SECTION 2 CURRENT USE AND THE TREND OF COMPUTERS

2.1 Use of Computer Hardware and Software

(1) Use of Computers

The use of computers is roughly classified into three areas: routine business applications mainly for data processing, technical calculations mainly by simulation, and database management and its provision. Software and an operating organization are indispensable for the use of computers.

1) Routine business applications

The routine business applications mainly for data processing include corporate systems such as those for accounting & finance, personnel administration, payment of salaries and planning, and support systems such as those for banking, insurance, production control, purchasing & order entry. In data processing for these operations, input & output processes and data accumulation play a more important role than the overall load on the CPU. Although various support systems involving design and production are often classified as technical calculations, they should belong to the routine applications mentioned here.

2) Technical calculations

These are mainly used for possible simulation where a large volume of computations is repeated using combination of theoretical formulas of various phenomena in such analyses as stress, destructive testing, weather forecasting and environmental analysis. Generally, in technical calculations, the CPU load is heavy.

3) Database service

This service supplies users with information and data they require from a computer's file storage of various information and data. The database service requires a large external storage capacity.

4) Software and others

For controlling computers, application software, basic software such as OS (operating system) which controls computer hardware and communications, enviroments, and an efficient staff organization for operating the entire system are indispensable.

(2) Summary of the Domestic Use of Computers

The use of computers in the Republic of Indonesia is steadily spreading in governmental organizations, universities, large and small firms. The use of personal computers is becoming popular among them.

The recent economic recession in the Republic of Indonesia has not drastically reduced the demand for computers. This may be due to a recognition of the productivity improvement contributed by computers used in governmental organizations and firms. However, the Indonesian rupiah was devaluated against the U.S. dollar by 45 % in 1986, and this resulted in large price increase for computers, for which the Republic of Indonesia depends upon imports. This increased price is suppressing the increase in the demand.

There is no drastic difference between the Republic of Indonesia and the developed countries in the use of computers for data processing and routine application. However, there are some differences between the Republic of Indonesia and leading countries in the on-line operation of data processing and strategic information systems.

The database is not being broadly used, although some overseas databases are being used in certain sectors. In the domestic market, there are no private suppliers of data, and only some of the governmental organizations are handling technological literature information and statistical data.

In the use of computers for scientific and technical applications, simple calculations, for designing and planning for individual production processes are usually performed, and they are fragmentary. These should be classified as routine operations. There are extremely few cases of computer applications for preliminary examination or basic research and study by simulation, which is the main stream in scientific and technical applications. However, a potential demand exists for scientific and technical applications in design-related operations in various fields, and future development is expected.

(3) Current Situation and Future Computer Use at Laboratories in the PUSPIPTEK-Serpong Complex

1) Use of computers in each laboratory

Tables III-7 and III-8 show the use of computers in each laboratory for administration, scientific and technical applications.

Table III-7 Installation and Application of Computers in the Laboratories

Name of Laboratory [No. of personnels]	Application of Computers		Computers Installed [incl. personal computers] (Note 1)	Number of Programmers
	General business Processing	Scientific and technical calculations		System/application [Average years of experience]
KIM (435)	・Personnel administration ・Inventory control ・Financial control ・Materials and resource planning	・Gathering of observed data and processing systems	VAX 750 VMS PDP 11 (Note 2) IBM PC (Multiple)	1 /4 [4]
LAGG (50)		・Gathering of observed data and processing systems	HP1000/A60 HP1000/A90×3	3 /10 [3]
LFT (220)			Olivetti PC	
LKT (280)	・General administration ・Report preparation (with dBASE III)	・Numerical analysis ・SPSS/PC ・AutoCad II	PC (Multiple)	2 /4 [5]
LSDE (107)	・General administration ・Data preparation	・Data analysis ・Data transmission	IBM PC/XT ×6 IBM PC/AT ×4	2 /2 [3]
LUK (144)	・Inventory control ・Other small business calculations	・Data verification of CN235 (Airplane) ・20 other programs	HP1000 F/45 PDP11/23×3 GA-16/400 (Note 3) HP ser200 ×2 PC/XT(Multiple)	2 /5 [4]
RSG-LP (4 branch laboratories)	・Salary calculation ・Personnel administration ・Inventory control ・Permission and administration of radioactive materials	nuclear codes are under conversion	VAX 8550 micro VAX II VAX Station GPX_×2	5 /12 [3]

Note 1: Includes IBM compatibles
Note 2: This system is not in operation
Note 3: Hardware manufactured by General Automation
Source: According to the field survey

Table III-8 Application of Computers in the Laboratories

KIM	Previously they planned to install a general-purpose computer, but this was not realized. They strongly request the installation of computers to improve the environment of research activities.
LAGG	If they can use large, high-speed computers for technical calculations, their operation will not only be restricted to current data processing based upon test measurements, but they can also handle database management by simulations using softwares for fluid dynamics and structural analysis.
LFT	Currently, they are busy shifting the center of their research and development activities from Bandung to PUSPIPTEK-Serpong step by step, and at the moment they have no time to develop computer applications.
LKT	Instead of purchasing an expensive measuring system, they would like to learn how to build data gathering systems by themselves by using personal computers, purchasing only the related measuring device (data generating part) for integration with the data gathering systems in order to realize a low-cost measurement system.
LSDE	They are operating personal computers relatively efficiently, but they express that the processing capacity of their personal computers, data storage and retrieval functions are limited. Computer education is conducted within the laboratory.
LUK	Their stress measuring system for airplanes is very similar to that of the wind tunnel of LAGG. In addition to the measuring systems, scientific and technical caluculations are performed in many fields. A minicomputer is also installed in place of a mainframe, and smoothly utilized both in business and scientific and technical calculations.
RSG-LP	The VAX 8550 is installed in this laboratory. The following applications were noted; ① It is used for some of the business processing such as salary calculation; ② The OA environment will be enlarged by installing LAN among the branch laboratories; ③ 25 nuclear codes are being converted for scientific and technical calculations, but are not in operation yet; ④ With many terminals connected to the VAX 8550 using their own made text for training numerical analysis, they are making an effort to upgrade the quality of the nuclear energy-related programmers and other staff.

Source: According to the field survey

2) Purpose of usage

After analyzing the purpose of computer utilization in each laboratory, they can be classified into the following four different purposes. Each purpose relates the scale and functions of existing computers and their researchers.

① LA (laboratory automation) where computers are used for gathering and managing real-time data from experimental test equipment.

② Data collected from the computers are processed on a non-real-time basis for accumulation in a database, calculations or graphic transformations are performed accordingly .

③ OA (office automation) functions covering simple calculations for research and reporting, word processing, document filing, and small-scaled database applications.

④ Data processing and OA functions, like sub-systems being utilized by private firms for personnel administration and payment, management of research facilities, documentation and management of library information, etc.

Furthermore, the foregoing purposes ①~④ can be classified into the following two groups:

a. Group 1: The information processing system characterized as measuring systems in ① and ②. The purpose is limited to grasping the actual measured data, and a computer will not be used for further detection and forecasting. Therefore, further steps in technological development are difficult.

b. Group 2: The information processing system of ③ and ④ for both data processing and scientific and technical calculations as the functions of a mainframe and OA; most cases are to collect fragmentary pieces of business. Standardization and integration of research supporting systems are not always realized. Moreover, in business administration, personnel administration and salary calculation, the administration of facilities and equipment are all separate and individual, which are far from consistent corporate systems.

In the current situation, computers are not being properly used as a tool for supporting research activities. The factors which are deterring the promotion of the effective use of computers will be summarized as the following five items:

① They do not have a sufficient number of researchers and administrative personnel who can aggressively apply computers to research activities, supporting activities and research management.

② It is difficult to find trainers capable of giving computer education to researchers, and potential users do not have an opportunity to receive computer training.

③ Except for a few cases, the laboratories do not have computer facilities with excess capacity available for computer education.

④ Generally, scientific and technical calculations are batch-processed; however, the lack of on-line capacity through communication lines makes it necessary to go to the computer site. Due to this, some want their own computers at hand.

⑤ There is no official exchange of information and coordination among the laboratories for solving these problems.

There is a big difference between the use of computers at each laboratory and that in private firms, as will be explained later, in the area of research activities, support activities and research management but excepting highly advanced measuring systems.

3) Analysis of needs

Table III-9 shows the hardware and software which were disclosed in the plans and requests of each laboratory for computers that they want to install or prepare in future. According to the table, the following two points can be listed as important factors common to every laboratory.

① Modeling experiments with computers_

There is a limitation to the data that can be collected from the conventional type of experiments with real objects. To further develop research, there is the need for problem solving by computer simulation. This is supposed to be the basic task of scientific and technical calculations.

② Approach to computer-aided design and manufacture

Each laboratory has an obligation to return the results of their research and development activities to the industry, and CAD/CAM is a suitable means for effective technology transfer.

Table III-9 Hardware and Software Plans for Each Laboratory

Laboratory	Software under Plan/Request	Hardware under Plan/Request
KIM	• CAD/CAM • AI expert system • Industrial process simulator • Software development system • CASE (Computer-aided software engineering) • UNIX	• Integration & Maintenance system through the telephone network • VAX 6250 system • PC/AT - 90 units • APOLLO workstation - 3 Units
LAGG	• Aero-acoustic related field • Drafting software (CAD)	• If they can use powerful computers, they would like to utilize them for applications such as in fluid dynamics.
LFT	• (None)	• (None)
LKT	• Analysis of process controls • Database management system • CAD/CAE • IMSL (general-purpose mathematical routine) • MEDUSA (PRIME 3D CAD)	
LSDE	• Analysis by mathematical modeling • Numerical analysis • Simulation • Computer graphics — Design simulation of an energy conversion system	
LUK	• Computer-aided testing (CAT) • Modeling • CAD/CADD/CAE • Project control	• Interconnection to domestic communication lines.
RSG-LP	• Database management • Safety analysis of nuclear reactors • Nuclear reactor • CAD/CAM	

Source: According to the field survey

(4) General Use of Computers - Present and Future

1) Use for data processing

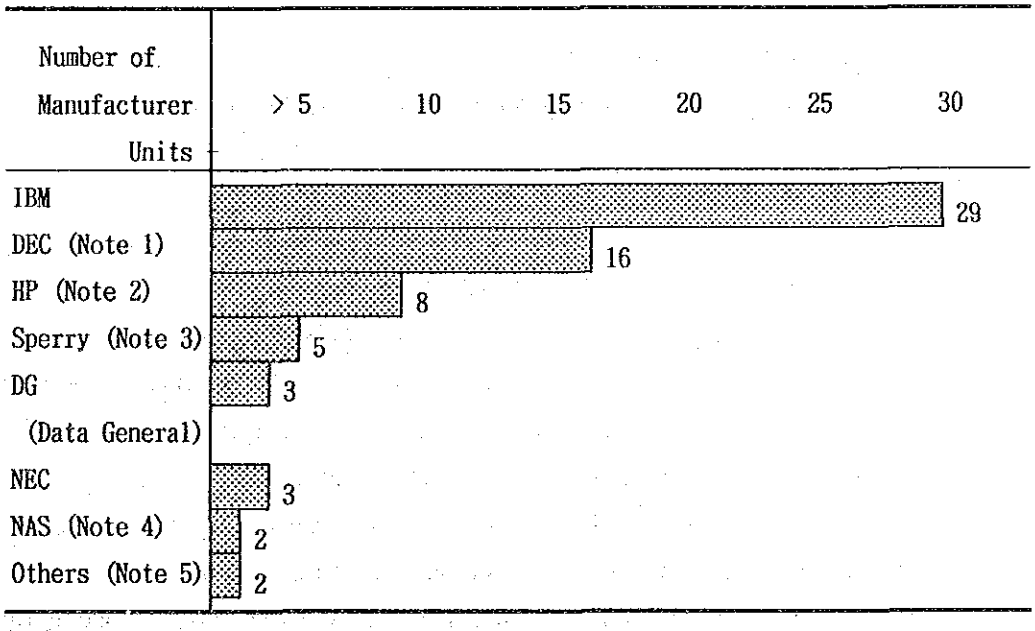
The use of computers for data processing is not the subject of this study; however, we will briefly mention the software development, hardware vendors, background and environment for the use of communication lines, in relation to the establishment and operation of the Center.

① Mainframe

As shown in Table III-10, IBM is in the leading position in the market share of mainframes and minicomputers in the Republic of Indonesia.

This has something to do with the fact that the users of mainframes are either foreign principals or firms having some relationship with overseas companies. It is highly possible that machines made by specified manufacturers are chosen to operate the software developed overseas for specified businesses. In this respect, there is little qualitative difference between this country and developed countries in the applications of computers. A difference seems to exist in the software development.

Table III-10 Installation of Computers



Note 1: Digital Equipment Corp.
Note 2: Hewlett-Packard Corp.
Note 3: Sperry Land UNIVAC Division, currently UNISYS
Note 4: National Advanced Semiconductor Corp.
Note 5: ICL (U.K.) and Burroughs
Sources: From the field survey, and from a tabulation of the purchase of computers over $ 1 million as shown in the Asian Computer Directory 1987.

Tables III-11 and III-12 show examples of the use of computers for data processing by firms and general users visited during the field survey. Inside those firms (in-site level), operations are reasonably made on-line; however, extensive on-line operation is rare, with the small number of communication lines, except in special fields or types of firms (banks, airline companies, petroleum companies, etc.).

These firms without extensive on-line operation may not require much information processing capacity compared with the amount of data expected for the current business, or they may limit the applications to be processed. Therefore, relatively small machines are used for processing their information and data. In those cases, they design their systems to cut down expensive computer cost and communication line cost by using messengers for transmitting a large volume data instead of a communication line.

Almost all of the firms that have on-line operation use dedicated lines with higher reliability, and none of them use telephone lines. The general network configuration is regional concentration (whereby data is first concentrated on a regional basis and thereafter sent to the Center for final consolidation). The cases of a central concentration system which requires a large number of communication lines are very few.

② Minicomputers/office computers

This area shows the same trend as that for mainframes.

③ Personal computers

The number of personal computers in the Republic of Indonesia is roughly estimated to be around 20,000-30,000 (according to the information from the Ministry of Industry), although no formal statistics are available. Most of them are the IBM PC/XT and its compatibles. The Ministry is currently promoting the policy of domestic assembly of personal computers, and 8 out of 10 or more domestic companies are in this project.

The general application of personal computers for data processing is mostly as OA equipment (word processing), and these machines are yet to become widely used as small business machines. It will be easy to understand the developing stage of computer use from the fact that the curriculum of computer school is mainly based upon the application of personal computers.

④ General trend of computer applications for data processing

In the area of computer applications for data processing, the major tasks which the industry are facing is upgrading of the quality of communication

Table III-11 Use of Computers at Institutions and Corporations Covered by Field Survey- 1

Name of Institution [Type of Operation]	Computer Application (underlined:engineering example) (* communication lines used)	Computers Installed (underlined:engineering application)	Remarks
BAKOSURTANAL [Coordinating Board for Surveying and National Mapping]	·Aero-survey ·Remote sensing ·Mapping	VAX 8350 - 2 units	Used exclusively for routines
BAPPENAS [National Land Planning Bureau]	·Statistical application	PC-96 units	Re-editing data in the Bureau of Statistics and each governmental organization.
Bandung Institute Technology	·School administration ·Computer education (for students and coutside) ·Computer research	IBM 3031, S/36 DEC VAX IBM PC compatible - 400 units	Computer science, of Education center, research and curriculum
Bogor University of Agriculture	·Computer education ·Research activity support ·University administration (Enrollment/staffing/facilities administration)	PC XT compatibles - 59 units Other PCs - 3 units PERKIN ELMER 3220	In addition, remote sensing based on the IBM PC
BPPT [Agency for the Assessment and Application of Technology]	·Research activity support in general	HP3000/40 SUN-3/260M SUN-3/160M DG/MV2000	LAN interconnection and connection with PCs in progress
BPS [Central Bureau of Statistics]	·General statistics	ACOS 500 ACOS 1510	SA Programmers - 40 Data Entry operators - 100
GRATIKA [Information processing, education, etc.]	·Hardware rental ·Software development ·Hardware sales ·Education & training	UNIVAC IBM S/36 - 4 units PC (multiple)	Providing service to insurance firms and 30 others with INDOSAT & PERUMTEL, staffing servic ealso available
University of Indonesia	·Inter-university network * X.25 - 1 ·Electronic mail and 3 other services * X.75 - 3	VAX 11/750, 8250 DG MV/7800, 8000	UNInet center function, under supervision of Ministry of Education & Culture
INDOSAT [International Telecommunications Company of Indonesia	·Tourist guide ·Inventory control * dedicated Lines ·Personnel & salary × 4 ·Planning * X.25 × 2	IBM 4381	"ORACLE" database software used. Also sales of software.

Source: According to the field survey (continued)
Note; Underline shows an engineering purpose,
* means a communication line.

(continued)

Name of Institution [Type of Operation]	Computer Application (underlined: engineering example) (* communication lines used)	Computers installed (underlined: engineering application)	Remarks
Ministry of Industry	·Reginal economy ·Personnel administration ·Institutional statistics ·Financial administration	ACOS 630/10	ACOS 630 just installed; Operation being arranged
PDII [Center for Scientific Documentation and Information]	·Collection and provision of scientific and technological bibliographical information	HP3000	Stores 3,000 classes of information and data, with access to overseas database
PERTAMINA [National Petroleum corporation]	·Order entry ·Simulation of petroleum refining ·Production control * 9600 bps× 10 lines	IBM 3090 NAS 9150	2 computers are configured duplex system
P.T. BBI [Machinery manufacturing]	·General administration	IBM-PC compatible - 17 units	Demand on new technology for modeling and evaluation technology
P.T. INTI [Communication equipment manufacturing]	·Production planning control ·Development of softwares loaded to switching system ·Salary ·Inventory control	SIEMENS 7536 PDP11	In addition, they have 8-layer PCB CAD running under PC/AT.
P.T. IPTN [Airplane Manufacturing]	·Airplan CAD/CAM ·General administration ·Computer education and training	IBM 3090/400E(2VF) IBM 3081, 4341	NASTRAN, VSAERO and DINA3D also being used.
P.T. KRAAKTAU STEEL [Iron/steel works]	·Sales & inventory ·Finance & accounting ·Steel mill process control ·Personnel administration * 2400 bps × 2 lines	IBM 4331 NAS 8023 recently installed IBM S/36 - 2 units SIEMENS	Future plan for real-time management of production control, strengthening of networking capacity, and centralized monitoring system.
P.T. PAL [Shipbuilding]	·General institutional systems ·Shipbuilding CAD/CAM	IBM 3083E VAX 11/750	Ideal installation environment
P.T. PLN [National electric power]	·Billing ·Inventory control ·General administration ·Power supply planning ·Generation/transformation & transmission/distribution	IBM 4381 HP1000 micro VAX II	Information section is regionally spread; planning dept. partially uses 4381.
Sepuluh Nopember Institute of Technology	·Education	PC - 50 units DG mini	

Source: According to the field survey
Note; Underline shows an engineering purpose,
* means a communication line.

Table III-12 Computer Installation in Major Institutions (not from field survey)

Type of Business	Computer Installed (Maker & Model)	Communication Line Used(bps)	Application
Governmental organization A	ICL 2904/50		Regional surveying and data processing
Governmental organization B	Sperry 80, VAX 11/750		Management of waterways and ship-building docks
Governmental organization C	IBM 4341, IBM 4331	7×2400	General administration, planning control
Regional administration	IBM 370/135, IBM 370/145		General administration, science and technology
Airline company	IBM 3031, IBM 4341×2	17×2400, 9600	Reservation, flight management, maintenance and engineering
Bank A	IBM 4361	2×9600	Banking operation
Bank B	IBM 4341	1	Banking operation
Bank C	IBM 4331		Banking operation
Bank D	IBM 4381, 4361, 4331	3×4800	Banking operation
Life insurance company	IBM 4331, IBM 370/115		Insurance business
Health care organization	IBM 4331, IBM S/3		Billing, public employees,, administration, complaint handling and salary processing
Petroleum company A	IBM 4341		Administration, science and office administration
Petroleum company B	IBM 4341×2, VAX11/780×3	2400	Engineering, exploration and production control
Petroleum company C	VAX 11/780×2	2	Storage simulation
Petroleum company D	IBM 4381, IBM S/36×2	2×9600	General administration
Mining company	HP3000/33, HP3000/64	2400	Inventory control, maintenance, wells database and field management
Geological information	SEL 3287		Geological data processing
Technology consulting	VAX11/780, HP9000, HP1000 Sperry 1106, IBM S/36		Structural design, process control, technical calculations, network analysis, database and information processing
Consulting	APPLEII ×30, HP1000		Structural analysis, project control and CAD drafting
Information processing A	Burroughs A/ET/B20/XE	1200~19200	Banking business, hospital business, government and private sector
Information processing B	VAX 11/780×2		Storage simulation and digitizing
Information processing C	Sperry 1106, 1100/71	2×2400 2×dial UP	Administration, science and technology
Information processing D	IBM 3081KX4	2×9600 International 9600	Information processing service, customer assistance and international data communication

Source: Asian Computer Directory 1987 (this table includes sites with machines costing over US$1,000,000)

lines and lifting regulatory restrictions. Once these problems are solved, there may be no gap between this country and the leading countries.

2) Development of software

The contracted development of software for data processing by mainframes is not clear. For general data processing, users depend upon imported software or self-developed software. However, the dependence upon overseas software is not clear. Already in Jakarta, there are as many as 51 software houses, firms, as can be seen in Table III-13, which must be developing software under contract; however, there are no statistics on how much software is being developed for mainframes. It seems that the software developing industry has not yet been established in this country.

As stated elsewhere, in the computer school curriculum, personal computer application is dominant, and schools are not yet offering courses on the operation of terminals for general-purpose computers or system design for a broad area of applications.

Table III-13 Software Firms and Consulting Companies

Regional Location of Firms		Breakdown in Number of Employees	
Territory	Number of Businesses	Number of Employees [persons]	Number of Businesses
Jakarta (including suburbs)	51	<10	17
Bandung	3	11-20	23
Surabaya	2	21-30	9
Semarang	4	31-50	4
Other regions	3	>51	3

Source: Asian Computer Directory 1987

3) Provision and use of information (databases)

① Overseas database use

For access to some overseas databases, ASEANnet can be used, in which the University of Indonesia participates as a representative of the Republic of Indonesia, as well as ARPAnet in North America. However, due to limitations of data communication in the country, those databases are not widely used in universities or research institutes.

② Use of domestic databases

The application of databases on domestic computers is very limited, with

typical examples explained in 1.2 of Section 1, where cases of the use of scientific bibliographical information in PDII and the Central Bureau of Statistics were given.

In database applications with machines smaller than minicomputers, the case of BAPPENAS (the National Land Planning Bureau) can be pointed out. However, small-scale database applications with in-house personal computers and database software packages is starting, as well as the wider use of database software packages distributed by INDOSAT (The International Telecommunications Company of Indonesia). Furthermore, packaged software such as CD-ROM is being experimented on UNInet.

In developed countries, the users access to databases is usually done through telephone lines, since the low volume of data and frequency of access are not constant. In the Republic of Indonesia, however, where the quality of the telephone communication lines is not stable, on-line access to databases is not in service. Databases on floppy disks are partially supplied, but the mainstream of information and data provision is in the form of hard-copy.

4) Scientific and technical applications

The use of computers in the Republic of Indonesia for scientific and technical applications is restricted to fragmentary design works, data collection and analysis, planning control and other spotty routine operations of individual job sites. This is understandable from the fact that software is purchased as part of a ready-made total system of hardware, or systems are introduced with hardware specified by overseas software developers, and these systems are being used just like black boxes.

However, there is a potential demand for the application of computers to more sophisticated computer-aided design, and for technical calculations to verify design. In our field interviews, we found the following cases:

a. One architectural design firm used several IBM PC/XTs for calculating the strength and vibration response against earthquakes of a building with two-axis symmetry, dividing the horizontal stress against the building through 90 degrees into 18 cases of 5 degrees each. The design firm was complaining that this whole calculation took several months with several computer units, which was just too long and not practical.

b. In shipbuilding and machine manufacturing companies, they would like to upgrade their products by using FEM (Finite Element Method) software for design verification. By doing so, they could contribute to export more internationally competitive products as well as to improve accuracy and

safety. They regret, however, that they cannot find trained staff or software to do the work.

The demand for more sophisticated applications such as design and design verification is becoming evident.

Also from the observation and questionnaire survey on the use of computers for scientific and technical applications, the use of CAD, design systems or packaged software is dominant. This survey could not find any case of higher level computer simulation for design verification, inference, or application for basic research and development activities, or the self-development of software for such activities.

① Mainframes

Use of mainframes for scientific and technical applications is very restricted as shown in Tables Ⅲ-11 and Ⅲ-12. Probably due to the high dependency on ready-made packaged software, the hardware is restricted to certain models. As a case of the use of exclusive machines, this survey found P.T. IPTN using an IBM 3090-400E System (with 2 Vector Facility units) for design and manufacture support systems in conjunction with CADAM/CATIA systems. However, the purpose is mainly for detailed design, and not for basic design and the verification of parts and materials.

② Minicomputers

As shown in Tables Ⅲ-11 and Ⅲ-12, this type of computer is being used for various applications due to its ease of purchase, although most are being used for fragmentary routines. However, they are generally being used for individual processes or operations (design, control, etc.). There are only very few cases of systems integration or design simulation, and there are no software databases or trained staff capable of handling such sophisticated work.

(5) Consideration in Future

It can be understood from a viewpoint of the increasing use of personal computers that when the communication lines are improved, there will no obstacle on data communication. In addition, when the restrictions on communication lines are lessened, data communications using personal computers will be wide-spread with a help of database provisions.

As for scientific and engineering computation, demands for more sophisticated applications will increase little by little.

As stated in Part II, section 2, manufacturing import substituted and international competitive goods requires more sophisticated and frequent use of computers.

The more computer performance is improved, the more computers will be used for various fields.

The Center in PUSPIPTEK-Serpong, where a mainframe is installed, will create a circumstance for a sophisticated use of computers. Without possessing their own mainframes, laboratories and domestic firms can access the mainframe with low expenses. The Center in PUSPIPTEK-Serpong will have to be a hub for computer use technologies.

2.2 Current Situation of Computer Use Education

(1) Introduction

As explained in 2.1, the importance of use of computers has been recognized in the business field as well as in other fields, and the use of computers has been expanding, particularly of personal computers. Several computer schools have been established in Jakarta and other cities, universities and colleges have been establishing information science divisions, and graduate schools have also been offering courses on information science. This means that, at least at the educational level, environments to improve knowledge about the use of computers has been developing and more opportunites have been provided for people to familialize themselves with computers.

However, when the details of computer education are carefully reviewed, this education is aimed mainly at basic matters such as language education and the use of packaged software. There are still a number of problems to be solved such as the more extensive use of application software in the industrial technological field, supporting researchers and engineers to carry out their research and development activities, more extensive use of research institutes, and more promotion of education.

The following analysis explains the current status of computer use education carried out in PUSPIPTEK-Serpong, universities and computer schools.

(2) Laboratories in PUSPIPTEK-Serpong

Table III-14 shows the current status of computer use education at each

laboratory in PUSPIPTEK-Serpong. As explained in 2.1, when the use of computers in PUSPIPTEK-Serpong is viewed from the standpoint of hardware, the researchers mainly use minicomputers and personal computers. In particular, each laboratory is very positively using personal computers. The computer education depends mainly on individual efforts to study and OJT, but some laboratories such as RSG-LP and KIM have established introductory numerical analysis and language education courses which are open to the public. Some open courses require fees which provide some cost generation for the laboratories.

Table III-14 Computer Use Education in Each Laboratory

Name of Laboratory	Type	Details	Scope
RSG-LP	Education course	FORTRAN, introduction to numerical analysis	Open to public
KIM	Education course	C language, BASIC	Open to public
LFT	Education course	Personal computer databases	Restricted
LAGG	OJT	FORTRAN	Restricted
LKT	Individual study, OJT	BASIC, FORTRAN, C language	Restricted
LSDE	Individual study, OJT	Personal computer databases, simplified languages	Restricted
LUK	Individual study, OJT	Personal computer database, simplified languages	Restricted

Source: Based on the results of the field survey

Since the mainframe computer has not yet been introduced, the use of computer education to support research and development by researchers and engineers has not yet become possible. However, many people have accumulated experience in the use of minicomputers and personal computers, and a considerable number of young researchers have acquired overseas university degrees by studying abroad. Therefore, the present situation is such that once the use of mainframes is started, each laboratory will become capable of properly meeting the requirements for use and use education. For reference, Table III-15 shows the index of the text used in the Introduction to Numerical Analysis course offered by RSG-LP.

Table III-15 Index to the Course "Introduction to Numerical Analysis"

Chapter 1. Introduction
- A. Why to learn the numerical method
  - Formulation/specification problem
  - Making mathematical model
- B. Computational error

Chapter 2. Solution of nonlinear equations
- A. Introduction
- B. Bisection method
- C. NEWTON method
- D. SECANT and REGULA FALSI method

Chapter 3. Interpolation
- A. Introduction
- B. Lagrange interpolations

Chapter 4. System of linear equations
- A. Introduction
- B. Gaussian method
- C. Flowchart for Gaussian method
  - :Triangularization/Backsubstitution
- D. Gauss-Seidel iteration method

Chapter 5. Differentiation and integration
- A. Introduction
- B. Differentiation
- C. Integration: Trapezoidal rule/Monte Carlo method

Chapter 6. Curve fitting
- A. Introduction
- B. Linear regression
- C. Polynominal regression
- D. Exponential, Geometric and Trigonometric regression
- E. Multiple regression

Chapter 7. Ordinary differential equations - Initial value problems
- A. Introduction
- B. First order equation: Runge-Kutta method/Predictor-corrector method
- C. System of differential equations
- D. Second order differential equations

Chapter 8. Ordinary differential equations - Two-point boundary value problems
- A. Introduction
- B. Finite difference method: second order linear equations
- C. Shooting method

Sources: RSG-LP, PENGATAR METODE NUMERIKA, OLEH M.BUNJAMIN

(3) Universities

In the Republic of Indonesia, 28 out of 43 universities have computers which are used for education and research. Among these universities, Bandung Institute of Technology is the highest grade of all science and engineering colleges in the Republic of Indonesia, and the current status of computer use education in this college will be described here.

Each year, about 30 students graduate from the division of information science of this college. This college is provided with the Computer Science Information Center as a facility for all the students in the institute. The staff working in this facility include five operators, five programmers and five systems analysts, who operate this facility and are engaged in computer use education. For the educational purposes, approximately 20 courses are offered about three times a year, each of which includes a wide range of topics such as programming, simplified languages, computer graphics and AI. Table III-16 shows an example of these courses.

Table III-16 Example of a Computer Education Courses at Bandung Institute of Technology

Name of Course	No. of Days for course
·Introduction to Microcomputers	5[days]
·Introduction to Mainframe Computers	5
·Programming (BASIC)	4
·dBASE-III Plus (intermediate class)	5
·Word Processors	-
·Programming (PASCAL)	5
·SAS Statistics Package	5
·Programming (FORTRAN 77)	5
·Simplified languages(word processors, databases, spreadsheets)	-
·Computer Graphics	5
·Packaged Programs (personal computers)	-
·Packaged Programs--Simulation	-
·Introduction to Artificial Intelligence	5
·Expert System	5
·LOTUS 1-2-3	5
·Computer Education Staff	4
·Information Systems	3
·Project Control	3
·CAI	3
·Data Communication Systems	-

Source: Data from PUSAT ILMU KOMPUTER SISTEM INFORMASI

Each course lasts several days and consists of theory and practice on a fifty-fifty basis. Lessons are given for 8 hours and 30 min (including breaks) daily. Tuition fees vary depending on the course, but are between 40,000 and 200,000 rupiahs. Students, faculty members and staff of the Institute do not have to pay as much as others.

The lecturers for these courses are selected from about 800 staff at the college. The lecturers are sometimes required to undergo training at another institute, because the computers installed in this institute are not of the latest type.

According to the field survey in Bogor University of Agriculture located in the suburbs of Jakarta, 60 personal computers are installed for the purpose of such education as introductory courses on PASCAL, FORTRAN and statistical packages (BMDP and SPSS). In Sepuluh Nopember Institute of Technology in Surabaya, which is the second largest city to Jakarta, about 50 personal computers are installed for the education of students. They also have Honeywell minicomputers, but scarcely use them because these computers are rather old, and once a mainframe is installed, it will be much used for research purposes.

(4) Computer Schools

The total number of computer schools in Jakarta is approximately 50, and about 20 of these are concentrated in Jakarta. The number of computer schools are not large, and most of them are rather newly established, because governmental organizations and private companies are now emphasizing the use of computers. These computer schools can be classified into the three types according to the people who attend the school, and an example will be given of each type;

① Schools for 3 -5 years of education for high school graduates
② Schools for the general public
③ Schools for those who are working for governmental organizations and private companies

As an example of schools established for high school graduates and the general public, we visited SEKOLAH TIGGI TEKNIK KOMPUTER TERAPAN INDONESIA and AKADEMI KOMPUTER & SISTEM INFORMASI. The former is a 5-year school with about 500 students. The tuition fee is about 1 million rupiahs per year, which includes computer use, cost of text books, etc. This school runs daytime and

evening lessons, and Table III-17 shows the curriculum for computer technology in this school.

The curriculum includes most of the generally required courses such as computer software, hardware and programming languages, as well as mathematics, physics, electronics, etc. Lessons are given for 5 -6 hours a day and it was stated that computers are used for practice mainly on Saturdays and Sundays. Most of the graduates of this school are said to work for private companies, a few work for governmental organizations, and some become teachers of a computer school.

The second school, AKADEMI KOMPUTER & SISTEM INFORMASI, is a 3-year school with about 300 students studying in the daytime and evening classes. The tuition fee is 500,000 rupiahs without the cost of text books. Lessons are given for about 3 hours a day, and there seems to be a trend for 3-year schools becoming less popular, because, in recent years, college graduates have had more advantage when they look for employment. To cope with this situation, computer schools are now said to be planning to open short-term courses of 3 months or 6 months.

We also visited P.T. PUSAT INFORMATICA to investigate a school established for governmental organizations and private firms. This school is open to individuals, but compared with the two above mentioned schools, its tuition fee is considerably higher, thus making it difficult for general working people to study in this school at their own expense. The lessons taught in this school are mainly for databases on personal computers, simplified languages and high-level languages.

Table Ⅲ-17 Example of a Computer School Curriculum

Major Subjects of Computer Technology by Semester

1st Semester
- English-1
- Mathematics-1
- Basic chemistry
- Basic physics-1
- Introduction to computer science
- Programming (Basic 1)
- Basic physics, practice

2nd Semester
- English-2
- Mathematics-2
- Basic physics-2
- Basic physics-3
- Computer programming languages
- Programming (Basic 2)
- COBOL
- Digital connecting technology-2
- Programming, practice
- Computers

3rd Semester
- Management
- Mathematics-3
- Built-up languages
- Electric connecting technology
- Algorithms
- Boolean algebra
- PASCAL
- Language (practice)
- Connecting technology

4th Semester
- Basic culture
- Religion
- Mathematics-4
- Statistics
- Computer system
- Microprocessors-1
- Data structure and algorithms
- Basic functions of computer systems
- Microprocessors-1 (practice)

5th Semester
- Basic social science
- Planning-1 (assignment)
- Electronics-2
- High-level programming languages
- Programming instruction methods
- Filing systems

6th Semester
- Electronics-1
- Databases
- Operating systems-1
- BASIC compiler
- Microprocessors-2
- Planning-2 (assignment)
- Numerical analysis-2
- Microprocessors-2 (practice)
- Electronics-1 (practice)

7th Semester
- Investigation method
- Electronics-2
- Operating systems-2
- Operations research-1
- Computers and society
- Labor law
- Electronic drafting
- Electronics-2 (practice)

8th Semester
- Electronics-3
- Graphics
- Operations research-2
- Management information system
- Making reports
- Data communications
- Introduction to image processing
- Microcomputer systems
- Electronics-3 (practice)

9th Semester
- Introduction to robotics
- Graduation report
- Hybrid systems
- Introduction to intelligence
- Introduction to semantics

Source: Data from SEKOLAH TINGGI TEKNIK KOMPUTER TERAPAN INDONESIA

SECTION 3 INFRSTRUCTURE RELATED TO THE INTRODUCTION OF A COMPUTER

3.1 Information Communication Network

(1) General Situation

1) Current and future telephone facilities

The diffusion rate for subscribed telephones in the Republic of Indonesia was 0.33 per 100 persons in 1984 as shown in TableⅢ-18, which is the lowest among ASEAN countries. One problem is installation delay, resulting in about 300,000 applications waiting.

Table Ⅲ-18 Telephone Diffusion Rates in ASEAN Countries (1984)

Country	No. of Subscribed Telephone Lines	Population	No. of Subscibed Lines	Remarks
	[1,000]	[Million]	per 100 Persons	
Indonesia	536	161.58	0.33	Jakarta 256
Malaysia	849	15.30	5.55	
Philippines	481	53.35	0.90	
Singapore	743	2.54	29.20	
Thailand	519	50.58	1.03	
Brunei	20	0.22	9.00	

Source:ITU Yearbook of Common Carrier Telecommunication Statistics 1975-1984, 1986

Most of the telephone switching boards installed before 1985 are foreign made and many models have been introduced as shown in Table Ⅲ-19, thus making interfacing complicated between them.

The automation proportion was 86% in 1984 for subscribed telephone lines, although most telephones are manually operated outside cities. The rate is as low as about 26% in terms of telephone exchanges.

Junction cables between city telephone exchanges are not sufficient for current traffic. To cope with this, digital computerization using fiber optic cables is now going on. In Jakarta and Surabaya, the facilities are now being renovated and extended with Japanese and European fiber optic cables.

Table III-19 Models of Local Switching Boards

System		Maker	Models
Manual		LME	ABK (local battery system) ADK (common battery system)
Automatic	Electromagnetic	SIEMENS	EMDF6, F6A, 55V, ESK10.000
		PHILIPS	UR49a
		LME	ARF101, 102, ARK521
		SEL	HKS44223S
		BTM	PC-1000
		NIPPON ELECTRIC	NEC-230S/B/L, NEC-100B
		HITACHI LTD.	HIT-C23S
	Electronic	PHILIPS	PRX 205A (analog system)
		BTM	MC/10C (analog system)
		PT. INTI	STDI/EWSD (digital system)

Sources : FUNDAMENTAL TECHNICAL PLAN INDONESIA 1985, DIRECTORATE GENERAL OF POST AND TELECOMMUNICATIONS, MINISTRY OF TOURISM, POST AND TELECOMMUNICATIONS

Work in Jakarta is planned over two stages. The first stage has already been completed in June 1983 and the second stage is to be completed by 1992. The second stage of the program includes the installation of fiber optic cables between Jakarta and PUSPIPTEK-Serpong.

Since 1974, the Telecommunication Corporation (PERUMTEL) has worked out 5 year plans to expand telephone facilities, making the following its important policies:

① Fulfilment of demand for telephones, centering on major cities
② Establishment of automatic direct dialing networks between major cities
③ Expansion of telephone networks to major remote cities through the introduction of a domestic satellite communication system

As a result, 523,000 telephone terminal facilities had been installed in 15 years during the third 5-year plan to increase the telephone diffusion rate (no. of subscribed telephone lines per 100 persons) from 0.15 in 1969 to 0.33 in 1984. Currently, the fourth 5-year plan (1984-1989) shown in Table III-20 is underway. This plan intends to install about 1,000,000 terminals to improve the telephone diffusion rate to 0.8, the automation rate to 96%, and the digital computerization rate of automatic switching boards to 54%. In fact, however, the plan has been greatly delayed.

Since 1985, digital automatic switching boards (STDI/EWSD) have been produced by the state-run communication equipment manufacturer PT. INTI under a license agreement with SIEMENS. Although some parts are provided

Table III-20 Outline of the Fourth 5-year Plan

Equipment \ Plan Period		End of Third 5-year Plan (Estimate) (Apr. 1979-Mar. 1984)	End of Fourth 5-year Plan (Apr. 1984-Mar. 1989)
No. of subscribed telephones [1,000]		536	1,450
No. of switching board terminals [1,000]		698	1,700
No. of telephone exchanges		683	752
Automation Rate	Subscribed telephone line	86%	96%
	Telephone exchanges	26%	47%
Telephone lines per 100 persons		0.33	0.81

Sources :PERUMTEL TRAFFIC 82/83, 83/84 and PERUMTEL PELITA-IV

by SIEMENS, this is now in the full-scale manufacturing phase. Newly installed switching boards are of this type, reaching 100,000 terminals in the middle of 1987.

In order to make a long-term development plan for the telecommunication system, which lasts until the year 2004, the Indonesian government requested Japan in 1986 to conduct a study, which was done by the Japan International Cooperation Agency. This study report was submitted in February 1987. Subsequently in the same year, the Telecommunication Corporation commissioned the joint organization of three companies, TORIBAYA ENGINEERING, NIPPON TELEGRAPH & TELEPHONE CORPORATION and NIPPON TELECOMMUNICATIONS CORPORATION, JAPAN, to design a communication network for seven major cities (Jakarta, Surabaya, Bandung, Sumaran, Medan, Ujun Pandang, and Denpasar) in order to prepare for an expansion of telephone facilities.

This communication network design includes training PERUMTEL's personnel in Japan as well as preparing the tender specifications used in giving orders to local construction companies.

2) Current and future of suburban commuication routes

For ground communication, a 5,000 km-long microwave route has been completed as a suburban trunk, running from Achu in Sumatra island to Ujun

Pandang in Surawesi island via Java and Flores islands. Branch communication routes use coaxial cables, and many of them terminate in naked wire.

For satellite communication, the second-generation Parapa satellite system is used for domestic communications. Currently, B1 and B2P are operated by PERUMTEL. The number of ground stations is about 250. The Parapa satellite system leases repeaters to the ASEAN countries (except Brunei).

In the fourth 5-year plan, in order to further improve the microwave route and to install a 390 km-long fiber optic undersea cable between Surabaya and Panjalmashin in Kalimantan island, the Indonesian government appointed NIPPON TELEGRAPH & TELEPHONE CORPORATION, Japan, and two other Japanese companies as consultants. This work is due to be completed by the end of 1989.

Also, a digital microradio system is planned to be introduced to improve the suburban communication routes of rural telephone stations. For this purpose, a local communication network construction project has been entrusted to SUMITOMO CORPORATION and TOMEN Group in Japan. This project is due to be completed in autumn 1989.

The fourth 5-year plan also schedules the construction of another 100 ground stations for the domestic communication satellite. If they are completed, the suburban communication routes will be greatly improved for remote areas. It is planned to improve connection delay and quality of suburban communications, where waiting for connection is currently dominant.

3) Current and future of data communication networks

① Domestic public data communication network

As a domestic data communication network, SKDP packet communication operated by PERUMTEL is available. Its switching center is located in Jakarta, and services are currently provided for four cities, Jakarta, Bandung, Medan and Surabaya, the number of terminals being about 200.

Although SKDP provides connections from the telephone network as well as connection via direct lines, it is generally difficult to use because of the poor quality of the telephone network.

The communication rate is 4,800 bits/s max. for a direct line, and 1,200 bits/s max. when connecting from the telephone network. The terminal communication protocols used are the internationally standardized ones.

② International public data communication network

As an international data communication network, INDOSAT operated by the

state-run International Communication Corporation (P.T. INDOSAT) is available. Interlinked with SKDP, it is connected to the packet exchange networks in 28 foreign countries. Overseas databases can be retrieved either by connecting via SKDP or connecting by directly subscribing to the INDOSAT system.

③ Special-purpose data communication network

As a special-purpose data communication network, the inter-university data communication network UNInet is available. Currently, seven universities subscribe to it, and it is planned to extend the network to 44 universities in future. The network is based on SKDP and its major functions for use are as an electronic bulletin board and for electronic mail.

It is also connected to overseas special-purpose data communication networks, including ASEAN countries, U.S.A., Japan, Europe, South Korea and Australia.

In addition to UNInet, there are ideas for IPTEKnet supervised by the Indonesian Institute of Sciences (LIPI) and SIMNUS net supervised by the Ministry of Industries.

Financial institutions and other large enterprises are independently building their dedicated communication networks.

SKDP has a plan to extend its services to two other cities, Ujun Pandang and Palembang, by the end of 1988, in addition to the four cities already mentioned. The ultimate aim is to provide its services in all major cities in future.

The telephone network provides no scope for use in data communications under current circumstances because of its low diffusion rate, and there are not many cases where it is used as a means for connection to SKDP due to the low quality. As switching boards and communication routes are made digital and connection of subscriber lines progresses, however, it is expected that more people will use SKDP via the telephone network.

It is also expected in future that the telephone network will increasingly be made digital throughout the country, and that an Integrated Service Digital Network (ISDN) will start its services and provide digital data line exchange and packet exchange.

(2) Information Communication Networks of PUSPIPTEK-Serpong

Information communication networks are of two types: one between the laboratories in PUSPIPTEK-Serpong and the computer introduced to the Center for Industrial Technological Information, and the other for retrieving the databases, overseas ones included, from the Center and making use of the computer at the Center from the outside.

1) Local information communication network in PUSPIPTEK-Serpong

Direct lines are used for connection between the computer of the Center for Industrial Technological Information and each of the laboratories. The cables installed in the site of PUSPIPTEK-Serpong for telephone switching can be used as these direct lines (see Fig. III-3).

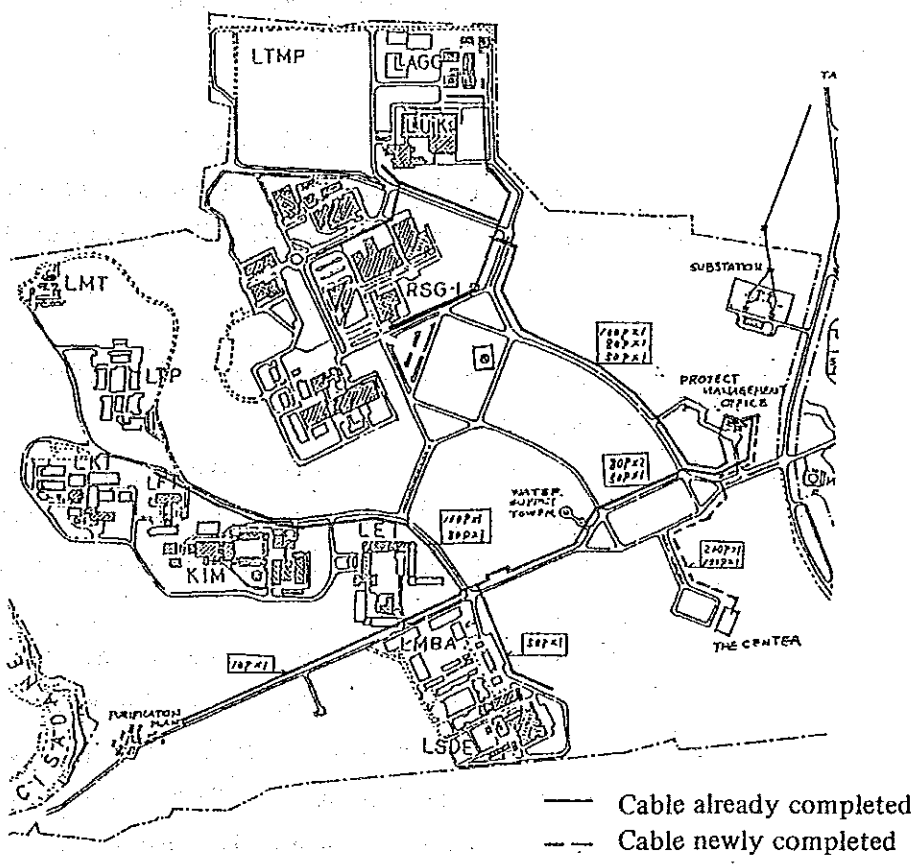


Fig. III-3 Private Communication Cable Route in PUSPIPTEK-Serpong

Source: Prepared from results of the field survey

The cables installed for telephone switching are sufficient not only for telephones, but also for data communications in quality and method. Furthermore, as they are installed underground, there is no problem with their safety and stability. The number of pairs of cables has a sufficient line capacity to allow combined use of the cables for both telephones and data communications.

To make use of this line facility, it is necessary to install a cable between the Center for Industrial Technological Information and MDF in the Project Management Office, there being no problem in installing the cable underground between them. To unify management of the line facility, cable installation and maintenance should be taken care of by the Project Management Office.

The cable length is within 3 km, even between the Center construction site and the farthest laboratory (LMT), and private modems are available. Current commercially available private modems can be stably used up to 19.2 kilobits/s, which is sufficient for the communication rate of the computer introduced to the Center for Industrial Technological Information.

PUSPIPTEK-Serpong has a digital PBX CBX-II made by ROLM INC. in U.S.A. for telephone switching. With modems, data communications between the laboratories can be achieved through this PBX. Electronic mail is also provided by adding a function.

2) Information communication network for connecting outside PUSPIPTEK-Serpong

① Public packet exchange network

The SKDP domestic public packet exchange network operated by PERUMTEL is currently available in four cities, and will cover six cities by the end of 1988. It is planned to make its services available in all of the major cities in future.

An overseas database from the Center for Industrial Technological Information can be retrieved by connecting a foreign packet exchange network through this SKDP and the international public packet exchange network, INDOSAT, operated by the International Communication Corporation.

The same route is taken when accessing the database at the Center from overseas.

To retrieve the database or to make technical calculations by connecting to the computer of the Center for Industrial Technological Information from a domestic government office, university or enterprise, it is most general to use SKDP.

To use SDKP at the Center, it requires a data communication line between the Center and the nearest SKDP node location, Jakarta. Currently, there is no data communication line between PUSPIPTEK-Serpong and Jakarta. According to a project of the Posts and Telecommunications Agency, however, fiber optic cables are to be installed between Jakarta and PUSPIPTEK-Serpong by 1992. In the near future, it will be possible to use SKDP at the Center.

② UNInet

The inter-university network UNInet currently has seven universities connected to it. In future, 44 universities will subscribe to it.

To make use of the computer at the Center from a UNInet-subscriber university, it is necessary to connect UNInet to the computer of the Center. This, however, depends on the construction of a data communication line between Jakarta and PUSPIPTEK-Serpong like the case of SKDP. Since the UNInet network is based on SKDP, communication protocols have no problems because they are internationally standardized like SKDP.

③ Telephone network

The Current telephone network is of poor quality and not suitable for data communications. As its preparation and expansion progress, however, it is expected that there will be no hindrance for data communications in the near future.

If the telephone network can be used for data communications, it is also possible to directly connect from Jakarta, etc. to the computer of the Center through the telephone network, because recent telephone line modems are advanced and of high speed, and those of 9,600 bits/s (V.32) are internationally standardized.

In the long term, switching boards and communication lines will gradually become digital, and ultimately, when the integrated service digital network (ISDN) is completed as in developed countries, this will make it easily possible to use the computer of the Center from anywhere in the Republic of Indonesia.

3.2 Power Supply

(1) Introduction

In the Republic of Indonesia, where diffusion of electricity is at extremely low level, electricity is not only the base of industries, but also

an important pillar of the Indonesian government policy to promote regional development through the diffusion of electric light and communications. The fourth 5-year master planalso emphasizes the importance of developing the electricity grid.

Electricity is generated, transmitted and distributed by the state-run Electric Power Corporation (PLN) under the control of the Electric Power and New Energy Agency of the Ministry of Mining Energy. In addition, many plants generate electric power by themselves for their own use, and private enterprises also generate electric power to sell it to PLN. In remote areas, small generators are used for non-utility generation. For such electrification of villages, the Ministry of Public Services and the Agency for the Assessment and Application of Technology (BPPT) are participating in and promoting various projects.

As shown in Table III-21 , the generation equipment capability in PLN has been steadily improved annually and reached 5,400 MW in 1985. The amount of generated power was also considerably increased to 16,853 GWh in 1985, but, the power sold was only 12,284 GWh (data from the Central Bureau of Statistics) after transmission and distribution losses.

Table III-21 Generation Equipment Capability and Generated Power of PLN

Year	Generation Equipment Capability[MW]	Generated Power [1000MWh]
1979	2,536	7,004
1980	2,554	8,420
1981	3,033	10,138
1982	3,437	12,165
1983	3,935	13,296
1984	4,568	14,782
1985	5,400	16,853
1986		18,756

Sources: Government report on the second year of implementaion of Pepelite IV.
Data for 1986 is derived from Neraca Jul. 13, 1987

Table III-22 shows the proportion of primary energy sources and generated electric power.

Oil accounts for 32.29%, petroleum gas 19.27% and diesel 17.12%. Oil related energy sources account for 67.73% in total, which is a considerably high ratio compared with other domestic energy sources.

As previously described, a diffusion rate of electricity in the Rebulic of Indonesia is still low, which is said to be at a level of 10% or 20%, although not accurately known. The transition of the number of PLN customers, however, was 2,347,457, favorably increased to 4,771,759 in 1983 and 6,437,191 in 1985, and it is still increasing.

Table III-22 Primary Energy Sources for PLN Generation (1985)

Source	Based on Generated Power [%]	Based on Equipment Capability [%]
Water	12.77	13.69
Oil	56.79	32.29
Coal	8.97	15.32
Diesel	12.46	17.12
Petroleum gas	6.03	19.27
Natural gas	1.65	1.74
Geothermal	1.33	0.57
Total	100.00	100.00

Source: Data from the Ministry of Mining Energy

As shown in Table III-23, current electric charges of the PLN (revised in 1986) are classified into 17 groups depending on the purposes of use. Calculation criteria for electric charges are the power-receiving capacity and the amount of power used. Since the laboratories at PUSPIPTEK-Serpong are governmental organizations, 15(G_1) and 16 (G_2) are applied.

Table III-23 PLN Calculation Criteria for Electric Charges (Revised in 1986)

No.	Group No. (Note 1)	Classification by Range of Use	Consigned Charge [Rp/kVA]	Charge for Consumption Power [Rp/kWH] (Note 2)
1	S_1	– 200 VA	*)	
2	S_2	250 VA – 200 kVA	2,100	43.50
3	R_1	250 VA – 500 VA	2,100	70.50
4	R_2	501 VA – 2,200 VA	2,100	84.50
5	R_3	2,201 VA – 6,600 VA	3,680	126.00
6	R_4	6,601 VA or more	3,680	158.00
7	U_1	250 VA – 2,200 VA	3,680	134.00
8	U_2	2,201 VA – 200 VA	3,680	150.00
9	U_3	201 kVA or more	2,300	WBP= 158.00 LWBP= 99.00
10	U_4	–	–	307.00
11	I_1	– 99 kVA	2,300	WBP= 97.50 LWBP= 60.50
12	I_2	100 kVA – 200 kVA	2,300	WBP= 92.50 LWBP= 57.50
13	I_3	201 kVA or more	2,100	WBP= 90.50 LWBP= 56.00
14	I_4	5,000 kVA or more	1,970	WBP= 77.00 LWBP= 48.50
15	G_1	250 VA – 200 kVA	3,680	96.00
16	G_2	201 kVA or more	1,970	WBP= 99.00 LWBP= 65.00
17	J	–	–	76.50

* Group S_1 (reserved)

No.	Grouo No.	Classification by Purpose of Use	Long-term Charge [Rp/Month]
1	S_1	60 VA	1,550
		75 VA	1,940
		100 VA	2,510
		125 VA	3,200
		150 VA	3,765
		175 VA	4,350
		200 VA	5,025

(Note 1)

$S_1 \sim S_2$: School, trmples, churches, etc.

$R_1 \sim R_4$: Housing

$U_1 \sim U_4$: Industry, offices, shopping centers, etc.

$I_1 \sim I_4$: Plants, hotels, etc.

$G_1 \sim G_2$: Government offices, diplomatic offices, foreign aid offices, etc.

J : Street and road lights

(Note 2) WBP (allotted charge at peak time) from 18:00 to 22:00 local time
LWBP (allotted charge at off-peak time) from 22:00 to 18:00 local time

(2) Current Situation in PUSPIPTEK-Serpong

The power to each laboratory is supplied at 3-phase 150 KV, 50Hz as a specially high voltage from a substation located at the north eastern corner of the site for PUSPIPTEK-Serpong and distributed to each laboratory through underground cables, with its voltage stepped down to 20 kV there. The substation capacity is 60 MW for current consumption with 60 MW stand-by, which is sufficient as a power supply capability. PLN is responsible for the operation and management of this substation and for the power supply to each laboratory. Each laboratory has a control room which steps down the voltage to 380 V/220 V and distributes power to each room.

Electric charges are individually paid to PLN by each laboratory. (The telephone charges of these laboratories are paid from a budget of the Project Management Office as a provisional step).

3.3 Other Infrastructure

(1) Water Supply Facilities

At PUSPIPTEK-Serpong, the water required for each laboratory and housing for the researchers is supplied by self-owned water supply facilities. That is, water is taken from the adjacent river Cisadane into a water purification plant located southwest of the vast site of PUSPIPTEK-Serpong, purified through ① a reservoir, ② settling pond, ③ filter bed, ④ sand filter bed, ⑤ sterilizing equipment and ⑥ underground water reservoir (1,000t×2), fed to a water tower (50 m high) located near the center of the site by water feed pumps (0.07 m^3/s capacity, 2 units), and supplied to each user. The water purification plant can purify water at a rate of 0.18m^3/s for the moment; 0.1 m^3/s for RSG-LP and 0.08m^3/s for other facilities.

The Cisadane river, from which water is taken, originates in Mt. Saraku, and the foot of the mountain near Bogor is well known as the rainiest region in Java island.

(2) Drainage Facilities

PUSPIPTEK-Serpong independently drains its vast site. Drainage water from the laboratories or streets on the site is collected in a large pond near the mosque through an underground main sewer.

Sewage and waste water caused by experiments are separately treated.

(3) Site Facilities

PUSPIPTEK-Serpong is well-provided with streets. Main streets are 6 m wide and partly have two lanes with median strips provided. Most of the streets are paved with asphalt. The major portions of the streets have sidewalks, and have L- or U-shaped ditches to drain rain water. In addition, the main streets are equipped with hydrants, and pillar boxes for private telephones and street lighting, etc. on the roadside. Tree planting at major parts of the site is almost completed except around incomplete laboratories.

3.4 Regulations Related to Construction in the Republic of Indonesia

Major regulations and criteria concerning construction in the Republic of Indonesia are listed below. However, some of these describe only guidelines and they may not have details of design and construction. Thus, it may be necessary to arrange the details with authorities concerned for each project. The construction work of the Center will require planning meetings in advance, because the work will be under the control of the Center Office of PUSPIPTEK-Serpong, as was the case for the existing laboratories.

(1) Pertauran Bangunan Nasional 1978

(2) Pertauran Pjrencanaat Tahan Gempa Indonesia Untuk Gedung 1981

(3) Pertauran Beton Bertulang Indonesia 1971 N1-2

(4) Pertauran Konstruksi Kayu Indonesia N1-5 PKKI 1961

(5) Pertauran Umum Untuk Bahan Bangunan D1 Indonesia N1

(6) Pertauran Umum Instalasi Listrik Indonesia 1977

(7) Pedoman Instalasi Penyalur Petir

(8) Pedoman Plambing Indonesia 1977

(9) Pedoman Instalasi Alarm Kebakarfn Buku Pedomank & KK No. 17th 1980

(10) Others

Laws such as labor social security insurance on employment of local workers.

In PART Ⅲ, in addition to infrastructures related to computer environment, the present utilization of databases, computers and educational institutes was explained.

In PART Ⅳ, based on the stated situation and problems on database systems, computational systems and education/training, needs and problems in these three fields will be analyzed and necessary functions of the Center will be proposed with detailed counter-measures.

PART IV

FUNCTIONS

FOR

THE CENTER

FOR

INDUSTRIAL TECHNOLOGICAL INFORMATION

SECTION 1 FUNCTIONS OF THE CENTER FOR INDUSTRIAL TECHNOLOGICAL INFORMATION

1.1 Preconditions for the Needs Analysis

The Investigation of needs and demands for the Center for Industrial Technological Information was first conducted in the laboratories of PUSPIPTEK-Serpong. Major themes for an investigation fell into the following categories:

① Database system
② Education/training system for computer users
③ Technical calculation system

Further, in order to clearly grasp the current state of use of computers in general industrial fields, and also requests to the Center from industries, personal interviews were simultaneously conducted with state-run enterprises, private firms, governmental organizations, universities and research institutes. Thirty-five enterprises, which are listed in the Appendix, were canvassed.

1.2 Outline of Results of the Needs Analysis

Details of the needs analysis concerning the above three categories are described in Sections 2 to 4. In this section, an outline of the analysis results is presented.

(1) Needs for Database Systems

In relation to database systems, the needs are discussed mainly regarding procedures for information management and distribution to effectively carry out research and development in PUSPIPTEK-Serpong.
Table IV-1 summarizes these needs.

Although having a small-sized library for its own use, each laboratory still lacks a sufficient number of publications to provide high-quality advanced technological information to its researchers. Especially, technological information often depends on overseas resources, and requires

much time and cost to acquire. In other words, it becomes essential to have available a distribution service of technological information and, at the same time, to maintain its quality.

The results of research and development, at present, simply kept separately by each laboratory. This is caused by that the management method for serving necessary information related to experiment and for systematizing standard data structures and formats is not utilized. No systematic management based on a comprehensive plan has yet been practiced. These research results, as well as the publications, are not yet available as publicly common information. Therefore, considering the future development of research studies and technology transfer to industries, PUSPIPTEK-Serpong as a whole should make all efforts to collect research papers, etc. and to make them into a database, aiming at systematic manegement and distribution.

Such a collection should include technical reports, papers, developed software and experimental data as shown in Table IV-1.

Table IV-1 Needs Concerning Information Management and Distribution

① Improved efficiency in obtaining and using information necessary for research and development
e.g. : Procurement of reference books and data books in specialized fields
: Obtaining the latest technological information (use of overseas on-line databases)
② Facilitation of information exchange and research activities
e.g. : Mutual exchange of information among laboratories
: Practice of interdisciplinary forums and joint research
③ Systematic management and distribution of research results
e.g. : Management and distribution of reports, papers and experimental data
: Sharing of computer software resources

At present, information exchange among laboratories still rare, where research activities are rather individually carried out. Therefore, interdisciplinary research activities, which is the aim in founding of PUSPIPTEK-Serpong, have not yet been realized. Joint research needs to be encouraged by increased mutual exchange with the industries, etc. through the use of interdisciplinary forums and other means.

(2) Needs Concerning Education/Training in Computer Use

Education/training in computer use should be considered in relation to the needs of technical calculation systems. In other words, while education

and training courses for computer use technologies are widely offered, the aspect of use of computer for research and development should be emphasized at the same time.

A computer should be a tool to support research and development for each researcher, whereas learning a computer language can not be a major object. However, computers are indispensable in carrying out modern research and development in order to save labor and improve efficiency. Therefore, upon introducing software for technical calculation in each field, it is also necessary to organize an environment suitable for the most effective use of computers. In the present situation, where the use of personal computers and minicomputers is dominant, there is not sufficient use of software for technical calculation. As one of conditions necessary to achieve this goal, it is necessary to set up education/training courses in computer use. Emphases on education/training in computer use should be placed not only on training in general programming languages, SA/SE education and effective use of the Center, but also on the matters listed in Table IV-2.

Table IV-2 Emphases on Education/Training in Computer Use

① Learning computer use techniques as a tool to support research and development
e.g. :Numerical analysis
:Methods to use technical calculation software
② Learning methods to process measured experimental data using computers
e.g. :Error analysis, Regression analysis, etc.

(3) Needs Concerning Technical Calculation Systems

① Problems in carrying out research and development

At present, technical calculation is not widely practiced in the PUSPIPTEK-Serpong laboratories. This is partly due to insufficient introduction of large computers. On the other hand, personal computers and minicomputers that were introduced in a fairly large number are still limited in their use, and they are not used for technical calculation. The reasons for such a situation can be summarized into the three points shown in Table IV-3. In order to actively use computers for technical calculation, it is necessary to emphasize such aspects as the potential of research activity, improvement in incentive, capable personnel with leadership, and the improved morale of researchers, in addition to the establishment of computers and software.

Table IV-3 Problems

Characteristics of Laboratories	Outline of Problems
a. Characteristics	○Laboratories largely categorized into those conducting their own research and those conducting commissioned research. Although the former have insufficient experimental equipment due to financial reasons, they can be expected to become capable of achieving theoretical studies when appropriate computers and software are introduced. The latter, on the other hand, mainly conduct measurements and gathering of data. However, with computers and software introduced, they can be expected to expand their territory, to experiments, measurement and analyses, and not be limited to data collection.
b. Background	○None of laboratories has a long history and the number of research staff is insufficient. They are especially lacking experienced leaders, thus having problems in selecting subjects and guiding young researchers.
c. Presentation of research activities	○Researchers' incentive is not strong because opportunities for presenting research activities are scarce.

② Needs for computer use

The use of large computers has become essential for laboratories and institutes which are carrying out up-to-date research and development, in order to save both labor and time and to help researchers for creating new ideas. Thus, the needs of technical calculation can be clarified by the purpose of computer use in research. It is especially important to develop the orthodox approaches of computer use shown in a. - c. of Table IV-4 and, at the same time, new computational science fields, keeping both in good balance.

Table IV-4 Needs for Computer Use

Method of Use	Outline
a. Experimental analysis	Reliability of data obtained from experiments is confirmed.
b. Predictive analysis	Confirmation of safety of newly planned experiments, precomputation of performance/behavior (especially in fields of nuclear power, airplanes, shipbuilding, large-scale construction, etc.)
c. Design calculation	Calculation of design aspects in lenses, ICs, etc.
d. Computational science	Research is carried out by simulating phenomena on computers This can be expected in the fields which involve high experimental cost and accompanying risk, and in which experiments on the ground can not be conducted. For example, simulation of tidal waves, flood, large-scale structures, design of new materials or molecules, etc.

1.3 Defining and Developing the Major Functions

The investigations concerning the needs of laboratories pinpointed five major functions for the Center. Table IV-5 shows these five functions, of which three functions (① - ③) were defined concerning database systems. These three will be described in detail under "Technological Information Management and Support for Research and Development".

It seems to be, however, too difficult to realize all these functions at the same time in practice. Therefore, appropriate steps to realize these functions are described in Table IV-6 in three phases. Details of each concept will be described in Section 2 to Section 4 in which the main emphasis will be put on the functions planned in Phase 1.

Table IV-5 Defined Functions

Main Theme for Needs Investigation	Defined function
• Database system	① Effective support to reseach and development through information distribution
	② Systematic technological information and technology transfer to industries
	③ Translation/publication and promotion concerning industrial technological information
• Computer use education	④ Computer use education/training
• Technical calculation system	⑤ Technical calculation service and consultation

(Note) Functions ①- ③ are discussed under "Technological Information management and Support for Research and Development"

(1) Technological Information Management and Support for Research and Development

The database, whose objects are to manage technological information and to effectively support research and development activities, comprises three main attributes, the details of each being discussed in Section 2.

1) Effective support for research and development through information distribution

The aim is to obtain effectively the information needed for research and development and to offer it to each researcher. For this purpose, reference books and data books in each specialized field have to be organized and the use of overseas on-line databases must be promoted. In order to activate research at PUSPIPTEK-Serpong, joint studies with other institutes and industries or interdisciplinary studies should be promoted via interdisciplinary forums. In other words, the creation of opportunities to exchange expert information and facilitate research and development are attributes of this function.

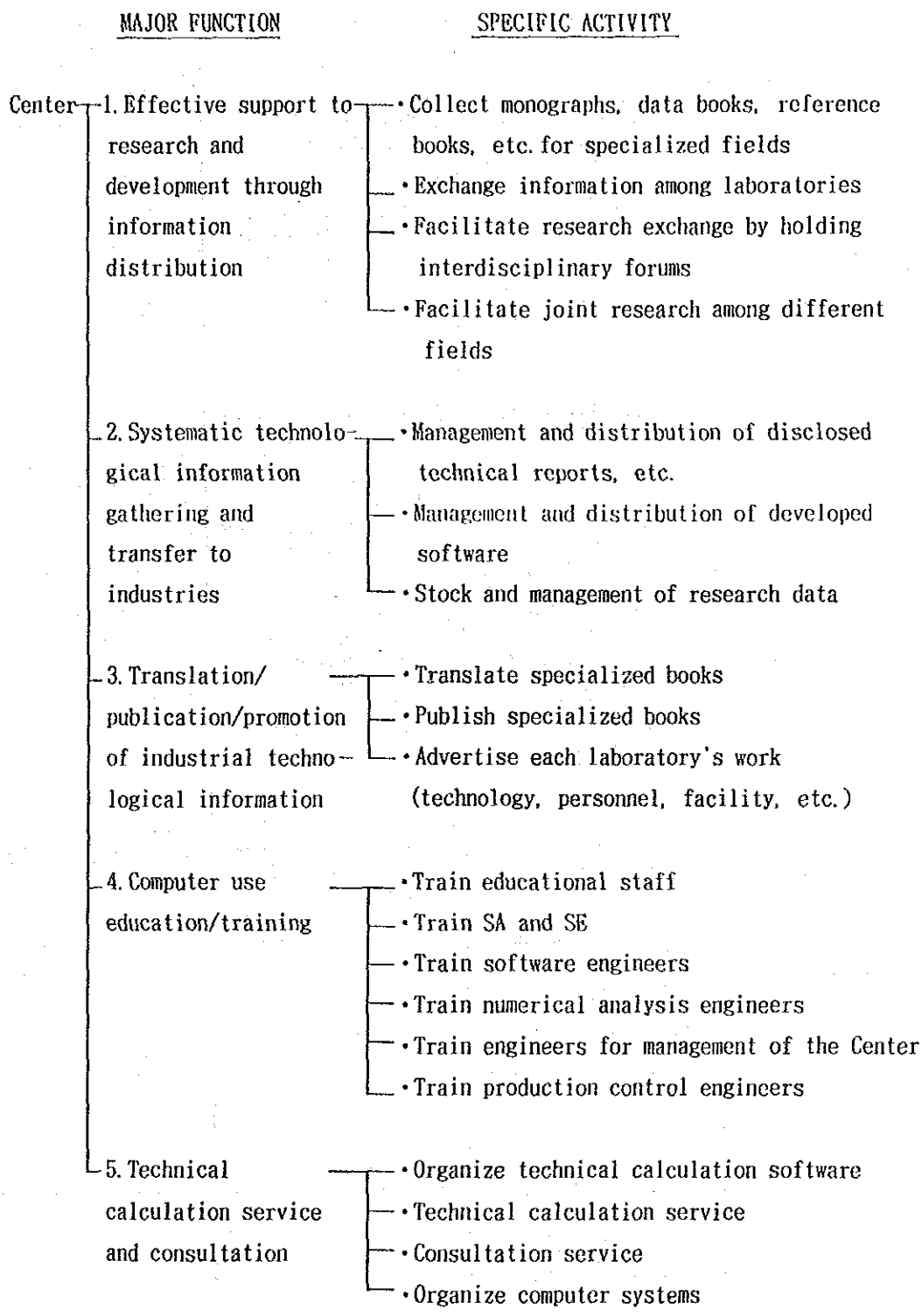


Fig. IV-1 Functions of the Center for Industrial Technological Information

Table IV-6 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 ○ Technical consultation

2) Systematic technological information and technology transfer to industries

Under this function, the results of research and development are systematized as technological information and are distributed not only to PUSPIPTEK-Serpong's laboratories but also to the industries, technology transfer being encouraged.

For this purpose, systematic management of information resources should be conducted in the following fields, being input into a database to be distributed to each laboratory. For experimental data, however, evaluation and verification should be conducted to carefully select the most reliable to be input into the database.

① Technological information database‥ • Common use of research and development results information, journals and books
② Software management ····· • Common use of software resources
③ Experimental data management ····· • Efficient management of experimental data

3) Translation/publication/advertisement concerning industrial technological information

The object of this function is to translate specialized books and to distribute industrial technological information widely to the industries as well as in educational fields. In addition to these, promotional activities are carried out in order to facilitate exchange with other institutes, industries, etc.

① Translation/publication/sales of specialized books
② Advertising activities for each laboratory (details of work, technology, facility, etc.)

(2) Computer Use Education/Training Function

As shown in Table IV-7 , this consists of training of teaching personnel and computer users. Details are discussed in Section 4.

Table IV-7 Computer Use Education/Training Courses

Field of Education	Outline of Course
1. Training teaching staff	○Center users training
	○SA/SE training
	○Programmer training
2. Computer language	○FORTRAN (incl. graphics)
	○C language (incl. graphics)
	○Softwares for personal computers
	○Software development and support system
3. Center use procedure	○Use of mainframes (for engineers and programmers)
4. Numerical calculation techniques	○Numerical calculation
	○Training on the use of application software
5. System technology	○Assemblers
	○Data communication
	○Interface techniques
	○Automatic data aquisition system

(3) Technical Calculation Service and Consultation Function

With a view to developing technical calculations and adding more sophistication to research and development, programs with specific functions should be prepared in the following fields. Table IV-8 shows the types of software to be prepared, and the details are discussed in Section 3.

Table IV-8 Preparation of Application Software

Field	Outline (sample programs)
1. Structural analysis	○Programs which carry out structural analyses concerning not only static/dynamic analyses and linear/nonlinear problems but also thermal conductivity and sound. by the finite element method.
2. Impact analysis	○Programs dealing with nonlinear large deformation behavior of gases, liquids and solids when impact is applied. Either the finite difference or finite element method is used.
3. Fluid analysis	○Liquid analysis programs (constant/non-constant analyses of incompressible/compressible viscous fluid, turbulent flow and multilayer analyses)
4. Nuclear power	○Programs concerning running the research reactors of RSG-LP. Evaluation of the core performance (group constant calculations, and burn-up calculations) and programs relating to screening)
5. Chemistry	○Programs concerning the molecular orbital method and molecular dynamics
6. Chemical engineering	○Programs necessary to design piping, regenerator and distillation towers
7. Optics	○Lens-design programs
8. Electronic	○Programs to analyze the electrical feature of engineering electronic circuits ○Logic circuit design programs
9. Electromagnetism	○Programs to calculate magnetic fields, magnetic forces, electric fields and eddy currents
10. Mathematical	○General-purpose science and technological program routines library
11. Graphical routines	○Programs to enable color image output

SECTION 2 TECHNOLOGICAL INFORMATION MANAGEMENT AND SUPPORT OF RESEARCH AND DEVELOPMENT

2.1 Analysis of Current Problems and Needs

(1) Analysis of Current Problems and Needs

Table IV-9 shows a summary of the problems and needs concerning technological information management and research and development support for the database. In this table, problems and their corresponding causes, and needs and their corresponding background are listed with possible measures.

These problems and needs relating to the database are analyzed with emphases on the methods for procurement and use of information necessary to carry out research and development, and on the way for systematization of research and development results as information. Basically, they are attributed to the management of "input information" needed for research and development and "output information" as research and development results. The results of the problems and needs analysis listed in Table IV-9 can be summarized as follows:

① Procurement and use of information necessary for research and development
—Use of books and data books in specialized fields (procurement of basic information)
—Procurement and use of the latest technological information

② Mutual use of information to promote research activities
—Mutual information exchange among laboratories in the PUSPIPTEK-Serpong complex
—Facilitation of joint research with outside institutes or those of industry

③ Systematic Arrangement and use of research and development results
—Arrangement and distribution of reports and papers
—Shared use of software resources
—Management and distribution of experimental data

Table IV-9 Problems/Needs Analysis Chart

No.	Problem/Need	Reason/Cause	Countermeasure	Category* ①	②	③
1.	○ Book volume is not large enough to maintain a sufficient information for reserches. (PDII, a core institute for scientific documentaion distribution, has the same problem due to financial restrictions,)	○ Each lobratory has its own small library, which is lacking both in quality and quantity.	○ Translation/ publication of specialized books, and organization of monographs, reference books, etc. into specialized fields.			◎
		○ It is difficullt to grasp the actual number of journals and books held by PUSPIPTEK-Serpong as a whole.	○ Information relating to books and journals held by each laboratory is input into a database for common use.	◎		
			○ Clearing service is set up to offer information on access to journals/books held by each laboratory in PUSPIPTEK-Serpong.		◎	
2.	○ Both long time and high cost are spent to obtain the latest technical documents necessary for research activities	○ PDII, a core institute for distributing science and technology documents is far away from PUSPIPTEK-Serpong.	○ Communication means is to be established between PUSPIPTEK-Serpong and PDII.			◎
			○ Arrangement should be made between PDII and the Center for Industrial Technological Information so that information can be obtained without visiting PDII.		◎	
		○ Overseas on-line database, although effective, incur high cost and have not been used much	○ Aim to reduce or eliminate use charges to internal researchers by subsidizing from charges made to external users.			◎
			○ Train professional database searchers for effective retrieval.			◎

(To be continued)

(Continued)

No.	Problem/Need	Reason/Cause	Countermeasure	Category* ①	②	③
3.	○ It is difficult to mutually grasp the activities of each laboratory in PUSPIPTEK-Serpong. Therefore, mutual exchange of research results is not improved.	○ Combination of research themes extending over many fields to create advanced subjects, which was the original aim of PUSPIPTEK-Serpong, has not been realized.	○ Collect and distribute information relating to research projects, personnel, facilities and equipment in each laboratory		◎	
		○ No place has been set for information exchange of research activities.	○ Set up meetings for information exchange.		◎	
4.	○ Interdisciplinary joint studies with both internal laboratories and external institutes or industries should be developed.	○ No place has been set for research exchange with other fields.	○ Hold interdisciplinary forums to maintain close contact with other fields.		◎	
			○ Use an information exchange network such as UNInet, and discuss the use of overseas information networks.		◎	
		○ Opportunities are scarce for joint research with external institutes and industries.	○ Actively conduct joint research internally and with external institutes or industries to inform about the activities (technology/personnel /facilities) of each laboratory of PUSPIPTEK-Serpong.		◎	
5.	○ Reports/papers as results of R & D are not systematically maintained at PUSPIPTEK-Serpong as a whole. Therefore, information cannot be smoothly offered upon request from reseachers, industries, etc.	○ Results reported by each laboratory and bibliographical information are individually maintained. Therefore, they are not available for common use as resources for PUSPIPTEK-Serpong as a whole.	○ Collect and distribute technical reports and papers issued by each laboratory, and input bibliograhical information into a database.	◎		
6.	○ As R & D expands in PUSPIPTEK-Serpong, much software as tools to support R & D is developed and purchased.	○ Aim to reduce development and purchase cost by preventing duplication in developement/purchase by laboratories.	○ Manage all the software developed and purchased by laboratories input them into a database, share software resouces.	◎		

(To be continued)

(Continued)

No.	Problem/Need	Reason/Cause	Countermeasure	Category*		
				①	②	③
6.	○ Resources, are scattered if maintained individually. Unified management is recommended to produce the best resource from results of R & D.	○ Software originally developed contributes to technology transfer through distribution to other institutes and industries.	○ Manage the software developed or purshased at each laboratory in one place and promote sharing of software resource by inputting the bibliographical information into database.	◎		
7.	○ Management of experimentai data is often left to each researcher, and results may be scattered as R & D develops and expands in future.	○ Management of experimental data is not organized.	○ Prepare SOP to define the management procedure for experimental data in each laboratory.		◎	
	○ As R & D develops, the volume of experimental data increases in each laboratory. Data is currently managed mostly by personal computers.	○ As the data volume increases, data management by personal computer tends to cause inconvenience in use.	○ Process and store data by general-purpose computers.	◎		
	○ It is necessary from now on to effectively process and store experimental data and to systematically store, manage and distribute those with wide application expected.	○ Screening of experimental data widly distributed database use or for individual is not practiced.	○ Make a database and distribute, starting from data with high need by external institutes, etc. based on assessment and verification.	◎		

Notes: * Category of approach to solve problems.

① "Systematization" → Preparation of a database and information system
② "System/Organization" → Improvement, modification and establishment of systems and organizations
③ "Others" → Measures other than ① and ②

(2) Needs for the Use of Technological Information

A needs investigation was conducted concerning the use of the existing database and the source data to be input into a database in each laboratory of PUSPIPTEK-Serpong. Analyses of the results from the "Questionnaire on Creating a Database" and from personal interviews conducted in each laboratory will be discussed next. Replies were obtained from six laboratories (LKT, LAGG, LUK, KIM, RSG-LP and LSDE)which were in operation as of the time of the investigation.

Technological information that is used to set up a database is hereinafter referred to as "source data". The needs for a database can be divided into the following based on the source data concerned:

① Use of source data created and stored through research and development activities in each laboratory of PUSPIPTEK-Serpong.
② Use of source data created outside PUSPIPTEK-Serpong.

1) Needs of source data created and stored inside PUSPIPTEK-Serpong

In the needs investigation, attention has been paid first to source data commonly used by staff members of each laboratory. Table IV-10 shows examples of source data subject to the investigation. As mentioned below, source data which can be subjected to common use generally show a higher need for use.

① Source data subjected to the common use of research staff show relatively high needs (refer to Table IV-11).

② Strong interest in the activities and facilites of other laboratories was indicated by those members with an interest in mutual exchange of information.

Table IV-10 Source Data Created in PUSPIPTEK-Serpong

① Information concerning each laboratory (facility/specialization)
② Research staff in each laboratory
③ Reserach groups in each laboratory
④ Library information in each laboratory
⑤ Information concerning application software either developed or purchased
⑥ Technical reports and papers disclosed

The following needs exist concerning the preparation of a database of experimental data (numerical data) created in each laboratory. However, because of the nature, they are unlikely to be distributed widely, and are used in reseach and development at individual researcher level. For example, the needs for source data management shown in TableIV-11 exist. Databases currently in use are mostly for personal computers. In discussing the preparation of a databases, comprehensive management and distribution for the entire PUSPIPTEK-Serpong are recommended concerning experimental data, research project results and library information.

Table IV-11 Needs for the Preparation of a Database

Institute	Needs	Currently in Use
LSDE	• Measured data and budget management	• Measured data, library information, budget management (dBase III is used)
RSC-LP	• Personnel and financial management • Project management • Numerical data (nuclear cross-section data)	–
KIM	• Research subjects, research outlines • Measured data management (equipment used, measurement conditions, etc,)	–
LUK	• Research activities (personnel, materials, equipment, time, test results outline) • Research results (report, personnel, test data)	• Test report (material, testing device) • Airplane (prototype) fatigue test data
LAGG	• Library information management	–
LKT	• Device analysis data management • Project management	–

Note: ( ) indicates examples of source data.

2) Needs of source data created outside PUSPIPTEK-Serpong

Source data created outside PUSPIPTEK-Serpong are, as shown in Table IV-12, roughly divided into the basic information necessary to carry out recearch and development and industrial technological information in various fields. The needs of these source data show the following characteristics:

① In relation to the use of library information and overseas on-line database services necessary to support research and development, relatively high demand was observed, as was the case in PUSPIPTEK-Serpong.

② On the other hand, demand is not always very high for source data concerning scientific and technological administration, patent information, patent regulations, industrial standards and various statistical data. The extent of demand for these source data is considered to largely depend on the specialized field of a researcher and on the actual activities of a laboratory. For example, in the laboratories engaged in industrial technology field the demand for such source data as industrial standards is high. On the other hand, such a demand was hardly seen in the laboratories which are mainly engaged in fundamental research, in their research activities.

Table IV-12 Source Data Created Outside PUSPIPTEK-Serpong

(1) Fundamental information needed for promoting of R & D (mainly in the Republic of Indonesia)
   ① Information concerning laboratories
   ② R & D project information (research institutes/private enterprises, etc.)
   ③ Library information (books in outside libraries, etc.)
   ④ Research staff in each laboratory
   ⑤ Research group in each laboratory
   ⑥ Activities of academic societies
   ⑦ Use of overseas database services
(2) Industrial technological information in various fields
   ① Planning on technology development by government
   ② Patent information and patent regulation
   ③ Industrial standards (domestic, U.S., Europe, Japan)
   ④ Various statistical data (domestic)

2.2 Possible Future Approaches

In the preceding sections, problems and needs analyses were discussed as to "what" are the problems to be solved and the needs to be realized. In this section, the results of discussions on "how" they are to be realized are described. The major approaches are summarized into the following three, and Table IV-13 shows how these can be achieved. Based on these approaches, suggestions ideas concerning technological information management and support for research and development will be discussed in 2.4.

① To support research and development effectively through information distribution
- — Organize and obtain sufficient monographs, data books reference books, etc.
- — Use overseas on-line databases and train professional database searchers
- — Conduct research exchange and joint studies extending over many fields

② To manage technological information systematically and to promote technology transfer to industries
- — Prepare a database for technological information
- — Manage software
- — Manage experimental data

③ To diffuse industrial technological information widely through translation, publication and PR activities
- — Translate and publish specialized books
- — Promote PR activities of the work of each institute

Table IV-13 How to Achieve Better Information Management

No.	Main item	Sub item	Assignment of Tasks
1.	○Effectively support R & D through information distribution.	○Effectively obtain information for specialized fields.	○Each laboratory, although having a small library, does not have enough books to maintain a high-quality information service to its researchers. Books/data in specialized fields should be organized and offered. Bibliograpic Information of Journals/books held by each laboratory should be put into a database for unified management and distribution, and for common use as an information resource. At the same time, contact with PDII should be strengthened so that technological information can be obtained more effectively (in a short time). A clearing service to offer information on access to various documents should be set up. Database searchers sould be trained and overseas on-line databases should be used effectively.
		○Facilitate information exchage among laboratories of PUSPIPTEK-Serpong.	○Mutual research exchange, combined research of inter-fields and creation of high-level subjects within PUSPIPTEK-Serpong have not been developed enough. Therefore, mutual exchange should be activated through holding regular meetings to integrate information concerning the research projects, personnel, facilities and technology of each laboratory.
		○Facilitate research exch-ange with other fields.	○Research exchange and joint research inside PUSPIPTEK-Serpong and with outside institutes or with industries have not been well developed. Research exchange and joint research should be encouraged through holding interdisciplinary forums inside and outside PUSPIPTEK-Serpong, including with industries.
2.	○Systematically manage and transfer technogolical information to industries.	○Systematicaiiy manage and distribute technoiogical reports, etc. as research results.	○Technical reports, papers, etc. disclosed by each laboratory are maintained individually. Thus, mutual untilization of R & D results is difficult and can not be met promptly upon any request. Technical reports, papers, etc. issued by each laboratory should all be collected. Bibliographical information should be put into a database to be distributed to each laboratory and to be available upon an external request.
		○Make developed and purchased software resources available for common use to prevent them from being scattered as assets of each laboratory.	○As R & D develops, various software is developed, much of which is left as an unused asset. Information concerning software developed and purchased by each laboratory should be put into a database for unified management and distribution, and for more common and effective use. At the same time, duplication in development and purchase will be prevented. Software assets as R & D results should be offered to industries, etc. to promote technology transfer.

(To be continued)

(Continued)

No.	Main item	Sub item	Assignment of Tasks
2.		○Prevent scattering of experimental data.	○Management of experimental data (especially raw data) that is to be left to each researcher. As R & D develops in future, these results will be subject to the danger of scattering. Management regulations (SOP) for experimental data should be created for each laboratory, and should be as comprehensive as possible for PUSPIPTEK-Serpong as a whole.
		○Manage experimental data effectively.	○A large quantity of experimental data is created, most of which is currently stored and controlled by personal computers, Depending on the data quantity and form of use, sufficient measures can not be taken. Instead, storage and management by general-purpose computers should be practiced. As for data verified and assessed to have a large demand, this data should be put into a generally available database.
3.	○Diffuse widely industrial technological information through publication and PR activities.	○Translate and sell specialized books to widely distribute them.	○Not only purchase and organize imported specialized books, but also translate and publish them in Indonesian, thus distributing them at a low price toindustries and educational fields to diffuse industrial technilogical information.
		○Inform the work datails of each laboratory to industries	○Widely inform the work details of each laboratory (subject/personnel/technology/facility) of PUSPIPTEK-Serpong to facilitate forums/joint research with outside institutes/industries. Prepare and distribute PR materials.

2.3 Technological Information Management and Support Plans for Research and Development

(1) Effective Support for Research and Development Through Information Distribution

1) Objectives

① Objectives

The primary objective is to obtain and to distribute information needed in research and development. Therefore, it is necessary to prepare monographs and data reference books for specialized fields and to provide an environment where overseas on-line database services are available. However, the full contents of these monographs data books and reference books do not need to be put into a database as they already exist in hard copy for use.

Since its foundation, PUSPIPTEK-Serpong has aimed at creating higher research subjects by combining inter-field assignments and at creating an interdisciplinary environment through research exchange among many fields. It aims to offer "places" where project information and interdisciplinary research can be exchanged and joint research can be conducted, thus overcoming individually isolated situations and facilitating joint activities.

② Categorization of source data and preparation of the database

In order to achieve these objectives, preparation and use of databases (including existing commercial database services) are essential. It is especially necessary to assess and discuss the source data categories and scope of data to be carried in the database. Table IV-14 is a summary of these concepts. Discussions included those subjects for common use as information resources, and those as individual information resources in laboratories.

It is not a practical approach to manage and offer all source data in the database in view of the cost and likely use. For example, with specialized monographs and databooks, although the bibliographical information needs to be managed and distributed, the necessity to build a full-text database is rather low. It should be sufficient when a researcher has free access to them in the form of documents. The assessment of whether or not to input source data into a database should be made in respect of the following aspects:

a. Usefulness as a common information resource

b. Distinction between bibliographical information as a search tool and actual information as a study tool

Compared with information input into a database and widely distributed, there are other types such as experimental data created in each laboratory, whose range of use is relatively limited. With such source data, the following approaches should be considered:

a. Not to incorporate into a database for the time being, but to be offered as a data logger to each laboratory.

b. Based on a verification and assessment of the data by researchers, only develop a database on the source data whose reliability is assured. It is essential, however, to confirm the value of the stored data and its demand for use. In case of outer service, user's needs should be analyzed and a database should be constituted by joint cooperation between researchers and center staff.

Table IV-14 Categorization of Source Data to be Used in the Preparation of a Database

Data Category		Form of Management		
		1. Database	2. Data logger	3. Manual
	Monographs/ data reference	◎		
	Research information			◎
	Technological information (research results)	◎		
	Technological information (software)	◎		
	Experimental data (source data)		◎	
	Experimental data (assessed/verified)	◎		

Notes
1. Input into a database as common use information and distributed widely.
2. Sufficient by a data logger management.
3. Sufficient by manual management. Bibliographical information management on reference books, however, is necessary.

2) Preparation of reference books and data books of specialized fields

Reference books and data books in specialized fields should be available to each researcher, whose basic information is necessary for research and development is offered. Also, as characteristic of an information center, it is necessary to prepare reference books concerning the use of computers, and especially the development of application software and related uses. Table IV-15 summarizes the major research fields for laboratories which are either under operation/construction or in the planning phase.

Table IV-15 Major Research Field Needing Reference Books

Name of Laboratory	Major Research Field
(1) LAGG: Aerodynamics, Gas-dynamics and vibration laboratory	• Low-speed wind tunnel experimentation • High-speed wind tunnel experimentation • Flight dynamics • Sound/vibration experimentation
(2) LUK : Strength of Materials, Components and Structures Laboratory	• Material testing (destructive/non-destructive) • Structure fatigue testing • Vibration testing of large vehicles
(3) LTMP: Thermodynamics, Engine and Propulsion Systems Laboratory	• Thermodynamics/thermal conductivity • Fluid equipment • Engine/propulsion systems
(4) LET : Applied Electronics laboratory	• Electronic circuits/communication technology/computers • Electronic materials • Electronic devices • Standardization and production
(5) LKT : Research and Development Center for Applied Chemistry	• Chemical analysis • Basic chemistry • Food chemistry • Applied chemistry
(6) LFT : Research and Development Center for Applied Physics	• Structure and property of materials • Dynamic characteristics of materials • Metallurgical physics • Polymerization technology • Ceramics
(7) KIM : Research and Development Center for Calibration, Instrumentation and Metrology	• Dynamic measurement • Electric/electronic measurement • Thermal measurement • Optical measurement • Acoustic measurement
(8) LMT : Applied Metallurgy Laboratory	• Metallurgy • Metals • Corrosion • Nonmetallic substances
(9) LTP : Process Technology Laboratory	• Production of macromolecules and complex materials • Physical/chemical processing of materials • Material handling • Container packaging for transportation of products
(10) RSG-LP: Multipurpose Reactor and Supporting Laboratories	• Operation of multipurpose reseach reactors • Production of radioisotopes • Nuclear fuel • Radioactive waste • Radiation experimentation • Safety research • Maintenance and development of nuclear power-related equipment • Nuclear physics/chemistry
(11) LMBA: Natural Disaster Mitigation Laboratory	• Collection of data on natural disasters • Method/technology concerning safety • Disaster preventive structures • Education/training for disaster prevention

(To be continued)

(Continued)

Name of Laboratory	Major Research Field
(12) LSDE: Energy and Energy Resources Laboratory	• Alternative energy (solar, wind, biomass, gasification, liquefaction technology) • New energy (MHD, ocean-thermal energy conversion) • Energy-saving technology • Energy economics/model analysis • Development of energy industries

Source : PUSPIPTEK summary materials

3) Use of overseas on-line databases

Overseas on-line databases should be used so that the latest technological information for specialized fields can be effectively obtained. For this purpose, it is necessary to train professional database searchers for quick access to a specific document. Although the fields vary in each laboratory, an extensive range of databases will become available through user contracts made with major data distributors (e.g., DIALOG, SDC, BRS). Any use of databases for extremely specialized fields not covered by these should be discussed separately.

4) Exchange of Research Information

Mutual Cooperation should be promoted through information exchange among laboratories of the PUSPIPTEK-Serpong complex. Interdisciplinary forums and joint research among different fields should be promoted for mutual exchange. Information exchange among laboratories would be strengthened by the following methods:

① Information exchange on a regular basis (by meetings)
② Periodical distribution of information concerning major research subjects, facilities and personnel
③ Promotion of the use of existing information networks such as UNInet
④ Links with overseas networks through UNInet
(Refer to Part Ⅲ-Section 1.)

5) Interdisciplinary forums

By holding forums on a regular basis (once every month or so), the first step in setting up the basic conditions would be taken for joint studies among different fields or with industries. All efforts should be made to create an environment which encourages inter-field joint research.

① Set up interdisciplinary forums in PUSPIPTEK-Serpong and hold regularly on selected subjects (jointly with outside institutes)

② Achieve joint research and common use of facilities inside PUSPIPTEK-Serpong

③ Achieve joint research projects with outside institutes such as those in the industries

(2) Systematization of Technological Information and Technology Transfer to Industries

1) Objectives

The main objectives are to systematically manage research and development results as technological information, widely distribute it not only among laboratories of PUSPIPTEK-Serpong but also to industries, and to facilitate technology transfer. It will first be necessary to make technological information available for use as a common resource. Considering technology transfer and external information distribution, it is essential to systematically manage the information. Technology transfer, in its true sense, is made possible when "technological information" stored through research and development, trained "personnel", and established "hardware" are integrated. The most important thing, which in fact is often overlooked, is systematic management and distribution of relevant technological information.

Discussions should include information management/distribution as a common resource and management of individual experimental data created in each laboratory. The former should be input into a database for wider use, while management of source data should be studied to promote research and development more effectively for the latter. Individual experimental data has limited users. If any experimental data accumulated will create a high use rate in future, it can be input into the database for distribution. Therefore, source data, but it has to be assessed, verified and given reliability. Thus, it will be necessary for the time being, to manage source data by a data logger.

① Technological information
- Management/provision of research and management results
- Bibliographical information of books/journals held by each laboratory

② Software management
- Management/distribution of software as development results
- Common use of software assets

③ Management of experimental data
- Improvement in the Management of individual experimental data
- Provision of a data logger

2) Technological Information Database Management

① Object of management

Technical reports, periodicals, papers, etc. prepared as research and development results of each laboratory would be collectively managed and distributed. These results should be widely offered to researchers, industries, universities and related institutes for diffusion and for technology transfer. At the same time, research and development results for the entire PUSPIPTEK-Serpong complex should be systematized as technological information into a unified system for re-use. It is aimed that PR activities should be carried out concerning the work of PUSPIPTEK-Serpong and, at the same time, the results should be offered. They will further contribute to mutual information exchange among loboratories.

② Managed information and information items

Managed information consist of technical reports, periodicals and papers disclosed as research and development results of each laboratory, and related bibliographical information. At the same time, information concerning journals and books held by each laboratory would be offered with the aim of a common use of resources. Management of these journals and books should be left to each laboratory. Table IV-16 shows examples of information items that are needed for results, as well as for journals and books.

③ Distribution service

a. On-line information sistribution

On-line retrieval should be made available to each laboratory of PUSPIPTEK-Serpong concerning information about research results. A consigned retrieval service should be conducted to external institutes for

Table IV-16 Technological Information Management(by Item)

Information Item	Category	Remarks
① Original title	C	Report/periodical/paper name
② English title	C	
③ Author's name	C	
④ Section to which author belongs	C	
⑤ Research project name	C	Needed when the results sre attributed to a specific project
⑥ Meterial category	C	Category of publication, etc. within an academic society, general publication or PUSPIPTEK-Serpong
⑦ Publisher	C	
⑧ Abbreviated name fo material	C	
⑨ Volume, isseue No.	N	For periodicals
⑩ No. of pages	N	
⑪ Data of isseue	N	
⑫ Abstract	C	
⑬ Registration No.	N	Assigned at registration
⑭ Date of registration	N	
⑮ Medium category	C	Book, microfiche, etc.
⑯ Language used	C	Indonesian, English, etc,
⑰ Key words	C	
⑱ Classification code	C	e. g. UDC system
Date volume per document		2000 bytes

Note C: character data, N: numerical data

the time being. This, however, could be changed to on-line, depending on the availability of communication lines with PUSPIPTEK-Serpong.

b. Clearing service

Inquiries from researchers or the industries outside can be dealt with by a section of the Center. Not only a database retrieval service but also an information procurement service should be offered concerning information held by laboratories of PUSPIPTEK-Serpong.

c. Material provision

Material is given upon request from users. Materials which can be disclosed could be given not only to laboratories of PUSPIPTEK-Serpong but also to the industries and external institutes. Initially, the procedures, for disclosure restriction, period and review need to be set up. It is also important to allocate a service cordinator who distributes materials to customers.

④ Management period

Information management should be maintained by the database at least for the period of that material is held by the Center or each laboratory. The period available for on-line retrieval, however, should be for about 10 years. Materials which are older than 10 years would be kept on magnetic tapes, which can be accessed as the need arises. All bibiographic information on journals and books would be offered.

⑤ Estimate of data volume

As show in Table IV-17, managed data volume has been estimated for the case when all the PUSPIPTEK-Serpong laboratories are brought into operation and their activities are established. Information on about 100 documents per laboratory would be registered and managed annually, which would be stored on disk for a 10-year period for on-line provision. Information concerning all journals and books held by each laboratory should be provided.

Table IV-17 Estimate of Data Volume

①	Institutes under this scheme (final stage)	12
②	Center for Industrial Technological Information (incl. documents managed by the Center)	1
③	Research result document (per laboratory per years)	100
④	Journals, books (per laboratory)	10000
⑤	Data volume per document (bytes)	2000
⑥	Period (years)	10
⑦	Total data volume (refer to the note)	= 0.28 GB

Note : ⑦= [(①+②) ×③×⑤] ×⑥+ [④× (①+②) ×⑤]

⑥ Preparation of the database and management system (personnel, etc.)

Preparation of database and management are discussed in the following paragraph.

3) Software database management

① Management objectivies

Information concerning software developed or acquired by each laboratory should be collectively managed so that duplication in development or purchase is prevented. As research and development expands in PUSPIPTEK-Serpong, not only the acquisition of application softwares but also its development is expeced to grow. In particular, any software that is developed is the result of in-house technology and should be treated as an

"asset". Disclosure of such software to the industries would encourage technology transfer.

② Management item and information item

Management items consist of bibliographical information item concerning software (programs and documents) and software contents. Table IV-18 shows typical management items and information items for documenting software.

Table IV-18 Software Management (by Item)

Information Item	Category	Remarks
① Software name (in Indonesian)	C	
② Software name (in English)	C	
③ Software name (English abbreviation)	C	
④ Version No.	N	
⑤ Program registration No.	N	Assigned at registration
⑥ Program function.	C	
⑦ Input data	C	Major items only
⑧ Program outline	C	
⑨ Output data	C	Majoy items only
⑩ Source program Y/N	C	
⑪ Language used	C	
⑫ No. of steps	N	
⑬ Development environment/OS	C	
⑭ Medium (MT, FD, etc,)	C	
⑮ MT: No. of tracks	C	
⑯ MT: recording density	N	
⑰ MT: code (EBCDIC, ASCII)	C	
⑱ Section that developed/purchased	C	
⑲ Development consignee or seller	C	
⑳ Date of development/purchase	C	
㉑ Date of program registration	C	
㉒ Document Y/N	C	
㉓ Document medium	C	
㉔ Document title	C	User's manual
㉕ Document registration No.	N	Assigned at registeration
㉖ Other information	C	Attached data Y/N
Data volume per document		3000 bytes

Note C: character data, N: numerical data

They are roughly divided into software function, form of presentation and attached documents. For software purchased by the Center, programs and documents would be managed enbloc by the Center. For software purchased or developed by individual laboratories, it is recommended that the Center manage them as much as possible.

③ Distribution service

a. On-line information distribution

On-line retrieral, depending upon the software available, should be realized for the laboratories of PUSPIPTEK-Serpong. An on-line service to external institutes would be left for future planning.

b. Retrieval service

Inquiries by telephone, etc. made by internal researchers would be accepted by the appropriate section at the Center. Inquiries from external institutes would be accepted in the same way.

c. Distribution of information and programs

Distribution of information concerning software and programs should be a basic service. For the distribution of individual application software, the handling method will be different between those originally developed by laboratories and those purchased. Purchased software could involve possible problems concerning the intellectual property right of the developer, and the right of use by users should be carefully discussed. Software originally developed should be available for wide use as a common resource, while paying due attention to intellectual property rights.

d. Preparation/distribution of a software list

A list of software registered in the database should be prepared and be regularly distributed (once a year or so) to each institutes and institutes outside.

④ Management Period

Software should be managed according to its life cycle (development/ purchase→ use→ renewal→use →abandonment). Upon termination of the life cycle and withdrawal from use, a software registration would be canceled.

⑤ Estimate of data volume

The data volume managed has been estimated according to Table IV-19 with a volume of 3,000 bytes per source.

Table IV-19 Estimate of Data Volume

①	Research institutes covered	12(final stage)
②	Center for Industrial Technological Information	1(incl. software acquired by the Center)
③	No. of items of software included	100(per laboratory)
④	Data volume per source (bytes)	3000
⑤	Total data volume [(①+②) ×③×④] =26	MB

⑥ Personnel required for database management

Setting up and managing the database will need the following personnel:

a. Data gathering

b. Data input

c. Data renewal (for modification)

d. Database operating manager

e. Database searcher

4) Individual management of experimental data

Experimental data, which are expected to be created in quantity in each laboratory, should be managed individually in the dedicated file space provided for each laboratory, and be not managed collectively by the Center as is the case for the common use information. These source data, for the time being, will only have limited use. Also, all the data will not necessarily be used widely when they are incorporated into the database. What will be necessary is effective management and processing of experimental data for improvement in research and development.

It will be most practical to prepare the database, not at the initial phase, but when demand becomes apparent, when the data has been assessed and verification. Further, before initiating computerized management, it will be necessary to prepare management standards for these experimental data which cover the creation of source data, its management, and use.

(3) Translation/Publication/Advertisement of Industrial Technological Information

1) Translation and publication of specialized books

① Fundamental reference books for specified fields are not just bought and organized, but should be translated into Indonesian to be distributed not only to researchers but also to the industrial/educational fields for better diffusion of industrial technological information.

② At the same time, through publication and sales of translated books,

distribution should be expanded.

2) Advertising activities

Advertisement concerning research technologies, facilities, etc. of laboratories of PUSPIPTEK-Serpong should be carried out. These advertising activities will contribute to study exchange and joint research among different institutes and industries.

SECTION 3 TASKS FOR TECHNOLOGICAL CALCULATIONS AND UPGRADING OF RESEARCH AND DEVELOPMENT

3.1 Problems in Current Situation

At present, technological calculations at PUSPIPTEK-Serpong are not making active progress, Partly due to the lack of large computers. However, the use of existing personal computers, or medium-size computers is restricted and are not utilized for technological calculations.

The performance of personal computers today is remarkably advanced, performance is approaching that of the large general-purpose computers of two generations ago (such as the IBM7090). Furthermore, among the technological calculation programs developed for personal computers (package softwares), there are many known high performance programs. It is true that some package software is expensive, and this prevents from broad use of personal computers for technological calculations.

Nevertheless, personal computers evidently have limitations for technological calculations. While the calculation speed of super-computers for most advanced technological calculations is about to exceed 1 GFLOPS, the speed of typical 16-bit personal computer is 0.1 MFLOPS, and that of so-called engineering work stations is about 1 MFLOPS. This makes for a difference of over 1,000 times in calculation speed. Differences in calculation speed can not be simply compared; however, it does affect the efficiency of research and development to some extent. Although the speed of super-minicomputers is estimated around 5 MFLOPS, the effective calculation speed (turn-around time) drastically slows down when multi-users do calculations at the same time, thus making the computers practically useless. From this viewpoint, it is necessary for the Center to install mainframes to provide many users with efficient data service.

The current level of achievement of technological calculations in the laboratories established at PUSPIPTEK-Serpong is still relatively low, and the reasons may be summarized as follows.

① Description of laboratories

The laboratories already established in PUSPIPTEK-Serpong are divided into two groups according to the nature of their operations. The first group (LKT, LFT, RSG-LP, etc.) does independent research, and does not accept consigned research from outside. The operation of the second group (LAGG, LUK, KIM, etc.) consists mostly of consigned research from outside sources.

The first group of laboratories, conducts mainly experimental research.

However, due to financial reasons, facilifies are insufficient. If computers are installed and suitable software purchased for the Center, theoretical research using these computers will become possible.

Most of the activities of the second group of laboratories are consigned research from the private sector, although these may be in research areas. Very few of these activities are based upon independent research themes of laboratories. As a result, there is little incentive for researchers to initiate their own research projects, and research morale is low. This may be due to the fact that their consigned researches consist merely of the collection of experimental figures from various tests. With computers and software installed at the Center, consigned activities can be broadened, expanding analysis of experiments and tests.

② History of research

As shown in Table I-1, it has not been long since laboratories in PUSPIPTEK-Serpong started their activities, and they do not have sufficient staff, especially in the area of experienced researchers. Furthermore, due to a lack of researchers with leadership skills, young staff are not being given appropriate training in their research projects.

③ Presentation of research results

Few opportunities exist for the presentation of research results, and from this viewpoint alone, there are few research incentives. For example, no annual reports from the laboratories are being issued.

To summarize, it is clear that the problems surrounding technological calculations can not be solved merely by the introduction of computers and software. For more active participation of researchers in technological calculations, it is important to promote the potential for research especially in human resources, it is important to acquire personnel with leadership qualities and research workers with higher morale. It is also important to issue periodical publications and to provide an opportunity to present results from research activities.

3.2 Needs of Analysis

We will now examine the needs of laboratories for technological calculations.

For laboratories and individuals engaged in leading research activities, computers (here, we particularly refer to large computers) are indispensable

tools in accomplishing research activities, for time and labor saving, assisting the thought process, etc. We will now plan to define the needs for technological calculations from computer application for research activities.

① Experimental analysis

Experimental analysis to verify the reliability of experimentally obtained data. Verification using experimental values of premise, hypothesis and assimilation are used in analysis.

② Forecast analysis

Important application of computers in research in the field of nuclear energy, airplanes, warships, large-scale structures, etc., for safety verification for new experimental tests and test runs, and for calculation for forecasting performance and behavior.

③ Design calculation

In PUSPIPTEK-Serpong, laboratories such as KIM carry out design and manufacfuring. Therefore, designs for lenses, ICs, etc will also be conducted.

The computer applications explained so far are traditional cases. However, with the considerable upgrading of scientific and technological computation, which was sparked by the emergence of super-computers, a concept for a new computer applications are growing in particular for technical calculation.

Computers in this field are considered as an indispensable tool for starting research activity just like accelerators in elementary particle physics. As research progresses by simulating phenomena in a computer simulation that would otherwise involve high cost and risk (such as a tidal wave), large-scale structures (tall buildings and dams), chemistry (new materials and design of molecules) and astronomy-related phenomenon which can not be tested on earth, each become possible.

From the above, we can see the unlimited needs for technological calculations in the world, and these needs are expected to increase year by year. This is also clear from the future plans of computer centers established at universities in the U.S. and Europe. In the planning of the Center for Industrial Technological Information, it should be the basic concept for successful project to build up the technological calculations for well balanced development of the categories ①, ② and ③ of calculation science.

3.3 Establishment of Tasks and Direction for Solving Problem

(1) Establishment of Tasks

As mentioned earlier, the first priority in promoting technological calculations with computers is education of computer-retated staff. As pointed out earlier, it is important to acquire staff with research leadership capabilities. From this viewpoint, the most fundamental task for this project is to activate and upgrade research.

Here, we will deal with the tasks of the Center for Industrial Technological Information as technological calculation center with emphasis on technological matters. Uses of the Center by researchers of laboratories in PUSPIPTEK-Serpong will be classified as follows:

① Preparation of new software programs and calculation
② Use of package software

(2) Direction for Solving Problems

1) Training of Application Engineers

The basic specifications for preparing the programs as stated in ① above may be prepared by researchers. As a result, the Center staff will program according to such specifications. The Center will only be required to have programmers who know languages for technological calculations, such as FORTRAN, C, etc.

In ②, the Center will require new types of engineers, as explained below. The softwares made available to the Center will be the most advanced for each field of scienfific and technological application. This software, however, is not designed to be user-friendly . Furthermore, for diversification of the subjects of analysis or flexibility of calculation models, large volume of input is requested, and preparing proper input data is not an easy task. On the other hand, although researchers may understand the problems to be analyzed, they may have no experience or interest in how to express those problems as input data. The most important task for the Center is to find and train engineers (called "application engineers") to link researchers with programs.

2) Qualification and Obligation of Application Engineers

Application engineers require a full understanding of not only programs and package software, but some knowledge of the technological field in which

the programs will be applied. To explain the importance of application engineers, we offer the following example. An actual phenomenon occurs in 3-dimensional space. The change of the phenomenon with elapse of time will become a problem. On the other hand, the innovation of computer hardwares and softwares, especially after emergence of super-computers, is remarkable. In spite of this, however, it is impossible to make a direct simulation of an actual phenomenon on the basis of 3-dimensions with elapse of time except for highly particular cases. Accordingly, in analysis with programs, the phenomenon is changed to time-independent and the volume of input is changed to assimilated 2-dimensions. For performing this assimilation and modeling, not only the understanding of the programs but a considerable degree of understanding is necessary in the field of the engineering and science of the phenomenon under analysis.

Application engineers can not only explain the use of programs as requested by researchers, but they also perform tasks such as demonstrations or public relations for programs or package software. They perform a demonstrations of program applications to researchers, to motivate their interest in technological calculations, and thus can further promote the usefulness of the Center. Application engineers can also be expected to participate in the planning of research projects, and to give advice regarding technological calculations.

As outlined above, the first task for achieving the establishment of the Center as technological calculation center is the recruitment and training of application engineers. For training of application engineers, it will be necessary to further train engineers and researchers, who have been educated in various engineering fields (such as structural analysis, nuclear engineering, fluid dynamics, etc.) so that they become fully acquainted with the various programs. It is generally difficult for universities to provide such education and training. One method would be to receive education on the programs planned to be introduced to the computer centers in a national research institute, private firms or a computer center in develeped countries.

3) Arrangement of Software

At the time of the start-up of the Center, 10 to 20 programs may be introduced (see below). These programs, however, generally become obsolete quite rapidly. Because of this, it will be necessary to continuously introduce new programs and update old ones. The replacement of programs, however, may be necessary once every few years, unless completely new programs are needed. It is expected that with the expansion of research fields, programs not initially introduced by the Center will later be requested. The

revision or new introduction of programs or package softwares appears feasible from a budgetary standpoint.

3.4 Concept for Scientific and Technological Calculation Softwares

We will now discuss details on scientific and technological software to be installed at the Center for Industrial Technological Information in accordance with the classifications described in 3.1.

(1) Experimental Analysis

Each laboratory is currently conducting various research activities. However, experimental test data is not practically and academically effective. Test data is complete as research data only when it has been properly analyzed. Experimental analysis is essential to guarantee the reliability and accuracy of the experimental data. The need for experimental analysis is not limited to this, but extends to

① Modeling for calculation,
② Selection of softwares and preparation of input volume, and
③ Calculation,

Through such activities, knowledge and know-how to forecast phenomena can be accumulated without experiments. For the laboratories in the Center, software in the field of structural and fluid analysis are necessary for experimental analysis.

(2) Forecast Analysis

Generally, forecast analysis means pre-experimental analysis for forecasting the scale and time needed for an experiment. The software necessary for forecast analysis is nearly the same as that needed for experimental analysis. At this point, however, we will deal with analytical work necessary for the operation of a research reactor. For operation of the reactor, special safety precautions that are different from those at other experimental facilities are required. It also requires careful planning for the burning nuclear fuel for economic a operation of the reactor, and precisely detailed analysis for quality assurance of neutron flux for users. For these, the Center must be prepared with a series of proper softwares.

(3) Design Calculation

The Center performs design and production functions for certain types of products, such as functions at LIPI. Also, the majority of users besides those of PUSPIPTEK-Serpong will be from industries. The Center will be therefore required to have design calculation softwares. However, there is a limited field of products at this moment that can be designed with softwares only, even using the current super-computers. For design calculations, the Center should have softwares for optics (lens design) and electronics (LSI, IC chip design). For other fields, part of the large total system can be designed with softwares, a combination of which will contribute to the whole design. As such softwares with a relatively high independent nature, the Center should have design softwares for piping design and distillation towers which chemical plants will necessitate.

(4) Computational Science

As mentioned in 3.1 that computational science is a relatively new scientific field. It tries to analyze natural phenomena and engineering problems by simulation using computers (especially, super-computers), and it represents the most advanced application of computers today. The software which the Center requires and which can be classified as computational science software are in the field of chemistry (molecular design in a broad sense), fluid & impact analysis and electromagnetics. The impact means instant deformation such as result of vehicle collision, and electromagnetics refers to the problems such as distribution of magnetic field necessary for designing motors.

SECTION 4 COMPUTER USE EDUCATION, TRAINING AND PERSONAL TRAINING

4.1 Analysis of Current Problems and Needs

In the Republic of Indonesia with the present trend to industrialize the economy, it is most needed to train and educate a breed of technical and scientific engineers and searchers specialized in technological information to support the core of research and development in that country. Presently, computer education is offered at various places including the laboratories of PUSPIPTEK-Serpong. However, most of the existing education and training systems are limited to the basic and introductory applications of computers, resulting in a lack of training for the more advanced applications of computers which is necessary for the development of industrial technology. This should be incorporated in the regular training and education as part of a comprehensive human resources development plan.

As previously explained, the computer is an indispensable and important element in industrialization as well as scientific and technological development. This can aid the researchers and engineers in the conduct of their research and other activities in a more efficient and effective manner. To provide this important support for the reseachers or engineers, an appropiate computer hardware and expanded software as well as proper and comprehensive educational system are most urgently needed.

4.2 Establishment of the Theme and Direction for Solving Problems

(1) Establishment of Theme

1) Required role

As mentioned previously, the fundamental objective of the Center is to promote the four phases to improve the level of industry and technology in the country. Considering that the computer plays a critical role in the improvement of industrial technology, the computer education is expected to be one of the three main functions of the Center. Therefore, the Center is obligated to effectively contribute to the upliftment of the computer use in industrial and technical fields. However, what is required is not mere education for computer use based on the technical aspects of computers, but also the inclusion of control and management sciences as a part of

industrial technology.

2) Object, expectation and effects of efficient use of computer

At each of PUSPIPTEK-Serpong laboratories, computers are used for independent data processing applications only. Considering the versatility and many applications of computers in scientific fields, computers must be used as a powerful tool in the conduct of their research and scientific activities. Hence, the use and application of computers both in scientific and management fields require considerable improvement. For this, proper awareness of the researchers and managers of this problem is necessary. This is essential to the modernization and indutrialization of the country.

3) Scope of education

To rationally improve the computer operating environment and its use is quite important. However, objective and effective measures to monitor the efficiency and the improvement of the computers technology are just as essential. It is therefore necessary to include basic management, quality and production control techniques in the curricula as an indispensable part of industrial technology. The following explains a possible outline for such curricula:

① Promoting use:

To promote the use of computer as an essential tool for research and adopt methodologies to promote the use of computers.

② Introduction to use:

To increase the number of people who use computers. To get rid of the concept of computers as a black box. To give guidance to allow access to the industrial technological information.

③ Use of higher grade tools:

Required techniques to handle problems which can not be solved with the existing software.

④ Manager education:

To educate the research managers to promote effective use of computers.

⑤ Operating technique:

To transfer the know-how behind the organization and operations of the Center to the industries.

⑥ Controlling technique:

To transfer the quality and production control techniques to the industries.

4) Object and scope of education

It is needless to say that the researchers are the main focus of the training for computer usage (hereinafter referred to as "user education") but considering the overall research activities the scope of such education must be expanded as follows:

① Reserchers, assistant researchers, research managers and office workers in PUSPIPTEK-Serpong.

a. Researchers:

Researchers should have interest in the improvement of research activities, and should realize the importance of the use of computers as a tool for reserch activity.

b. Assistant researchers:

Assistant researchers should not be mere assistant technicians. They should closely cooperate with the researchers as an active part of the research team.

c. Research managers:

Research managers are required to be fully aware of the importance of the use of computers for the improvement of the working environments of the researchers and assistant researchers.

d. Office workers;

Office workers must be able to use computers so as to improve the efficiency of research related and support activities.

② Users outside PUSPIPTEK-Serpong laboratories

PUSPIPTEK-Serpong should be the place where not only the researchers of governmental organizations and industual fields, research managers, production engineers, etc. could use computers but also outsiders should be given access to study and orient themselves in computer technology, as well as exchange opinions with the PUSPIPTEK-Serpong people thus, allowing them to realize their potentials.

5) Necessity of public relation activities and incentives

Some of the aspects of education are rather difficult for outsiders to understood. Due to the fact that the effects and results of such education can not be recognized in a short period of time, it is, therefore, necessary to publicize PUSPIPTEK-Serpong as a center for user education, and to systematically cooperate with each laboratory regarding the educational plan.

(2) Solution Strategy

Generally speaking, researchers, the main users of computers, do not know much about computers and their applications. Researchers use computers as a tool in support activities, however, effective use of computers as a research tool is hampered by lack of knowledge, insufficient experience, limited skills, and improper environment for use as explained in PartⅢ "Current Condition of Use".

In addition to the education provided by the Center, researchers study by themselves, but such study and education are rather partial and limited to specific areas, hindering the upliftment of the standards of the laboratories as a whole. An effective way to solve this problem is to give intensive training conducted by trainers who have been trained and have mastered their own specific area in the Center. The following are some of the ways to deal with these problems:

① Promotional and introductory eduation for trainees to realize and confirm the convenience of computing tools.
② Establishment of a system which meets the demand for higher degree of user education.
③ Education and training for managers.
④ Establishment of a system for computer operation and management technology and education.

1) Convenience of computing tools and introductory education

First the researchers and assistant researchers must be trained so that they could identify the areas and aspects of their research in which computers may be used as a suitable tool for problem solving. If a problem can be solved with the existing software, the researcher is relieved of the programming task and starting from scratch. Therefore, initially researchers must be educated on the use of the existing software, to enable them to obtain accurate and valuable results quickly as long as the

necessary data is available. It is therefore necessary that researchers are made to fully appreciate the merits of this environment before the actual training. We may not need to reiterate the importance of the introductory education, but it is necessary to realize that with the increase in number of users from a wide range, not only the efficiency of research activity is improved but also the overall activities of the institute itself are benefited as well.

2) Education system to meet the demand for higher level usage

This is in connection with the plan to organize a database of industrial technological information, and to provide the necessary application software or package for scientific and technical applications. However, as a next step it is to be expected that in some cases the existing software could not be used to handle certain applications, and there will be need for a higher level of computer application on an individual basis.

When user education is given in the level of application programming, it may be required to train numerical analysis programmers who can either understand the scientific or engineering concepts. These programmers can be the researchers themselves, if they learn the proper techniques and actually apply them, which can be one of the solutions. However, if the researchers can not continue their research activities due to their study of such computer skill, the education should be given to the assistant researchers or researchers specialized in application programming, thus using them as a specialist in this field. Since this type of work assignment for each researcher is dependent on the basic education policy of each laboratory, actions should be taken according to the conditions present in each laboratory.

In early stages, it may be difficult to provide training in system analysis or system engineering. This kind of education may be assigned as an outside consulting service.

3) Education system for managers

For the user education to be given to researchers and assistant researchers, research managers must first be required to properly understand the nature of this education. It is necessary to establish an education system, which provides proper motivation to enable the research managers to recognize the necessity to improve the efficiency and accuracy of research activities by using computers. A training course with this objective may be established later.

4) Education in computer operation and management techniques

The education for computer operation techniques given at the Center according to the experiences on constructing and operating of computers will be necessary in the future as a service to be offered to the outside industrial fields, if the consulting service is also to be offered at the same time. This service requires a considerable accumulation of experience in this field, but in the developed nations where computers have already been applied extensively, this type of service is being established as a system service.

Training in management and quality control techniques will become the foundation of industrial technology in the Republic of Indonesia. For manufacturing low-price and high-quality products with strong competitive power for export, both education for management techniques and computer use should be promoted in the country. It may take a considerable time before this is fully realized but a continued and consistent effort is required until such realization. This training course is expected to be added in the future.

4.3 Plans for Education and Training in Computer Use

(1) Phased Program

1) Education cource

In Section 1 of PartVI, the functions and development of the Center were divided into three phases, and details of education in computer use will be studied according to these phases. Phase I should be conducted immediately after the Center is opened. During this period of time, the education will be given mainly to staff in the PUSPIPTEK-Serpong complex.

① Training to use the Center facilities

The primary objective is to train researchers in PUSPIPTEK-Serpong so that they can use the Center's large computers as a tool in their research and development activities.

In each laboratory, researchers are presently using FORTRAN for their problem solving on PCs or microcomputers, but due to the hardware and software limitations, this is not a very effective tool. Therefore, they should be educated and trained on the use of large computers and application programs, thus enabling them to use these when they are actually introduced in the Center.

Course 1 : What is "OS"?
How to use JCL
How to use various application programs

② Training to use the laboratory computer facilities

Introductory training should be given to promote the use of computers in the laboratories. This education can be offered to researchers, programmers, office workers, etc.

Course 2 : Introductory training

2-1 Introduction to Computers
2-2 Introduction to Programming
2-3 FORTRAN
2-4 PASCAL or PL1
2-5 Graphics
2-6 What is "OS"?
2-7 How to use JCL
2-8 C Language, UNIX
2-9 Applied use technique for Personal Computers

③ Training to meet the demands for higher level usage

It is necessary to train numerical analysis programmers who can understand both the application software and the subject phenomena. In the introductory training courses, only the use of programming languages is taught, but this subsequent course is designed to provide an introduction by which the trainees can understand the fundamentals of various techniques used for scientific and technological calculations and the numerical analysis of higher grade applications.

Course 3 : Foundation of numerical calculations
Cource 4 : Software development and support

④ Application programmer

As explained in Section 3, those who have completed ①, ② and ③ or people with the same qualifications may be given further training on application software which will be introduced in the Center, at any foreign laboratory, national reserch institutes, organizations, or computer centers in U.S., Europe, or Japan, or in any specialized domestic institutions. It is also necessary to greatly increase the number of engineers and technical people, as well as expand to other areas of engineering and scientific research in this coutry, this education is essential.

2) Required trainers

Before starting Phase I, the following trainers should be hired and given the necessary training themselves, and also the education curriculums/texts should be prepared. Approximately two years are required for the education. The following table shows the length of period and number of people required until the training is started. It is recommended to train the above mentioned people in a foreign training center, for example prior to the opening of the Center. It would also be possible to give jobs in the Center to graduate students after finishing their courses.

Course	Trainers requirements	Persons
1	Over 1 year of experience in the use of large computers (in combination with 2-3)	1
2-3	Over 2 years of experience in programming in FORTRAN	2
2-4	Over 2 years of experience in programming in PASCAL or PL1	1
2-8	Over 1 year of experience in C language, UNIX	1
2-9	Over 1/2 year of experience in various softwares for personal computers	1
3	Staff in Course 2-3 can also teach this course	1
4	Staff in Course 2-3 can also teach this course	1
Total		5

3) Other education

Phases II and III should be introduced when the Center is in full operation. The training program should be expanded to cover not only personnel in PUSPIPTEK-Serpong, but also those of other organizations and institutions to promote computerization in the country. To achieve this, is will be necessary to educate and train system engineers and system analyists to take charge of this task. It is also necessary to have periodical seminars introducing various computer applications for further understanding them. This kind of seminar will also help senior researchers in laboratories for their better understanding of computer applications.

(2) Outline of Each Course

The followings are detailed explanations on each of the four courses described in paragraph (1).

1) Course 1 Training to use the Center facilities)

Trainees: Anyone who uses the Center's computers.

Target : To equip the participants with the basic knowledge of the operating systems used in the Center, the trainee must be able to prepare his/her own JCL when using the Center's computers.

Contents: Basics of operating system, usage of JCL and practices

Period : Three weeks

2) Course 2-1 Introduction to Computer

Trainees: Programmers and other staff (especially those who use computers in their work).

Target : After completing this course, the trainee should have a clear understanding of the basics of computers and their applications.

Contents: CPU, I/O devices, Basics of computer software concepts and applications.

Period : One week

3) Course 2-2 Introduction to Programming

Trainees: Pogrammers

Target : After completing this course, the trainee should be able to make flow charts according to given specifications.

Contents: Basics and examples of flow charting (including three principles)

Period : One week

4) Course 2-3 FORTRAN

Trainees: Researchers or programmers who have completed the introductory courses 2-1 and 2-2, or those with equivalent experience.

Target : After completing this course, the trainee should be able to;

① Explain each command of FORTRAN.

② Program in FORTRAN according to given specifications.

Contents: Basics for understanding FORTRAN statements and syntax

FORTRAN commands and syntax

Introductory FORTRAN (with exercises).

Intermediate FORTRAN (with exercises).

FORTRAN workshop

Period : Three weeks

5) Course 2-4 PASCAL or PL1

Trainees: Researchers or programmers who have completed the introductory courses 2-1 and 2-2, or those with equivalent experience.

Target: After completing this course the trainee should be able to;

① Explain about each command of PASCAL or PL1

② Program in PASCAL or PL1 according to given specifications

Contents: Basic knowledge to understand PASCAL or PL1 statements and syntax

PASCAL or PL1 statements and syntax.

Introductory PASCAL or PL1 (with exercises).

Intermediate PASCAL or PL1 (with exercises).

PASCAL or PL1 workshop

Period : Three weeks

6) Course 2-5 Graphics

Trainees: Researchers or programmers who have completed 2-3 (FORTRAN), or those with equivalent experience

Target : After completing this course, the trainee should be able to;

① Explain the basics of graphics

② Write a program for charts made by a library plotting routine in FORTRAN.

③ Explain graphic standards

Contents: Basics of 2-dimensional and 3-dimensional graphics, and how to use a library plotting routine with a case study and graphic standards

Period : One week

7) Course 2-8 C Language, UNIX

Trainees: Researchers and programmers

The minicomputers used in PUSPIPTEK-Serpong use UNIX, and therefore the researchers and programmers must be study C Language.

Target : After completing this course, the trainee should be able to use the UNIX system and program in C language.

Contents: UNIX commands, editor, shell and file usage. Functions.

Case study.

Period : Four weeks

8) Course 2-9 Introduction to Software for Personal Computers

Trainees: The Center's staff and others

Target : After completing this course, the trainee should be able to;

① Make tables and graphs by using spreadsheet software and software for statistical analysis.

② Manage small-scale databases by using personal computer database software in the laboratory.

Contents: Basics of spreadsheets, Introduction to graphs, Introductionto statistics, basics of database management systems and expanding function menus.

Period : One week

9) Course 3 Basics of Numerical Methods and Analysis

Trainees: Researchers or programmers who have completed course 2-3 or those with equivalent experience.

Target : After completing this course, the trainee should be able to understand the basics of numerical analysis and write simple programs by using matrices, differential calculus, integral calculus, or ordinary differential equations.

Contents: Basics of numerical analysis, interpolation, matrices, differential calculus, integral calculus, ordinary differential equations, and a case study.

Period : Three weeks

10) Course 4 Software Development and support

Trainees: Researchers or programmers who have completed course 2-3, 2-4, 2-6.

Target : After completing this cource, the trainee shoud be able to:

① Make document standard forms.

② Design more efficient programs.

Contents: Document forming, program design (with exercise)

Period : Three weeks.

In PART IV, the required center functions were explained.

In PART V, the basic policy to realize a center operation and a conceptual design for hardware system and related facilities will be explained based on the stated required functions of the Center.

PART V

CONCEPTUAL DESIGN

FOR

THE CENTER

FOR

INDUSTRIAL TECHNOLOGICAL

INFORMATION

SECTION 1 BASIC POLICY

The Part IV clarified the establishment of the functions of the Center for Industrial Technological Information and further covered the three functions of database management, user education and computing, all of which are done with a mainframe and which are included in the step-by-step development of the Center. (This section will clarify the contents, purpose and brief specifications of the various resources as a requirement for design of the Center.) They will be necessary for fulfillment of these functions as well as their smooth activity.

1.1 Basic Policy for Designing the Center for Industrial Technological Information

(1) Basic Policy of Design

1) Basic requirement

The basic requirement for establishing the Center for Industrial Technological Information to be constructed in PUSPIPTEK-Serpong (hereinafter called the Center) is to fulfill three (basic-primary) functions in the form of user services.

① Collective gathering of industrial technological information and provision of such information
② Scientific and technological data processing
③ Education on the use of computers for broadening the application technology of computers as research and development tools

In order to achieve the above basic functions, the Center should have the following three plans of action:

① To establish the user services as defined by the Center's primary functions.
② To structure an environment and facilities sufficient for the conducting these services.
③ To maintain the organization and appropriate staff for the services.

The three policies for realization must be considered to be incorporated in all the phases, from the conceptual design to the actual operation. They should be broken down into components and their forms should be shaped in accordance with the characteristics of the Center and

its primary purpose.

2) Basic policy

Explained below are three points concerning the basic conditions for the Center, elements of the Center primary functions and plans for services as basic policies for structuring the Center.

① Basic conditions for the Center functions

a. The Center should be able to make a step-by-step progress and be cost effective, with priority placed on satisfaction of customers' need.
b. Each element of the Center should have the characteristics as detailed below in "Common requirement for the center elements" and be always maintained.
c. The spirit of the a. and b. above should be consistently reflected in every stage from the basic concept of the Center to detailed designs, construction and operation (service).

In light of the fact that the Center is going to be the first of its kind to be constructed and operated in the Republic of Indonesia with a view to contributing to the country's industrial development and that the Center should become a model of other similar centers which may be successively constructed. The above three conditions are further broken down into the following check list for the Center functions.

② Common requirement for the Center elements

a. The Center will place priority on service to users. [Convenience]
b. The Center will get the best result with the lowest cost. [Economy]
c. The Center functions will progress step by step. [Expandability]
d. The Center will follow the changing needs of outside sectors. [Flexibility]
e. The Center will constantly maintain and upgrade its functions. [Perpetuality]
f. The Center will become precedent of other similar functions [Advancement]
g. The Center will pay attention to comfort of users and (providers.) [Comfort]
h. The Center will demonstrate its unprecedented characteristics. [Commemorative]

Economy should be the top priority of the Center. It should provide efficient service at low cost by concentrating efforts of each function and avoiding duplication. The actions recommended and the results expected are as follows:

③ Realization policies for service functions

a.	The Center should concentrate on gathering and providing of data and information. This will accelerate a joint effort of laboratories in gathering information, and will facilitate the timely and efficient provision of data and information. This will contribute to the promotion and development of future research and development activities.
b.	The Center should have common computer facilities, which will save an investment cost of each laboratory. Such common computer facilities will help speed up large-scale calculations, and will contribute to the promotion and development of future research and development activities using computers.
c.	The Center should also have common softwares, which will optimize software development. This will enable the required calculations to be made at lower cost and in less time, and will also contribute to the promotion and development of future research and development by use of software.
d.	The Center's staff should provide user education and training staff to researchers in order that they may be able to become familiar with the technology in a short period of time. This will promote future research and development through the use of a computer as a research tool.
e.	As a result of the above mentioned steps a to d., cost and labor reduction as well as general progress in the field may be expected. This will enable each laboratory to concentrate on its research and development works, and will provide an environment which will enhance progress.

(2) Elements of the Center Facilities

The major elements of the Center facilities consist of the following, and will be detailed in 1.2/1.3 and SECTION 2 and thereafter.

1) Buildings and related facilities of the Center
2) Computers, software, communication facilities & terminals and related facilities of the Center
3) Organization and staff of the Center

(3) Definition of the Period of Construction of the Center

The whole construction project starts from the time of the construction start-up and will be complete upon approved delivery after installation and adjustment of various equipment and machinery upon completion of the construction works.

(4) Observation of Basic Policies

These basic policies, and the conditions based upon these policies, should be observed and applied continuously even after the completion of the construction of the Center.

1.2 Concept of Systems of the Center for Industrial Technological Information

The Center is a provider of service. While the Center may receive supplies from providers of information and other resources, such resources are not for in-house consumption but for re-supply to users. In other words, the Center integrates industrial technological information as current resources (assets) and provides this information as requested by users. The Center also functions for as an educution, training, and computing facility, incorporating the buildings and facilities, computers and sofwares, staff, etc. into a unified service.

(1) Services Provided

The services to be provided by the Center are to accomplish the goals discussed in Part IV, and are further broken down from each item of the previously discussed basic requirements (supplying of industrial technological information, computer use education and computing services). These may be separated into the follow services.

① Supplying of information and support of research and development (Inside PUSPIPTEK-Serpong, for the time being)
② Technological information and technology transfer to industries (Inside PUSPIPTEK-Serpong, for the time being)
③ Publication and supply of industrial technological information and consulting
④ Education and training on use of computers

⑤ Scientific and technological calculation including application software (Inside PUSPIPTEK-Serpong, for the time being)

The service menu items ①~③ belong to provision and are part of a broad information service. Some of this information will be provided with the help of computers and some with the remainder being provided by conventional media.

The service menu item ④ is the transfer of technology use to researchers, and item ⑤ sets out to provide researchers with of computers implements. The menu item ④ is also a function to promote the item ⑤.

The Center should be structured in order to be able to constantly provide and maintain these services while upgrading such services as the need and opportunity arises.

(2) Users of the Center

The Part IV briefly discussed the users of the Center. It is possible to separate users into two categories, although it will be unnecessary to separate them in actually providing the services.

① Researchers belonging to the laboratories of PUSPIPTEK-Serpong

Estimates show that the total number of employees of all the laboratories will be around 2,000 at the time of the completion of the construction of laboratories presently under construction or in the planning phase with, 75 % of them, that is about 1,500, being researchers. Further, estimates reveal that 50 % of these researchers, that is about 750, use the Center for 1/10 of their working hours. Approximately 75 full-time users are expected.

② Research and development workers belonging to the government and industries

No quantitative forecast can be made at this moment, however, one may expect some potential users to come from this group.

For any potential users of the Center, the Center should provide education and training on the use of computers as shown in the menu item, ④ to promote effective use of the Center.

(3) Providers of Resources to the Center

These providers of resources are ① providers of information, ② suppliers

of software and ③ hardware vendors.

For the menu items ①~③ in 1) for industrial technological information, each laboratory of PUSPIPTEK-Serpong uses the centers resouces while at the same time, provides information regarding its own research activities to the Center.

(4) Methodology for Achieving the Center Functions

To establish the functions of the Center for supplying of the service items listed in 1), the Center should prepare the basic functions and work out the most appropriate layout of the resources required for each service item, in order to realize the most efficient mode of operation.

1) List of service functions

The service of the Center can be broken down into the following three areas:

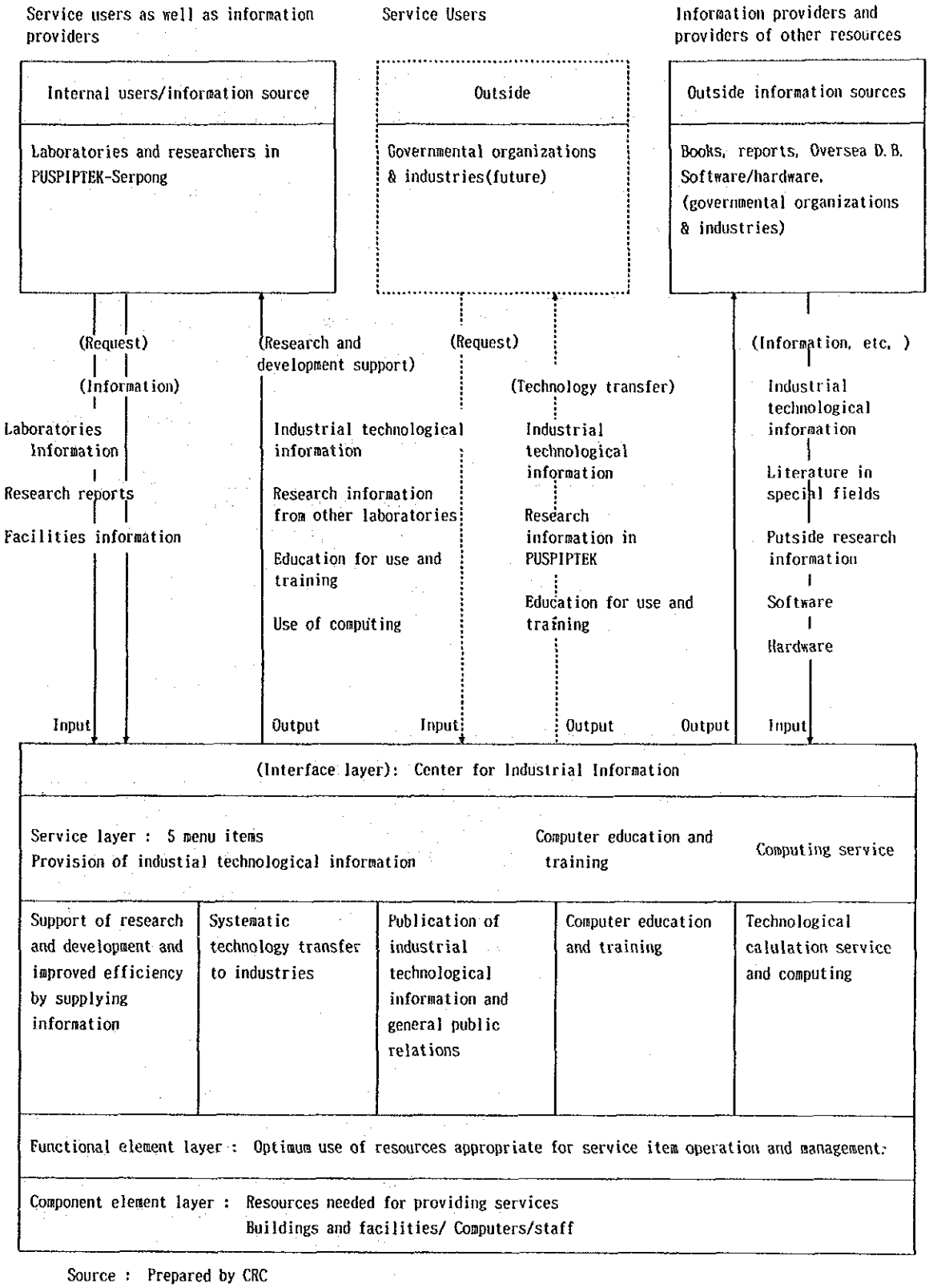
① Service items - 5 menu items
② Combination of functional elements for providing the menu items
③ Components of the Center～ organization, personnel, facilities (buildings), service supporting facilities (computers, terminals, audiovisual equipment, etc.) which make up the functional apparatus.

2) Optimum use of resources

The structure of the above three items is not independent of each menu item. Part of the common resources will be used at different rates according to individual menu items. For instance, computers will be used for any service item in the area supplying industrial technological information, user education, training, and scientific and technological computing. These common resources should not be kept in duplicate in individual laboratories. These, as well as the resources should be economically centralized for common use. This will enable the center to obtain a scale merit.

(5) Conceptual Chart of the Center

Fig. V-1 shows the relationship of the various elemants with the use and service of the Center described in (1) to (4) above.



Source : Prepared by CRC

Fig. V-1 Center Concept

(6) Structure of the Center Functions

We have previously dealt with the elements comprising the functions of service of the Center. To further define the whole structure of the Center, it will be necessary to clarify the relationship between the organization supporting the service functions and the necessary resources Fig. V-2 refers to this structure.

	Center for Industrial Technological Information				
Organization	Planning and management Policies / Plans / Budget PR / Operation		Center operating functions Center reception		Administrative functions Administration / Finance Accounting / Personnel/ Labor relations
Service	5 service items to be provided.				
	Research and development to support higher efficiency	Systematic information and technology transfer	Forum, publishing and public relations	Computer use education and training	Providing computer services
Functions	(Organizational activity for optimum use of common resources) Information service	Publication service	Education and training service	Computation	
Resources	Building facilities		Service facilities		Staff
	Forum room and lobby (forum for information exchange) Computer classroom Building facilities Computer room		Database software Database Scientific and technological softwares Language processing softwares Mainframe User terminals Educational terminals Audiovisual equipment for education		Receptionists Information gathering and providing staff Publication service staff Library staff Trainers Application staff Computer-related staff

Fig V-2 Concept of the Center Functions

Source : Prepared by CRC