THE FEASIBILITY STUDY ON THE ESTABLISHMENT OF
THE CENTER FOR INDUSTRIAL TECHNOLOGICAL INFORMATION IN THE REPUBLIC OF INDONESIA

# THE FEASIBILITY STUDY
# ON
# THE ESTABLISHMENT
# OF
# THE CENTER FOR INDUSTRIAL TECHNOLOGICAL INFORMATION
# IN
# THE REPUBLIC OF INDONESIA

MARCH, 1989

MARCH, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

# THE FEASIBILITY STUDY
# ON
# THE ESTABLISHMENT
# OF
# THE CENTER FOR INDUSTRIAL TECHNOLOGICAL INFORMATION
# IN
# THE REPUBLIC OF INDONESIA

MARCH, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

# PREFACE

In response to a request from the Government of the Republic of Indonesia, the Japanese Government decided to conduct the study on the Establishment of the Center for Industrial Technology Information and entrusted the survey to the Japan International Cooperation Agency (JICA). JICA sent to Indonesia a study team headed by Mr. Mayuki Takeno, Century Research Center Corporation from July 31 to September 7, 1988.

The team held discussions with concerned officials of the Government of the Republic of Indonesia, and conducted a field survey. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the development of the project and to the promotion of friendly relations between our two countries.

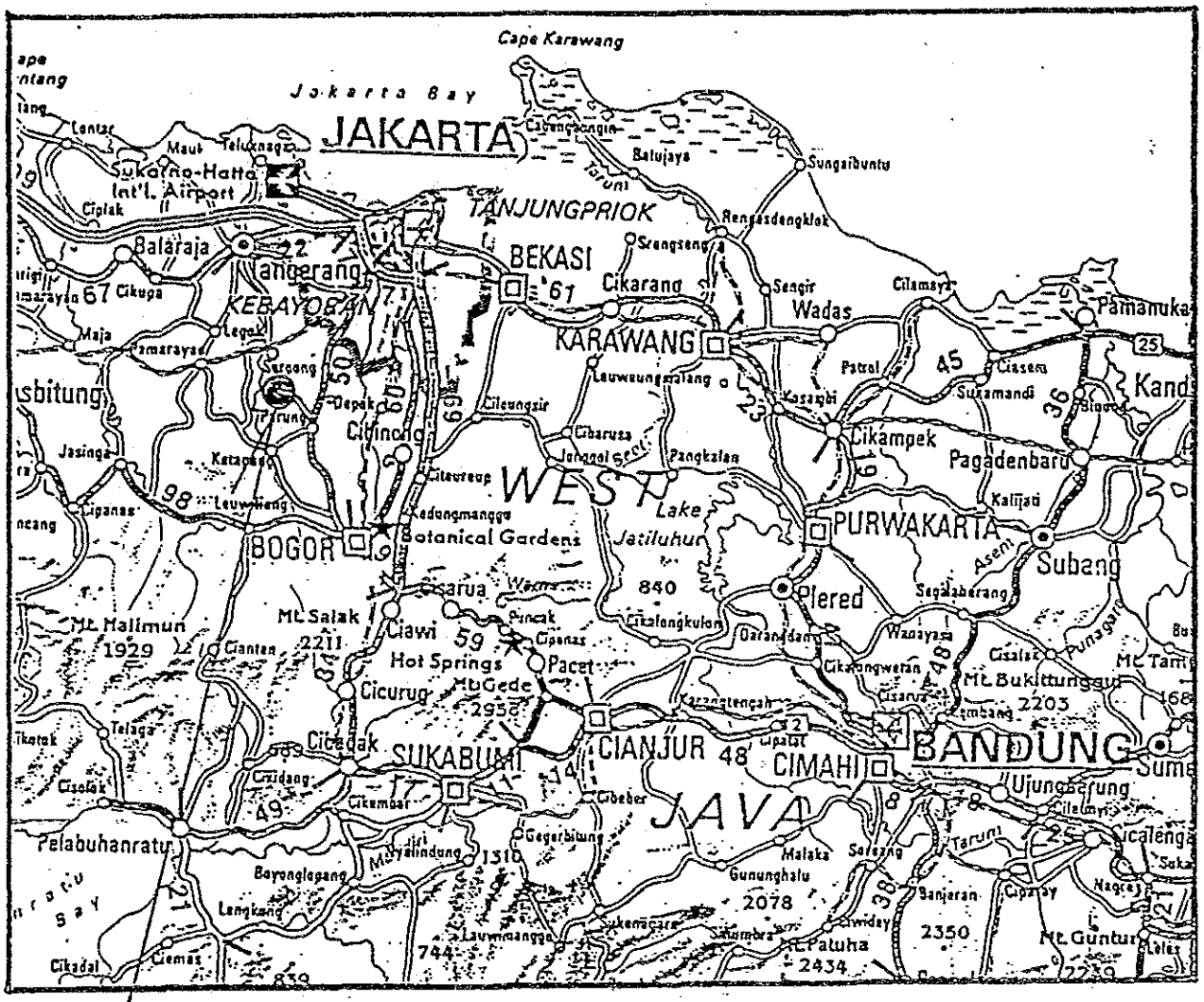
I wish to express my sincerest appreciation to concerned officials of the Government of the Republic of Indonesia for their close cooperation extended to the team.

March, 1989

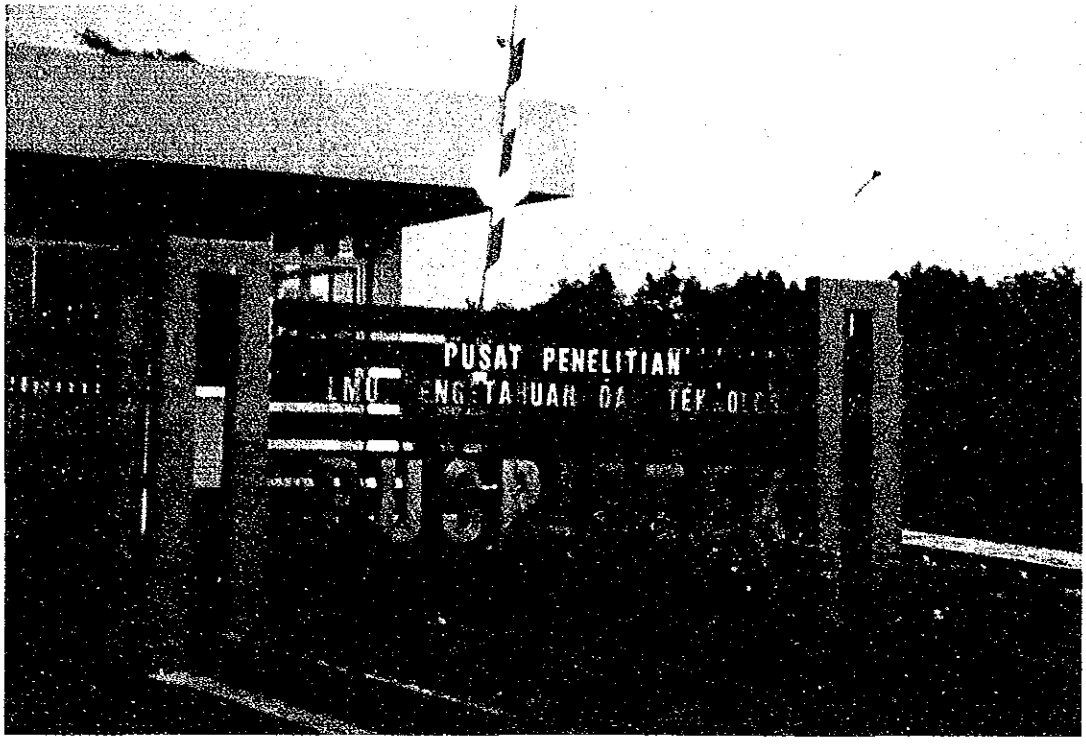
Kensuke Yanagiya
President
Japan International Cooperation Agency

## – TABLE OF CONTENTS –

SITE LOCATION



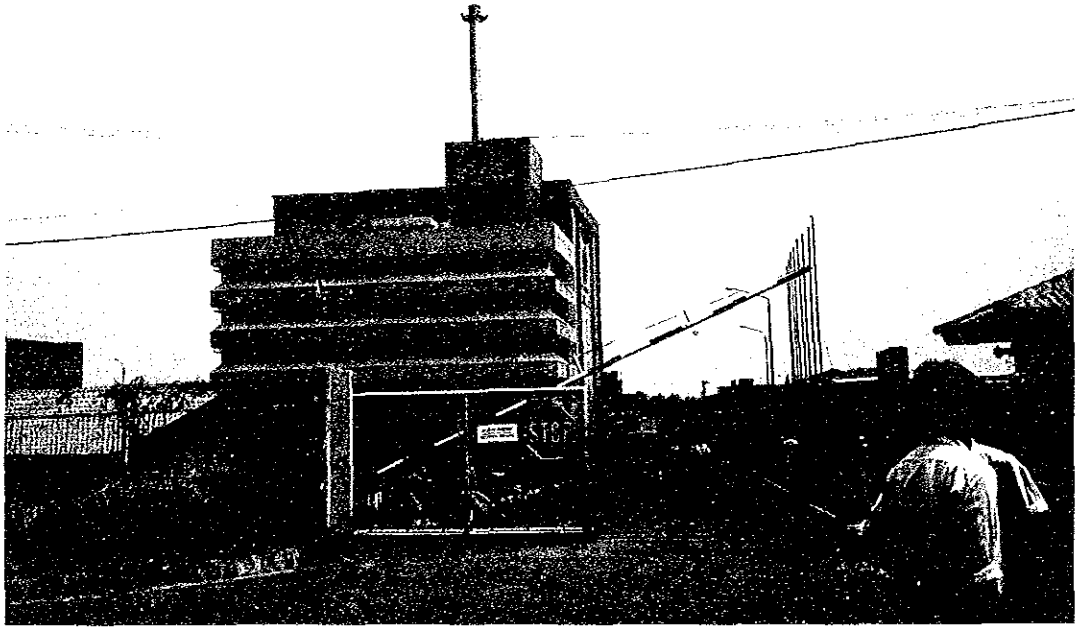

PUSPIPTEK – Serpong



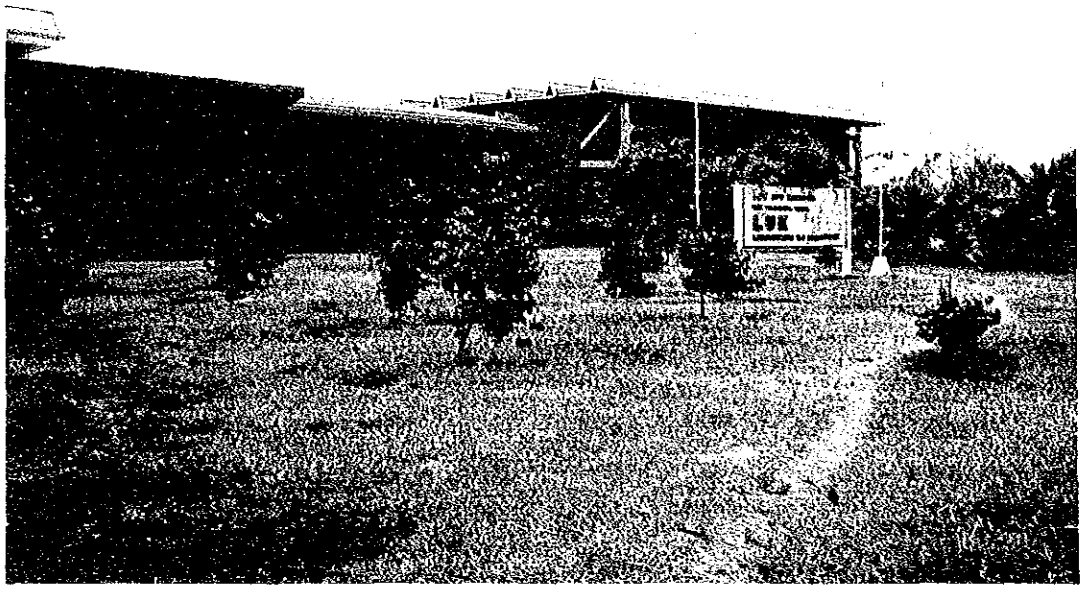

PUSPIPTEK-Serpong main gate


PUSPIPTEK-Serpong crossing road

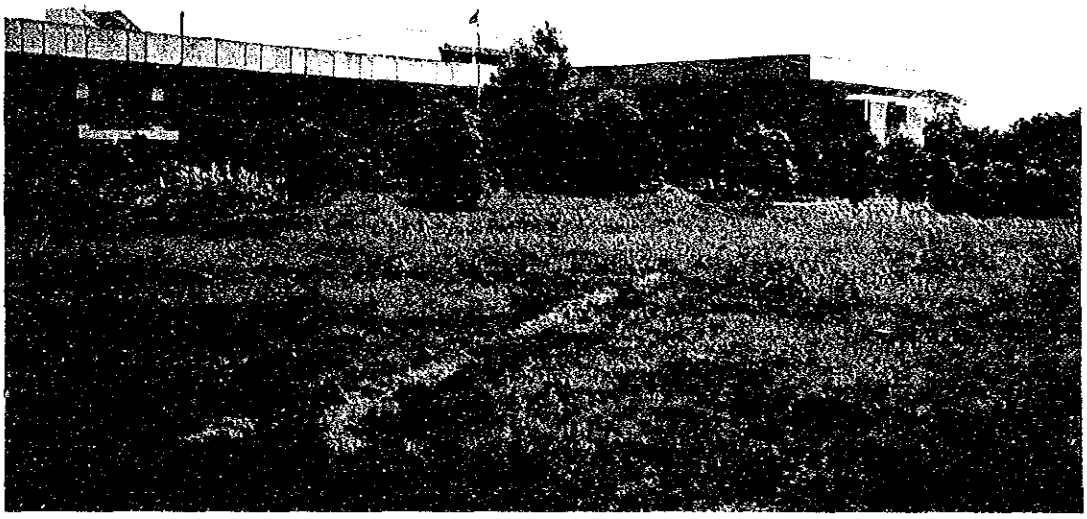
K I M laboratory



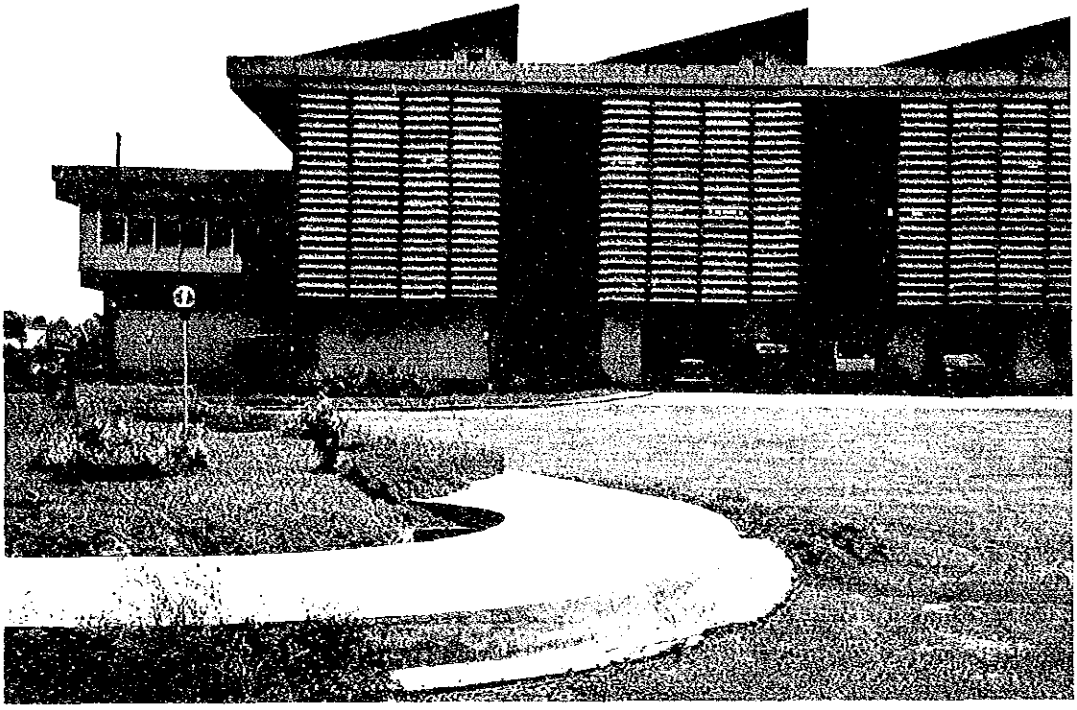
R S G-L P laboratory



L U K laboratory



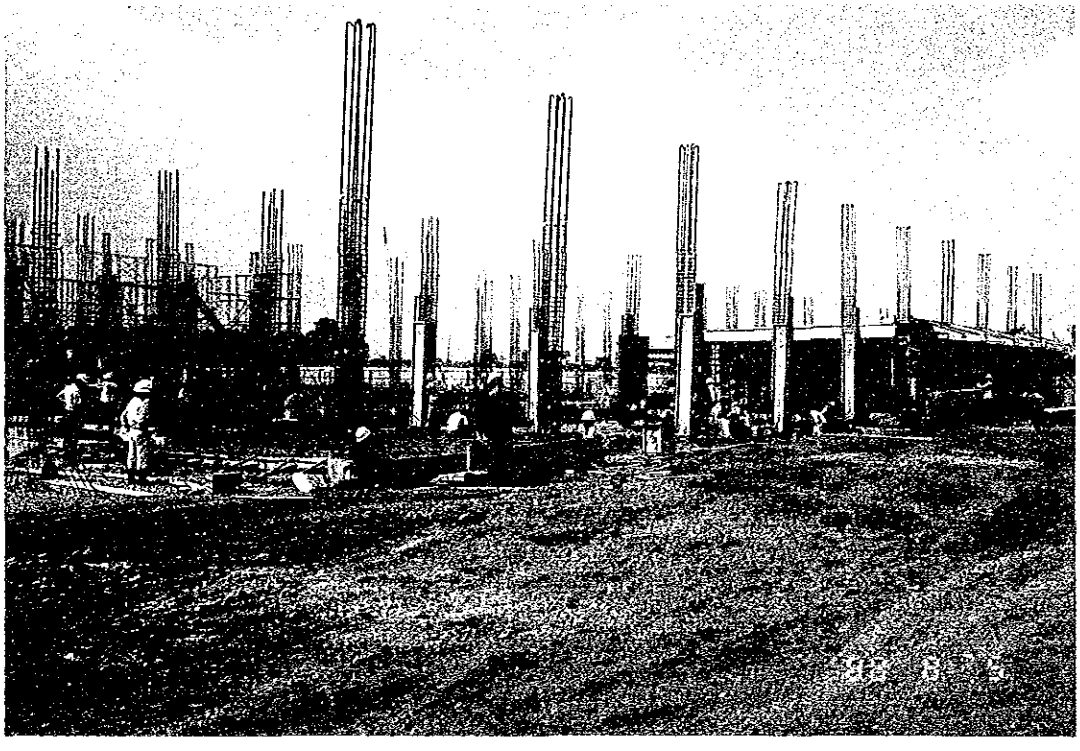
L E F laboratory



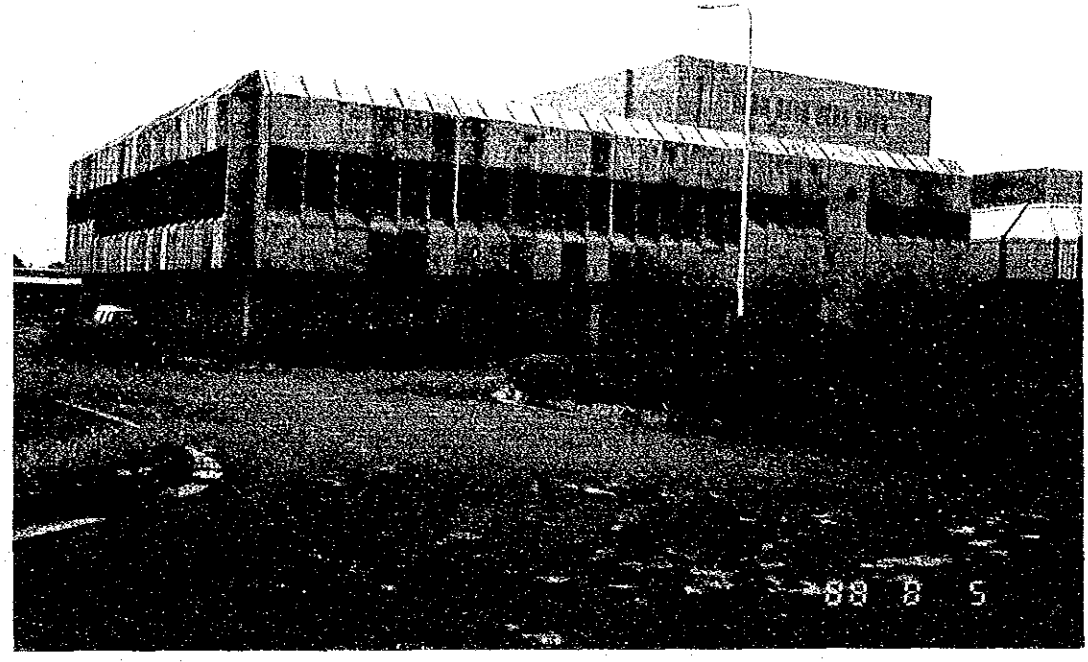
L K T laboratory

L E T laboratory

L S D E laboratory



Construction scene of L M T laboratory



L A G G laboratory

Site location of the Center

## SUMMARY AND CONCLUSION

Based on the results of oral interviews and questionnaire responses from the field survey, we made a feasibility study on the Center for Industrial Technological Information to be established in PUSPIPTEK-Serpong. The summary of the study follows.

### 1. Desirability of the Center for Industrial Technological Information

(1) The Republic of Indonesia is currently facing a slowdown in technological development and growth due to the vicious cycle defined below.

Dependence on foreign technology→ Not designing domestically → Not carrying out technological calculations/Not managing technological information systems → Low use of computers → Inability to develop and produce items for import substitution and for international competitiveness → National income remaining dependent on oil and gas → Dependence on foreign technology

The government of the Republic of Indonesia is establishing the PUSPITEK-Serpong complex to overcome this vicious cycle by identifying various elementary technologies, developing them and applying them. The Center for Industrial Technological Information is indispensable for effectively supporting the collection and use of technological information and data analysis at each laboratory in PUSPIPTEK-Serpong. The effect will not only benefit researchers at each laboratory in PUSPIPTEK-Serpong, but can also have a remarkable impact on future developments of industrial fields such as shipbuildings, constructions, vehicles, aircrafts, steel products (tank design) and industrial machineries which need the engineering computation for their structual designs.

In addition to these industries, electronic industry (printed circuit board design) and industries in a remote sensing for a mining field and an optic field will be effected.

(2) If the Center for Industrial Technological Information is widely used by laboratory staff in PUSPIPTEK-Serpong and by people in the industrial technological field in the Republic of Indonesia as a receiving center for industrial technological information and as the core location for data analysis in the country, the industrialization of the Republic of Indonesia will further progress and national income from the non-oil/non-gas field can be expected.

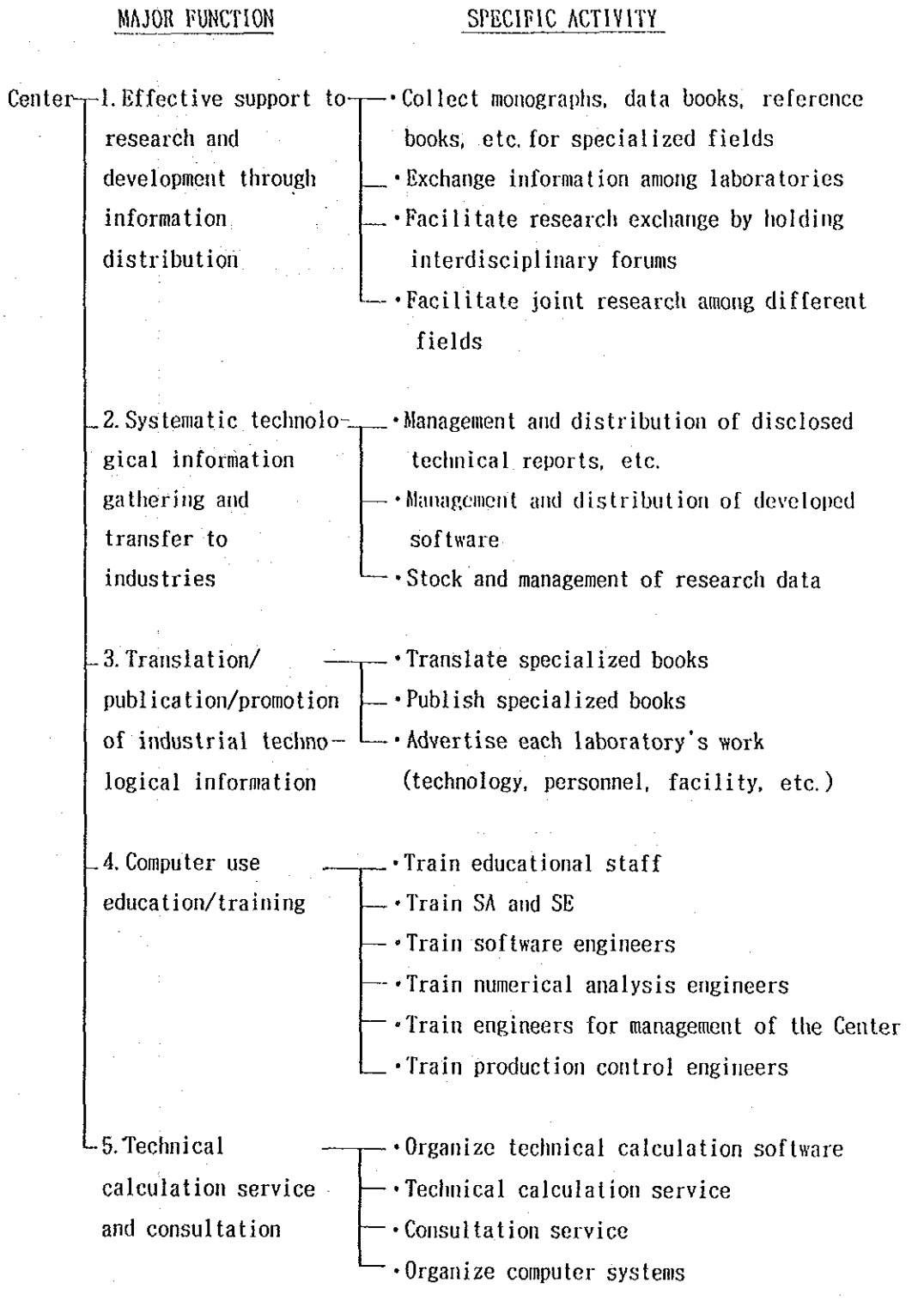
(3) Exchanges of research results and promotion of the common use of information between laboratories and enterprises will be promoted, and efficient collection of technological information and avoidance of duplicated efforts in research can be realized by changing from the current non-centralized use of information by personal computers to the use of a large central computer in the PUSPIPTEK-Serpong complex for the entire industrial technology of the Republic of Indonesia.

## 2. Functions and Size of the Center for Industrial Technological Information

(1) The following chart shows the results of developing the three core functions of the Center, a database system, an education/training system for computer use and a technological calculation system, based on the needs at the time of the field survey.

In practice, it may be difficult to realize these core functions at the same time. Therefore, the plan has been divided into three phases, and the functions can be developed step by step as shown on Phases of the Center Functions.

These phases are determined so as to concentrate most functions in Phase I in order that the Center offers services as early as possible. Therefore the aquisition of center staff, collection of data books, etc. should be stared before the opening. Phases II and III will be followed so as to develop functions of Phase I.




Functions of the Center for Industrial Technological Information

Phases of the Center Functions

| Function \ Phase | I | II | III |
|---|---|---|---|
| 1. Effective support to research and development through information distribution | ○ To gather monographs, data books, etc. | ○ Management/ distribution service | ○ ——— • ——→ |
| | ○ To train database searchers | ○ To offer latest expert information (use of overseas on-line databases ) | ○ ——— • ——→ |
| | ○ To distribute expert information (exchange of information among laboratories) | ○ ——— • ——→ | ○ ——— • ——→ |
| | ○ To encourage exchange research(forums) | ○ ——— • ——→ (interdisciplinary forums) | ○ ——— • ——→ (joint research among different fields) |
| 2. Systematic technological information gathering and transfer to industries | ○ To stock/manage technical reports, etc. (to make them into a database) | ○ Management/distribution service(to offer to PUSPIPTEK and others) | ○ ——— • ——→ |
| | ○ To collect/manage developed software (to make them into a database) | ○ Management/distribution service (to researchers in PUSPIPTEK) | ○ ——— • ——→ |
| | ○ To manage and distribute research results (distribution of a data file) | ○ Management/distribution service (to researchers in PUSPIPTEK) | ○ ——— • ——→ |
| 3. Tanslation/publication/advertisement industrial technological information | ○ To translate specialized books | ○ ——— • ——→ (publication and sales) | ○ ——— • ——→ |
| | ○ To publish specialized books(Technology, capacity, facility, etc.) | ○ ——— • ——→ | ○ ——— • ——→ |
| 4. Computer use education/training | ○ To carry out software technology education (Educating staff should be trained beforehand. ) | ○ ——— • ——→ | ○ ——— • ——→ |
| | ○ To carry out numerical analysis education (Educating staff should be trained beforehand.) | ○ ——— • ——→ | ○ ——— • ——→ |
| | ○ To train educating staff for center management/operation | ○ Center management/ operation education | ○ ——— • ——→ |
| | | ○ To train SA and SE educational staff | ○ To practice SA/SE training courses |
| | ○ To train educational staff for production control technology | ○ To practice production control education courses | ○ ——— • ——→ |

(To be continued)

(Continued)

| Function \ Phase | I | II | III |
|---|---|---|---|
| 5. Technical calculation service and consultaion | ○ To offer a technical calculation service (technical calcula – tion software) | ○ To facilitate the use of technical calculation software | ○ To promote development of technical calculation software<br>○ Technical consultation |

(2) In determining the size of the Center, a system which can satisfy the functions in Phase I will be considered. Moreover, the system should allow for possible expansion in Phase II and thereafter by adding extra devices, bearing in mind the economy of doing this. Futhermore, the system should be sized larger than VAX8550 system which was already installed in RSG-LP laboratory, one of twelve laboratories in PUSPIPTEK-Serpong and should fulfill present demands.

As an ideal system, a mainframe of database system and that of computation system would be independent, considering a different characteristic of CPU usage. However, two mainframes effect big cost impact and this idea does not seem to be a practical way because an establishment of such a center is the first trial in the Republic of Indonesia. Therefore, one common mainframe should be introduced at an initial stage and an additional mainframe might be installed later on, depending on the situation of using first mainframe. At this time, each mainframe will be utilized for each purpose, database and computation.

The following shows the requirements of the hardware elements in the system's configuration.

1) CPU (Central Processing Unit)

It has hardware functions which satisfy basic software functions, such as processing speed, which is necessary for processing database reference, scientific and technological calculation, and program development job smoothly. It must also have enough I/O channels.

In this system, a processing speed of more than 15 MIPS shall be required, and the required number of I/O channels shall be more than twelve.

2) Main storage

As job processing performance is largely affected not only by the processing speed of the CPU but also by the capacity of main storage, the mainstorage must have a capacity that is large enough for effective job

processing and future extensibility.

In this system, a storage capacity of more than 32 MB shall be required.

3) Magnetic disk device

The magnetic disk device must fulfill reguirements of smooth job processing, ease of use, and extensibility. In order to insure smooth job processing the magnetic disk control device must have a cross-call function. The magnetic disk device shall also be arranged separately for the database and for other systems.

4) Magnetic tape device

The recording method and recording format of the magnetic tape shall be compatible with different machines, and shall be able to read and write data with 1600 bpi/6250 bpi record density which are being generally used. Also, it shall have cross-call function, and shall have extensibility as to the number of devices to be placed in preparation for the future increase in demand.

In this system, a minimum of 2 for data I/O and 1 for work are required.

5) Line printer

One line printer shall be required for printing job processing result output with the performance of 136 characters/line and 800 lines/minute print speed by alphanumeric character set.

6) Laser printer

One laser printer shall be required not only for job processing result output, but also for high-quality output such as research thesis and reports.

7) Floppy disk device

One floppy disk device shall be required for keyed-in data input by key punchers and for data output.

8) XY plotter

The XY plotter shall have an output precision and performance which can be used for architecture drawing (maximum A0 size) such as graphic output of calculation results and output of design drawing.

9) Communication control device

One communication control device shall be required, equipped with more than 64 ports and able to connect 105 terminals (including several CAD

terminals). This device shall have a provision for a future expansion due to a demand increase.

(3) Based on the above-mentioned hardware system, the construction cost for the Center has been calculated as follows:

Construction cost (in 1,000 yen)

| | Local Currency | Foreign Currency | Total |
|---|---|---|---|
| 1) Building construction cost | 550,000<br>*) 385,000 | 450,000<br>*) 315,000 | 1,000,000<br>*) 700,000 |
| 2) Cost for related facilities (CVCF, receiving/transforming facilities, battery, a generator, etc. . .) | 1,000 | 199,000 | 200,000 |
| 3) Computer system cost (hardware, basic software, application software) | — | 1,400,000 | 1,400,000 |
| 4) Construction cost for communication facilities (for computer networks) | 5,000 | 5,000 | 10,000 |
| 5) Education equipment cost | — | 6,000 | 6,000 |
| 6) Purchasing cost for publications etc. | — | 50,000 | 50,000 |
| 7) Cost for recording medium of computer | — | 8,000 | 8,000 |
| 8) Accessories cost | 10,000 | 23,000 | 33,000 |
| 9) Basic software preparation cost (Residential cost of manufacturer's SE for a year) | — | 20,000 | 20,000 |
| 10) Consultant charges (36 persons · month) | — | 90,000 | 90,000 |
| 11) Transport insurance cost | — | 20,000 | 20,000 |
| Grand Total | 566,000<br>*) 401,000 | 2,271,000<br>*) 2,136,000 | 2,837,000<br>*) 2,537,000 |

*) The case excluding the forum building

(4) Based on Phases I through III, the operation cost has been calculated as follows. Regarding the maintenance and repair costs for the hardware system, this has been included in the construction cost for the first and the second years of service, but that for following years will be included in the operation and maintenance cost thereafter.

Operation and Maintenance cost (1,000 rupiahs/year)

| | First half of preparation phase | Second half of preparation phase | Initial year and the second year | In full operation (third year onwards after the initial year) |
|---|---|---|---|---|
| 1) Personnel | 48,000 | 60,000 | 78,000 | 120,000 |
| 2) Maintenance and repair | | | | 1,200,000 |
| 3) Facilities repair | | | 20,000 | 20,000 |
| 4) Electricity | | | 60,000 | 60,000 |
| 5) Consumables for computer (paper, etc.) | | | 40,000 | 40,000 |
| 6) Other consumables | | | 40,000 | 40,000 |
| 7) Database construction | 2,500 | 2,500 | 2,500 | 1,500 |
| 8) Book purchase | | | 15,000 | 15,000 |
| 9) Overseas database uses | | | 25,000 | 50,000 |
| Total | 50,500 | 62,500 | 280,500 | 1,546,500 |

## 3. Requirements for Effective Operation of the Center for Industrial Technological Information

As the conditions which make the establishment of the Center feasible, the following two items are mandatory.

1) It will be necessary to make firm budgetary arrangements for the maintenance and repair costs (1.2 billion rupiahs per year) which will be incurred in the third year after the atart of service and thereafter.

2) It will be necessary to acquire 40 personnel at the beginning of the Center operation.

The table, Phased Personnel Plan by Grade, shows a suggested personnel plan from the preparation phase of the establishment of the Center to the time for effective operation of the Center (around the third years after starting the service). The acquisition of personnel can use this suggested personnel plan as a guideline.

## 4. Suggestions for Realization of Establishing the Center for Industrial Technological Information

The following five items are suggested to realize and promote operation of

the Center for Industrial Technological Information, based on the current situation of industrial technology and research and development in the Republic of Indonesia as well as the concept and problems in developing the functions of the Center.

1) Following the conceptual design, BPPT, which is the primarily promotive body, should arrange staffing and funding. Fellowship overseas program will give a great help to early staffing.

2) The research and development personnel associated with the related industrial technologies should gather opinions on how the Common Information Center should be set up. These personnel should also establish a common objective for the growth and development of the Center through continuing collaboration with the related staff.

3) The personnel of the goverment agencies and budgetary administration who are involved in the realization and operation of the Center must be made aware that considerable efforts, the necessary budgetary allocation (1200 million rupiahs per year) and staffing at initial stage (40 staff) are required. They should also emphasize the efficiency in the collection of technological information and the elimination of redundant research effort.

4) The personnel responsible for research and development of industrial technology must come to recognize the current lack of a systematic accumulation and exchange of technological information and the means of appropriate analysis of advanced information. These leaders need to understand and exhibit enthusiasm for the concept of the Center and cooperate in improving the quality of information as well as the accumulation and proper utilization of such information, so that the ultimate aim of the Center, the development of the nation, will be achieved.

In order to effectively realize above in early stage, it is necessary to invite specialists from overseas.

5) The government and the head administrator of the Center must continue to stress the importance of the wide use of the functions of the Center at each and every level in PUSPIPTEK-Serpong in order to maximize its potential for future technological development. In so doing, the Center will become recognized as a primary source of Industrial Technological Information and will become a model for similar information centers that will be needed for the governmental and private sectors in the future.

Phased Personnel Plan by Grade

| Appointment | Third year onwards after the service starts | | First half of preparation phase | Second half of preparation phase | Starting operation increase/ total |
|---|---|---|---|---|---|
| | (grade) | no. of persons | person | | |
| Chief director | ( 1 ) | 1 | 1 | / 1 | / 1 |
| Secretary | ( 6 ) | 1 | | | |
| Planning manager | ( 2 ) | 1 | 1 | / 1 | / 1 |
| Staff | ( 4 ) | 3 | 1 | / 1 | / 1 |
| Staff | ( 6 ) | 2 | 1 | / 1 | / 1 |
| Administration manager | ( 2 ) | 1 | 1 | / 1 | / 1 |
| Manager class | ( 3 ) | 2 | 2 | / 2 | / 2 |
| Staff | ( 7 ) | 3 | | | 2 / 2 |
| Staff | ( 8 ) | 5 | 3 | 2 / 5 | / 5 |
| Staff | ( 9 ) | 4 | | | |
| Operations manager | ( 2 ) | 1 | 1 | / 1 | / 1 |
| Publications manager | ( 3 ) | 1 | | | 1 / 1 |
| Staff | ( 4 ) | 2 | 1 | / 1 | / 1 |
| Staff | ( 6 ) | 2 | | | |
| Information service manager | ( 3 ) | 1 | | | 1 / 1 |
| Staff | ( 4 ) | 1 | 1 | / 1 | / 1 |
| Staff | ( 4 ) | 1 | 1 | / 1 | / 1 |
| Staff | ( 7 ) | 2 | | 1 / 1 | / 1 |
| Librarian | ( 4 ) | 1 | 1 | / 1 | / 1 |
| Assistant | ( 6 ) | 1 | | 1 / 1 | / 1 |
| Education manager | ( 3 ) | 1 | 1 | / 1 | / 1 |
| Staff | ( 4 ) | 2 | 2 | / 2 | / 2 |
| Staff | ( 5 ) | 2 | | | 1 / 1 |
| Computer manager | ( 3 ) | 1 | 1 | / 1 | / 1 |
| Service div. | ( 4 ) | 1 | | | 1 / 1 |
| Staff | ( 6 ) | 4 | | | 2 / 2 |
| Operations div. | ( 4 ) | 2 | | | |
| Staff | ( 6 ) | 4 | | | 4 / 4 |
| Staff | ( 7 ) | 4 | | 1 / 1 | / 1 |
| System div. | ( 4 ) | 1 | | 1 / 1 | / 1 |
| Staff | ( 4 ) | 1 | | | |
| Staff | ( 5 ) | 3 | | | |
| Application engineering div. | ( 2 ) | 3 | 2 | 1 / 3 | / 3 |
| Staff | ( 4 ) | 2 | | | |
| Total | | 67 | 21 | 7 / 28 | 12 / 40 |

Note)

| Grade | Type of job |
|---|---|
| 1 | General manager |
| 2 | Chief engineer |
| 3 | Manager |
| 4 | Officer, manager |
| 5 | Assistant engineer |
| 6 | Foreman |
| 7 | Mechanic |
| 8 | Operator, driver, typist |
| 9 | Helper, guard |

# PART I

# INTRODUCTION

# SECTION 1 PURPOSE AND BACKGROUND OF THE STUDY

## 1.1 Background of the Study

In light of low petroleum and gas prices worldwide, the Republic of Indonesia is currently planning to shift its income resources from primary products such as petroleum, gas, etc. to secondary/tertiary products such as industrial products with higher values added. To carry out industrialization, the government of the Republic of Indonesia has first established state-run strategic enterprises to introduce oversea technologies through contracts for licenses with oversea enterprises and those for joint technology developments. By placing these state-run strategic enterprises in charge of industrialization, the Republic of Indonesia aims to substitute imports of industrial products with domestic industrial ones by bringing up related medium- and small-sized enterprises, and finally, to promote exports to obtain foreign currencies.

The chairman of the Agency for the Assessment and Application of Technology (BPPT), Minister Habibie, proposes the following 4-stage technical developments as processes to change the Republic of Indonesia into an industrialized country.

The first stage makes use of existing know-how in processes to increase values added in assembling and manufacturing products already prevailing on the market; that is, to import technologies from overseas for production under licensed contract. This stage cultivates the ability to understand product processes developed overseas and provides manufacturing know-how and managing ability.

The second stage introduces existing know-how into the designing and manufacturing of completely new products. This stage selects optimum elementary technologies from among existing ones at the time of designing a new system and builds up a final system by combining the selected elementary technologies. In this stage, it is necessary to become familiar with existing technical information worldwide, including advanced technologies. It is also necessary to increase laboratory facilities and improve facilities required for design, inspection and simulation.

The third stage develops technologies. This stage requires innovation and the creation of technologies to produce parts which are to be incorporated in

products requiring advanced technologies. This stage will secure international product competitiveness.

The fourth stage creates new lifestyles and ways of working through the application of advanced technologies.

Industry in the Republic of Indonesia is currently undergoing the first ofthe four stages mentioned above. Although some of the state-run enterprises have already moved into the second stage, most enterprises are still in the first. As described above, in order to substitute imports of industrial products with domestic industrial ones and to promote exports, it is important to verify what are the elementary technologies and to develop and diagnose new technologies required for second and third stages.

In order to do this, the government of the Republic of Indonesia established the National Center for Research, Science and Technology in Serpong located near Jakarta under the leadership of the BPPT (Agency for the Assessment and Application of Technology) and started a construction project in 1980. The construction of the center is currently under way. This national project is called PUSPIPTEK (Proyek Pusat Penelition Ilmu Pengetahuan). In the future, the government of the Republic of Indonesia has conceived of the idea to carry out in similar national projects in other regions, although they will be in different fields. The objective project of this survey is to be called PUSPIPTEK-Serpong (with the place name added to distinguish it from the other projects).

Upon establishing PUSPIPTEK-Serpong, the government of the Republic of Indonesia expects the following results:

① Carrying out an efficient research by bringing together researchers and engineers, who will participate in common scientific and technological fields at a single location.
② Saving facility investment by concentrating required research facilities in one location.
③ Producing more advanced research themes by combining interdisciplinary research subjects.
④ Achieving international exchanges in scientific and technological fields by providing an academic environment through exchanges between researchers in many fields and inviting researchers from oversea countries.
⑤ When doing research work requested by enterprises other than PUSPIPTEK-Serpong, each laboratory can get a high income by incorporating a value

added in research results, and at the same time, can contribute to technical improvements in the Republic of Indonesia.

Looking back at activities at some of the existing laboratories, however, the following problems have arisen. These problems are expected to apply to the laboratories to be completed in the future and must be solved by 1992, the completion date for PUSPIPTEK-Serpong.

① Liaison and cooperation systems among governmental organizations such as BPPT (Badan Pengkajian dan Penerapan Teknologi), LIPI (Lembaga Ilmu Pengetahuan Indonesia), BATAN (Badan Tenaga Atom Nasional), which are the parent bodies for each laboratory, are not completed yet, and each laboratory proceeds with its research individually. This, in turn, interferes with mutual exchanges of necessary scientific and technological information and increases the amount of labor necessary to collect information.

② Information exchange is difficult because proper data communication networks are not functioning not only between individual laboratories but also between Serpong and Jakarta.

③ A computer environment, which sufficiently serves as a tool for the verification of elementary technologies, and development and evaluation of technologies has not yet been established.

In order to solve these problems, the Indonesian government has requested the Japanese government to conduct a feasibility study for establishing the Center for Industrial Technological Information in PUSPIPTEK-Serpong, taking into account the industrial technological information systems in the Republic of Indonesia. This report has been compiled based on the field survey results and analyses performed by the study team.

## 1.2 Purpose of the Study

The following four items delineate the purposes of this study.

① To grasp the problems related to industrial technological information systems of each laboratory in PUSPIPTEK-Serpong, and to present the functions to be established for the Center for Industrial Technological Information, taking into account the roles of PUSPIPTEK-Serpong in the field of industrial technology field in the Republic of Indonesia.

② To consider a construction schedule, centering around three functions of database, scientific and technological calculation and education/training and to make a concrete development plan for the functions. When making the function development plan, considering priority of the functions realized as much as possible, in accordance with significance of the functions and actual situation of PUSPIPTEK-Serpong.

③ To conduct the feasibility study on the Center according to the above function development. A proportion of the operating costs can be recovered by charging for some of the services.

④ To simultaneously review the economical and social effects to be had on the Republic of Indonesia by establishing the Center.

## 1.3 Progress of the Study

In July 1987, the government of the Republic of Indonesia requested the Japanese government to conduct a feasibility study for establishing the Centerfor Industrial Technological Information. Based on this request, the Japanese government dispatched a pre-study team to the Republic of Indonesia in March 1988 and S/W related to this study was discussed with the Indonesian government and subsequently determined.

Afterward, a main study team was dispatched to the Republic of Indonesia in July 1988. The team remained there for about a month and surveyed the collection and use conditions of industrial technological information in each laboratory of PUSPIPTEK-Serpong, use condition of computers for scientific and technological calculation and needs for the Center for Industrial Technological Information. Furthermore, this main study team visited not only PUSPIPTEK-Serpong but about 30 private companies and governmental organizations as well in major cities like Jakarta, Bogor, Bandung and Surabaya. A survey was conducted by personal interview to discover the need for technological information and scientific and technological calculation. They also conducted a questionnaire survey as well and obtained about 20 valid responses.

Based on the results of such field surveys and data collection, the main study team started preparing a report in September 1988 and finally, reported the results of the feasibility study. Meanwhile, a meeting to explain a draft final report was held at the office of BPPT in the Republic of Indonesia in January 1989 and this report was officially finalized.

## SECTION 2 CURRENT SITUATION AND FUTURE OF PUSPIPTEK-SERPONG

### 2.1 Geographic Outline

PUSPIPTEK-Serpong is located about 27 km southwest of downtown Jakarta, andabout 100 m above the sea level. Its plottage exceeds 350 ha. The site isdivided into two parts by a road which connects Jakarta and Bogor; one of them is a laboratory zone, and the other is an area used for houses for the staff, schools, hospitals, mosques, and for various recreation areas including sports facilities. The laboratory zone also includes two valleys and the Cisadane river. Based on these geographical features, the laboratory zone is divided into five areas. (Fig. I-1)

### 2.2 Situation of Construction of Each Laboratory in PUSPIPTEK-Serpong

#### (1) Outline

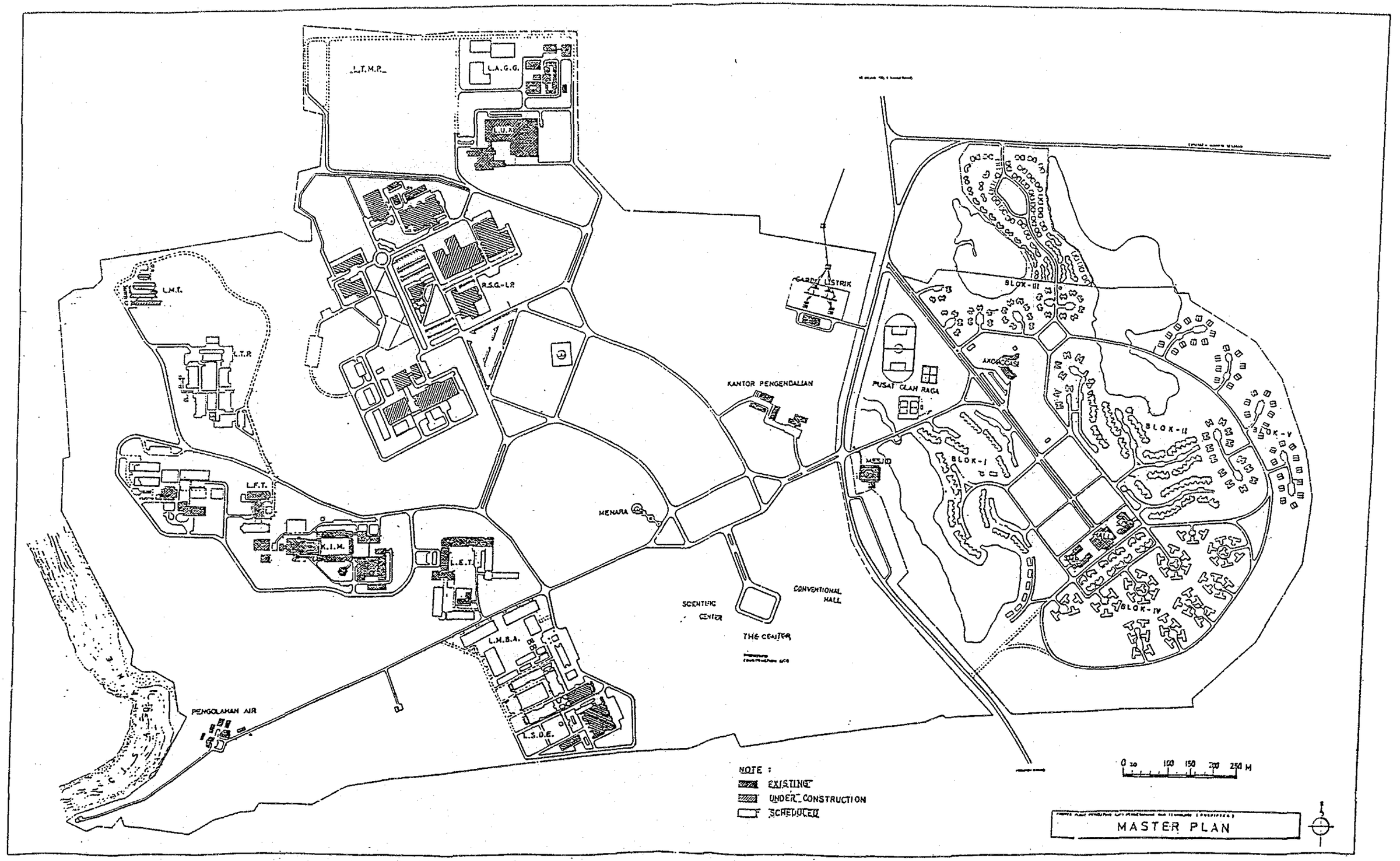
Since the start of construction of PUSPIPTEK-Serpong in 1980, about 60 % ofthe planned 12 laboratory facilities have been completed as of August, 1988 with about 20 % still under construction. The remaining 20 % are still being planned. In the housing zone across the main road, 80 % of the construction of housing for staff have been completed on the schedule.

Both in the laboratory and the housing zones, paving of roads, planting of trees and other plans for the environment have made considerable progress. Also, most of buildings have been completed by governmental organizations of the Republic of Indonesia.

#### (2) The Past, Present and Future of Construction in PUSPIPTEK-Serpong

1) Laboratory zone

The PUSPIPTEK-Serpong construction project was designed from 1976 through 1977. Preparation of the infrastructure started in 1977 and the construction started in 1980. Initial construction included three laboratories; LUK (Strength of Materials, Components and Structures Laboratory), KIM (Research & Development Center for Calibration, Instrumentation and Metrology), and RSG-LP (Multipurpose Reactor and Its




Source: Prepared by the study team based on the material provided by the Project Management Office

Fig. I-1 Layout of PUSPIPTEK-Serpong

Table I-1 Constructional Situations of Laboratories in PUSPIPTEK-Serpong

| | Laboratory | Parent Organ | Situation (Note) | Year Started - Year Completed | Cooperative Countries |
|---|---|---|---|---|---|
| 1 | LAGG | BPPT | B | 1984～1988 | The Netherlands, West Germany |
| 2 | LUK | BPPT | A | 1980～1984 | West Germany |
| 3 | LTMP | BPPT | E | | France |
| 4 | LET | LIPI | F | 1982～1991 | U.S.A. |
| 5 | LKT | LIPI | B | 1983～1991 | |
| 6 | LFT | LIPI | B | 1983～1992 | |
| 7 | KIM | LIPI | A | 1980～1988 | West Germany |
| 8 | LMT | LIPI | D | 1988～1993 | Japan |
| 9 | LTP | BPPT | E | 1990～1994 | U.S.A. |
| 10 | RSG-LP (including 8 labs) | BATAN | C | 1980～1991 | West Germany, France, U.S.A., Italy, Canada, Japan |
| 11 | LMBA | BPPT | E | 1990～1994 | Japan (Pending) |
| 12 | LSDE | BPPT | C | 1983～1992 | U.S.A., West Germany, Japan |

(Note) A : Completed with research activities in progress
B : Partially completed with research activities in progress
C : Under construction with planning, and research activities in progress
D : Under construction and still planning
E : Under planning
F : Buildings completed with research activities not yet started

Source : Prepared by the study team

Supporting Laboratories). Completion of the first construction project was celebrated on Dec. 19, 1984. At that time, the measurement facilities at KIM and all facilities at LUK had also been completed. In addition, construction was begun on an experimental wind tunnel at LAGG (Aerodynamics, Gasdynamics and Vibration Laboratory) and an experimental reactor at RSG-LP.

On Aug. 20, 1987, a reactor and a fuel manufacturing system were completed at RSG-LP and the completion of the second construction project was celebrated. Of 12 laboratories (19 of them in total, if 8 laboratories at RSG-LP are included), two laboratories have been completed and have begun their research activities, and six other laboratories have been partly completed and have also initiated research activities simultaneously with construction.

Eight of the remaining 11 laboratories are still under construction, and the last three laboratories are in the establishment planning phase. Table I-1 shows their construction status.

Among the laboratories under construction, completion of RSG-LP has received top priority at present and the government has allocated most of the budget to its completion. Compared with other laboratories of a similar kind in the Republic of Indonesia, the building of RSG-LP represent an especially high grade of thoroughness and deserve a particularly high rating. On the contrary, no governmental budget was allocated for the unfinished part of construction of the LKT (Research and Development Center for Applied Chemistry) and the completion date remains unknown. Moreover, supporting funds from the Japanese government were given for construction of LMT (Applied Metallurgy Laboratory).

One of the urgent construction goals of PUSPIPTEK-Serpong is the completion 12 laboratories. A future plan includes establishment of educational facilities for the Institute of Technology, Indonesia (plottage of 150 ha.), and creation of an office complex for the Indonesian Academy of Science, the National Research Council, the Indonesian National Academy of Engineering and Indonesian National Academy of Medicine.

2) Housing and recreation area

In PUSPIPTEK-Serpong, there is a housing and recreation area which is distiguished with the laboratory zone by the main road. The area contains a guest house, housing for staff and their families, a meeting hall, a kindergarten, an elementary school, a middle school, a mosque and sports facilities. With respect to the houses, about 700 units, which is equivalent to about 80 % of the entire plan, has already been completed.

## 2.3 Status of Activities at Each Laboratory

### (1) Aerodynamics, Gasdynamics and Vibration Laboratory (LAGG)

1) Constituent personnel

50 persons in total (to be increased to 117 for researchers, 20 for assistant researchers, and 40 for clerical personnel)

2) Research objectives

This laboratory researches problems related to aerodynamics, aeroacoustics and vibration. It takes charge of technical developments with respect to various fields of industries such as aeronautical technology and

transportation. It also performs research entrusted by P.T. IPTN and its licenser, Boeing Inc.

3) Overview of laboratory

About 60 % of the laboratory buildings were completed in 1987. Although the experimental wind tunnel is partly made of ferro-concrete, the laboratory is mostly made of steel frame. The other experimental and office buildings are located adjacent to the wind tunnel and made of ferro-concrete with two stories. Their total floor area is 7,500㎡. The buildings were built by the Indonesian government. Machines and facilities have been introduced with support from foreign loans.

(2) Strength of Materials, Components and Structures Laboratory (LUK)

1) Constituent personnel

Researchers: 123 persons, Assistant researchers: 20 persons, Clerical personnel: 47 persons

2) Research objectives

This laboratory conducts research into mechanical testing (tensile strength, strain, fatigue, corrosion, etc.) of various materials, and the characteristics and structures of materials (metals, concrete, plastic, etc.) used for such structures employed in vehicles, trains, ship, airplanes, buildings and bridges, etc.

For requested research projects, the laboratory conducts a fatigue tests on airplanes manufactured by P.T. IPTN and research conducts on vibration for large vehicles manufactured by Mercedes Benz.

3) Overview of laboratory

This laboratory building was completed 100 % in 1981 and began research activities in 1984. A large one-story experimental building which allows real-body experiment of airplanes, it is made of steel frame and ferro-concrete, and the main building is made of ferro-concrete with two stories. Their total floor area is 13,600 m. The buildings were constructed by the Indonesian government, and machines and facilities were introduced using foreign aid.

(3) Thermodynamics, Engine and Propulsion Systems Laboratory (LTMP)

Construction of this laboratory is still in the pending phase. It was designed with financial assistance from France. It is anticipated to carry

out research and development of large-scale industrial machines such as power machines, hydraulic machines and heat exchangers.

The basic design of the laboratory building is under progress with aid from foreign countries. At present, plans for construction of buildings and installation of machinery have not yet been determined.

(4) Applied Electronics Laboratory (LET)

1) Constituent personnel

230 persons in total (to be increased to 700 persons within 10 years)

2) Research objectives

This laboratory is intended to carry out research in various fields such as electronic circuit instruments, electronic materials, electronics, telephone switching systems, broadcasting/communications and electric engineering.

3) Overview of laboratory

The buildings completed account for 55 % of the plan so far. The laboratory is made of ferro-concrete, with two stories, including a partial one-story section with a floor area of about 11,300㎡. It was built by the Indonesian government and machines were introduced with funds from foreign loans.

(5) Applied Chemistry Laboratory (LKT)

1) Constituent personnel

280 persons in total

2) Research objectives

This laboratory makes various analyses such as general chemical analyses and fundamental chemical analyses, and conducts fundamental chemical research, food chemical research, applied chemical research, and so on. For the moment, however, this research has no link with private enterprises and centers around independent research within a govenmental budget. Most of the research is carried out at its headquarters in Bandung and the number of researchers working here is limited.

3) Overview of laboratory

Although this laboratory building represents only 20 % of its entire construction plan, it has already started research activities. Of the buildings completed, the large experimental building is made of steelframe,

but the main building is a two-story ferro-concrete building. The main building has a floor area of about 5,300㎡ The construction of both buildings and the introduction of machines was handled by the Indonesian government. Although a plan does exist to expand the laboratory in the future, its schedule has not been determined due to restrictions imposed upon the governmental budget.

(6) Applied Physics Laboratory (LFT)

1) Constituent personnel

220 persons in total (to be increased to 150 for researchers and 350 for other personnel by 1990)

2) Research objectives

This laboratory conducts research into structural and physical characteristics, solid technical and mechanical characteristics, material technology, polymerization technology, ceramic technology, etc.

3) Overview of laboratory

The laboratory building has seen about 70 % completion of its construction plan and already begun research activities. Like LKT, this laboratory has almost no ties with private enterprise in its research activities and operating expenses are covered by a small governmental budget. Research activities and facilities are heavily restricted due to strict governmental budgets in recent years. The laboratory is a 2-story building made of ferro-concrete, with a total floor area of about 3,800 ㎡ Construction as well as introduction of machines were carried out independently by the Indonesian government.

(7) Calibration, Instrumentation and Metrology Laboratory (KIM)

1) Constituent personnel

435 persons in total

2) Research objectives

This laboratory provides guidance for research and development of measuring technologies used in physics and engineering, assurance and maintenance/management of domestic and overseas measuring standards as well as promotion and guidance for the establishment of Indonesian instrument manufacturers, education and training of experts in the field of measurement, and technical information and services in this field. The

laboratory also undertakes work on a project basis from private enterprises and governmental organizations thus obtaining considerable operating funds from outside sources. The ratio of such income is greatly increasing due to a recent reduction of a governmental budget.

3) Overview of laboratory

The laboratory building completed 100 % of its construction plan in 1984 and research activities started in 1987. There are 3-story and 2-story buildings, all of which are made of ferro-concrete. The total floor area of the laboratory is about 2,500m². It has experimental and research rooms, clerks' offices, other related rooms plus a canteen, the only one among the laboratories at PUSPIPTEK-Serpong. Its interior decoration and utensils are slightly superior to those at the other laboratories. The buildings were constructed by the Indonesian government, and machines were introduced partly through foreign aid and loans.

(8) Applied Metallurgy Laboratory (LMT)

1) Constituent personnel

250 persons in total, of which 75 persons are to be researchers

2) Research objectives

This laboratory is intended to conduct research into metal refinement, metal materials and nonferrous metal materials as well as to conduct various corrosion tests.

3) Overview of laboratory

The laboratory building, which consists of experimental rooms, testing plant, materials warehouse, etc., is made of ferro-concrete with 1-story and 2-story sections. It has a total floor area of about 3,000m² It is currently under construction with aid from the Japanese government. Financial aid includes construction of the buildings and furnishing of machines. It is expected to be completed by March, 1989.

(9) Process Technology Laboratory (LTP)

This laboratory does research and development of process technology and provides guidance for research. It also researches manufacturing methods for polymer and composite materials, and studies and develops material handling methods and product storage/packing/transportation methods. It is still in the construction planning phase. The scale of the total floor area of the

laboratory building is planned to be about 10,000 m².

(10) Multipurpose Reactor and Its Supporting Laboratories (RSG-LP)

1) Constituent personnel

Researchers: 148 persons, Assistant researchers: 195 persons, Clerical personnel: 87 persons

2) Research objectives

RSG-LP consists of eight laboratories. Its main roles include;

① Development of scientific technology for nuclear power.

② Education and training for experts in nuclear power.

③ Production of fundamental parts used for reactors.

The reactor has a 30 MW-class thermal output. Although it is currently being operated at a thermal output of 10 MW, its output is planned to be increased to 30 MW in near future.

3) Overview of laboratory

90 % completion of all facilities is anticipated by the end of 1988. With technical cooperation from West Germany, France, U.S.A., Italy, Canada and Japan, it is clear that the Indonesian government is putting a great deal of emphasis on these laboratories. Out of the total construction plan for the laboratory buildings, about 60 % of the laboratory/administration buildings (including the reactor) have been completed. About 30 % are still under construction, and the last 10 % are under planning. After completion completion of all the construction, the total floor area will be over 40,000m², making it the largest-scale facility at PUSPIPTEK-Serpong. Most of buildings are made of ferro-concrete and their interior design is of the highest among all the laboratories.

(11) Natural Disasters Mitigation Laboratory (LMBA)

This laboratory is designed to study actual conditions of nature and natural disasters, and to find out and provide methods for securing human safety. It is expected to measure various disasters and forecast weather, earthquakes, volcanic eruptions, etc. Its construction is still in the planning phase and foreign aid is expected to help complete the plan.

(12) Energy and Energy Resources Laboratory (LSDE)

1) Constituent personnel

66 researchers out of 107 persons in total (to be increased to 462 persons in future)

2) Research objectives

This laboratory aims to contribute to an integrated energy policy for the country in order to cope with future energy demands. It also directs strategic schedules for the development of the energy industry and supports accomplishment of its policies. Although the Republic of Indonesia is one of the world's prominent energy-exporting countries, it is now actively working to tackle energy problems on a global basis. This laboratory is also planning to study use of energy resources such as solar energy, wind force and biomass, and other future energy technologies, as well as development, manufacturing, storage and economy of energy resources.

3) Overview of laboratory

The laboratory building is 60 % completed and it has already started some of its research activities. It is made of ferro-concrete with two stories and its total floor area is about 5,000 m It was constructed by the Indonesian government.

(13) Project management office

This office undertakes the management of all facilities, their constructions and infrastructures such as water supplies, roads, electricities, telephones. This office is also engaged in a future development plan of PUSPIPTEK-Serpong.

PART I introduced the background, the purpose and the progress of the study, and the outline of PUSPIPTEK-Serpong.

PART II will explain an outline of economic and social environment and a present situation of industries, emphasizing on a technology development related to a computer use.

# PART II

# ANALYSIS

# OF

# INDUSTRAL, ECONOMIC AND TECHNOLOGICAL

# CIRCUMSTANCES

# IN

# THE REPUBLIC OF INDONESIA

# SECTION 1 ECONOMIC AND SOCIAL ENVIRONMENTS

## 1.1 Outline

### (1) Geographical Features

The Republic of Indonesia is located between the two continents of Asia and Oceania, and faces two oceans, the Indian Ocean and the Pacific Ocean. It has an abundance of natural resources and comprises the world's largest archipelagic country, ranging over an area of about 5,100 km from Saban in the island of Sumatra to the west to Merauke in the island of Irianjaya. Geographically, it stretches at 6° north latitude to 11° south latitude, and from 95 ° to 144° east longitude.

The Republic of Indonesia covers a total area of about 1,920,000 km² (about 5.5 times the size of Japan) and consists of 17,000 large and small islands, of which about 3,500 are inhabited.

### (2) Climate

The climate is tropical and manifests no seasonal changes because the country is located near the equator. It is generally divided into two seasons; rainy and dry seasons. An annual average temperature ranges at around 27℃ and with very little variation throughout the year; the rainy season is more comfortable. The amount of rainfall over all Indonesia averages about 700 mm (a tropical rain belt).

On the island of Java, the rainy season generally begins in October of every year and ends in around March of the next year. The dry season extends from April to September. About 60 % of the nation consists of wooded regions, giving the Republic of Indonesia the largest tropical forestry in the world.

### (3) Population

According to the national census of October, 1980, the population of the Republic of Indonesia was about 147,000,000. Population estimates for 1988 are 175,000,000 (data in 1987). The mean annual rate of population increase was 2.1 % during the 1961-1970 period and 2.3 % during the 1971-1980 period. It is estimated that the total population will reach 220,000,000 by the year 2000. The population is distributed highly unevenly with about 60 % of all the population located in the Java and Madura islands, land accounting for only 6.9

% of a total area of the country (data in 1987). Although an average population density throughout the nation is 91 persons per km², density for the Java and Madura islands is 799 persons per km², making the two islands world-famous as overpopulated regions. On the contrary, the Kalimantan (Borneo) and Irianjaya islands, which are extremely depopulated regions, have a population density of 16 and 4 persons per km², respectively (Table II-1).

Although the population mainly consists of people of Malaysian extraction, it is divided into many tribes such as Java tribe (eastern and middle regions of Java island), Sunda tribe (western region of Java island), Madura tribe (eastern region of Java island, and Madura island), and so on. These peoples speak different languages and live by different customs. Although there do exist 250 different languages, the Indonesian language is spoken as the national language.

Table II-1 Land Areas of Major Islands and Distribution of Population

| Island | Area | | Population (1988 Estimate) | | Population Density per km² (persons) |
|---|---|---|---|---|---|
| | (k m²) | Component Ratio (%) | (1,000) | Component Ratio (%) | |
| Sumatra | 473,606 | 24.67 | 35,789 | 20.43 | 76 |
| Java, Madura | 132,187 | 6.89 | 105,560 | 60.25 | 799 |
| Kalimantan | 539,460 | 28.11 | 8,406 | 4.80 | 16 |
| Sulawesi | 189,216 | 9.85 | 12,317 | 7.03 | 65 |
| Irianjaya | 421,981 | 21.99 | 1,506 | 0.86 | 4 |
| Others | 162,993 | 8.49 | 11,638 | 6.64 | 7 |
| Total | 1,919,443 | 100.00 | 175,216 | 100.00 | 91 |

Source : Statistic Indonesia, 1987

Most of the people of the Republic of Indonesia live in farm and fishing villages, and in small local cities centering around markets mainly for agricultural products. The government of the Republic of Indonesia defines a town of 5,000 population or more as an urban city. Looking at population distribution classified in this manner, the rate of urbanization has increased to 22.4 % in 1980 and 26.2 % in 1985 all over the country (data in 1987).

Generally speaking, farm village areas on Java island, (comprising almost half the total population of the Republic of Indonesia), cannot bear any further increase in population. In addition, modernization and reduction of labor in agricultural production has decreased job opportunities in the farm village areas. Although the government has promoted a policy of migration from Java island to Sumatra island, etc., it may be a long time before achieving better distribution of population.

Under the current circumstances, surplus population in the farm villages has been migrating to the cities, resulting in further expansion of urban population (Table II-2).

Table II-2 Populations in Cities and Farm Villages in Indonesia (1980)

(Unit: 1,000 persons, %)

| Region | City Area | Farm Village Area | Ratio of City Area |
|---|---|---|---|
| Java | 22,926 | 68,291 | 25.1 |
| Others | 9,919 | 45,140 | 17.9 |
| Sumatra | 5,481 | 22,515 | 19.6 |
| Kalimantan | 1,441 | 5,276 | 21.5 |
| Sulawesi (Celebes) | 1,654 | 8,746 | 15.9 |
| Entire country | 32,740 | 113,431 | 22.4 |

Source : Statistic Indonesia, 1983

(4) Industrial Population

Now, let us discuss the industrial population as well. According to announcement made by Prof. Dr. Habibie, the chairman of the Agency for Assessment and Application of Technology at the International Conference for Aviation Science and Technology, about 50 % of the total population described above consists of laborers, and as of 1986, 27 % of them were unemployed. With consideration to this point, the government has set a target to reduce an unemployment rate to 10 % by the year 2000 (Fig. II-1 and Fig. II-2).

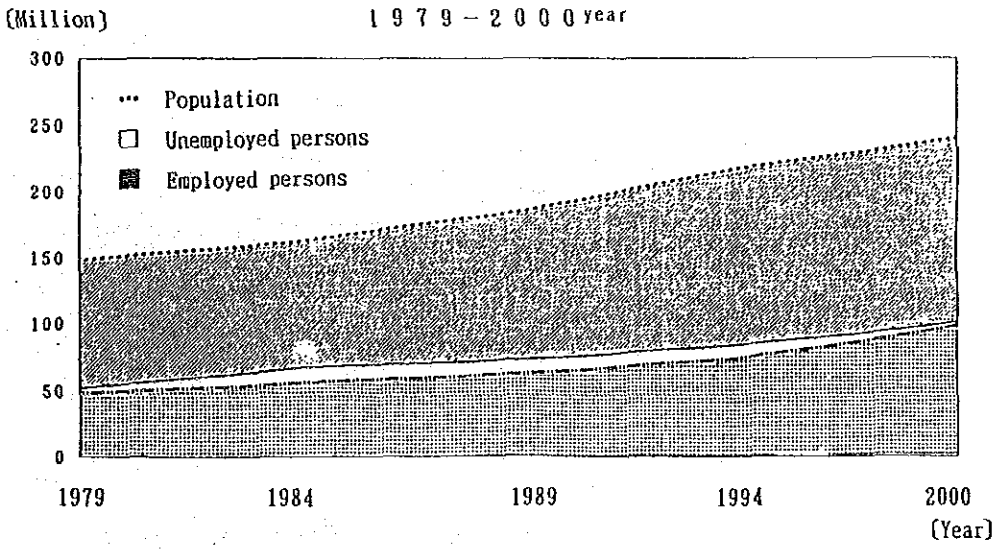



Fig. II-1 Employment and Unemployment Rates among the Population

Source : Data from Dr. Habibie's Lecture in International Conference for Aviation Science and Technology, June 1986

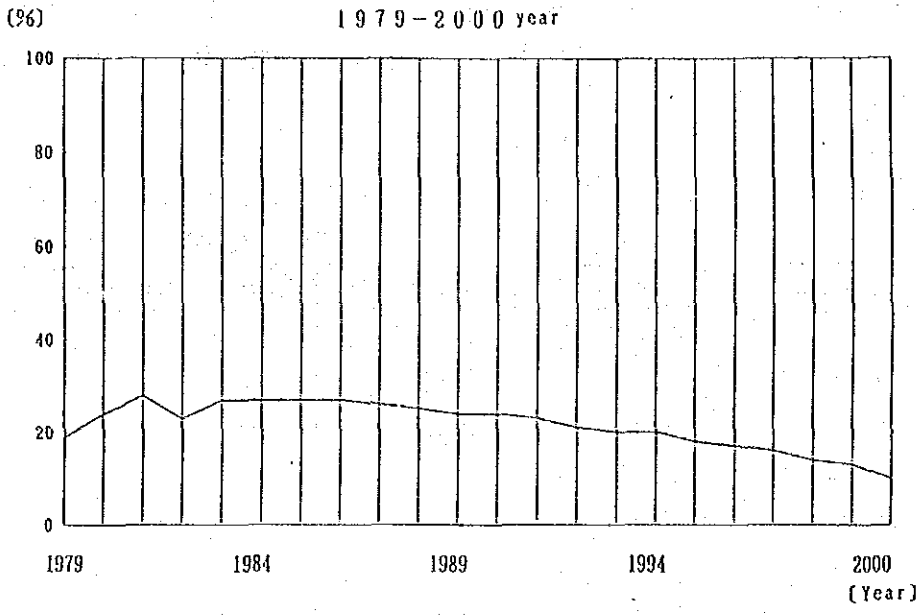



Fig. II-2 Transition in the Unemployment Rate

Source : Data from Dr. Habibie's Lecture in International Conference for Aviation Science and Technology, June 1986

Next, the farming population is expected to increase slightly but should remain nearly constant up to the year 2000, as shown in Fig. II-3. On the other hand, the population engaged in the service and manufacturing industries is expected to increase rapidly by the year 2000.

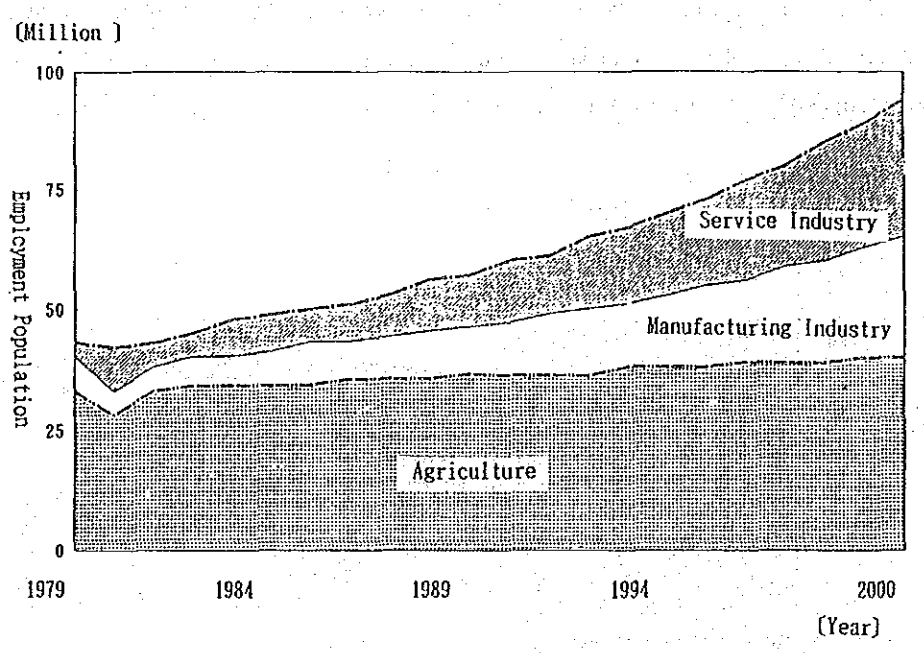



Fig. II-3 Transitions in Distribution of Employment Population

Source : Data from Dr. Habibie's Lecture in International Conference for Aviation Science and Technology, June 1986

As stated above, the Republic of Indonesia aims at the reduction of the unemployment rate and switching from primary industries to the secondary and tertiary industries. To accomplish this, the Indonesian government is striving to first promote industrialization which will guarantee employment opportunities.

## 1.2 Economy

Under the government of Suharto, the first four of the 5-year master plans have been carried out since 1969. The year 1988 will mark the last year of the fourth 5-year master plan. Currently, the contents of the fifth 5-year master plan are being discussed in detail. The following outlines economic trends in the Republic of Indonesia based on these 5-year master plans.

The first 5-year master plan accomplished a substantial growth rate in the GNP on an average of 7.7 % due to relatively stable political and economic situations both domestically and internationally. This plan brought about various successful results, such as increased yields of rice, an end to inflation, etc.

In the second 5-year master plan, started in 1974, the economy was greatly enhanced due to increased export prices of crude oil caused by the first "oil shock." However, the GNP growth rate grew no more than 6.9 % compared with a target growth rate of 7.5 % because of the subsequent worldwide depression and the financial failure of Purutamina in 1975. Furthermore, in November of 1978, the currency of Indonesia, the Rupiah was devaluated by 50 %.

The third 5-year master plan began in April 1979, which encountered many fortunate obstacles such as increased export prices for crude oil. The plan revised many existing economic and political systems such as the tax system, tariffs, exports, building up of medium- and small-sized enterprises, etc. As a result, there was remarkable progress in both the economy and standard of living. The GDP growth rate reached 6.3 % in 1979, 9.9 % in 1980 and 7.9% in 1981; the GNP per capita exceeded US $500 in 1981 and the Republic of Indonesia became a middle-income country (according to classification by the World Bank). However, the oil market continued to be sluggish due to a deep worldwide depression that began in 1981, and the Indonesian economy, greatly dependent on oil exports, was greatly damaged. The GNP growth rate dropped sharply to 2.2 % in 1982. To make up for revenue shortages caused by low export prices for oil, the Republic Indonesia devaluated its currency 38 % from 703

rupiahs U.S. to 970 rupiahs for US$1 in March 1983, and also took special measures in May to reconsider major projects, etc. Although the GNP growth rate recovered slightly to 4.2 % in 1983, the third 5-year master plan ended rather fruitless. An average GNP growth rate during this period was 6.0 %, which was lower than the expected rate of 6.5 %.

The fourth 5-year master plan was initiated in April 1984. The target GNP growth rate was set at an annual average of 5 %, which was lower than previous master plans because of vague prospects for international demands. Although, in 1985, the Indonesian government reformed its economic structure because excessive dependence on oil, and tried to increase exports of non-oil/non-gas products through the promotion of economic efficiency, etc. However, the Indonesian economy stayed sluggish again under more severer economic conditions such as the abrupt reduction of oil prices and the stagnation of the world economy. The GNP growth rate in 1985 was only 1.9 %. In 1986, the Indonesian economy was forced to face difficulties caused by an unexpectedly sharp decline in oil prices resulting from a share expansion strategy of a crude oil export proposed by OPEC. : In May of the same year, the Indonesian government decided upon comprehensive economic policies related to the promotion of non-oil and non-gas product exports and the introduction of foreign capital. It also introduced various measures to simplify administrative procedures, etc. However, balance of international payments deteriorated continuously, and in September of the same year, a rupiahs-to-dollar conversion rate was further devaluated by 45 % (31 % devaluation according to the IMF system).

From that time up until now, a strict budget has been imposed due to the uncertainty of oil prices and to increased repayment of foreign loans.

Table II-3 shows transition of economic indexes.

Table II-3 Transition of Major Economic Indexes

| Item \ Year | | 1984 | 1985 | 1986 |
|---|---|---|---|---|
| 1. GDP | (billion rupiahs) | 78,144.4 | 79,910.8 | 82,474.5 |
| 2. GDP per capita | (rupiahs) | 490,010 | 490,554 | 495,765 |
| 3. GNP | (billion rupiahs) | 74,442.3 | 76,330.4 | 78,645.5 |
| 4. GNP per capita | (rupiahs) | 446,796 | 468,575 | 472,748 |
| 5. National income | (billion rupiahs) | 69,405.4 | 69,942.8 | 69,890.0 |
| 6. National income per capita | (rupiahs) | 435,212 | 429,363 | 420,118 |
| 7. GNP except oil and gas | (billion rupiahs) | 60,764.3 | 62,963.3 | 64,717.4 |
| 8. Population | (1,000 persons) | 159,475 | 162,899 | 166,358 |

Source : Statistical data according to the Central Bureau of Statistics

## 1.3 Finances

The financial policy for the Republic of Indonesia is geared to prevent inflation by balancing expenditures and domestic revenues, plus foreign financial aid. Therefore, the difference between revenues and necessary expenditures is automatically used as a development budget, and insufficient funds required for development are compensated by foreign financial aid. The Government of the Republic of Indonesia pays close attention to maintain the delicate balance between prevention of inflation and investment for development. Table II-4 and Table II-5 show trends in the national budget of the Republic of Indonesia. This data provides us with the following points:

① For domestic revenues, oil company tax and LNG tax accounted for 64.2 % of the total domestic revenue in 1983 and 1984, 59.7 % in 1985 and 54.6 % in 1986, comprising more than half of the total each year. In the 1987 and 1988 fiscal budgets, however, dependency on oil and gas was reduced due to falls in international oil prices, and revenue ratios of oil and gas to domestic revenues were 40.3 % and 40.6 %, respectively; the ratio of these to the total revenue dropped greatly to 30.5 % and 30.6 %, respectively. These figures are considerably low compared with previous ones.

② Income tax, value-added tax, consumption tax, etc. account for large ratios of non-oil and non-gas revenues. In 1987 and 1988 fiscal budgets, value added tax and luxury tax have accounted for larger ratios than income tax. This shows that reduction of income from oil and gas is intended to be compensated by taxes from the people.

③ On the other hand, foreign financial aid for development has risen sharply. As described in Section 2, the sharp rise in revenues for development causes a simultaneous burden in repaying foreign loans. This problem has been further aggravated by devaluation of the currency resulting from the depression of the oil industry.

④ There have been large increases in expenditures, due to repayment of foreign loans.

As described above, financial circumstances in the Republic of Indonesia have seen a major turning point over these two years. Particularly, revenues from oil and gas have been gradually replaced by tax payments from the people and by foreign loans. While a large number of foreign loans continue to be

taken, it is necessary to direct development investments to import substitute and export industries. These development investments are also desired to provide international competitiveness for Indonesian industry. On the other hand, the operational budget, which was deficient in past years, is being prepared by means of foreign loans (1000 billion rupiahs set aside in 1987) and smooth execution and operation of projects to be supported by foreign aid is also expected.

Table II-4 Transition of National Budget of Indonesia (1) (Unit: billion rupiahs)

| Revenue budget \ Year | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 | % of increase/decrease to the previous year |
|---|---|---|---|---|---|---|---|
| A. Internal revenue | 13,823.6 | 16,149.4 | 18,677.9 | 17,832.5 | 17,236.1 | 21,803.0 | 26.5 |
| I. Oil and gas revenues | 8,869.1 | 10,366.6 | 11,159.7 | 9,738.2 | 6,938.6 | 8,855.8 | 27.6 |
| 1. Oil company tax | 7,902.6 | 8,895.1 | 9,479.6 | 8,145.5 | 5,978.0 | 7,774.5 | 30.1 |
| 2. LNG tax | 996.5 | 1,471.5 | 1,680.1 | 1,592.7 | 960.6 | 1,081.3 | 12.6 |
| II. Non-oil and non-gas revenues | 4,954.5 | 5,782.8 | 7,518.2 | 8,094.3 | 10,297.5 | 12,947.2 | 25.7 |
| 1. Income tax | 1,156.8 | 2,451.0 | 3,074.0 | 2,880.5 | 3,315.9 | 3,762.1 | 13.5 |
| Individual | 281.6 | 577.6 | 797.3 | 720.5 | 940.4 | — | — |
| Corporate | 875.2 | 1,873.5 | 2,276.7 | 2,160.0 | 2,375.5 | — | — |
| 2. M.P.O. | 741.5 | — | — | — | — | — | — |
| 3. Sales tax | 487.1 | — | — | — | — | — | — |
| 4. Import sales tax | 298.9 | — | — | — | — | — | — |
| 5. Value-added tax, luxury tax | — | 958.2 | 1,666.4 | 2,143.3 | 3,546.0 | 4,787.6 | 35.0 |
| 6. Import tax | 678.0 | 681.4 | 717.1 | 580.0 | 661.7 | 1,068.3 | 61.4 |
| 7. Consumption tax | 687.9 | 727.5 | 963.3 | 1,054.8 | 1,075.9 | 1,331.5 | 23.8 |
| 8. Export tax | 88.1 | 123.6 | 101.7 | 78.8 | 70.9 | 144.4 | 103.7 |
| 9. IPEDA (Local tax payment) | 130.3 | 150.6 | 167.4 | — | — | — | — |
| 10. Real estate tax | — | — | — | 284.0 | 274.0 | 322.0 | 17.5 |
| 11. Other taxes | 183.9 | 75.4 | 96.4 | 119.0 | 189.5 | 272.0 | 43.5 |
| 12. Other incomes than taxes | 502.0 | 615.0 | 731.9 | 953.9 | 1,049.3 | 1,259.3 | 20.0 |
| 13. Incomes related to sales of petroleum fuel | — | — | — | — | 114.3 | — | — |
| B. Development revenue | 2,741.0 | 4,411.0 | 4,368.1 | 3,589.1 | 5,547.0 | 7,160.6 | 29.1 |
| I. Program aids | 5.0 | 39.5 | 70.9 | 81.4 | 121.3 | 1,163.0 | 858.8 |
| II. Project aids | 2,736.8 | 4,371.5 | 4,297.2 | 3,507.7 | 5,425.7 | 5,997.6 | 10.5 |
| Total | 16,565.4 | 20,560.4 | 23,046.0 | 21,421.6 | 22,783.1 | 28,963.6 | 27.1 |

Source : Prepared according to the figures announced by the government

Table II-5 Transition of National Budget of Indonesia (2) (Unit: billion rupiahs)

| Expenditure \ Year | 1983/84 | 1984/85 | 1985/86 | 1986/87 | 1987/88 | 1988/89 | % of increase/ decrease to the previous year |
|---|---|---|---|---|---|---|---|
| A. Ordinary expenditure | 7,275.1 | 10,101.1 | 12,399.0 | 13,125.6 | 15,026.5 | 20,066.0 | 33.5 |
| I. Personnel expenses | 2,597.1 | 3,189.5 | 4,177.3 | 4,212.6 | 4,316.9 | 4,816.3 | 11.6 |
| 1. Food allowance | 344.0 | 415.7 | 482.5 | 482.5 | 482.5 | 482.5 | 0 |
| 2. Salary, wage, pension | 1,834.5 | 2,307.9 | 3,115.8 | 3,211.1 | 3,276.1 | 3739.2 | 14.1 |
| 3. In-kind wage | 271.3 | 256.6 | 313.3 | 313.3 | 315.0 | 323.2 | 2.6 |
| 4. Other expense on domestic personnel | 93.4 | 99.9 | 116.6 | 116.6 | 118.0 | 140.8 | 19.3 |
| 5. Expense on personnel abroad | 54.3 | 79.4 | 89.1 | 89.1 | 125.3 | 130.6 | 4.2 |
| II. Non-personnel expenses | 1,148.9 | 1,263.9 | 1,529.9 | 1,366.1 | 1,175.1 | 1,333.2 | 13.5 |
| 1. Domestic non-personnel expenses | 1,098.8 | 1,207.8 | 1,451.8 | 1,296.7 | 1,086.2 | 1,222.0 | 12.5 |
| 2. Foreign non-personnel expenses | 50.1 | 56.1 | 78.1 | 69.8 | 88.9 | 111.2 | 25.1 |
| III. Local supplements | 1,388.4 | 1,784.6 | 2,590.4 | 2,639.7 | 2,649.1 | 2,893.0 | 9.2 |
| 1. Irianjaya | 43.2 | 48.2 | 2,349.0 (Personnel) | 2,374.3 | 2,433.7 | 2,656.1 | 9.1 |
| 2. Others | 1,345.2 | 1,736.4 | 241.4 (Non-personnel) | 265.4 | 215.4 | 236.9 | 10.0 |
| IV. Repayment of loans | 1,416.8 | 2,686.1 | 3,559.1 | 4,232.2 | 6,805.4 | 10,648.0 | 56.5 |
| 1. Domestic | 30.0 | 30.0 | 30.0 | 40.0 | 40.0 | 40.0 | 0 |
| 2. Foreign | 1,386.8 | 2,656.1 | 3,529.1 | 4,183.2 | 6,765.4 | 10,608.0 | 56.8 |
| V. Provisions expenses | — | — | — | 417.4 | — | — | — |
| VI. Others | 723.5 | 1,177.0 | 602.3 | 266.2 | 80.0 | 375.5 | 369.4 |
| 1. Oil supplements | 698.5 | 1,147.0 | 532.3 | 142.4 | — | 266.5 | — |
| 2. Others | 25.0 | 30.0 | 70.0 | 123.8 | 80.0 | 109.0 | 36.3 |
| B. Development expenditure | 9,290.3 | 10,459.3 | 10,647.0 | 8,296.0 | 7,756.6 | 8,897.6 | 14.7 |
| I. Expense in rupia | 6,553.5 | 6,087.8 | 6,349.8 | 4,788.3 | 2,330.9 | 2,900.0 | 24.4 |
| II. Project aid | 2,736.8 | 4,371.5 | 4,297.2 | 3,507.7 | 5,425.7 | 5,997.6 | 10.5 |
| Total | 16,565.4 | 20,560.4 | 23,046.0 | 21,421.6 | 22,783.1 | 28,963.6 | 27.1 |

Source : Prepared according to the figures announced by the government

## SECTION 2 STRUCTURE OF INDUSTRIES AND TRADE

### 2.1 Industries

Table II-6 shows the transition of GDP by industry in 1984, 1985 and 1986.

Table II-6 Transition of Industrial Structure

(Units: billion rupiahs, %)

| Industry | 1984 | | 1985 | | 1986 | |
|---|---|---|---|---|---|---|
| | Amount | Component Ratio | Amount | Component Ratio | Amount | Component Ratio |
| (Values at 1983 prices) | | | | | | |
| Agricultural, Forestry and Fishery Industries | 18,431.1 | 23.4 | 19,209.0 | 23.7 | 19,687.0 | 25.8 |
| Mining Industry | 14,788.7 | 18.4 | 13,980.5 | 16.3 | 14,572.0 | 11.1 |
| Manufacturing Industry | 9,770.3 | 12.7 | 10,579.1 | 13.5 | 11,161.5 | 14.4 |
| Electricity, Gas and Water Services | 550.3 | 0.8 | 594.9 | 0.8 | 633.7 | 0.9 |
| Construction | 4,393.8 | 5.5 | 4,508.0 | 5.6 | 4,497.6 | 5.4 |
| Transportation and Communications | 4,442.4 | 5.9 | 4,481.8 | 6.5 | 4,541.6 | 6.6 |
| Commerce | 12,159.7 | 6.1 | 12,363.0 | 5.4 | 12,730.3 | 6.7 |
| Financial Business | 2,422.3 | 3.1 | 2,430.6 | 3.0 | 2,558.5 | 3.4 |
| House Holdings | 2,072.3 | 2.6 | 2,145.2 | 2.6 | 2,220.7 | 2.7 |
| Public Business | 5,996.7 | 7.4 | 6,438.5 | 8.4 | 6,601.4 | 8.6 |
| Services | 3,116.8 | 4.3 | 3,180.2 | 4.2 | 3,270.2 | 4.3 |
| Gross Domestic Products | 78,144.4 | 100.0 | 79,910.8 | 100.0 | 82,474.5 | 100.0 |

Source : 1987 Fiscal Budget Message and the Central Bureau of Statistics, "National Income of Indonesia"

In this table, the GDP component ratio for the mining industry has declined, whereas that for the manufacturing industry has risen. It has been almost stable for the other industries. These phenomena are considered to be the result of a gradual change in the industrial structure of the Republic of Indonesia from primary industry to secondary and tertiary industries.

(1) Manufacturing Industry

1) Current situation in the manufacturing industry

The manufacturing industry in the Republic of Indonesia is largely divided into two categories; large-scale enterprises centering around a small number of state-run strategic enterprises, and small home manufacturers that form the majority. There is an extreme difference in the value added output of these two groups, showing what is called a polarized structure. This phenomenon can also be seen in Table II-7 "Composition of the Indonesian Manufacturing Industry by Business Size". In this table, the value added for a small home manufacturer in 1986 has not been made public.

In order to understand the manufacturing industry in the Republic of Indonesia, the subsequent analysis describes national strategic enterprises.

The strategic industries in the Republic of Indonesia have been determined by the Ministerial Council for Raising Strategic Industries presided over by Minister Habibie, and eight strategic enterprises are listed.

① Airplane manufacturing

The state enterprise IPTN in Bandung produces four kinds of helicopters and two kinds of small airplanes under license contracts. Its number of employees is 13,000.

② Shipbuilding

In cooperation with Mitsui Engineering & Shipbuilding, the state enterprise PAL builds 3,500-ton class tankers and freighters. Its number of employees is 5,727.

③ Land transportation machinery

The automobile industry mainly comprises private enterprises. Six domestic groups produce automobiles as joint ventures with major enterprises in Europe, Japan and the U.S.A. Commercial vehicles such as buses and trucks are produced rather than passenger cars.

The state enterprise INKA manufactures railway vehicles under a license contract with Nippon Sharyo Seizo. Its number of employees is 830.

④ Communication equipment

The state enterprise INTI produces digital telephone switching systems under a license contract with Siemens of West Germany, and cellular telephones as a joint venture with Japan Radio. Also, under license

Table II-7 Composition of the Indonesian Manufacturing Industry by Business Size (1979 & 1986)

| Item / Year / Size | Number of Businesses | | Number of Employees | | Value-added Production Indicated by Market Price (billion rupiahs) | | Employees per Office | | Value-added Production per Company (million rupiahs) | | Value-added Production per Employee (thousand rupiahs) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1979 | 1986 | 1979 | 1986 | 1979 | 1986 | 1979 | 1986 | 1979 | 1986 | 1979 | 1986 |
| Large-/mid-size | 7,960 | 12,902 | 870,000 | 1,684,035 | 1,660.5 | 8,066 | 109.3 | 130.5 | 208.6 | 625.2 | 1,909.0 | 4,790.0 |
| (%) | (0.5) | (0.8) | (19.4) | (31.9) | (77.6) | N.A. | – | – | – | – | – | – |
| Small-size (%) | 113,024 | 98,129 | 827,100 | 750,311 | 187.3 | N.A. | 7.3 | 7.6 | 1.7 | N.A. | 226.0 | N.A. |
| | (7.4) | (6.4) | (18.4) | (14.2) | (8.8) | | – | – | – | – | – | – |
| Home manufacturer | 1,417,803 | 1,422,593 | 2,794,800 | 2,852,190 | 291.4 | N.A. | 2.0 | 2.0 | 0.2 | N.A. | 104.0 | N.A. |
| (%) | (92.1) | (92.8) | (62.2) | (53.9) | (13.6) | | – | – | – | – | – | – |
| Total | 1,538,787 | 1,533,624 | 4,461,900 | 5,286,536 | 2,139.2 | N.A. | 2.0 | 3.4 | 1.4 | N.A. | 476.0 | N.A. |
| (%) | (100.0) | (100.0) | (100.0) | (100.0) | (100.0) | | – | – | – | – | – | – |

(Notes) Large-/mid-size: 20 employees or more

Small-size: 5 to 19 employees

Home manufacturer: 1 to 4 employees

Sources: "Industri Kecil, 1979", Economy Census 1986, B.P.S.

contacts with NEC and ITT of the U.S.A., it constructs ground facilities for wireless communications. Its number of employees is 1,500.

⑤ Steel

The state enterprise KRAKATAU STEEL produces 3,500,000 tons of steel annually and exports it as well. Its number of employees is 7,000.

⑥ Gunpowder manufacturing

The state enterprise DAHANA produces dynamite used for mining and construction. Its number of employees is 750.

⑦ Electronics

With four electronics-related laboratories as the core, PUSAT LEN produces parabolic antennas, wireless transmitters, and so on. Its number of employees is 450.

⑧ Weapons manufacturing

Under a license contract with a Belgian company, the state enterprise PINDADT produces rifles and bullets. Its number of employees is 5,200.

These strategic enterprises were not established only to obtain foreign currency. Rather than that, the Indonesian government invested to establish them after considering the potential domestic demand due to the specific conditions and geographic features of the Republic of Indonesia.

As described in 1.1, the Republic of Indonesia extends from east to west by a distance equivalent to that between New York and Los Angeles, and has almost countless small islands. Accordingly, securing means of transportation and communications is an essenitial condition. Therefore, the Indonesian government has fostered such industries as airplane, shipbuilding, land transportation machines and communication equipment. At the same time, the Indonesian economy will maintain a prosperous condition if foreign currency is obtained by exporting these products.

On the other hand, technologies in these fields have already been established in developed countries. Currently, the Indonesian government is introducing them by making license contracts and joint venture contracts with private companies in Europe, U.S.A. and Japan. These strategic enterprises are categorized as part of the metal products and machine manufacturing industries in Table II-8 and belong to a minor group even among large enterprises, from the viewpoint of the number of businesses and employees. Regardless of the size of a business, the food and tobacco industry has the

Table II-8 Number of Businesses Industry, by Size and by Number of Employees

| Size / Industry | Large Enterprise | | Mid-size Enterprise | | Small-size Enterprise | | Home Manufacturer | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Businesses | Employees | Businesses | Employees | Businesses | Employees | Businesses | Employees | Businesses | Employees |
| Food/tobacco | 661 | 405,210 | 3,219 | 114,239 | 36,953 | 281,457 | 443,796 | 1,077,435 | 484,629 | 1,878,341 |
| Textile/leather | 647 | 296,255 | 2,222 | 85,105 | 14,865 | 122,010 | 149,336 | 210,620 | 167,070 | 713,990 |
| Wooden/furniture | 345 | 149,799 | 859 | 32,084 | 15,501 | 111,600 | 467,135 | 765,600 | 483,840 | 1,059,083 |
| Paper/paper product, printing | 134 | 37,879 | 470 | 18,801 | 2,706 | 23,156 | 9,136 | 17,270 | 12,446 | 97,106 |
| Chemical product | 518 | 201,673 | 1,108 | 46,958 | 2,552 | 22,522 | 7,844 | 13,514 | 12,022 | 284,667 |
| Ceramic/stone | 127 | 50,914 | 1,122 | 38,081 | 12,148 | 89,326 | 105,907 | 265,835 | 119,304 | 444,156 |
| Basic metal | 24 | 15,115 | 6 | 532 | – | – | – | – | 30 | 15,647 |
| Metal product/machinery | 412 | 141,990 | 871 | 37,385 | 4,901 | 36,842 | 33,403 | 87,640 | 40,587 | 302,857 |
| Others | 26 | 7,034 | 131 | 4,981 | 8,503 | 63,398 | 205,036 | 414,276 | 213,796 | 489,689 |
| Total | 2,894 | 1,305,869 | 10,008 | 378,166 | 98,129 | 705,311 | 1,422,593 | 2,852,190 | 1,533,624 | 5,286,536 |

Large enterprise: 100 employees or more

Mid-size enterprise: 20 to 99 employees

Small-size enterprise: 5 to 19 employees

Home manufacturer: 1 to 4 employees

Sources: Economy Census 1986, B.P.S.

largest number of employees and businesses, followed by the wooden furniture manufacturing industry. From the viewpoint of value-added output, when limited to large- and medium-scale manufacturing industries, the food and tobacco manufacturing industry has the greatest, followed by the chemical product manufacturing industry, and then by the metal product and machine manufacturing industry.

In the manufacturing industries of developed countries, such fields as automobiles, electronics and electrical/machinery make up the bulk of their industrial output. In the Republic of Indonesia, on the other hand, most of the major products have a home manufacturer's characteristic.

As already stated, large enterprises give high value-added production compared with the home manufacturers. This will be because of differences in production control and production efficiency between the two groups, but not of the difference of values added to their products. However, the products manufactured by some of the state-run strategic enterprises are similar to those manufactured in developed countries, and these enterprises make products with higher added values than other products. In world markets, on the other hand, the demand for products from such industrial fields as food and tobacco, textile and leather products, wooden products and furniture, which have the largest labor population in the Republic of Indonesia, does not seem to be great enough to become a sufficient income source of foreign currency for the Republic of Indonesia. It is instead expected that necessary foreign currency would be obtained through the industrial fields that the state-run strategic enterprises are involved in; that is, technological industries such as shipbuilding, airplanes, steel making and electrical machinery, by acquiring international competitiveness.

2) Problems in the manufacturing industry

The manufacturing industry in the Republic of Indonesia is still in a developing phase and is suffering from various problems.

First, there is no mutual support system between the state-run strategic enterprises and the other enterprises in the design/production of products and procurement of parts. Taking developed countries as an example, the shipbuilding, airplane, electrical machinery and automobile industries have many subcontractors which support them. These subcontractors research and produce in cooperation with them and supply parts. In the Republic of Indonesia, however, the state-run strategic enterprises have extremely strong ties with overseas enterprises rather than local industries for the design and procurement of parts. As a result, local industries have not been brought up.

Since the parts manufacturing industry hardly exists in the Republic of Indonesia, it depends on parts procurement from overseas countries, and as a result, cannot obtain a high value-added income. Currently, the industrial technology required is only for parts procurement or assembly. However, this technology will not be satisfactory for manufacturing parts, which will require in the near future controlling the quality of finished products and verifying imported technologies.

Next, it was confirmed during the field survey that products are rarely designed by themselves, even by the state-run strategic enterprises. This will also be the case for almost all firms. Most of the designs are provided by overseas enterprises, based on license contracts. Although the airplane industry does some design by itself, most of the businesses have assembling work as their main activity. Therefore, they should completely master technologies from overseas as early as possible and establish their own design methods. This would reduce by a large amount the license fees paid to overseas enterprises, and increase the international competitiveness of their products.

To design products by themselves, it is necessary not only to directly use the technologies and designs of foreign enterprises, but also to verify those technologies by themselves for assimilation purposes. The need for verification has been proven from the fact that industrial countries also have passed through a similar process during their growing period. In such technology verification and self-designing processes, it is necessary to have methods for the verification of safety and optimization, and a computer is an indispensable tool. Since there are not sufficient computers with necessary functions and personnel for them, however, it is almost impossible to carry out sufficient verification of technologies and self-designing.

Thus, the Republic of Indonesia is currently facing a slowdown in technological development and growth due to the vicious cycle defined below.

Dependence on foreign technology → Not designing domestically → Not carrying out technological calculations/Not manageing technological information systems → Low use of comouters → Inability to develop and produce items for import substitution and for international competitiveness → National income remaining devendent on oil and gas → Dependence on foreign technology.

In order to overcome this vicious cycle, it is necessary to introduce computers as an effective means for realization of domestic design capability. When computers are introduced and the environment for domestic design is prepared, designers and researchers become accessible to computers; they are then able to assess, verify and simulate overseas technologies. In the long run, import substitution and export encouragement through international

competition are expected to be realizaed.

(2) Other Major Industries

1) Agriculture

The production volume of rice, which is a staple food in the Republic of Indonesia, is increasing year by year. In 1986, 26,280,000 tons of rice was produced. The per capita consumption has reached 160 kg and self-sufficiency seems to have almost been established. As a background, the Indonesian government has conducted irrigation works, adopted collective farming methods, introduced new strains and used chemical fertilizers in recent years to contribute to a larger production volume.

However, most of the farmers are tenants, and they mainly produce rice for their own consumption and cannot afford to market it. Therefore, the amount of marketed rice is about 15 % of the total production, which is extremely low. The amount of rice needed to be stored by the government cannot be fully secured, and such self-sufficiency may collapse, depending on the climate conditions in a year. Also, it is necessary to increase the production of rice because of a future increase in population, so that one still cannot be optimistic about the self-sufficient system.

2) Forestry

Although it has been only twenty years since full-scale forestry development was started in the Republic of Indonesia, there is a destruction of nature caused by rapid deforestation. For this reason, the Indonesian government is bringing up a plywood industry, while promoting afforestation. In order to improve the degree of domestic woodworking, exports of unprocessed timber are resticted. The Republic of Indonesia is the world's largest plywood exporting country, with its export value reaching 1.04 billion dollars in 1986.

3) Mining industry

Only about a quarter of the country has been logged in a geological survey map so far and there are still undiscovered mineral resources. Only oil, natural gas, tin, nickel, bauxite, copper and coal have been confirmed for their reserves.

According to a survey by the U.S. Department of Energy (1984), oil reserves are estimated to be about 21 billion barrels, of which about 11.5 billion barrels, that is 50 % or a little more, have already been lifted (at the end of 1987). The remaining reserves are equivalent to a 20-year span for

the output in 1987, 480 million barrels. Natural gas reserves are estimated to be about 50 trillion cubic feet (Oil & Gas Journal, January, 1987). This amount is equivalent to about a 30-year span for the output in 1987, 1.7 trillion cubic feet.

As described in Section 1, the Indonesian government is promoting industrialization in order to find national revenue sources in non-oil and non-gas fields. Unless industrialization is achieved by the year 2010, the Republic of Indonesia may be driven into a tight corner. This is not limited to the Republic of Indonesia alone, but is a problem of global energy resources. Particularly, it is most significant to Japan which depends on Indonesian energy resources.

## 2.2 Trade

### (1) Outline of Exports and Imports

Table II-9 and Table II-10 show transitions of export and import amounts. As is clear from these tables, the Republic of Indonesia exports primary products such as mineral resources and agricultural, forestry and marine products, and imports industrial products, intermediate goods and capital goods.

Table II-9 Transition of Exports (Unit: million dollars)

| Export Product | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| Food/Livestock | 1,093.1 | 1,368.5 | 1,383.1 | 1,773.8 | 1,581.7 |
| Beverage/Tobacco | 47.8 | 43.5 | 48.7 | 68.7 | 82.2 |
| Raw material | 1,649.7 | 1,761.9 | 1,403.1 | 1,473.1 | 1,725.7 |
| Oil/Gas | 16,153.0 | 16,044.6 | 12,753.3 | 8,309.6 | 9,585.5 |
| Animal & plant oil | 148.7 | 174.9 | 414.1 | 165.7 | 174.7 |
| Chemical | 119.0 | 169.7 | 210.0 | 260.3 | 200.7 |
| Processed material products | 1,349.7 | 1,565.3 | 1,804.4 | 1,984.4 | 3,044.0 |
| Machinery (incl. transportation machines) | 133.3 | 223.2 | 98.0 | 62.6 | 54.7 |
| Sundries | 213.2 | 372.2 | 437.1 | 678.0 | 657.1 |
| Special goods | 238.4 | 164.0 | 30.9 | 28.8 | 130.9 |
| Total | 21,145.9 | 21,887.8 | 18,586.7 | 14,805.0 | 17,237.2 |

Source: Statistical data according to the Central Bureau of Statistics

Table II-10 Transition of Imports (Unit: million dollars)

| Import Product | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| Food/Livestock | 1,134.5 | 676.2 | 556.1 | 610.0 | 686.3 |
| Beverage/Tobacco | 27.8 | 29.1 | 20.9 | 28.1 | 30.4 |
| Raw material | 675.6 | 883.4 | 729.0 | 830.1 | 623.6 |
| Oil/Gas | 4,149.9 | 2,705.1 | 1,287.7 | 1,106.9 | 1,423.8 |
| Animal & plant oil | 12.1 | 51.7 | 35.5 | 17.9 | 108.2 |
| Chemical | 1,893.0 | 2,137.4 | 1,916.6 | 1,909.7 | 2,394.6 |
| Processed material products | 2,351.5 | 1,885.1 | 1,717.9 | 1,668.3 | 1,701.9 |
| Machinery (incl. transportation machines) | 5,684.0 | 5,036.9 | 3,617.0 | 4,117.5 | 4,548.6 |
| Sundries | 358.8 | 378.6 | 313.9 | 389.3 | 429.9 |
| Special goods | 64.6 | 98.6 | 46.5 | 40.6 | 81.2 |
| Total | 16,351.8 | 13,882.1 | 10,259.1 | 10,718.4 | 12,328.5 |

Source: Statistical data according to the Central Bureau of Statistics

The export values of oil and gas account for over half of the total. With the export values of oil and gas excluded, the trade balance has been in deficit every year. Since this deficit is not decreasing each year, the indsutry obtains the funds (foreign currency) required to make up for the deficit and balance the national budget every year by exporting oil and gas (Fig. II-4). As described in item 3) above, oil and gas reserves are not limitless, only about 500 million barrels having been allowed to be lifted in recent years, and it has been more practical to obtain financial aids from overseas countries.

In addition, petrochemical products that utilize oil and gas as raw materials, are imported in a relatively large amount. Domestic construction of oil refineries, petrochemical plants, etc. can restrain the export of precious natural resources, accordingly substitute the import of these products, and finally, export them. In practice, however, there are not sufficient project fund to achieve this.

As described so far for the Republic of Indonesia, a shortage of internationally competitive products leads to exports of oil/gas and loans from overseas countries, and as a result of its austere budget, this has the effect of suppressing development expenditures. To overcome this vicious cycle, it is necessary to promote industrialization that will lead to importsubstitute products and export products.

Fig. II-5 shows the transition of trading partners for the Republic of Indonesia. Japan, U.S.A. and Singapore have the highest trading amounts with the Republic of Indonesia in that order in both exports and imports. In 1987,

the total of exports to these three countries accounted for about three quarters of its total export value.

Also, exports to European countries have been progressively increasing in recent years. For imports as well, these three countries account for half of the total import amount. However, import amounts from these countries are gradually decreasing as exports and trade with other countries are increasing. Although a specific name is not defind in the ASEAN countries in Fig. II-5, it can be added that Singapore accounts for about 80 % of the total amount.

(2) Governmental Policies Related to Exports and Imports

To cope with the trend of increasing import goods, the Indonesian government has worked out the following export promotion measures for non-oil and non-gas products.

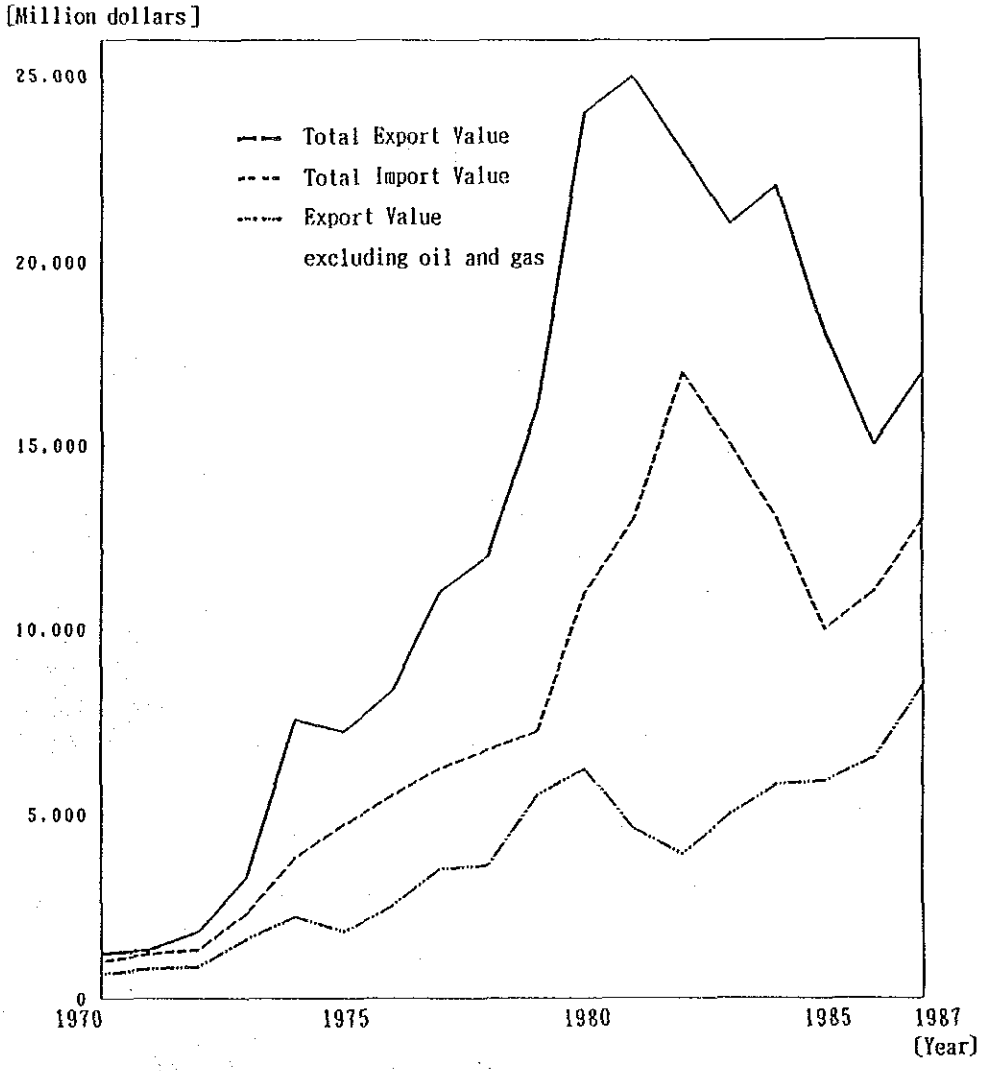
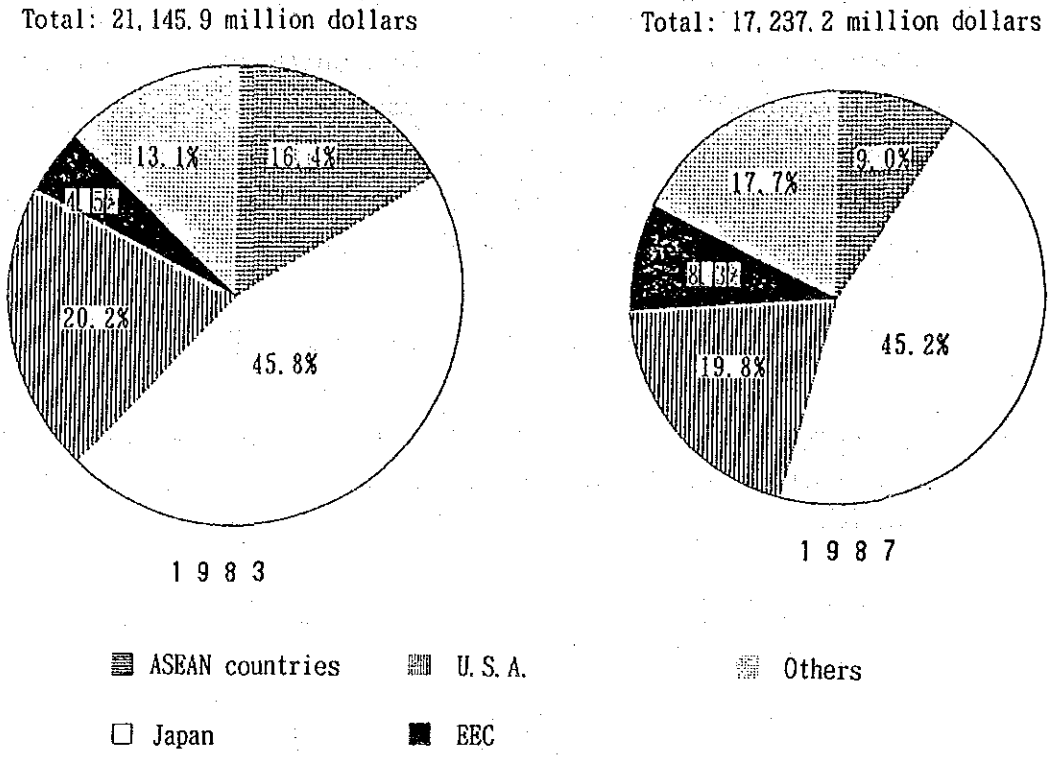



Fig. II-4 Comparison of Export and Import Trading (1970-1987)

Sourece :Statistical data according to the Central Bureau of Statistics

(1) Exports




(2) Imports

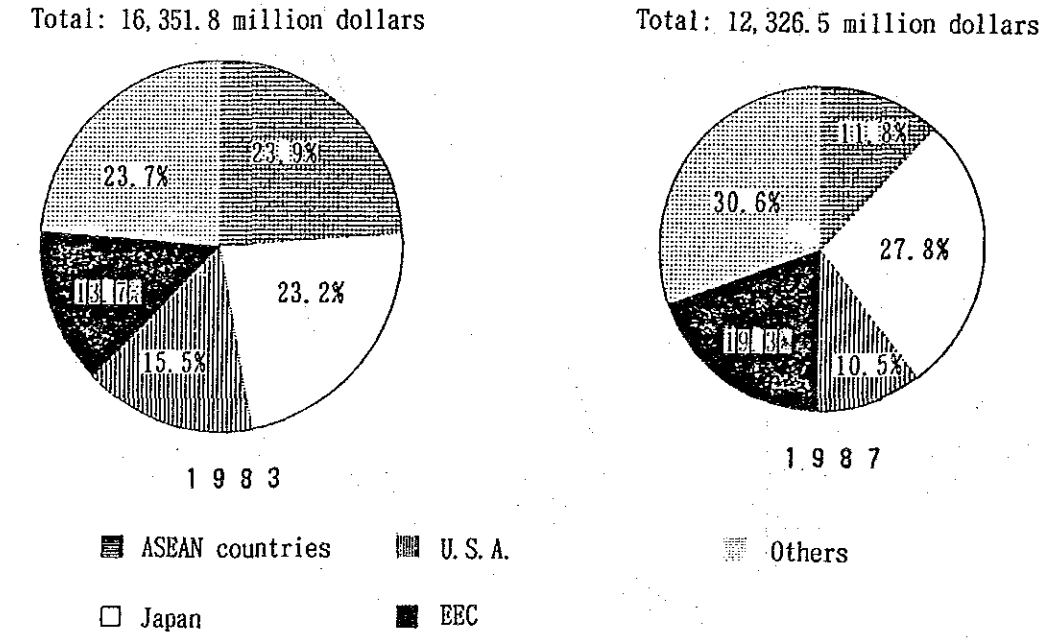



Fig. II-5 Trading Partners in 1983 and in 1987

Source: Statistical data according to the Central Bureau of Statistics

1) May 6, 1986 ("May 6 Package")

① Partial relaxation of the mandatory use of domestic products as an input to exporting products

② Refund of import duties, etc.

③ Tariff exemption system

④ Setting up a bonded area

2) Policies on Oct. 25, 1986

① Reduction of import duties

② Introduction of a tariff system

③ Expansion of an export financing system

3) Policies on Jan. 15, 1987

① Expansion of import-tax-free items to 103 items

② Expansion of importable items from authorized import trading companies to general registered import traders or manufacturers-cum-limited import traders

③ Expansion of import-tax-reduced items to 55 items

4) Feb. 3, 1987

Exemption of import duties on manufacturing materials for automobile

5) Dec. 24, 1987 ("December 24 Package")

The following list provides the major contents in the Package:

① Abolition of a special export license

② Relaxation of the mandatory use of domestic products as an input to exporting products, and expansion of employable foreign laborers in relevant businesses

③ Exemption of import tax on machine tools at exporting plants

Among the foregoing export promotion measures on non-oil and non-gas products, it can be realized that emphasis was placed on the relaxation of import taxes on manufacturing materials for exporting products. Judging from these policies, it can be concluded that current industries in the Republic of Indonesia are gaining profits out of product assembling processes, and that an emphasis is also put on inviting foreign investment.

## 2.3 Outline of Business Investments

Foreign investments are becoming active because of the promotion of international competitiveness of domestic products by deregulation policies

described in the foregoing paragraph, strengthening of international competitiveness by devaluation of the local currency (rupiah) in September 1986, relaxation of investment regulations, simplification of investment procedures, etc.

According to the totalized data by JETRO (Japan External Trade Organization), the number of new investments has increased from 28 in 1986 to 53 in 1987, and that of expanded investments from 23 (158.29 million dollars) in 1986 to 51 (420.31 million dollars) in 1987. New investments in 1987, which include few large plants, are particularly concentrated on the manufacturing industry, and the type of business varies. 31 of these 53 cases (233.70 million dollars) have been investments for the manufacturing industry. For expanded investments in 1987, 47 of the 51 cases (408.85 million dollars) have been for the manufacturing industry, centering on export-oriented fields such as textiles, chemical products, machines, instruments and metal products.

Although these export-oriented investments are partly due to the low growth of domestic markets, they show more positive aspects of business expansion to improve the international price competitiveness of the Republic of Indonesia. It is believed that export-oriented investments will further increase as the investment environment is arranged more suitably in future.

## 2.4 Regulations Related to Manufacturing Industry

### (1) Industrial Standards

The SII Standards have been enacted as the Indonesian industrial standards. As of the end of December 1987, 2,212 industrial standards had been enacted, but some are still being amended for full establishment. Also, the Indonesian government is introducing foreign technologies and has a plan to incorporate the most suitable of many different foreign standards into the SII standards. It would take a considerable time for the full establishment of these standards.

In future, as the SII Standards are complated, self-design and manufacturing procedures will gradually be established. By doing so, it is believed that the Republic of Indonesia can realize industrialization step by step, and finally, export industrial products with high values added.

### (2) Intellectual Property (Copyright)

Although the Copyright Act was enacted in Law #6 in 1982, the authorities have hardly maintained its control and this act does not refer to computer

technology, having no protection of right for the software. These facts have discouraged new software development. In order to overcome these conditions, measures to enforce an intellectual property were worked out in January 1987 to provide regulations for the following matters:

1) To extend the copyright protection period to 20-25 years.
2) To protect foreign works within the Republic of Indonesia as well.
3) To approve bilateral and multilateral agreements as to copyright protection.
4) To intensify penalties.

Furthermore, the "Copyright Act Amendment" was enacted in September 1987 to review intellectual property, including that for computer software, film and music. This act revised the protection period for video works, computer software, musical media, and translations to 25 years, and enacted concrete penalties.

In reality, however, control is still insufficient and one can see many people violating the law on the streets. On the other hand, software handling is a delicate matter because strict control may hold back the diffusion of overseas technologies.

### (3) Promotion Policy for the Use of Domestic Products

Like the other developing countries, the Republic of Indonesia is promoting the use of domestic products under strong guidance from its government. The following items are currently controlled, only typical items being mentioned for automobiles, and major items for the others:

① Mandatory use of domestic-assembly parts for diesel engines
② Mandatory use of domestic-assembly parts for commercial vehicles
③ Mandatory use of domestic-assembly parts for motorcycles and motor scooters (70 to 200 cc)
④ Mandatory use of domestic-assembly parts for complex monoaxial hand tractors
⑤ Mandatory use of domestic-assembly parts for mini-tractors
⑥ Mandatory use of domestic-assembly parts for agricultural and estate tractors (medium- and large-sized)
⑦ Mandatory use of domestic steel such as for plant construction materials
⑧ Mandatory use of domestic-assembly parts for 2 kWh meters
⑨ Mandatory use of domestic-assembly parts for construction equipment such as bulldozers

⑧ Mandatory use of domestic-assembly parts for 2 kWh meters
⑨ Mandatory use of domestic-assembly parts for construction equipment such as bulldozers
⑩ Mandatory use of domestic-assembly parts for rice cleaning machines and rice hullers
⑪ Mandatory use of domestic-assembly parts for home appliances (electric fans, radios, TVs, air-conditioners, tape recorders, radio cassette tape recorders, refrigerators)
⑫ Mandatory use of domestic-assembly parts for wireless and communication equipment
⑬ Mandatory use of domestic-assembly parts for exhaust fans
⑭ Mandatory use of domestic-assembly parts for amplifiers
⑮ Mandatory use of domestic-assembly parts for sewing machines
⑯ Mandatory use of domestic-assembly parts for forklifts
⑰ Mandatory use of domestic-assembly parts for electric motors
⑱ Mandatory use of domestic-assembly parts for machine tools
⑲ Fully manufactured modules for engines, transmissions, rear axles, propeller shafts, braking systems, steering systems and clutch systems for 4-wheel commercial vehicles

As previously described, protective measures are also applied to products manufactured by the state-run strategic enterprises. On the other hand, the following exceptional measures were taken in the "December 24 Package" released on Dec. 24, 1987.

Enterprises which export over 65 % of their products (85 % for the clothing manufacturing industry) can procure basic materials, intermediate materials and auxiliary materials;

① in the domestic market at prices lower than the import prices on international markets.

or

② from overseas without any import restrictions.

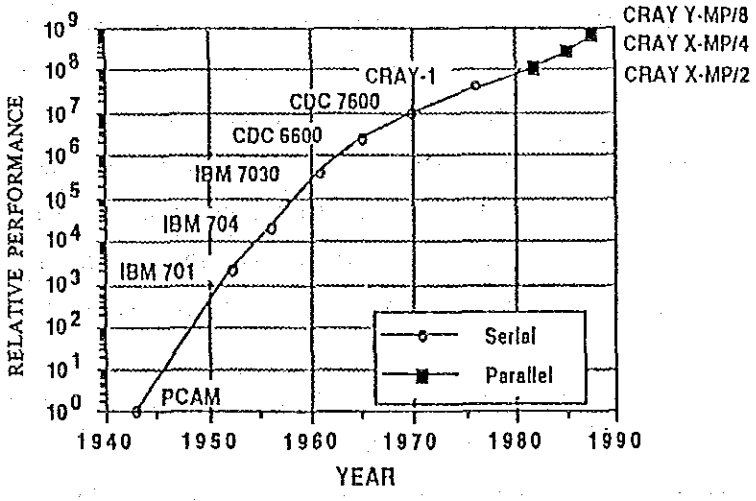
Thus, the Republic of Indonesia is shifting its attitude from conventional strict promotion policies for the mandatory use of domestic products, which has brought about a high-cost economy, to a more flexible attitude.

## SECTION 3 TECHNOLOGICAL DEVELOPMENT TRENDS

### 3.1 Current Situation and Problems of Technological Development in the Republic of Indonesia

In the following passages, the current situation and problems of technological development in the Republic of Indonesia are discussed in contrast to examples in developed countries.

One of the technological fields where the performance of products has been most rapidly improving is the field of computers, and the technology which supports computers has been developing remarkably. Fig II-6, for example, shows the trend of the computing power in Los Aramos National laboratory (LANL).




Note: The capability of punched-card accounting machine is counted one.

Fig. II-6 Trend in execution rate at LANL.

Source : Jack Worlton, "Technology Forecasting for Supercomputers", September, 1988, the JSME Seminar, Tokyo

Computers are made by the most advanced technology, and there has been keen competition among developed countries, especially between Japan and the U.S.A., where a huge amount of money has been invested for technological development. This severe competition is supported by technological development.

The technological development that has been carried out in the Republic of Indonesia may be understood more easily if we study the four-stage theory

announced by Minister Habibie regarding the industrialization of developing countries. As mentioned previously, this four-stage theory is planned in such a way that the developing country should (1) manufacture mainly foreign country's products under license agreements, which may be called "copy manufacturing"; (2) design and manufacture new products by utilizing existing technologies; (3) develop the technology and create new products and new manufacturing process; and (4) create the highest level technology, thus reaching the level of truly developed countries. Presently, the Republic of Indonesia is fundamentally in stage 1 with the exception that some of the state-run enterprises have just advanced into stage 2. The Indonesian industry would be truly competitive in the international market only when it reaches stage 3. Judging from these present situations, we can understand the importance of technological development in the Republic of Indonesia.

Since the word "technology" has a very broad concept, we define this word as one of the engineering methods used for creating industrial products. This is supposed to be the method used for "a computerized qualitative and quantitative" prediction of the performance and safety design of products. It is also believed to be the method for rationalization and optimization of design. These methods are necessary for the development and design of new products. It also means predictive calculations with a computer that is used for changing the design, so as to rationalize the design and to reduce the production cost of products which have already been developed or are available in the market.

We believe that when the above-mentioned concept of technology is taken into consideration, technological development may have two meanings. One is to manufacture a new product or improve a product by using technology, and this type of technological development should be actively carried out by private enterprises which are directly involved in production. The second meaning of technological development is to develop the technology itself. This type of technological development is fundamentally the same as the research activities conducted in each engineering and science field of universities. It should be carried out not only in universities but also in research institutes such as PUSPIPTEK-Serpong and research centers in private companies as well.

Although this definition of technological development has been divided into two meanings, they are closely related. Generally speaking, existing technology alone is not sufficient to design any product, the development of new technology being generally necessary in such a case. Therefore, what is vital is cooperation between the industry that is directly related to production and such research institutes as the ones located in PUSPIPTEK-

Serpong. This cooperation is the most important function of the planned Center.

An example of an organization in a developing country which has similar functions to the planned computer center is the Systems Engineering Research Institute (SERI) of KAIST (Korean Advanced Institute of Science and Technology). KAIST is sponsored by the Korean government, and is responsible for evaluation and promotion over a broad range of scientific and technological fields. SERI serves as KAIST's computer center, and in addition to having acquired a full range of powerful computing hardware, is engaged in software development services.

SERI was established in 1967, and in 1969 installed a CDC3300, which at that time was a large and powerful computer. SERI has since been expanding steadily, and expects to place a CRAY-2 supercomputer in service during this year (1988). In addition, SERI is actively engaged in assembling a library of the state-of-the-art software packages.

SERI functions primarily as an internal section of KAIST, but also markets its computer time and engineering services in the private sector. In this manner, SERI is able to recover a portion of its operating costs. The Center being planned for the Republic of Indonesia would be expected to play a central role similar to that played by SERI in Korea, and to provide the computer and engineering services necessary for Indonesia's industrialization of the Republic of Indonesia.

### 3.2 Role of the Computer in Technological Development

As explained previously, when technological development is defined as the development of new products and the improvement of existing products, the importance of computer technology and especially application software becomes evident. At the same time, the conditions most urgently required in this situation are environmental, where multi-functional high-performance application software can be fully utilized and the highly trained engineers can actually use the application software. The role of the computer is discussed with the concept that one entire system consisting of software and hardware is represented by the word "computer". The role of computer covers a wide range of applications, but in this particular report, we discuss only the following methods which require analysis by computer:

① Safety analysis

② Simulations for designing

③ Optimization of design

① Safety analysis

Safety analysis means the calculation and analysis necessary to confirm the safety of products. Every factor supporting modern civilization such as industrial products, large-scale structures (buildings, bridges and dams), chemical plants, transporting machines (road vehicles, ship and aircraft) and power plants must be checked for safety as the minimum requirement, if they are to be accepted in society. The safety of some products may be analyzed by various experiments, but the role of the computer used for such analysis is almost limitless. However, it is also true that none of these artificial systems can never be "absolutely safe". Therefore, safety is judged by what is called a "trade off" between the usefulness and cost. In this sense, safety analysis is closely related to the optimization of design in ③ above.

Safety design also needs appropriate safety standards. These safety standards should be officially issued by a public organization that can certify that commercial products, structures, etc. meet the standard. When cerfified, approval for manufacture or construction can be given. It is necessary to establish such a system.

② Simulations for designing

The most important role of the computer used in the field of technological development is in simulation for designing. Before computers were used for a wide range of applications, new products were designed by skillful engineers with many years of experience and intuition, and by the "handbook". Experiments were used very little for verification. However, as people started using computers, they could simulate their designs in ways never possible before, thus enabling to judgement on the validity of their designs. As a result, the performance of machines, equipment, etc. could be greatly improved, or economical merits obtained by making a comparatively small change in the design. When, for example, the Boeing 737-300 was designed, the engines under the wings were mounted in a further-forward position and the performance of the aircraft was greatly improved as a result. (With the convertional design, engines were hung directly under the wings.)

③ Optimization of design

For designing one industrial product or a large-scale structure, a great number of parameters can be changed, and when designing, the most optimum combination of these parameters is chosen. The object of choosing this optimum combination is to ensure the optimum cost, optimum performance, etc. in relation to the safety, design, materials and production process. It is not easy to find parameters most suitable for these "objective functions". Many methods to optimize these problems have been proposed, but so far, none have been utilized for practical design. As a result, optimization of design is made by the trial-and-error method, which means making as many parameter combinations as possible and designing for each of such combinations. Each design is then evaluated and the best one is chosen. Therefore, without using computers, it is impossible to obtain the best design by making many trial designs.

As already described, computers are indispensable for technological development. Computers are also indispensable for the analysis of currently used commercial products, large-structures, etc., in order to ensure their safety, although this type of application of the computer cannot be regarded as direct technological development. This type of computer application has not yet been fully developed in the Republic of Indonesia, but as the four-stage theory raised by Minister Habibie is further materialized, the lack of application technology will become one of the most important problems to be solved.

Part II explained the outline of industries, economy and technology development in the Republic of Indonesia.

Before analyzing the required computer system in PUSPIPTEK-Serpong, the present situation and level of database use, computer use and education/ training in the Republic of Indonesia should be recognized and will be stated in PART III.

# PART III

# USE OF
# INDUSTRIAL TECHNOLGICAL INFORMATION
# AND THE CURRENT
# RELATED INFRASTRUCTURE
# IN THE
# REPUBLIC OF INDONESIA

## SECTION 1 COLLECTION AND DISTRIBUTION OF INDUSTRIAL TECHNOLOGICAL INFORMATION

### 1.1 The Collection and Distribution of Industrial Technological Information

#### (1) Problems Concerning Collection and Distribution of Industrial Technological Information

In order to view the current status of industrial technological information in the Republic of Indonesia, let us look at the present situation of the country's libraries. Table III-1 shows the distribution of books in libraries in the Republic of Indonesia and Table III-2, the numbers of books in the major domestic libraries. In general, the number of books available is still insufficient. The same thing can be said for PDII the Center for Sciencific Documentation and Information, the nation's leading document/information institute in the field of science and technology. Many other libraries now face problems which are even more serious. In the field of science and technology, especially, as the latest information tends to be dependent on foreign sources, a library of sufficient size becomes necessary to maintain the quality of information distribution.

Table III-1 Distribution of Books in 295 Libraries (1981)

| No. of Books | No. of Libraries |
|---|---|
| •40,000 books or more | 11 |
| •30,000 - 40,000 | 4 |
| •20,000 - 30,000 | 13 |
| •10,000 - 20,000 | 33 |
| • 1,000 - 10,000 | 182 |
| •Less than 1,000 books | 51 |
| •Not reported | 1 |
| TOTAL | 295 |

Source: Workshop and Conference on SCIENCE AND TECHNOLOGY INFORMATION SERVICES, Summary Report, 1986

In collecting industrial technological information, the use of databases has become increasingly important all over the world. In the Republic of Indonesia, however, due to reasons to be mentioned later, a database service has not yet become the major means of information distribution. Therefore, the role of libraries and document centers is of considerable significance for researchers, engineers, educators, students, etc. who use them in collecting industrial technological information. An information distribution means by

Table III-2 Number of Books in Major Libraries (1986)

| Name of Library | No. of Books (incl. reports, microfilm/microfiche, etc.) |
|---|---|
| ・PDII-LIPI | 147,617 |
| ・PUSTAKA, BOGOR | 95,000 |
| ・NATIONAL LIBRARY | 350,000 |
| ・BPPT LIBRARY | 3,500 |
| ・ITB, BANDUNG | 55,840 |
| ・BATAN, JAKARTA | 6,501 |
| ・PUSLITBANG GEOLOGI, BANDUNG | 8,451 |
| ・LEMIGAS, JAKARTA | 4,000 |
| ・LMK, JAKARTA | 13,000 |
| ・PERPUS, SENTRAL-LIPI, BANDUNG | 11,500 |

Source: Workshop and Conference on SCIENCE AND TECHNOLOGY INFORMATION SERVICES, Summary Report, 1986

computers and communication systems will considerably contribute to the convenience and benefit of the users, when properly established in future.

As an approach to use limited information resources in the nation more effectively, the so-called STI (Science & Technology Information) service has been promoted. In 1986, a workshop was held jointly by the Republic of Indonesia and the U.S.A. concerning science and technology information services to discuss various matters. These services aim at integrating information resources so that they are easily accessible to users in various fields. This, however, still remains in the planning stage.

(2) Development of Database Services and their Current Situation of Use

In the Republic of Indonesia, on-line database services are not yet widely used, with some exceptions like PDII, which has access to overseas databases to carry out document research. However, due to the high cost required for utilization of overseas databases, even specialized institutes can not afford it. Besides these cost problems, in consideration of the quality of communication lines and the number of users secured, it is almost too difficult to carry out, on a large scale, on-line database services within the country. On the other hand, under off-line database services, there is currently an approach in which various databases can be used at a relatively low cost by CD-ROM. For example, information can be provided locally through the use of such a medium.

The use or preparation of a database is promoted individually by

government offices and private enterprises. This is based on their own needs and is not intended to serve wide public use.

## 1.2 PDII (Center for Scientific Documentation and Information)

### (1) Objects and Activities

PDII (the Center for Scientific Documentation and Information), set up under LIPI (Indonesian Institute of Science), has been collecting and providing scientific and technological information, both domestic and foreign, since its foundation in 1965. PDII offers a comprehensive information service in the field of science and technology in the Republic of Indonesia. The similar institute in Japan is the Japan Information Center for Science and Technology (JICST). The objects and activities of PDII are summarized as follows.

① Provides documents and information
② Prepares STI (Scientific and Technological information) services
③ Prepares lists of scientific and technological materials published within and outside the Republic of Indonesia
④ Prepares library services in the scientific and technological field
⑤ Collects publications relating to science and technology in the country
⑥ Maintains and manages a scientific and technological documentation database
⑦ Compiles publications for promoting and distributing information
⑧ Carries out research relating to documentation
⑨ Has developed on STI network system
⑩ Evaluates and plans scientific and technological document/information services

At present, however, as described below, PDII is facing a lack of personnel and book volume, a restricted budget, and problems with the construction of computer-related facilities. These problems have to be overcome first to attain the ultimate goal.

### (2) Collection of Materials

The current situation of the PDII in collection of materials is shown in Table III-3, with categories of information resources according to users' demands being listed in Table III-4. The number of publications in Jakarta and Bandung is approximately 180 thousand in total, mainly consisting of technical

journals, periodicals and reports. PDII is rather regarded more as an information center than a libraries. Approximately 70% of users' requests is for overseas information sources. On the other hand, in the respect of collection and purchase of materials, the following problems are now being encountered, where an information provision service sufficient to satisfy every researcher has not yet been realized.

① A system has not been organized in which domestic science/technology publications are automatically passed to PDII from, for example, research institutes.

② Overseas publications cannot be satisfactorily purchased because of budgetary restrictions.

Table III-3 Number of Books Publications in PDII
(Jakarta and Bandung)

| | Jakarta | Bandung |
|---|---|---|
| Technical journals/periodicals/ reports | 96,243 (61.6%) | 16,119 (70.8%) |
| Microfilm | 46,626 (29.8%) | 1,087 (4.8 %) |
| Various standards | 11,346 ( 7.3%) | -- |
| Theses and dissertations | 2,100 ( 1.4%) | -- |
| Others (Clippings) | -- | 5,548 (24.4%) |
| TOTAL | 156,356 | 22,754 |

Source: PDII-LIPI, ACHIEVEMENT AND FUTURE CHALLENGES IN THE INFORMATION ERA, PDII, 1988

Table III-4 Categories of Information Offered
(Domestic or Foreign) 1986-1987

| Information Source | Utilization (No. of requests made by users) |
|---|---|
| Domestic | 3,846 (31.8%) |
| Foreign | 8,303 (68.2%) |
| TOTAL | 12,167(100.0%) |

Source: PDII-LIPI, ACHIEVEMENT AND FUTURE CHALLENGES IN THE INFORMATION ERA, PDII, 1988

(3) Outline of Information Provision Services

1) Library services

The library in PDII offers a reference service to visitors to the Center. The range of users vary from those in the industries to researchers and students. The main users of the Center are university students.

2) Information provision service (document search)

PDII information provision roughly consists of a "Current Awareness

Service" and an "Information Retrieval Service". The former provides the following features:

① Informasi Kilat (Your Information Service)
② Kami Baca untuk Anda (We Read You)
③ Paket Informasi Teknologi (Technology Information Package)
④ Jasa Penyebaran Informasi Terseleksi (Selected Dissemination of Information)
⑤ Jasa Informasi Paten Terseleksi (Selected Patent Information Service)

The retrieval information service is conducted either with or without computers, the number of requests made from 1978 to 1986 being shown in Fig. III-1. Lately, the number of requests has amounted to approximately a few thousand annually. Users are mostly graduate students, researchers and people in industries. Depending on the enquiry, the use of an overseas on-line database probably can serve better for the purpose. However, because of the high cost involved, this use is very much limited.

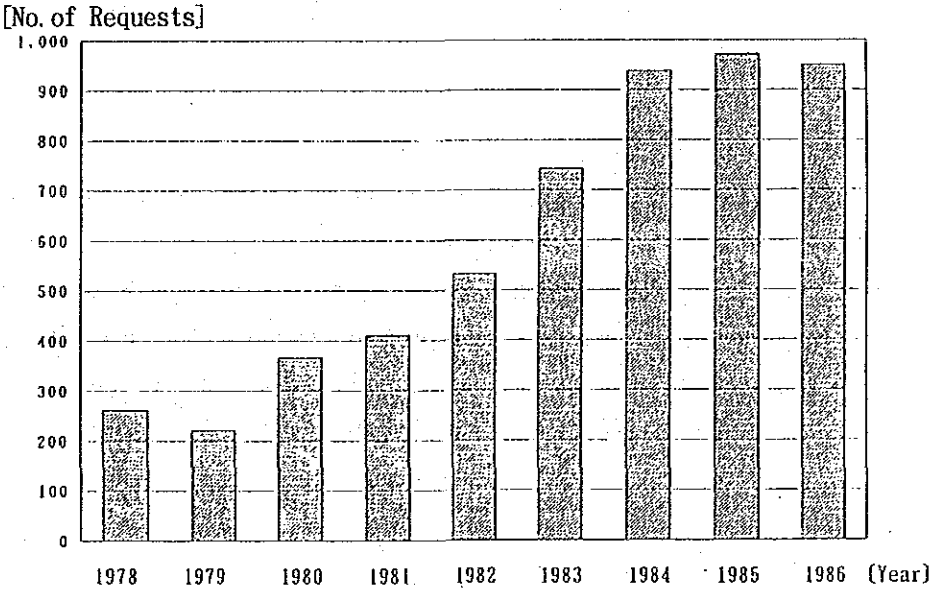



Fig. III-1 Number of Requests for Document Searches (1978-1986)

Source: PDII-LIPI, ACHIEVEMENT AND FUTURE CHALLENGES IN THE INFORMATION ERA, PDII, 1988

3) Use of the SDI service and overseas on-line database

PDII also offers an SDI (Selective Dissemination of Information) service, in which information is continuously collected and offered on the specific subjects to users' requests. This particular service aims at grasping the latest situation in the specific field of industry and technology for which the request has been made. This, however, is conducted

without computers at present by about 15 staff members who search various existing documents, and not through retrieval from an on-line database. There is much difference between the cost involved in the use of a database and the labor cost for manual work. Therefore, the overseas on-line database services are not yet used enough. At present, a few industrial companies, and some governmental organizations are enrolled in the system.

The DIALOG on-line database started to be used in 1986, and in addition to this, the following overseas databases are expected to become accessible soon:

① ESA-IRS (planned to be used from the end of 1988)
② PERGAMON-INFO LINE (ditto)
③ BLASE (ditto)

According to the staff member in charge of use of databases, the freqnency of access to on-line databases was 2-3 times a month at the beginning, and the number has increased to 2-3 times a week lately. In addition to on-line databases, a database on specific subjects through CD-ROM has been introduced and is used by personal computers. For example, in the field of medicine, MEDLINE, a typical document database, is used in the form of CD-ROM.

4) Creation and management of a database

Since 1984, PDII has been computerizing the following materials, and as a by-product, a bibliographic database is being prepared. This database manages in formation concerning as many as 30 thousand documents published in the Republic of Indonesia. At present, however, they are limited only to internal use, and no on-line service is offered to the public.

① Index of Indonesian Learned Periodicals
② Index of Survey and Research Reports
③ Index of Papers Submitted in Seminars
④ Union Catalogue of Periodicals
⑤ Union Catalogue on Dissertations
⑥ Directory of Special Library and Information Sources

### (4) Future Plans for Improving Services

PDII, being the core institute in the Republic of Indonesia for providing scientific and technological documents/information, is expected to solve a number of problems to maintain and enhance its services, which are summarized in Table III-5.

In the personnel aspect, staff members concerned with the management and provision of scientific and technological information are expected to have knowledge of physics, chemistry, technology, computers, etc. In the budgetary aspect, sufficient materials and reference books are needed in order to improve information services. Especially, overseas documents/information require a large amount of money for purchase. As is shown in Table III-1, the numbers of books in libraries, in general, is not sufficient, and expansion is expected in order to improve the quality of sevices to users. An improved computer environment is one of the key factors for future expansion and a higher level of services. At present, minicomputers (HP 3000/40) and microcomputers (HP 150) are used for creating and managing various materials, and for maintenance and operation of the database.

Table III-5 PDII Shortcomings

| |
|---|
| • Lack of specialists |
| • Lack of publications, necessary to maintain services |
| • Budgetary restrictions |
| • Incomplete basis for computer communication |

Source: PDII-LIPI, ACHIEVEMENT AND FUTURE CHALLENGES IN THE INFORMATION ERA, PDII, 1988

## 1.3 Information Exchange with the UNInet Information Network

### (1) Objectives

UNInet began its development in 1986, aiming at attaining mutual cooperation in the fields of education, research, and data processing through an information network of the nation's universities and related research institutes. Its ultimate goal is to link 44 universities, research institutes, etc. into a network through the assistance of the Ministry of Education & Culture. The objectives which UNInet intends to realize include the following:

① To support the operation and management of higher educational institutions such as universities. To realize this, UNInet offers an information processing system on a network basis to planners and decision makers of each institute.

② To facilitate a common use of information in scientific and technological fields. To realize this, UNInet has established a scientific and technological in formation service on a network basis to link other

information service institutes and research organizations.

③ To facilitate communication among researchers in scientific and technological fields. Especially, this object is realized by provision of message exchanging service on the network basis.

④ To realize this, UNInet has established a message exchange service on the network basis that is available to researchers and educators.

Table Ⅲ-6 lists the hosts connected. UNInet is linked not only within the country but also to overseas networks such as in the U.S. (NETNORTH, CDN, ARPANET, BITNET, CSNET, USENET), Japan (JUNET), European nations (JANET, EARN, EUNET), Australia (ACSNET, CSIRONET) and South Korea (SDN) as shown in Fig. Ⅲ-2.

Table Ⅲ-6 UNInet's Hosts

| University/Institute | Location |
|---|---|
| • UNIVERSITAS INDONESIA | Jakarta |
| • INSTITUT TEKNOLOGI BANDUNG | Bandung |
| • UNIVERSITAS GAJAHMADA | Yogyakarta |
| • INSTITUT TEKNOLOGI SURABAYA | Surabaya |
| • UNIVERSITAS TERBUKA - OPEN UNIVERSITY | Jakarta |
| • UNIVERSITAS HASANUDDIN | Ujung Pandang |
| • INSTITUT TEKNOLOGI PERTANIAN BOGOR | Bogor |
| • DIRECTORA GENERAL OF HIGHER EDUCATION | Jakarta |

Source : Report on UNInet's First Development Stage, UNIVERSITY OF INDONESIA, 1987

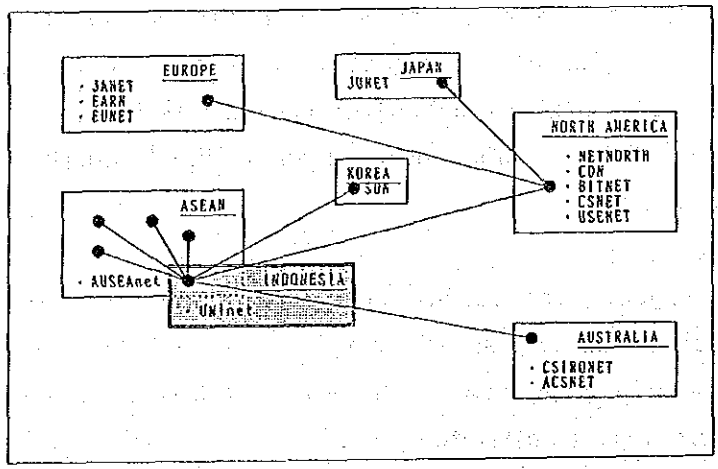



Fig. Ⅲ-2 Connection with Overseas Networks

Source : Report on UNInet's First Development Stage, UNIVERSITY OF INDONESIA, 1987

(2) Distribution Function and Current Utilization

UNInet's major functions are:

① Message exchange
② Electronic bulletin board
③ File transfer
④ Connection to other systems
⑤ Remote batch jobs

However, not all these functions are sufficiently used at present. Especially, the functions concerning the common use of computer systems under ④ and ⑤ are not yet sufficiently utilized due to information communication cost and the present state of general-purpose computers. In many cases, UNInet is mainly used for its functions of message exchange and as an electronic bulletin board, where message exchange is sometimes used just as in facsimiles. Staff members with the ability to use UNInet terminals are still small in number and many others do not know how to use them.

(3) Other Problems

To facilitate the use of information networks, the following aspects need to be discussed:

① Microwave is used among major cities as the information communication basis, which assures high reliability. However, within a city, there are problems in the quality of communication lines, which greatly affects expansion in the use of an information network such as UNInet.

② Information exchange among researchers to facilitate research and development has not yet been well established. Therefore, UNInet's object of communication among researchers and common use of scientific and technological information tends to be greatly affected by this.