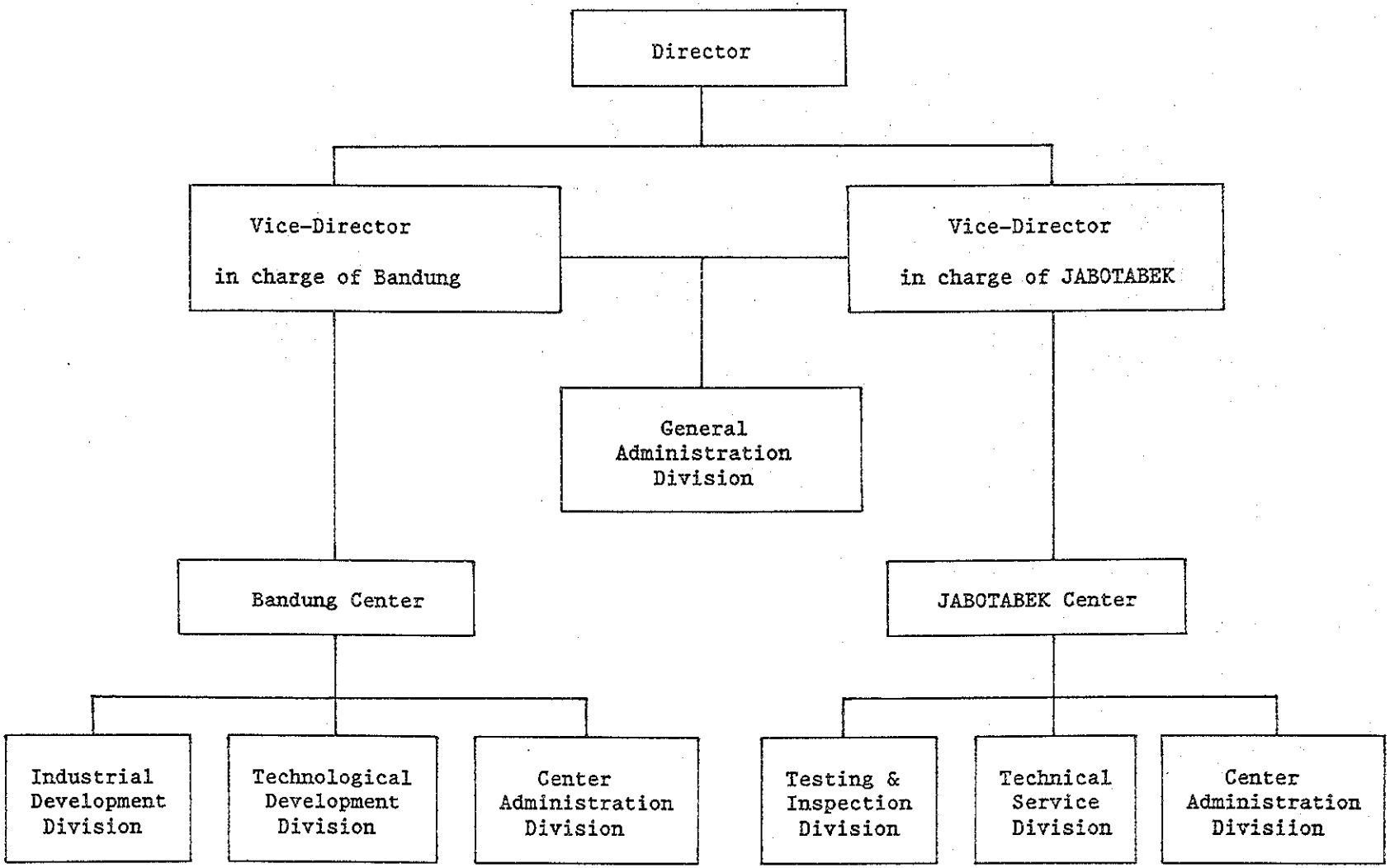


Fig. 9.1-2 Alternative Organization Chart

7.4 Candidate Site for the Center

(1) Original Plan

The conclusion was reached that the construction of a new center in the JABOTABEK area is the top priority, considering the total demand on the Center, as described in CHAPTER 6. However, because the JABOTABEK area is very expansive and the MOI does not have a site for construction of the Center, the study team evaluated through field survey the National Center for Research, Science and Technology (PUSPIPTEK) located in Serpong City in the outskirts of Jakarta as the most suitable and favorable location for the Center, and selected it as the candidate site for construction of the Center.

(2) Alternative Plan of Candidate Site for the Center

As alternative plans of site location, the purchase of new land for construction of the Center would not be welcomed. Instead, the study team examined the possibility of whether or not the Center could be constructed within the site of BBIK in the JABOTABEK area which is one of the laboratories operated by the BPPI of the MOI (refer to Figs. 9.2-21 and 9.2-22). The conclusion was reached that the Center having the same functions as the original plan (except for the trainees' dormitory) could be constructed. However, the construction site should be additionally purchased in Alternative Plan II.

7.5 Layout of the Center

Although the site location and configuration are unknown at present, the layout plan of the Center, as shown in Fig. 9.4-1, has been made in order to make functions of the Center effectively and efficiently.

7.6 Machinery and Equipment to be Installed in the Center

On the basis of functions requested for the Center as described in Chapter 5, kinds of main facilities to be installed in the Center were selected according to the present technical level of Metalworking industries in Indonesia as Phase I and future technological advance as Phase II.

7.7 Description of civil and building facilities

(1) Required site area

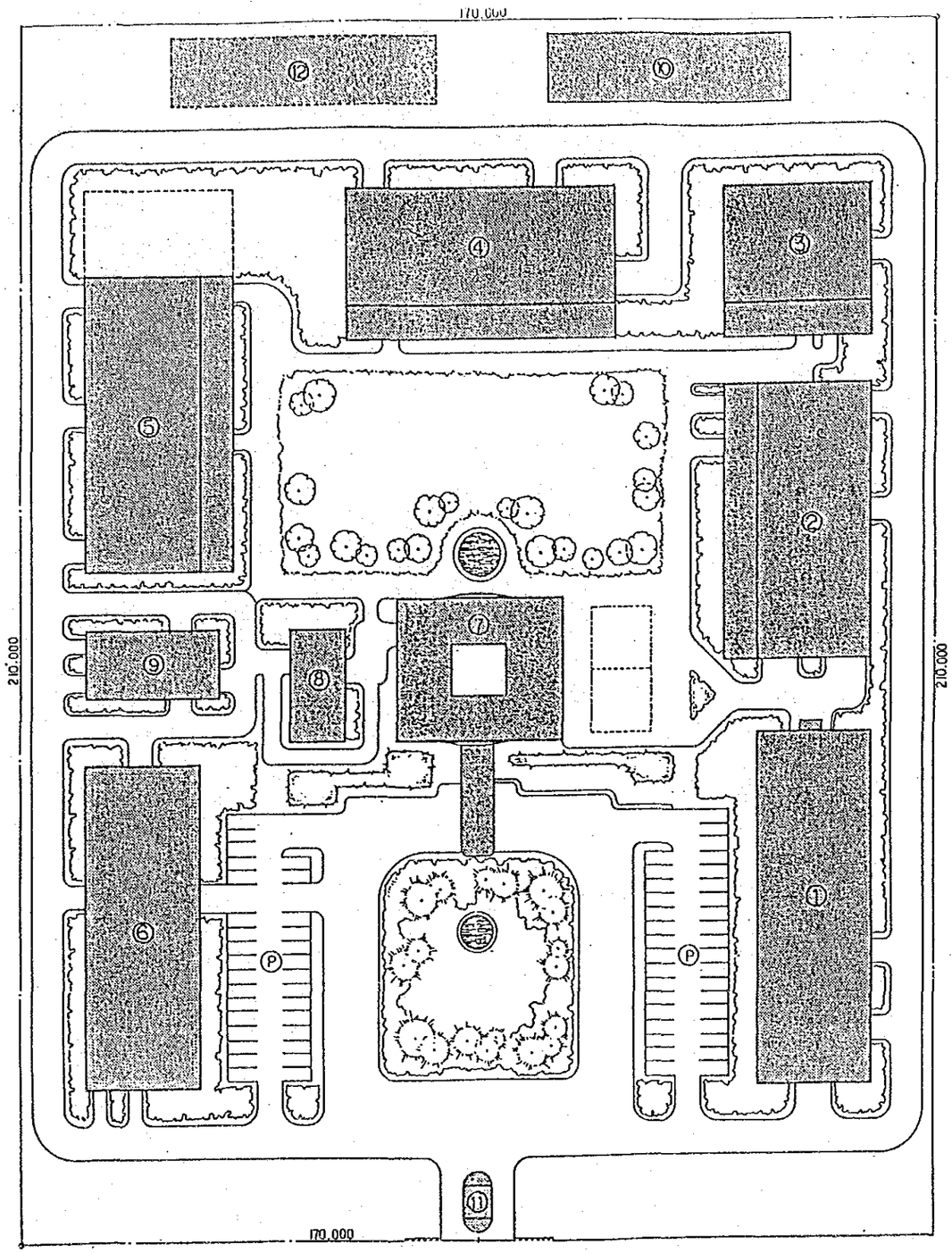
As shown in Fig. 9.2-4, required site area calculated is about 210 m x 170 m = 35,700 m^2.
This area does not cover the area for the access road and it includes the area for the future expansion space.

(2) Building & facilities necessary for the Center are as follows:

1) Testing & Inspection Shop
2) Plating & Heat Treament Shop
3) Forging Shop
4) Casting Shop
5) Sheetworking & Welding Shop
6) Machining Shop
7) Administration Building
8) Canteen
9) Main Substation
10) Dormitory
11) Gate House
12) Water Treatment system

Following work items are considered to be necessary as another exterior work.

a. On-premise road and parking area
b. Rainwater drainage and sewerage
c. Fence and gate
d. Plantation
e. Site grading (if necessary)



① TESTING AND INSPECTION SHOP
② PLATING AND HEAT TREATMENT SHOP
③ FORGING SHOP
④ CASTING SHOP
⑤ SHEETWORKING, PRESSWORKING AND WELDING SHOP
⑥ MACHINING SHOP
⑦ ADMINISTRATION BUILDING
⑧ CANTEEN
⑨ MAIN SUBSTATION
⑩ DORMITORY
⑪ GATE HOUSE
⑫ WATER TREATMENT SYSTEM

NO.	REVISION	DATE	REV'D	CHK'D
△				
△				
△				

DATE
DWN
CHK'D
APP'D

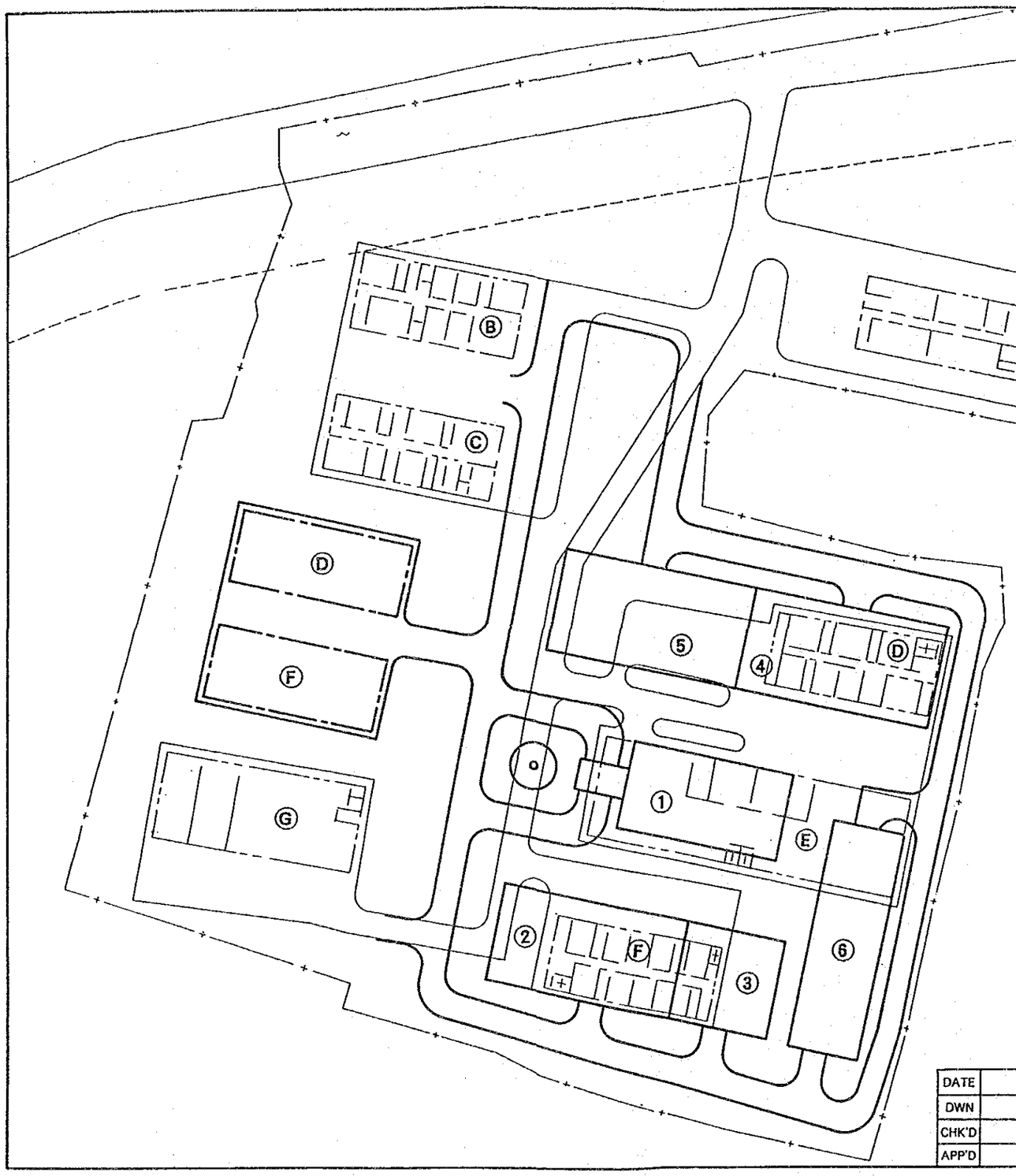
TITLE
PLOT PLAN OF THE CENTER

TESTING LABORATORY AND QUALITY IMPROVEMENT CENTER FOR THE METALWORKING INDUSTRY IN THE REPUBLIC OF INDONESIA

SH. NO.

SCALE 1/600

REV △



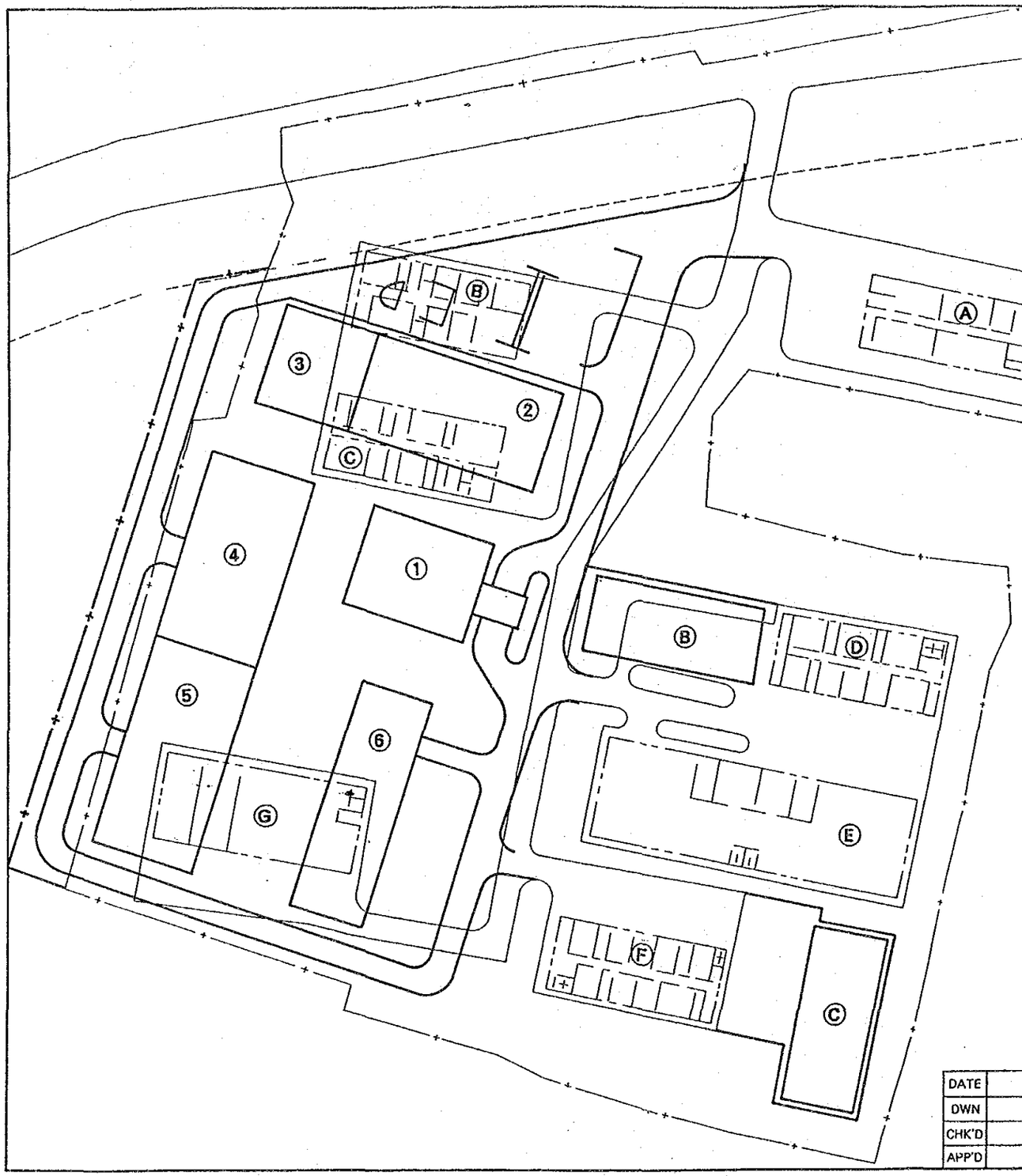
DESCRIPTION OF THE EXISTING BUILDINGS

NO	NAME OF THE BUILDING	STORY	BUILDING AREA (m²)	TOTAL FLOOR AREA (m²)
Ⓐ	KANTOR UTAMA	2	2,052	4,104
Ⓑ	BALAI PENELITIAN PUPUK & PETROKIMIA	2	756	1,512
Ⓒ	BALAI PENELITIAN KIMIA ORGANIK & PERMENTASI	2	756	1,512
Ⓓ	BALAI PENGEMBANGAN PUPUK & PETROKIMIA	2	756	1,512
Ⓔ	GEDUNG TEST HOUSE	1	1,872	1,872
Ⓕ	BALAI PENGEMBANGAN KIMIA ORGANIK & PERMENTASI	2	756	1,512
Ⓖ	BENGKEL BALAI BESAR INDUSTRI KIMIA	1	1,008	1,008
	TOTAL		7,956	13,032

DESCRIPTION OF THE BUILDINGS FOR THE CENTER

NO	NAME OF THE BUILDING	STORY	BUILDING AREA (m²)	TOTAL FLOOR AREA (m²)
①	TEST/INSPECTION, ADMINISTRATION, CANTEEN BULG.	4	800	3,200
②	PLATING & HEAT-TREATMENT SHOP	1	1,104	1,104
③	FORGING SHOP	1	576	576
④	CASTING SHOP	1	1,104	1,104
⑤	SHEETWORKING/PRESSWORKING/WELDING SHOP	1	1,200	1,200
⑥	MACHINING SHOP	1	990	990
	TOTAL		5,774	8,174

DATE		TITLE	PLOT PLAN OF THE CENTER	SH. NO.	SCALE
DWN			ALTERNATIVE PLAN A	FIG. 9.2 -21	1/1000 M
CHK'D			TESTING LABORATORY AND QUALITY IMPROVEMENT CENTER FOR		REV
APP'D			THE METALWORKING INDUSTRY IN THE REPUBLIC OF INDONESIA		△



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Ⓔ	GEDUNG TEST HOUSE	1	1,872	1,872
Ⓕ	BALAI PENGEMBANGAN KIMIA ORGANIK & PERMENTASI	2	756	1,512
Ⓖ	BENGKEL BALAI BESAR INDUSTRI KIMIA	1	1,008	1,008
	TOTAL		7,956	13,032

DESCRIPTION OF THE BUILDINGS FOR THE CENTER

NO	NAME OF THE BUILDING	STORY	BUILDING AREA (m²)	TOTAL FLOOR AREA (m²)
①	TEST/INSPECTION, ADMINISTRATION, CANTEEN BULG.	4	800	3,200
②	PLATING & HEAT-TREATMENT SHOP	1	1,104	1,104
③	FORGING SHOP	1	576	576
④	CASTING SHOP	1	1,104	1,104
⑤	SHEETWORKING/PRESSWORKING/WELDING SHOP	1	1,200	1,200
⑥	MACHINING SHOP	1	990	990
	TOTAL		5,774	8,174

DATE		TITLE PLOT PLAN OF THE CENTER	SH. NO.	SCALE
DWN		ALTERNATIVE PLAN B	FIG. 9.2 - 22	1/1000
CHK'D		TESTING LABORATORY AND QUALITY IMPROVEMENT CENTER FOR		REV
APP'D		THE METALWORKING INDUSTRY IN THE REPUBLIC OF INDONESIA		△

CHAPTER 8

REQUIRED CONSTRUCTION COST

CHAPTER 8 REQUIRED CONSTRUCTION COST

Although the estimated construction cost is calculated on the basis of the conceptual design, 10% of the calculated construction cost is added to the total construction cost as a contingency, because the candidate site is not finally decided, and changes in specifications for machinery and equipment, building size and products procured from foreign countries are forecasted in the basic and the detailed design stages.

Required total construction cost is roughly estimated below:

(1) Total construction cost (case 1)

Total construction cost including value-added tax and import duty tax that comform to the laws of Indonesia is as follows:

Table 10.8-1 Total Cost including Value-added and Import Duty Taxes

(Unit: Rp. 1,000,000)

	Foreign portion	Local portion	Total
1. Land price	-	1,071	1,071
2. Civil and building work	5,273	13,096	18,369
3. Machinery and equipment work	28,150	273	28,423
4. Engineering services fee	2,146	1,337	3,483
Sub total	35,569	15,777	51,346
5. Contingency	3,557	1,471	5,028
Total	39,126	17,248	56,374

(2) Total construction cost (case 2)

Total construction cost excluding value-added tax and import duty tax that comform to the laws of Indonesia is as follows:

Table 10.8-2 Total Cost excluding Value-added and Import Duty Taxes

(Unit: Rp. 1,000,000)

	Foreign portion	Local portion	Total
1. Land price	-	1,071	1,071
2. Civil and building work	3,637	13,096	16,733
3. Machinery and equipment work	2,146	273	2,419
4. Engineering services fee	19,418	1,337	20,755
Sub total	25,201	15,777	40,978
5. Contingency	3,557	1,471	5,028
Total	28,758	17,248	46,006

CHAPTER 9

FINANCIAL PLANNING

CHAPTER 9 FINANCIAL PLANNING

9.1 Project Revenue

The Center is expected to earn revenue for its services consisting of (1) tests and inspections, (2) technical assistance and training, and (3) R & D, rendered to private firms and governmental establishments, just as B4T or MIDC does.

(1) Revenue from tests and inspections

The volume of tests and inspections brought to the Center was estimated. The charges applied to the Center used the same rates applied to the same kind of tests and inspections done at B4T. For tests or inspections which are not listed on the B4T tariff, charges were estimated by the study team comparing rates for similar tests and inspections. The flow of revenue calculated based on test and inspection charges determined as above is shown in Table 11.1-1.

(2) Revenue from technical assistance and training

The flow of the volume of technical assistance and training was estimated. Comparing service charges of MIDC with those of similar institutions, the service charge for technical assistance is set at Rp. 60,000/man-day (for casting, only Rp. 40,000/man-day), and that for training is set at Rp. 500,000/man-month. Table 11.1-2 shows the flow of service revenue earned from technical assistance and training based on the above service charges.

(3) Revenue from research & development

Details and the number of R & D activities to be conducted by the Center were discussed in Chapter 8. For R & D services, it is not easy to set a single fixed charge since the difficulty of the project, the number of engineers needed, the degree of machine usage, or the volume of material used differs widely for each

project. In this chapter, the past performance of MIDC as well as that of similar institutions was carefully examined, and Rp. 2,000,000 is set for the Center. For the material cost, because the estimation is quite difficult, it was decided that such charges would be separately charged to the firms or the institutions. Revenue based on the volume and the service charges described above is shown in Table 11.1-2.

Table 11.1-1 Flow of Revenue of the Center from Tests and Inspection

(Unit : Rp.1,000)

Tests & Inspections	Inspection Charge	Test piece Processing	Test piece Frequency	Total Charge/Pc	Year									
					1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
[Category A]	(Rp./Pc)	(Rp./Pc)	(Rate)	(Rp./Pc)										
1) Brinell hardness	1,000	1,000	0.9	1,900	2,062	3,126	3,656	4,277	5,001	5,852	6,848	8,012	9,378	10,976
2) Vickers hardness	1,000	1,000	0.9	1,900	1,056	1,604	1,929	2,326	2,803	3,378	4,074	4,917	5,941	7,178
3) Tensile	2,000	2,500	0.9	4,250	46,130	69,874	81,753	95,638	111,898	130,921	153,196	179,274	209,806	245,565
4) Impact	1,000	2,500	0.9	3,250	10,579	16,029	18,753	21,944	25,669	30,033	35,139	41,126	48,129	56,326
5) Projector	2,000			2,000	6,510	9,864	11,540	13,504	15,796	18,482	21,624	25,308	29,618	34,662
6) Micro structure	2,000	1,000	0.9	2,900	19,337	39,057	48,992	56,582	68,196	82,305	99,522	120,660	146,821	179,530
7) Chemical analysis	2,000			2,000	21,708	32,882	38,472	45,006	52,658	61,610	72,092	84,364	98,732	115,560
[Category B]														
8) Surface roughness	2,000			2,000	3,566	4,140	4,884	5,764	6,808	8,040	9,494	11,212	13,244	15,646
9) 3-Dim. measurement	5,000			5,000	3,685	4,955	6,065	7,420	9,085	11,125	13,630	16,695	20,460	25,075
10) Gear tooth dim.	5,000			5,000	8,915	10,350	12,210	14,410	17,020	20,100	23,735	28,030	33,110	39,115
[Category C1]														
11) Magnetic particle	10,000			10,000	5,060	6,330	7,440	8,760	10,290	12,110	14,230	16,740	19,700	23,160
[Category C2]														
12) Ultrasonic	20,000			20,000	11,180	12,020	13,100	14,280	15,520	17,040	18,420	20,060	21,840	23,800
13) X-ray	10,000			10,000	5,970	6,510	7,110	7,780	8,500	9,000	10,180	11,130	12,180	13,320
Total					145,757	216,741	253,902	297,690	349,243	409,997	482,183	567,528	668,960	789,914

Table 11.1-2 Flow of Revenue of the Center from Technical Services

(Unit : Rp.1,000)

Capacity		Unit	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Training		Man-month	315	315	315	315	315	315	315	315	315	315
T/A	Casting	Man-day	300	300	300	300	300	300	300	300	300	300
	Frg/H.Trt	Man-day	70	70	70	70	70	70	70	70	70	70
	Others	Man-month	48	48	48	48	48	48	48	48	48	48
R & D		Man-month	78	78	78	78	78	78	78	78	78	78
Operation (%)			50	60	70	80	90	100	100	100	100	100
Actual Operation												
Training			158	189	221	252	284	315	315	315	315	315
T/A	Casting		150	180	210	240	270	300	300	300	300	300
	Frg/H.Trt		35	42	49	56	63	70	70	70	70	70
	Others		24	29	34	38	43	48	48	48	48	48
R & D			39	47	55	62	70	78	78	78	78	78
Revenue		Revenue/Unit (Rp.)										
Training		500 per mon.	78,750	94,500	110,250	126,000	141,750	157,500	157,500	157,500	157,500	157,500
T/A	Casting	40 per day	6,000	7,200	8,400	9,600	10,800	12,000	12,000	12,000	12,000	12,000
	Frg/H.Trt	60 per day	2,100	2,520	2,940	3,360	3,780	4,200	4,200	4,200	4,200	4,200
	Others	1,200 per mon.	28,800	34,580	40,320	46,080	51,840	57,600	57,600	57,600	57,600	57,600
R & D		2,000 per mon.	78,000	93,600	109,200	124,800	140,400	156,000	156,000	156,000	156,000	156,000
Sub Total			193,650	232,380	271,110	309,840	348,570	387,300	387,300	387,300	387,300	387,300

9.2 Cost for Maintenance and Operation

For the operation of the Center, such operation costs are needed as (1) employment cost, (2) maintenance cost for buildings and facilities, and (3) utilities, supplies and so on.

(1) Employment cost

The number of employees necessary to operate the Center was estimated in Section 7.(3).2). The levels of wages, taking those of B4T and MIDC into consideration, are assumed as follows:

Table 11.2-1 Assumption of the Average Wage Level

(Rp./month)

	Base wage	Family allowance (10%)	Other allowances	Total
Grade I	60,000	6,000	30,000	96,000
Grade II	100,000	10,000	50,000	160,000
Grade III, IV	200,000	20,000	80,000	300,000
Engineer (Foreign Expert)	-	-	-	12,770,000

(2) Cost for maintenance, utilities, supplies, and other miscellaneous costs

Various costs other than the employment cost, based on those of similar institutions in Indonesia or the cost records of similar institutions in Japan, were estimated as shown in Table 12.2-3.

Table 12.2-3 Estimated Annual Maintenance Cost in Economic Prices

(Unit: Rp. million)

Item \ Year	1992	2001
1. Maintenance Costs:		
Building (Construction costs x 0.5%)	80	80
Machinery & equipment (Acquirement costs x 0.2%)	39	39
2. Raw materials & consumables (Technical service fee x 15%)	29	58
3. Utilities (Total service revenue x 10%)	34	118
4. Other expenses (Total service revenue x 15%)	51	177
Total	233	472

9.3 Budget planning

Since the Center is expected to be controlled under BPPI, most of the costs necessary for the maintenance and the operation of the Center are borne out of the government budget as a routine budget and a project budget.

On the other hand, for revenue, except for actual costs charged to clients such as material costs, all of it is turned to the government account.

It is expected that the revenue of the Center will be higher than the maintenance/operation costs, although for some time just after the establishment of the Center receipts from the government budget will surpass the revenue.

The flow of the maintenance/operation costs and the revenue of the Center for 10 years from start of its operation is shown in Table 11.3-1.

Table 11.3-1 *Flow of Expense and Revenue of the Center, 1992 - 2001*

(Rp. million)

Item \ year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Routine & Project Budget	2,109	1,836	1,402	1,121	694	725	742	763	789	820
Operating Expenses	2,109	1,836	1,402	1,121	694	725	742	763	789	820
(Personnel)	(1,846)	(1,540)	(1,080)	(774)	(318)	(318)	(318)	(318)	(318)	(318)
(Maintenance)	(149)	(149)	(149)	(149)	(149)	(149)	(149)	(149)	(149)	(149)
(Others)	(114)	(147)	(173)	(198)	(227)	(258)	(275)	(296)	(322)	(353)
Service Revenue	339	449	525	608	698	797	869	955	1,076	1,177
(Tests & Ins)	(145)	(217)	(254)	(298)	(349)	(410)	(482)	(568)	(689)	(790)
(T/A, TR)	(116)	(138)	(162)	(185)	(209)	(231)	(231)	(231)	(231)	(231)
(R & D)	(78)	(94)	(109)	(125)	(140)	(156)	(156)	(156)	(156)	(156)

Excluding depreciation costs of buildings, machines and facilities

CHAPTER 10

STUDY OF ALTERNATIVE PLANS

CHAPTER 10 STUDY OF ALTERNATIVE PLANS

10.1 Overview

In Chapter 8, it was proposed that a new center should be established in JABOTABEK. The following 3 alternative plans, which focus on the reinforcement of the existing central and regional industrial research and development laboratories administered under the BPPI of MOI, were proposed in this chapter and studied in comparison with the original plan.

Original Plan : Establishment of the Center in JABOTABEK, which was proposed in Chapter 8

Alternative Plan I : Expansion and replacement of obsolete facilities of MIDC and B4T

Alternative Plan I' : Expansion of 3 BPPI regional industrial research and development laboratories located in Semarang, Surabaya, and Medan, in addition to expansion and replacement of obsolete facilities of MIDC and B4T

Alternative Plan II : Establishment of the Center in JABOTABEK, in addition to replacement of obsolete facilities of B4T and expansion of 3 regional industrial research and development laboratories in Semarang, Surabaya and Medan.

Alternative plan I' is to expand 3 BPPI regional laboratories in addition to alternative plan I. Alternative plan II is to replace obsolete facilities of B4T and to expand 3 BPPI regional laboratories in addition to the original plan. The following table shows the difference of each plan.

	The Center	MIDC/B4T	3 regional laboratories
Original plan	◎○		
Alternative plan I		◎○	
Alternative plan I'		◎○	○
Alternative plan II	◎○	○	○

◎ : New facilities for new functions
○ : Expansion and/or replacement of obsoleter facilities for existing functions

10.2 Outline of the Expansion and Replacement Plans of Facilities

(1) Alternative Plan I

This plan aims to expand and replace facilities of the MIDC and B4T. In order to achieve the aims of the deletion program of industrial products promoted by the Indonesian Government, some new facilities are proposed to be installed in the new Center. Out of these new facilities, those which are not presently owned by both MIDC and B4T should be newly installed and some obsolete facilities must be replaced with new ones. Details are summarized below:

1) Facilities to be expanded

(i) MIDC

① Installation of new forging facility
② Installation of new planting facility
③ Expansion of casting facility
④ Expansion of heat treatment facility
⑤ Expansion of sheetworking, pressworking and welding facilities (plate bending machines, etc.)
⑥ Expansion of machining facility (CNC machining center, etc.)

(ii) B4T

① Installation of new testing and measuring facilities necessary for forging, plating and casting

2) Facilities to be replaced

Facilities in the B4T have been used for more than 30 years and have deteriorated. Facilities that would affect future demand should be replaced with new ones. Table 9.3-1 indicates details of facilities to be replaced.

3) Buildings

Since there is not enough space for installing facilities in the existing buildings after expansion of facilities according to 1) above, the construction of the following new buildings for the expanded facilities would be needed:

(i)	One building for forging shop	18 m x 24 m
(ii)	One building for plating/heat treatment shop	24 m x 36 m
(iii)	One building for casting shop	16 m x 35 m
(iv)	One building for sheetworking, welding, pressworking and machining shops	8 m x 24 m

4) Approximate cost estimate for the implementation of Alternative Plan I

Investment costs necessary for the implementation of Alternative Plan I are approximately estimated below:

(Unit: Rp. million)

Cost for expansion of facilities	11,836
(for MIDC)	(9,853)
(for B4T)	(1,983)
Cost for replacement of facilities	383
Cost for expansion of buildings	3,900
Total	about 16,120

5) Problems

(i) There is not enough space to construct new buildings within the site of both MIDC and B4T, and there is no space to install new facilities and expand in the existing buildings.

(ii) Service ratio to total needs in Indonesia is low, since service activities provided by the existing institutions would not sufficiently cover JABOTABEK, where there is high demand for technical services.

(2) Alternative Plan I'

This plan is to expand and replace the existing facilities in regional laboratories in Medan, Surabaya and Semarang in addition to the expansion and replacement plans of MIDC and B4T, which are proposed in Alternative Plan I.

1) Facilities to be expanded

(i) Material testing facilities (test piece processing machines, dimensional measuring equipment, etc.) which are on the same level as that owned by B4T should be installed in each regional laboratory.

(ii) Installation of new audio visual facility

(iii) All R & D should be conducted by MIDC, and high level tests and tests requiring a long time (corrosion test, etc.), should be conducted by B4T through each regional center. Therefore, facilities necessary for such tests should not be installed in each regional laboratory.

2) Facilities to be replaced

Out of the facilities presently owned by each regional laboratory, those that have been used for more than 30 years and have deteriorated should be replaced with new ones.

3) Approximate cost estimate for the implementation of Alternative Plan I'

Investment costs necessary for the implementation of Alternative Plan I' are roughly estimated below:

(Unit: Rp. million)

Cost for expansion of facilities	13,360
for MIDC	(9,853)
for B4T	(1,983)
for regional laboratories	(1,524)
Cost for replacement of facilities	383
for B4T	(383)
Cost for expansion of buildings	3,900 + α
for MIDC	(3,900)
for regional laboratories	α
Total	about 17,640 + α

Cost for replacement of facilities in each regional laboratory is not included in the above estimation because detailed data on the existing facilities are not available.

4) Problems

(i) There is not enough space to construct new buildings within the site of MIDC and B4T.

(ii) Service ratio to total needs in Indonesia is low, since the plan would not provide JABOTABEK, where there is high demand for technical services, with sufficient service activities.

(iii) It is difficult to secure technical advisers for the regional laboratories.

(iv) Cost for maintenance and operation of regional laboratories would be great.

(3) Alternative Plan II

This plan is to establish the Center in JABOTABEK area (original plan), replace facilities in B4T, and expand and replace facilities in regional laboratories located in Medan, Surabaya and Semarang.

1) Facilities to be newly constructed in the regional laboratories in Medan, Surabaya and Semarang

(i) Material testing facilities (test piece processing machines, dimensional measuring equipment, etc.) which are on the same level as that owned by B4T should be installed in each regional laboratory.

(ii) Installation of new audio visual facility

(iii) All R & D should be conducted by MIDC, and high level tests and tests requiring a long time (corrosion test, etc.), should be conducted by B4T through each regional laboratory. Therefore, facilities necessary for such tests should not be installed in each regional laboratory.

2) Facilities to be replaced

(i) Deteriorated facilities owned by B4T should be replaced with new ones in the same manner as Alternative Plans I and I'

(ii) Out of the facilities presently owned by each regional laboratory, those which have been used for more than 30 years and have deteriorated should be replaced with new ones.

3) Approximate cost estimate for implementation of Alternative Plan II

Costs for the implementation of Alternative Plan II except for cost for replacement of facilities in each regional laboratory are estimated below:

	(Unit: Rp. million)
Cost for expansion of facilities	35,054
for the Center	(33,530)
for regional laboratories	(1,524)
Cost for replacement of facilities	383
for B4T	(383)
Cost for buildings expanded	22,840 + α
for the Center	(22,840)
for regional laboratories	α
Total	about 58,280 + α

4) Problems

(i) Investment costs are substantial.

(ii) It is difficult to secure technical advisers for the regional laboratories.

(iii) Cost for maintenance and operation of regional laboratories would be great.

Table 9.3-1 Facilities to be Replaced in B4T

Item No.	Equipment	Manufacturer/ Specification	Q'ty	Year of Service Since
1	Saw machine	Carl Schleper	1	1955
2	Universal testing machine	Amslar 50ton Capa	1	1912
3	Universal testing machine	Amslar 20ton Capa	1	1912
4	Universal testing machine	Gebruder 5ton Capa	1	1912
5	Wire torsion testing machine	6Kgm Capa	1	1912
6	X-Y recorder complete electric extensometer	Torse Type P x Y11	1	1917
7	Calibration boxes	Amslar 60-300ton Capa	1	1955
8	Proving ring	More house 300 - 200,000Lbs	1	1951
9	Pressure gauge tester	Amslar 300atm	1	1951
10	Colorimeter	Janke-Kunkal	1	1912
11	Viscometer	Pcpst Braum-Kuecht	1	1912
12	Electric multiple furnace	Heimann Co.	1	1912
13	Penetrometer	Inventum	1	1912
14	Refractometer	ABBO	1	1912
15	Tri roll mill & ball mill	NYE Res D75	1	1912
16	Microscope	Phillips	1	1912
17	Lathe machine	Atlas	3	1951
18	Scrape machine	Atlas	1	1951
19	Planer impact tester	Karl Frank	1	1951

10.3 Estimation of Service Ratios of Each Alternative Plan to the Aggregate Demand of Technical Services in Indonesia

The degree of coverage of the services of the original plan and the 3 alternative plans were estimated to consider how each plan would contribute to the development of metalworking industries in Indonesia. The degree of coverage, or the service ratios, of each plan over the total potential needs for test and inspection services in Indonesia, was calculated as follows, assuming the total potential needs in Indonesia to be 100:

Table 9.3-2 Service Ratios of Each Alternative Plan to the Aggregate Demand

	1990	1995	2000
Total potential needs for tests and inspections	100	100	100
Original Plan	84	89	89
Alternative Plan I	41	39	40
Alternative Plan I'	56	50	51
Alternative Plan II	99	99	99

The contribution of each plan to the development of metalworking industries in Indonesia should be measured not only by how much it satisfies test and inspection needs but also how much it provides R&D, training and technical assistance and other technical services. The above service ratios are, however, considered to correspond to those needs as well as to test and inspection needs.

10.4 Result of the Study

Comparison between the original plan and the three alternative plans was made from 3 points: (1) content of each plan, (2) service cover ratio to the total potential needs of test and inspection in Indonesia, and (3) investment cost. The result of the study was summarized in Table 9.3-3.

As shown in Table 9.3-3, Alternative Plan II is the most preferable considering the service ratio of tests and inspections. Judging from both investment cost and the service ratio together, however, the original plan, which proposes a new center to be established in JABOTABEK, is more advantageous than the other 3 alternative plans. As a result, under the present condition, where monetary constraint is put on the investment cost, the original plan is regarded as the most feasible, while in the long run, it is recommended to consider Alternative Plan II.

Table 9.3-3 Comparison of Alternative Plans (1/2)

Plan		Outline	Detailed description	Service ratio	Approximate construction cost (Rp. million)	Anticipated problems
Use of the existing institutions	Alternative Plan I	Instead of the establishment of the Center, 1) new installation and expansion of facilities in MIDC and 2) new installation and replacement of facilities in B4T	1) Facilities to be expanded (i) MIDC ① Installation of new forging facility ② Installation of new plating facility ③ Expansion of casting facility ④ Expansion of heat treatment facility ⑤ Expansion of sheetworking, pressworking and welding facilities (plate bending machines, etc.) ⑥ Expansion of machining facility (CNC machining center, etc.) (ii) B4T Installation of new testing and measuring facilities necessary for forging, plating and casting 2) Facilities to be replaced Among facilities presently owned by B4T, deteriorated ones which are not expected to satisfy the future demand should be replaced with new ones; facilities used for more than 30 years, as shown in Table 9.3-1, should be replaced.	1990 : 41% 1995 : 39% 2000 : 40%	Buildings : 3,900 Facilities : 12,220 Total : about 16,120	(i) There is not enough space to construct new buildings within the site of MIDC and B4T, and there is not enough space to install new facilities and expanded ones in the existing buildings. (ii) Service coverage to total needs in Indonesia is low, since service activities provided by the existing institutions would not sufficiently cover JABOTABEK, where there is high demand for technical services.
	Alternative Plan I'	Alternative plan plus expansion of regional laboratories in Medan, Surabaya and Semarang	1) Facilities to be expanded (i) MIDC ① Installation of new forging facility ② Installation of new plating facility ③ Expansion of casting facility ④ Expansion of heat treatment facility ⑤ Expansion of sheetworking, pressworking and welding facilities (plate bending machine, etc.) ⑥ Expansion of machining facility (CNC machining center, etc.) (ii) B4T Installation of new testing and measuring facilities necessary for forging, plating and casting (iii) The following facilities should be newly installed in regional laboratories in Medan, Surabaya and Semarang. 1 Among the basic testing and inspection equipment, those which are not presently owned by each regional laboratory should be installed 2 Installation of new audio visual facility 3 All R & D should be conducted by the MIDC, and high level tests and tests requiring a long time should be conducted by B4T through each regional laboratory. Therefore, facilities necessary for such tests should not be installed in each regional laboratory.	1990 : 56% 1995 : 50% 2000 : 51%	Buildings : 3,900 + α Facilities : 13,740 + α Total : about 17,640 + α	(i) There is not enough space to construct new buildings within the site of MIDC and B4. (ii) Service coverage total needs in Indonesia is low, since the plan would not provide JABOTABEK, where there is high demand for technical services, with sufficient service activities. (iii) It is difficult to secure technical advisers for the regional laboratories. (iv) Cost for maintenance and operation of regional laboratories would be great.

Table 9.3-3 Comparison of Alternative Plans (2/2)

Plan		Outline	Detailed description	Service ratio	Approximate construction cost (Rp. million)	Anticipated problems
	Alternative Plan I' (cont'd)		2) Facilities to be replaced (i) in B4T Out of the facilities presently owned by B4T, deteriorated ones which are not expected to satisfy the future demand should be replaced with new ones; facilities used for more than 30 years, as shown in Table 9.3-1, should be replaced. (ii) in the regional laboratories Out of the facilities presently owned by each regional laboratory, deteriorated ones which are not expected to satisfy the future demand should be replaced; facilities used for more than 30 years should be replaced			
Establishment of the new Center	Original Plan	Establishment of the Center in the JABOTABEK area	The Center having the following functions will be established: ① Casting facility ② Forging facility ③ Heat treatment facility ④ Sheetworking facility ⑤ Welding facility ⑥ Plating facility ⑦ Machining facility ⑧ Pressworking facility ⑨ Measuring equipment ⑩ Testing and inspection facilities ⑪ Audio visual facility	1990 : 84% 1995 : 89% 2000 : 89%	Buildings : 22,840 Facilities: 33,530 Total: 56,370	(i) Investment costs are substantial. (ii) Construction site needs to be secured in the JABOTABEK area.
	Alternative Plan II'	Original plan plus replacement of facilities in B4T and expansion of facilities in regional laboratories (with no change to be made in MIDC)	1) Facilities to be expanded (i) in the Center ① Casting facility ② Forging facility ③ Heat treatment facility ④ Sheetworking facility ⑤ Welding facility ⑥ Plating facility ⑦ Machining facility ⑧ Pressworking facility ⑨ Measuring equipment ⑩ Testing and inspection facilities ⑪ Audio visual facility (ii) in the regional laboratories ① Out of the facilities presently owned by each regional laboratory, deteriorated ones which are not expected to satisfy the future demand should be replaced; facilities used for more than 30 years should be replaced ② Audio visual facility ③ All R & D should be conducted by MIDC, and a high level tests and tests requiring a long time (corrosion test, etc.) should be conducted by B4T through each regional laboratory. Therefore, facilities necessary for such tests should not be installed in each regional laboratory. 2) Facilities to be replaced (i) Among facilities presently owned by B4T, deteriorated ones which are not expected to satisfy the future demand should be replaced; facilities used for more than 30 years, as shown in Table 9.3-1, should be replaced.	1990 : 99% 1995 : 99% 2000 : 99%	Buildings : 22,840 + α Facilities: 35,440 Total: about 58,280 + α	(i) Investment costs are substantial. (ii) It is difficult to secure technical advisers for the regional laboratories. (iii) Cost for maintenance and operation of regional laboratories would be great.

CHAPTER 11

PROJECT EVALUATION

CHAPTER 11 PROJECT EVALUATION

11.1 Framework for Project Evaluation

(1) General

Project evaluation has been conducted making use of the results of calculation of Financial Internal Rate of Return (FIRR) and Economic Internal Rate of Return (EIRR) of the Center.

Major objective of the project is to support the modernization of the metalworking industry in Indonesia from technical aspects, in which the indirect and intangible benefits are considered to be much larger than the direct and tangible benefits. Accordingly, the FIRR or the EIRR, which are calculated based on the direct and tangible benefits, are not the decisive but rather one of the indicative figures for evaluation.

The major assumptions posed on both financial and economic evaluations are as follows:

Project life	:	10 years after the completion of construction and installation works
Base year	:	1988
Prices	:	1988 constant prices
Construction period	:	From 1989 to 1991
Start of operation	:	1992
Residual value	:	66.7% for buildings and fixtures 10% for machinery and equipment

(2) Framework for financial evaluation

Financial evaluation has been conducted based both on the financial revenue flow consisting of (1) test & inspection service revenue, (2) technical assistance and training service revenue and (3) R & D

service revenue and on the financial cost flow consisting of (1) capital investment costs of land, buildings, machinery & equipment, and (2) maintenance and operating expenses of the Center.

From the proposal of the Center as one of the governmental organizations under the control of BPPI, the financial evaluation has been conducted dividing into following 4 cases.

Case I : All of the capital investment costs of land, buildings, machinery and equipment and all of the maintenance and operating expenses of the Center are borne by the Center.

Case II : The investment costs for land and buildings are borne by the Central government, and the investment costs for machinery and equipment and all of the maintenance and operating expenses are borne by the Center.

Case III: The investment costs for land and buildings and the operating expenditure for foreign experts are borne either by the Central government or by an overseas international organization, and the investment costs for machinery & equipment and the maintenance and operating costs excluding those for foreign experts are borne by the Center.

Case IV : All of the investment costs for land, buildings and machinery & equipment and the operating costs for foreign experts are borne by either by the Central government or by an overseas international organizations, and only the operating costs except for those for foreign experts are borne by the Center.

As for the price escalation mainly of operating expenses due to inflation in Indonesia, the service revenue fees are supposed to be increased in accordance with the increase of expenses, and the financial effect of the inflation is very small. Thus, the financial evaluations are all conducted at 1988 constant prices.

(3) Framework for economic evaluation

Economic evaluation has been conducted by comparing the cost and benefit flow of the project in economic prices. Only directly tangible benefits are counted as economic benefits. In practice, the economic benefits are measured by converting financial service revenue into that of economic prices. The economic costs are measured from financial capital investment and operating costs by subtracting such transfer items as import duty or income tax or by applying shadow pricing for the costs of simple laborers.

11.2 Project Cost

(1) Investment cost

The financial costs are divided into foreign and local portions. In the foreign portion, transportation costs, import duties and value added tax are taken into consideration in addition to CIF prices.

For the calculation of the economic costs, such transfer costs as import duties or value added tax are excluded. The present foreign exchange rate in Indonesia is considered to reflect the current market values, and no shadow pricing for foreign exchange is applied. Although there are no reliable data available, the unemployment rate in the DKI Jakarta areas is considered to be rather high. Accordingly, a 50% of shadow rate is applied for the unskilled labor costs.

The investment costs thus calculated are summarized and shown in Table 12.2-1.

(2) Maintenance and Operation Costs

The maintenance and operation costs of the new Center in financial prices are divided between the foreign and local portion.

For the calculation of the economic costs, such transfer costs as import duties and value added tax on imported raw materials and spare parts are excluded. In addition, the personal income tax portion of the personnel expenses among operation cost items is excluded as transfer costs. Flow of the employment cost in economic prices is shown in Table 12.1-3. The annual maintenance cost in economic prices is shown in Table 12.2-4.

The results of the estimated flow of the maintenance and operation costs are summarized and shown in Table 12.2-5.

Table 12.2-1 The Investment Costs of the Project

(Unit: Rp. million)

	Financial Cost			Economic Cost
	Foreign	Local	Total	
(1) Land acquisition	0	1,071	1,071	1,071
(2) Civil & building	5,273	13,096	18,369	15,979
(3) Machinery & equipment	28,150	273	28,423	19,691
Sub total	33,423	14,440	47,863	36,741
(4) Engineering fee	2,146	1,337	3,483	
(5) Contingencies	3,557	1,471	5,028	
Total	39,126	17,248	56,374	36,741

Note: Out of local costs in financial prices, a 11.5% is estimated as unskilled labor costs.

11.3 Project Revenue

(1) Test and inspection service revenue

The financial revenue from test and inspection services of the Center is estimated and shown in Table 11.1-1. The service charge rates used for the above calculation is those currently applied by B4T. However, those charge rates are not correctly reflecting the real market value because of the Governmental support through budget to B4T. Further, there are many metal parts imported, for which the test and inspection services of the overseas organizations are used. From the above reasons, the test and inspection charge rates used in the Japanese public service organizations are used as an approach to estimate the economic service charge rates. In order to put the economic evaluation results to the safety side, the lowest service charge rate among 3 representative public inspection service organizations in Japan is taken as an economic rate for each item of the inspection services. For those inspection items for which service charge rates are not available in the Japanese organizations, they are estimated from the rates applied for the similar types of inspection services.

The flow of test and inspection service revenue in economic prices during the period from 1992-2001 is shown in Table 12.3-1. (For the test and inspection revenue in financial prices, refer to Table 11.1-1.)

(2) Technical assistance, training and R & D service revenue

The financial revenue from Technical Assistance, Training and R & D services of the Center is shown in Table 11.1-2. The unit service charge rates applied for above calculation are the current charge rates at MIDC for similar services in Indonesia. As in the case of test and inspection service charges, these rates could not be considered to reflect the actual market value for the services, because they are decided politically in consideration of the nature of MIDC as a Governmental organization. Further, from the nature of the services that the types and levels of services are all different among programs, it is also very difficult to estimate the economic charge rates internationally acceptable. Accordingly, for the estimation of the economic unit charge rates for the services, the current service charges at MIDC are used with modification using the Governmental support rate of 187% in 1986/87.

The results of estimates of the revenue for Technical Assistance, Training and R & D services of the Center during the period from 1992 to 2001 in economic prices are summarized and shown in Table 12.3-2. (For the financial service revenue flows for Technical Assistance, raining and R & D, refer to Table 11.1-2.)

Table 12.3-1 Flow of the Test and Inspection Service Revenue in Economic Prices

(Unit: Rp.1,000)

Tests & Inspections	Inspection Charge	Test Piece Processing	Test Piece Frequency	Total Charge /Pc	Year									
					1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
[Category A]	(Rp.)	(Rp.)	(Rate)	(Rp.)										
1)Brinell Hardness	5,747	5,747	0.9	10,919	11,847	17,962	21,009	24,579	28,740	33,631	39,353	46,047	53,898	63,081
2)Vickers Hardness	5,747	5,747	0.9	10,919	6,071	9,216	11,083	13,365	16,106	19,415	23,411	28,259	34,145	41,253
3)Tensile	7,024	11,493	0.9	17,368	188,509	285,542	334,085	390,825	457,274	535,012	626,036	732,604	857,374	1,003,506
4)Impact	7,024	11,493	0.9	17,368	56,532	85,657	100,212	117,267	137,170	160,495	187,780	219,771	257,198	301,000
5)Projector	27,456			27,456	89,369	135,413	158,421	185,383	216,847	253,721	296,854	347,428	406,596	475,840
6)Micro Structure	27,456	11,493	0.9	37,800	252,048	509,086	612,506	737,510	888,898	1,072,793	1,297,210	1,572,732	1,913,723	2,340,066
7)Chemical Analysis	16,601			16,601	180,187	272,937	319,337	373,572	437,088	511,394	598,400	700,263	819,525	959,206
[Category B]														
8)Surface Roughness	8,939			8,939	15,938	18,504	21,829	25,762	30,428	35,935	42,433	50,112	59,194	69,930
9)3-Dim. Measurement	22,348			22,348	16,470	22,147	27,108	33,164	40,606	49,724	60,921	74,620	91,448	112,075
10)Gear Tooth Dim.	22,348			22,348	39,846	46,260	54,574	64,407	76,073	89,839	106,086	125,283	147,988	174,828
[Category C1]														
11)Magnetic Particle	22,986			22,986	11,631	14,550	17,102	20,136	23,653	27,836	32,709	38,479	45,282	53,236
[Category C2]														
12)Ultrasonic	37,799			37,799	21,130	22,717	24,758	26,988	29,332	32,205	34,813	37,912	41,277	44,981
13)X-ray	22,858			22,858	13,646	14,881	16,252	17,784	19,429	20,572	23,269	25,441	27,841	30,447
Total					903,226	1,454,873	1,718,276	2,030,743	2,401,644	2,842,572	3,369,275	3,998,952	4,755,489	5,669,448

Source: JICA Team Estimate

Table 12.3-2 Flow of Technical Service Revenue in Economic Prices

(Unit : Rp.1,000)

Capacity		Unit	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Training		Man-month	315	315	315	315	315	315	315	315	315	315
T/A	Casting	Man-day	300	300	300	300	300	300	300	300	300	300
	Frg/H.Trt	Man-day	70	70	70	70	70	70	70	70	70	70
	Others	Man-month	48	48	48	48	48	48	48	48	48	48
R & D		Man-month	78	78	78	78	78	78	78	78	78	78
Operation (%)			50	60	70	80	90	100	100	100	100	100
Actual Operation												
Training			158	189	221	252	284	315	315	315	315	315
T/A	Casting		150	180	210	240	270	300	300	300	300	300
	Frg/H.Trt		35	42	49	56	63	70	70	70	70	70
	Others		24	29	34	38	43	48	48	48	48	48
R & D			39	47	55	62	70	78	78	78	78	78
Revenue		Revenue/Unit (Rp.)										
Training		1,435 per mon.	226,013	271,215	316,418	361,620	406,823	452,025	452,025	452,025	452,025	452,025
T/A	Casting	115 per day	17,250	20,700	24,150	27,600	31,050	34,500	34,500	34,500	34,500	34,500
	Frg/H.Trt	172 per day	6,020	7,224	8,428	9,632	10,836	12,040	12,040	12,040	12,040	12,040
	Others	3,444 per mon.	82,656	99,187	115,718	132,250	148,781	165,312	165,312	165,312	165,312	165,312
R & D		5,740 per mon.	223,860	268,632	313,404	358,176	402,948	447,720	447,720	447,720	447,720	447,720
Sub Total			555,799	666,958	778,118	889,278	1,000,437	1,111,597	1,111,597	1,111,597	1,111,597	1,111,597

Source : JICA Team Estimate

11.4 Financial Evaluation

Table 12.4-2, Table 12.4-3, Table 12.4-4 and Table 12.4-5 show the financial cost and revenue flows and the results of financial evaluation, respectively.

The financial viability of the project was tested making use of the conventional criteria of FIRR (Financial Internal Rate of Return), and both B-C (Net present value Benefit minus Cost) and B/C ratio (Benefit and Cost Ratio) at two discount rates of 5% and 10%.

Table 12.4-1 Summary of Economic Evaluation

	Financial IRR (%)	Discounted at 5%		Discounted at 10%	
		B-C (Rp.million)	B/C (%)	B-C (Rp.million)	B/C (%)
Case I	minus	-43,577	0.10	-40,981	0.07
Case II	minus	-32,558	0.13	-28,131	0.10
Case III	minus	-27,293	0.15	-24,484	0.11
Case IV	9.28	135	1.03	-15	0.99

The major findings derived from the above evaluation results are briefly summarized as follows:

(1) Judging from the FIRR, the project becomes financially viable only in Case IV.

(2) Excluding the capital investment costs, the financial service revenue is expected to exceed the maintenance and operating costs after 5 years from the start of operation of the Center in all of 4 Cases.

(3) The cost burden of foreign experts is extraordinary high in operating expenses. Thus, it is highly desired to receive some form of external assistance in this cost item, or to achieve the technical transfer from foreign to local experts as soon as possible.

(4) In Case IV, in which all of capital expenditures and the costs of foreign experts are assisted either by the central government or by an overseas international organization, the FIRR reach as high as 9.3%. This rate is judged to assure rather healthy operation of the Center as one of the governmental technical support organizations for the industry.

Table 12.4-2 Financial Cost and Revenue Flows and the Results of Financial Evaluation - Case I

(Unit: Rp. million)

Year	Cost			Service revenue			Cash flow
	Investment	Operation	Total	Test & Ins.	Tech.service	Total	
1989	-2,116		-2,116				-2,116
1990	-6,421		-6,421				-6,421
1991	-47,837		-47,837				-47,837
1992		-2,109	-2,109	146	194	340	-1,769
1993		-1,836	-1,836	217	232	449	-1,387
1994		-1,402	-1,402	254	271	525	-877
1995		-1,121	-1,121	298	310	608	-513
1996		-694	-694	349	348	697	3
1997		-725	-725	410	387	797	72
1998		-742	-742	482	387	869	127
1999		-763	-763	568	387	955	192
2000		-789	-789	669	387	1,056	267
2001	+16,159[1]	-820	15,339	790	387	1,177	16,516

FIRR
FIRR = Minus

B-C
At 5% = -Rp. 43,577 million
At 10% = -Rp. 40,981 million

B/C
At 5% = 0.098
At 10% = 0.071

Notes: 1> Residual value for land (Rp. 1,071 million) buildings (Rp. 12,246 million) and machinery (Rp. 2,842 million)
2> See Table 11.4-7 for details of the flow of service revenue.

Table 12.4-3 Financial Cost and Revenue Flows and the Results of Financial Evaluation - Case II

(Unit: Rp. million)

Year	Cost			Service revenue			Cash flow
	Investment	Operation	Total	Test & Ins.	Tech.service	Total	
1989	0		0				0
1990	-3,333		-3,333				-3,333
1991	-29,997		-29,997				-29,997
1992		-2,109	-2,109	146	194	340	-1,769
1993		1,836	-1,836	217	232	449	-1,387
1994		-1,402	-1,402	254	271	525	-877
1995		-1,121	-1,121	298	310	608	-513
1996		-694	-694	349	348	697	3
1997		-725	-725	410	387	797	72
1998		-742	-742	482	387	869	127
1999		-763	-763	568	387	955	192
2000		-789	-789	669	387	1,056	267
2001	+2,842[1]	-820	2,022	790	387	1,177	3,199

FIRR
FIRR = Minus

B-C
At 5% = -Rp. 32,558 million
At 10% = -Rp. 28,131 million

B/C
At 5% = 0.127
At 10% = 0.100

Note: 1) Residual value of machinery

Table 12.4-4 Financial Cost and Revenue Flows and the Results of Financial Evaluation - Case III

(Unit: Rp. million)

Year	Cost			Service revenue			Cash flow
	Investment	Operation	Total	Test & Ins.	Tech.service	Total	
1989	0		0				0
1990	-3,333		-3,333				-3,333
1991	-29,997		-29,997				-29,997
1992		-577	-577	146	194	340	-237
1993		-610	-610	217	232	449	-161
1994		-636	-636	254	271	525	-111
1995		-661	-661	298	310	608	-53
1996		-694	-694	349	348	697	3
1997		-725	-725	410	387	797	72
1998		-742	-742	482	387	869	127
1999		-763	-763	568	387	955	192
2000		-789	-789	669	387	1,056	267
2001	+2,842[1]	-820	2,022	790	387	1,177	3,199

FIRR
FIRR = Minus

B-C
At 5% = -Rp. 27,293 million
At 10% = -Rp. 24,484 million

B/C
At 5% = 0.148
At 10% = 0.113

Note: 1) Residual value of machinery

Table 12.4-5 Financial Cost and Revenue Flows and the Results of Financial Evaluation - Case IV

(Unit: Rp. million)

Year	Cost			Service revenue			Cash flow
	Investment	Operation	Total	Test & Ins.	Tech.service	Total	
1989	0		0				0
1990	0		0				0
1991	0		0				0
1992		-577	-577	146	194	340	-237
1993		-610	-610	217	232	449	-161
1994		-636	-636	254	271	525	-111
1995		-661	-661	298	310	608	-53
1996		-694	-694	349	348	697	3
1997		-725	-725	410	387	797	72
1998		-742	-742	482	387	869	127
1999		-763	-763	568	387	955	192
2000		-789	-789	669	387	1,056	267
2001		-820	-820	790	387	1,177	357

FIRR
FIRR = 9.28 %

B-C
At 5% = Rp. 135.0 million
At 10% = -Rp. 15.0 million

B/C
At 5% = 1.029
At 10% = 0.995

11.5 Economic Evaluation

The details of the economic cost and benefit flows and the results of economic evaluation are shown in Table 12.5-1, in which the EIRR is calculated as 1.88%. This level of EIRR is considered satisfactory as this type of project.

As the indirect benefits which are expected from the project and not counted in the benefit counting in economic evaluation, there are following items:

(1) Increase of employment opportunities

Reviewing the employment structure of Indonesia, 71% of workers were employed in agriculture sector, 9% in industry sector and 21% in service sector in 1965, while they were shifted to 57%, 13% and 32%, respectively, In 1985. In REPELITA IV, the creation of 1,864,000 new workers per year is expected during the plan period, for which the creation of employment opportunities in industrial sector is most highly expected due to its growth potential. In industrial sector, the metalworking industry is one of the core sectors, as REPELITA IV clearly states "the metalworking industry and machine industry are the important industries for the expansion of productive employment in the industrial sector." Because the major aim of the project is to support the metalworking industry in basic technology development and to assist the linkage-type of small-scale firms to establish a firm linkage with assembly-type of large-scale firms, this project is expected to contribute largely to the expansion of employment opportunities by fostering highly labor absorptive linkage-type of firms.

(2) Saving of foreign exchange

REPELITA IV aims at the increase of foreign exchange reserves by achieving higher annual increase rate of exports (annual average of 10%) than imports (annual average of 7.7%). Since the proposed project is the import-substitution program of metal parts, which

could be achieved through the development of basic technology of local metalworking industry, the effect of savings of foreign exchange is expected to be high.

The development of metalworking technology would further contribute largely to the increase of foreign exchange earning capabilities In the long-term bases through the start of domestic production of capital goods or through the development of international competitive power of Indonesian industrial products in general.

(3) Influence of economic development in general

Repelita IV tries to enforce an economic policy in which an active participation of private sector is expected for economic development of Indonesia. In the policy, particular emphasis is placed on the development of small-scale of local firms which places the majority share of industrial establishment.

This project primarily aims at the development of these small-scale of firms as modernized medium-sized firms by acquiring higher technology and by achieving established relationship with assembly type of firms.

From the above, the implementation of the Project is expected to give a strong influence on the economic development of Indonesia based on the active participation of private sector.

Table 12.5-1 Economic Cost and Benefit Flows and the Results of Economic Evaluation

(Unit: Rp. million)

Year	Cost			Benefit			Cash flow
	Investment	Operation	Total	Test & Ins.	Tech.service	Total	
1989	-1,071		-1,071				-1,071
1990	-3,567		-3,567				-3,567
1991	-32,103		-32,103				-32,103
1992		-1,601	-1,601	903	556	1,459	-142
1993		-1,422	-1,422	1,455	667	2,122	700
1994		-1,130	-1,130	1,718	778	2,496	1,366
1995		-944	-944	2,030	889	2,919	1,975
1996		-658	-658	2,402	1,000	3,402	2,744
1997		-689	-689	2,843	1,111	3,954	3,265
1998		-706	-706	3,369	1,112	4,481	3,775
1999		-727	-727	3,999	1,112	5,111	4,384
2000		-753	-753	4,755	1,112	5,867	5,114
2001	+13,693[1]	-784	12,909	5,669	1,112	6,781	19,690

EIRR
EIRR = 1.88 %

B-C
At 5% = -Rp. 7,000 million
At 10% = -Rp. 12,929 million

B/C
At 5% = 0.78
At 10% = 0.55

Note: 1> Residual value of land (Rp. 1,071 million), buildings (Rp. 10,653 million) and machinery (Rp. 1,969 million)

CHAPTER 12

CONCLUSIONS AND RECOMMENDATION

CHAPTER 12 CONCLUSIONS AND RECOMMENDATION

(1) It is recommended that the Center be established, aiming to contribute to the modernization and the enhancement of the technological level, with specific emphasis on the improvement of quality, of the metalworking industries.

(2) The Center is proposed to have the following functions.
   1) testing and inspection
   2) technical assistance and training
   3) research and development

(3) The initial investment in the machinery and equipment would be made, based on the priority orders in consideration of costs and benefits. However, the Center should be so designed as to have space to allow for future expansion.

(4) The location of the Center is recommended to be in the JABOTABEK area, in consideration of the estimation of the demands of different areas for the services provided by the Center as well as of the location and service area of the existing similar institutions.

(5) It is proposed that the Center be an organization belonging to BPPI as B4T and MIDC are. This is because the functions of the Center are expected to contribute to the extension and complimentation of B4T and MIDC, so that the adequate exchange of information and personnel would be readily secured among the relevant institutions.

(6) Based on the results of the financial analysis, it is recommended that the initial investment for financing the costs of the land, the building, the machinery and equipment, and the personnel costs of the foreign experts be provided either by the Indonesian Government or by overseas aid.

(7) The results of the economic analysis also support the necessity for the urgent establishment of the Center.