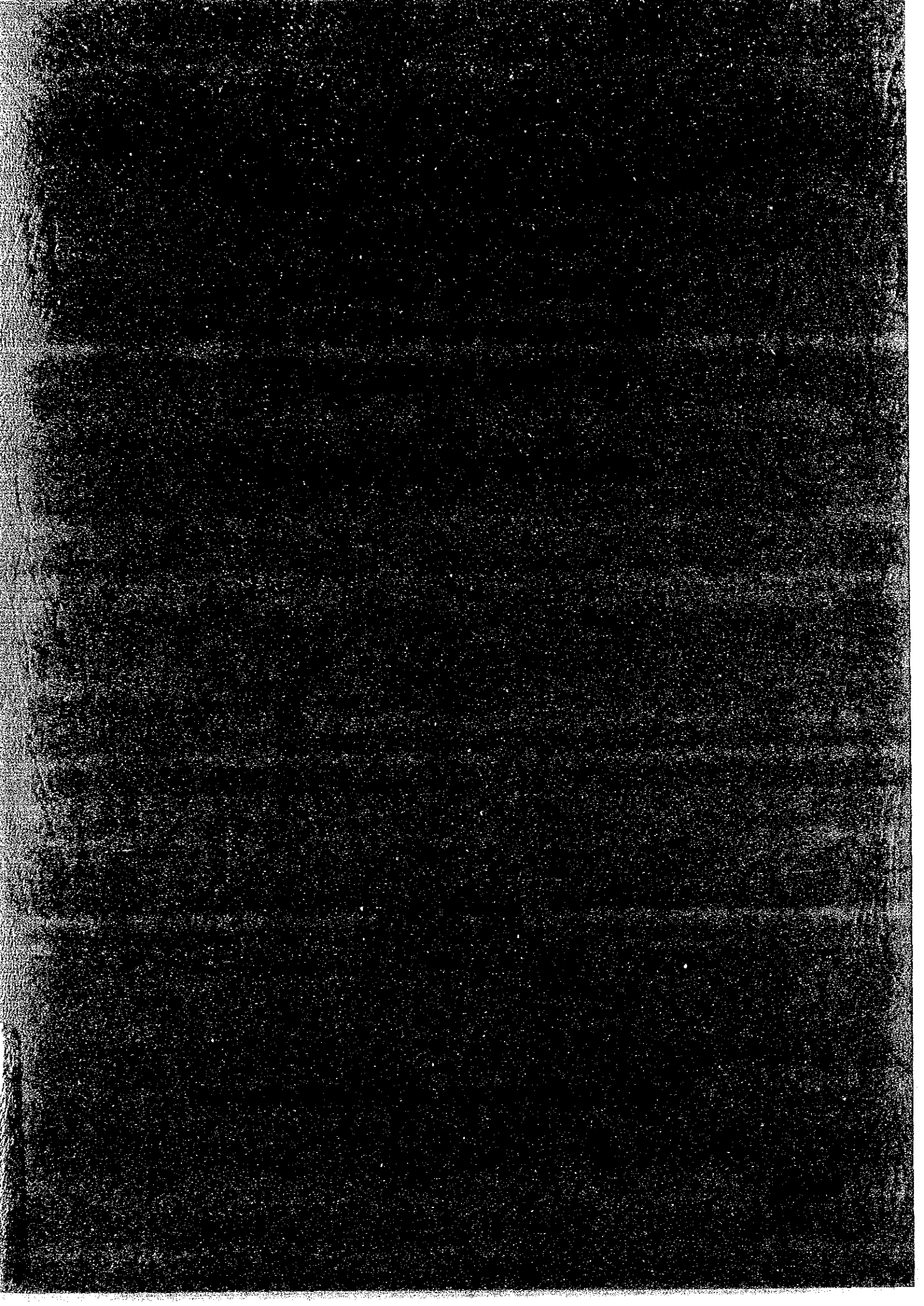

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR PROVIDING THE EQUIPMENT FOR THE HIGHER EDUCATION DEVELOPMENT SUPPORT IN THE REPUBLIC OF INDONESIA

JANUARY 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a Basic Design Study on the Project for Providing the Equipment for the Higher Education Development Support and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Indonesia a survey team headed by Dr. Fumio Nishino, Professor of Faculty of Engineering, The University of Tokyo, from August 14 to September 6, 1990.

The team exchanged views with the officials concerned of the Government of Indonesia and conducted a field survey. After the team returned to Japan, further studies were made. Then a mission was sent to Indonesia in order to discuss the draft report and the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the teams.

January, 1991

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

Basic Design Study on the Project for Providing the Equipment for the
Higher Education Development Support Project in the Republic of the Indonesia

Map of Location

	University	City		University	City
1	University of Syiah Kuala	Banda Aceh	7	Andalas University	Padang
2	University of North Sumatera	Medan	8	University of Sriwijaya	Palembang
3	Nommensen University	Medan	9	University of Lampung	Bandar Lampung
4	University of Medan Area	Medan	10	University of Tanjungpura	Pontianak
5	Dharma Agung University	Medan	11	University of Lambung Mangkurat	Banjarmasin
6	The Islamic University of North Sumatera	Medan			

SUMMARY

SUMMARY

The DGHE of the Republic of Indonesia has given prime importance to the reinforcement and expansion of higher education since the beginning of the 1980s. Recently, there is a tendency towards the reinforcement of higher education in the sciences and engineering fields, especially the outside of Java.

The present project is for the provision of student experimental equipment to engineering departments of 11 target universities of Sumatera and Kalimantan. It will form one of the supporting arches of the HEDS Program, and so complement the joint Japanese-American Project already underway for the support of higher qualification acquisition by young teaching staff. A request has been made by the Indonesian government to the government of Japan for grant aid for the realization of the Project.

Upon this request the Japanese government made a preliminary survey in relation to the above HEDS project and decided to conduct a basic design study on the provision of equipment under a grant aid. The Japan International Cooperation Agency despatched a Basic Design Study Team on grant aid cooperation to Indonesia from August 14 to September 6, 1990.

In the Basic Design Study on the Project for Providing the Equipmnet for the Higher Education Development Support (the Project), an evaluation of the requested equipment, a study of the maintenance and management systems, and a study of the equipment layout plans were carried out for the 35 departments of the engineering faculties of the 11 target universities in order to confirm the details of Japanese grant aid cooperation.

In particular regard to the requested equipment it was agreed that equipment for S-1 grade student in the engineering faculty and experimental purposes only was to be involved. Therefore, during the Basic Design Study including the on site survey and following office analysis in Japan, the analysis of the curricula and practical training courses currently conducted in the 11 target universities, investigation on available equipment and equipment to be provided through multilateral and bilateral assistance for some of the target universities were carried out in order to determine what equipment should be provided to the 11 target universities.

Equipment selection for the target universities required the elaboration of models of laboratory practice and a equipment details because of the lack of experiment guidelines widely applicable for all of the 11 target universities. However, as the experimental courses, levels and current equipment completeness etc. vary inevitably one university to another it was decided in response to a request from the DGHE to evaluate the following two case proposals for the Basic Design;

Case 1: Equipment selection required on a purely academic evaluation taking into account the curricula, laboratory study, available equipment, and equipment received through other assistance organizations of the target departments.

Case 2: Equipment selection taking account of practical factors including the particularities of the target universities and departments, the degrees of fulfillment or insufficiency of S-1 grade laboratory and experimental equipment and the policies of the DGHE.

On the basis of discussions held with the DGHE, it was decided to propose Case 2 in the Basic Design for the Project.

The Executing Body of the Project is the DGHE of Indonesia. The DGHE is the executive body for the above mentioned HEDS project and has already initiated the activities of implementing of HEDS project. It is considered necessary to establish an project management office similar to the PMO in the event of grant aid being made available for the Project.

Construction of Buildings under assistance programs from the ADB and Germany are still in progress at some universities and so project implementation will need to be co-ordinated with construction schedules so it is considered appropriate to divide the provision of equipment into two phases. The universities concerned are namely University of Syiah Kuala, University of Sriwijaya, University of North Sumatera and Nommensen University which are to be implemented in Phase II. The University of Andalas, University of Lampung, University of Lambung Mangkurat, University of Tanjungpura, University of Medan Area, Dharma Agung University and the Islamic University of North Sumatera will be implemented in Phase I group.

Table Major Equipment to be Provided and Implementation Phase for 11 Target Universities

No.	Target Universities	Department	Major Equipment to be Provided	Phase
1.	Andalas Univ. (National, Padan City)	Civil	Land Surveying Equipment, Hydraulic Exp. App.	I
		Mechanical	Material Testing Equipment	
2.	Univ. of Lampung (National, Bandar Lampung City)	Civil	Soil Mechanics Exp. Equipment, Road Testing Equipment, Concrete Testing Equipment	I
		Management	Personal Computer	
3.	Univ. of Tanjungpura (National, Pontianak City)	Civil	Land Surveying Equipment, Soil Mechanics Exp. Equipment, Road/Concrete Testing Equipment, Hydraulic Exp. App.	I
		Electrical	High Voltage Testing App.	
4.	Univ. of Lambung Mangkurat (National, Banjarmasin City)	Civil	Land Surveying Equipment, Soil Mechanics Equipment, Road/Concrete Testing Equipment, Hydraulic Exp. App.	I
5.	Univ. of Medan Area (Private, Medan City)	Civil	Personal Computer	I
		Mechanical	Work Shop Equipment, Material Testing Equipment, Flow Exp. App.	
		Electrical	Personal Computer	
		Industrial	Personal Computer	
6.	Dharma Agun Univ. (Private, Medan City)	Civil	Personal Computer	I
		Mechanical	Material Testing Equipment, Tools	
		Electrical	Personal Computer	
		Mining	Personal Computer	
		Industrial	Personal Computer	
7.	Islamic Univ. of North Sumatera (Private, Medan City)	Civil	Land Surveying Equipment, Soil Mechanics Exp. Equipment, Hydraulics Exp. App., Concrete Testing Equipment	I
		Mechanical	Personal Computer	
		Electrical	Personal Computer	
		Industrial	Personal Computer	
8.	Univ. of Syiah Kuala (National, Banda Aceh City)	Civil	Land Surveying Equipment, Concrete/Soil Mechanics Testing Equipment	II
		Mechanical	Material Testing Equipment, Tools	
		Chemical	Drying Exp. App., Flow Exp. App.	
		Management	Personal Computer	
9.	Univ. of North Sumatera (National, Medan City)	Civil	Land Surveying Equipment	II
		Mechanical	Material Testing Equipment	
		Electrical	High Voltage Testing Equipment	
		Chemical	Laminar Flow Exp. App., Filtering Exp. App.	
		Industrial	Process Design/Plant Layout Equipment, Statistics Exp. App.	
10.	Univ. of Sriwijaya (National, Palembang City)	Civil	Land Surveying Equipment	II
		Mechanical	Material Testing Equipment	
		Electrical	Basic Electric Exp. App., High Voltage Exp. App.	
		Chemical	Drying Exp. App., Material Handling Exp. App.	
		Mining	Personal Computer	
11.	Nommensen Univ. (Private, Medan City)	Civil	Personal Computer	II
		Mechanical	Personal Computer	
		Electrical	Electronics and Telecommunication Exp. Equipment	

As shown in the above, the Project will contribute by complementing the HEDS project already underway and effect an improvement in the quality of engineering education in the regional universities of Sumatera and Kalimantan, and thereby contribute to the development of industrial technology and science technology by upgrading engineers in Indonesia. It is therefore desirable that the Project should be promptly implemented.

However, in order to ensure that the full effect and benefit is realized by the project's implementation it is important that Indonesia would concentrate its own efforts on the following points:

(1) Assurance of Teaching Staff

It is desirable that attention be given to avoid any interruptions in the experimental guidance given to students which might result from the overseas training of teaching staff which forms part of the long term program of the target universities for assuring relevant teaching staff.

(2) Assurance of Running Costs

The equipment to be provided under the Project is basic experimental equipment for S-1 grade and covers a wide range of student experiment. The assurance of adequate running costs is therefore essential. During the discussion with the DGHE during the Basic Design Study it was agreed to exclude such items as glassware and tools which could easily be supplied within Indonesia. It is considered necessary that the DGHE be in close contact with the target universities during the implementation of the Project.

(3) Assurance of experimental guides and equipment manuals

Some of the target universities still continue to lack a complete provision of experimental guides and this needs to be rectified. Further, the manuals or instructions originally provided for a certain amount of the equipment which was received under previous multilateral and bilateral assistance to the target universities have been lost and consequently it is impossible to maintain the equipment. Therefore, it is desirable to give due attention to the storage of equipment instructions and manuals in the future.

CONTENTS

APPENDICES

ABBREVIATION

ADB	:	The Asian Development Bank
BAPPENAS	:	Badan Perencanaah Pembangurah Board, National Development Planning Board
DGHE	:	Directorate General of Higher Education
HEDS	:	Higher Education Development Support
HTI	:	Host Training Institutions
IUC	:	Inter-University Conters
IKIP	:	Institute Keguruan Ilmu Pendidikan
ITB	:	Institute of Technology, Bandung
IPB	:	Bogor Institute of Agriculture
KOPERTIS	:	Regional Coordinator for Private High Education
MIS	:	Management Information System
MOEC	:	Ministry of Education and Culture
NOMMENSEN	:	Nommensen University
OTO	:	Overseas Training Office
PMO	:	Project Management Office
Repelita	:	Five Year Development Plan
SETKAB	:	Secretary of Cabinet
USAID	:	United States Agency for International Development
S-1	:	Sarujana-1 (Bachelor)
S-2	:	Sarujana-2 (Master)
S-3	:	Sarujana-3 (Doctorate)
UGM	:	University of Gadjah Mada
UNAND	:	Andalas University
UISU	:	The Islamic University of North Sumatera
UNSYIAH	:	University of Syiah Kuala
USU	:	University of North Sumatera
UDA	:	Dharma Agung University
UMA	:	University of Medan Area
UNSRI	:	University of Sriwijaya
UNILA	:	University of Lampung
UNLAM	:	University of Lambung Mangkurat
UNTAN	:	University of Tanjungpura

CHAPTER 1. INTRODUCTION

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The project proposed as a joint project of Japan and USA aims at upgrading the level of higher education in Sumatera and Kalimantan as a part of the regional development programme of the Indonesian Government. It consists of the following programmes: to support training of teaching staff of the faculties of engineering of the 11 universities in Sumatera and Kalimantan at an appropriate domestic institution, to train higher degree holders for six months in Japan, organization of workshops and seminars on present methods of engineering education, recent topics in science and technology etc. On April 12, 1990 R/D on "Higher Education Development Support (HEDS)" Project was signed by the Japanese Government and the Indonesian Government and an agreement was reached on provision of Japanese experts, acceptance of Indonesian trainees in Japan, and provision of equipment necessary for training at the domestic institution.

The Japanese government also decided to make a Basic Design Study on a grant aid for the provision of equipment to the universities which are included in the HEDS project since the provision of equipment is a critical component to achieve the objective of the HEDS project. JICA dispatched a Basic Design Study Team to Indonesia in August 1990.

The Team discussed with the officials concerned in Indonesia on the requests from Indonesia and made surveys on the existing equipment, curricula, sites, buildings and facilities. The major points confirmed by both parties in the course of discussions were summarized in Minutes of Discussions (Appendix 3).

The results of the on-site survey were further analyzed in Japan by the Team.

This report summarizes the results of the Basic Design Study on the Project for Providing the Equipment for the Higher Education Development Support in the Republic of Indonesia.

CHAPTER 2. BACKGROUND OF THE PROJECT

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2.1 Present Situation of Higher Education in Indonesia

2.1.1 Outline of the Higher Education Sector

The higher education sector[1/] in Indonesia consists of general universities (4.5 years course), teacher's education colleges (4 to 5 years course) and polytechnic and diploma universities (3 years course).

At present there are 45 national universities including 10 teacher's education colleges (IKIP: Institute Keguruan Ilmu Pendidikan). In recent years 26 polytechnics were established to produce skilled technicians and engineers. Furthermore 6 polytechnics are being established.

The number of students in national universities and other national institutions is about 700,000 in 1989/90.

The number of private universities is 872 and the number of students is about 1,100,000. The students of private universities comprise 61.1% of the total students of 1,800,000.

The numbers of credits to obtain degrees and years required to complete a course at general universities are shown in Table 2-1. There are three kinds of degrees: S-1 (Sarjana-1) which is equivalent to a bachelor's degree, S-2 (Sarjana-2) equivalent to a master's degree and S-3 (Sarjana-3) equivalent to a PhD.

The distribution of students among faculties is as follows: 36% in faculties of social sciences, 30% in faculties of education, 12% in faculties of agriculture, 12% in faculties of engineering, 5% in faculties of natural sciences and 5% in faculties of medical sciences. The small proportions of engineering and natural science are noted.

Note: 1/ Refer to Appendix 13 regarding the educational system of Indonesia

The numbers of teachers holding degrees at national universities are shown in Table 2-2. Holders of S-2 and S-3 degree are only less than 18% of the total. The universities in Java have more higher degree holders than universities in other regions. The universities in which more than 20% of the teachers hold higher degrees are University of Indonesia (31%), University of Agriculture Bogor (41%), Institute of Technology Bandung (46%), Gadja Mada University (37%), Hasanuddin University (26%), Padjajalan University (21%), Airlangga University (27%), Brawijaya University (20%) and Syiah Kuala University (21%) which is included in the HEDS project.

There are ten universities in which from 10% to 20% of the teachers hold higher degrees. Most of them are IKIP. University of Andalas belongs to this group and 19% of its teachers holds higher degrees.

Universities in which less than 10% of the teachers has higher degrees are 29 and most universities in Sumatera and Kalimantan belong to this group.

The higher education sector is administered by the Directorate General of Higher Education (DGHE) of the Ministry of Education and Culture (MOEC).

The budget of the Ministry of Education and Culture consists of General Account and Development Budget. In the Replita IV period, the General Account of the MOEC was 6% of the total National General Account and the Development Budget was 7% of the total National Development Budget. The amount is increasing every year.

The budget allocated to the primary and secondary education sector has been proportionately higher than that to the higher education sector. However, since the Repelita IV started the percentage of the higher education sector budget increased in the MOEC.

The General Account budget of the higher education sector was 592 billion Rupiah and the Development budget was 127.1 billion Rupiah in 1988/89 fiscal year. The increasing rate over the previous year is 15% and 71% respectively.

Table 2-1 Credit load and expected time in years for three programs

Program	Standard international terminology	Number of Credits	Expected time in years
S - 1	Bachelor	140 - 160	4.5
S - 2	Master	40 - 50	2 - 2.5
S - 3	Doctorate	40 - 50	3 - 4

Table 2-2 Numbers of lecturers by their qualifications (1989/90)

Qualification	Numbers of lecturers	Percentages (%)
Dipolma	303	-
Bachelor	27,040	75
Bachelor of Medicine	2,050	6
Master	4,449	12
Master of Medical Faculty	208	-
Doctorate	1,744	5
Others	124	-
Total	35,923	100

2.1.2 Issues of Higher Education

Despite the implementation of various policies by DGHE in recent years, many issues related to the quality of teaching staff, university administration, education budget, inequalities in educational opportunities, and a gap between university education and needs of the economy and society continue to exist and require redressing.

(1) In addition to the shortage in number of graduates from engineering and science departments, the quality of the graduates is not up to the standard required by industry. There is a gap between the actual quality of graduates and the actual socio-economic requirements, rather than any inadequacy in the number of graduates. It is necessary to upgrade the quality of practical subjects in curricula of engineering and science courses.

(2) There are regional inequalities in opportunities for higher education. It is necessary to upgrade the quality of national and private universities outside Java and to increase opportunities for higher education outside Java.

(3) The budget for higher education is gradually increasing. However, the increasing rate of the number of students surpasses it. The shortages of educational facilities, educational equipment and books etc. are serious.

(4) There is a shortage of operating and maintenance funds for the individual universities. There are numerous cases of suspension of operations due to a lack of spare parts for the educational equipment which has been annually expanded in recent years, and a shortage of operating and maintenance funds such as those needed for repairs.

(5) A problem involving the DGHE and administration of the individual universities is the need to assure teaching staff numbers and upgrade their quality in the universities outside of Java. The number of staff holding degrees above M.Sc. is deficient and this represents a considerable problem.

(6) A problem confronted in the administration of educational policies and of individual universities is the increase in the number of drop outs and of students resitting years. While a degree course normally requires 4.5 years there has been a large increase in students requiring 8 years to graduate.

(7) There are equipment shortages and deficiencies in research facilities at many universities which function as open universities and carry out commissioned tests as a contribution to society and industry. This situation also acts to hinder efforts at raising the morale of teaching staff in the universities.

(8) With regard to the administration of universities there is a shortage of specialists equipped to deal with the planning, administration and evaluation of curricula and practical training courses, the capital goods administration, educational planning, and research management. A comprehensive university administration programme does not exist.

2.2 Outline of Higher Education Development Program

2.2.1 Government Policies for the Higher Education Sector in Repelita V

In Repelita V the major areas indicated for the higher education sector are the promotion of industrialization in the agricultural and information sectors.
The following policies are aimed at in education.

(1) Lines of Development to be followed in National and Private Higher Education

It is considered necessary to make appropriete adjustments in line with changes of the condition in the human resources and funds in the higher education sector, irrespective of whether national or private. For example, even in the cases of private universities which only have single faculty S-1 grade courses it is necessary to ensure that the core curricula is observed and moreover that a reform of curricula in the private universities be carried out in the Repelita V period which will bring these into line with the national universities. Such changes can be expected to result in a complementary reinforcement of development between the national and private university sectors of higher education.

(2) Upgrading the Quality of Higher Education

It is necessary to reform the administration of higher education institutions so that they may manage the funds and resources at their own judgement, depending on their management ability and development level.

To this end, ten postgraduate courses will be set up to train administrators and management staff and to let them obtain S-2 or S-3 degree. The priority will be placed on the training of teaching staff in the higher education institutions outside of Jave.

During the Replita V period, together with the use of Inter University Center and study abroad programmes, 33,000 students are expected to obtain S-2 or S-3 degree in the existing postgraduate programme. Of these, 26,000 students will be in the fields of science and technology.

After the completion of the Replita V, namely in 1993/94 the number of teaching staff in national and private higher education institutions will be 91,000, an increase of 55.8% over 1988/89 in which the number was 58,400. Of 91,000 of teaching staff, 59,000 will be placed in the national higher education institutions and 31,400 in the private institutions.

(3) Target of Indices of the Higher Education[1/]

During the Replita V period, diploma courses including polytechnics will produce 446,200 graduates and S-1 grade courses 715,400 graduates. It is planned to raise the percentage of higher education attendance in 1993/94 to 11% of the population of the age bracket 19 - 24 compared with 8.5% in 1998/99.

(4) Attitudes to Research

Priority should be placed on research related to the effective utilization of resources. To this end, some institutional reforms are necessary.

The role of higher education institutions is to disseminate widely their research results and to contribute to the development of the country providing solutions to various problems encountered in the development. It is also expected that the institutions stimulate the public interest in scientific approaches and develop expertise in the society. A lot of graduates are expected to participate in this activity.

Note: 1/ Refer to Table A-13-4 in Appendix 13 for the Education Guide-lines of the Repelita V program.

2.2.2 Policies of DGHE in the Higher Educational Sector

The DGHE sees it as necessary to raise the level of existing students and graduates to international standards in higher education and to that end has instituted a Second Phase Long Term Development Plan (1986 - 1995) for higher education currently in progress. This program was designed and is implemented in line with the following policies.

1) To reform in overall planning, budgeting and management of higher education at the national and institutional levels.

2) Continued increases in student fees to ease the burden of recurrent costs on the country's financial resources, and extension of the student loan scheme and expansion of the scholarship program for student.

3) Enhanced growth of private universities through deregulation of tuition fees and indirect subsidization such as tax credits together with extention of the student loan scheme to private university students.

4) Expansion of the scholarship program for teaching and research staff, particularly in the area of science and technology and increased provision for teacher honoraria.

5) Increased research funding to enhance the knowledge producing function of higher education in order to develop science and technological education and research in line with the needs of national and regional levels.

6) Enhanced research collaboration through the establishment of a cooperative network among industry, Government sponsored research institutes and universities.

7) Deregulation of importation of scientific books and journals, as well as their reproduction and distribution throughout Indonesia at low costs.

8) Curriculum development, diversification, and relevance in the context of national and regional manpower needs and accreditation of both public and private universities.

9) Expansion of provision of required laboratory facilities and research equipment and increase of maintenance and operation budget for educational equipment in order to give an incentive to engineering education.

10) Establishment and operation of a tracer system for university graduates to improve a quality of university education and to strengthen a cooperation among industry and universities.

11) Strengthening management capacity of university administrators through overseas training and seminars to improve a quality and efficiency of university management.

12) Adjusting the rate of expansion of public university enrollments to availability of financial resources to achieve an improvement of university management in the national and institutional level.

13) Operationalization of the management information system in all national universities to achieve an improvement in higher education sector and at institutes.

2.2.3 Outline of Present Activities of Multilateral and Bilateral Assistance

Multilateral and bilateral assistance worth 23 billion US dollars has been devoted to the development of the educational sectors of Indonesia since 1979. This represents between 60 - 70% of Indonesia's development budget for the educational sector. In particular, support to higher education represents the largest item and accounts for about 50% of the above total, with 80% of this higher education support taking the form of loans and the remaining 20% in the form of grant aid.

The following gives an outline of recent multilateral and bilateral assistance to the higher education sector.

(1) World Bank

a. Project for Upgrading the Quality and Efficacy of Higher Educational Programs (1988 - 1991)

The program of assistance to the Indonesian government in its implementation of planning and supervision of the higher educational systems is to ensure the upgrading of the quality and efficiency of education. In particular, this assistance program supports aspects relating to national and regional needs in the higher educational sector and accords particular emphasis to the importance of the private higher educational institutions. It has an estimated budget for 14 billion US dollars.

b. Project for Expansion of Accounting Training and Education (1988 - 1993)

The project aims to support the Indonesian government in its efforts to upgrade accounting skills in the public and private sectors, to improve the quality of accounting departments and their staff and to expand accounting education programs in the future. The estimated budget is for 113 million US dollars.

c. Secondary Phase of Project for University Development (1986 - 1991)

d. Secondary Phase of Project for Polytechnic Development (1983 - 1989)

e. Project for Training of teaching Staff (1982 - 1988)

f. Primary Phase of Project for University Development (1980 - 1987)

(2) The Asian Development Bank

a. Six Universities Development and Rehabilitation Project (1990 -)

The aim of the project is to upgrade the quality and efficiency of education of six universities through strengthening their administrative capacity, the support activities to the public sector, the research activities, scholarship programmes and

research programmes. The project includes the construction of buildings, the provision of laboratory equipment and educational materials, and the maintenance administration costs for the running of research funds and support activities to the public sector. The total cost of the project will be 142.5 million US dollars, 19% of which will go to the development of personnel resources, 30% to construction work and 20% to equipment provision including laboratory apparatus. Two of the six universities, namely UNLAM and UNTAN are included in the HEDS project.

b. Project for the Development of Marine Science Education (1988 - 1995)

The project is to establish new departments of marine research in six national universities. The total loan is 73 million US dollars.

c. Project for the Foundation of Agricultural Polytechnics (1984 - 1999)

This project is for the construction of agricultural polytechnics in seven Indonesian national universities. The total sum is 29 million US dollars.

d. Project for the Development of UNSRI (1983 - 1991)

The project is for the purchase of equipment and construction of buildings for the Faculty of Engineering, Faculty of Medicine and Faculty of Natural Sciences and Mathematics. Construction of buildings is now under way. This university is included in the HEDS project.

e. Project for Development of USU (1981 - 1988)

The project is for the construction of buildings and the expansion of equipment. The total loan is 30 million US dollars. This university is also included in the HEDS project.

f. Project for the Development of Hasanuddin University (1979 - 1987)

(3) The U.S.A.

a. Higher Education Development Program (1990)

This is a joint project with the HEDS project. It is for upgrading the quality of science education at universities in Sumatera and Kalimantan while the Japanese project in the HEDS project is for upgrading engineering education in these areas. The total estimate for financial assistance to be made available is 20 million US dollars.

b. Project for Higher Education Policy Making and Planning (1985 -)

The project aims at achieving long term policy planning based on an analysis of accurate data and information concerning the current situation in higher education, and the reinforcement of governmental policy formation for higher education with the overall intention of improving the quality of education in Indonesia. USAID will evaluate the following in order to realize the above aims:

1) Undertake to develop the capabilities of teaching personnel relating to the research and analysis of governmental policies

2) Improve the in-house administration of the Bureau of Research and Development of the MOEC

3) Evaluate important policies and measures

4) Support the information center in building up an information systems of policies

5) Support to build up a planning and information systems on a regional level.

The major constituents of the project are technical cooperation, domestic and overseas training, provision of data processing equipment, special research and fund for the evaluation. The allocated budget consists of 151 million US dollars in loan and 499 million US dollars in grant aid.

c. Program for General Overseas Study in the USA (1983 - 1992)

The project is for the expansion of personnel capacity development in private and public institutions. It consists of short and long term overseas training programs for university graduates in technical fields. The project also provides funds for research into training and for the follow-up of the trainees participated in the overseas training programmes.

A particular aspect of the project is the establishment of an OTO (Overseas Training Office) in Indonesia and the intention to ensure that at least 400 trainees complete short term training and 435 complete long term training before the completion of the project. Total assistance involves a loan of 25.5 million US dollars and a grant aid of 350 million US dollars.

d. Program for Strengthening the Capabilities of Western Universities in Agricultural Education

The project is to strengthen the capabilities of the agricultural departments and eleven universities which constitute the Confederation of Western universities. It involves technical cooperation, training in the U.S. and in Indonesia and the provision of educational equipment, books, published materials and experimental farms.
The total estimated budget is 940 million US dollars in grant aid and 150 million US dollars in loans.

(4) Japan

1) Reinforcement Program for Research Materials and Equipment (I)

The aim of the project is to provide educational equipment in the fields of basic science, engineering and medical science for the main national universities and thereby to effect an expansion of the educational and research activities of the universities concerned. The project was implemented from 1977 to 1980 with a total loan of 2 billion 100 million Yen. The five universities, the University of Indonesia, IPB, ITB, UGM and the University of Airlangga were included in the project.

2) Reinforcement Program for Research Materials and Equipment (II)

This is the second phase of the above project. The total loan was 5 billion 13 million Yen. The ten universities concerned were University of Indonesia, IPB, UGM, the University of Airlangga, IKIP Surabaya, Buranaiji, Sebelas Maret, Pattimura, UNILA and Jenderal Soedirman.

3) Other Assistance

The following is a list of other grants made for particular purposes since 1982.

a. Electron microscope for University of Indonesia, 40 million yen

b. Research equipment for University of Indonesia (1983), 42 million yen

c. Research equipment for IPB (1983), 50 million yen

d. Research equipment for ITB (1983), 50 million yen

e. Expansion Project for IPB (1984), 2 billion 340 million yen

f. Japanese Language Equipment for Padjajalan University (1985), 29 million yen

g. Project for establishment of Japanese Language Center at Padjajalan University (1985), 645 million yen

h. Medical Research Equipment for Medical Faculty of Hasanuddin University (1985), 45 million yen

i. Project for Construction of Electrical Engineering Polytechnic (1980), 1 billion 895 million yen

j. Language Lab system and audio visual equipment for ITB (1986), 32 million yen

k. Language Lab system and audio visual equipment for University of Indonesia (1987), 48 million yen

l. Published materials and Audio-visual equipment for Purusada University (1987), 47 million yen

m. Astronomical Telescope for ITB (1988), 49 million yen

n. Published materials and educational materials for Purusada University (1988), 48 million yen

o. Audio-visual equipment for USU (1989), 46 million yen

p. Japanology books and published materials for UGM University (1989), 3 million yen

(5) Other Bilateral Assistance Programs

a. Scholarship Project for ITB (Australia)

This project provides the S-1 degree teaching staff members in basic sciences at ITB with scholarship to study in Indonesia or Australia depending the results of 4 month language training.

b. Scholarship Project for IKIP (Australia)

With the purpose of upgrading the quality of the teaching staff in basic sciences at IKIP, this project provides teaching staff members of IKIP with language training at ITB and then scholarships to study in Australia.

c. Project for the Development of Universities in the Eastern Region (Australia)

This project aims to raise the educational level of local universities in the remote islands neighboring with Australia through the provision of equipment for the student experiments with technical cooperation.

d. Project for the Development of Universities in the Eastern Region (Canada)

This project aims to provide postgraduate students with scholarships to study in Canada, to provide intensive training in basic sciences and to expand educational and research facilities of University of Sam Ratulangi, University of Pattimura and University of Cenderawasih including technical cooperation with DGHE. The amount of grant is 17 million US dollars for 1988 - 1993.

e. Scholarship Programme for Postgraduate Study

This is a joint project with the World Bank with a total grant of 1.2 million US dollars. Candidates are selected after receiving 6 months language training in Indonesia.

f. Project for the Development of Hydrography Curricula

This three year grant project aims at the establishment of a hydrography course at ITB. The project includes provision of necessary books, published materials and experimental equipment. The total budget is 400,000 US dollars.

2.3 Project History and Details of the Request

2.3.1 Project History

The government of Indonesia has carried out a number of economic reforms over a considerable period. It has devoted its energies to developing a high value added increment to its particular national resources, to expanding the ratio of the non oil and non gas sectors of its industry and to expanding the exports of finished products of a secondary or higher processing nature.

The islands of Sumatera and Karimantan, rich in resources, are expected to play an important role in the economic development of the country along the above lines. In order to realize such potential, the government of Indonesia puts great emphasis on the need to increase the student population in basic science, engineering and management, and to reinforce the educational programs.

As a result of the efforts expended on expanding higher education by the Indonesian government in the last 40 years, 45 national universities and more than 800 private universities have been founded. The student population has increased by more than 10% every year and the number of full time teaching staff and administrative personnel tripled. In particular, private universities have increased from 350 colleges in 1975 to more than 800 with a total of about 750,000 enrolled students.

However, the government budget for higher education remains inadequate as heretofore. It is not possible yet to meet the requirements for educated human resources, and the attendance levels are low and educational quality inadequate. The percentage of university graduates among the total employed population is less than 1%, and the above trends are particularly evident outside of Java. Against this background the DGHE devised the HEDS, and requested multilateral or bilateral support in this area in order to undertake the development of higher education.

The project proposal started as an American proposal for the HEDS was submitted to the Japanese government in February, 1988 as an Japanese-American joint project. From July 3 to July 30, 1988 a Japanese party participated in the Project Design Survey carried out by the USAID. This survey constituted the first such survey for the collection of information and data concerning the Project.

Table 2-3 summarizes the progress and main items examined by the Japanese government from the inception of the first Project Design Survey mentioned above.

The project is for the upgrading of teaching staff of 11 universities in Sumatera and Kalimantan of Indonesia. Japan is to be responsible for engineering education and the USA to take charge of areas of basic science. The roles of the two participating parties of the Japan and USA are summarized in Table 2-4.

Table 2-3 Developments and Contents of Higher Education Development Support

Former Survey	Objects and Contents of Survey	Results of Survey and Discussions
1. Project Formation Survey (July 3rd, 1988 - July 30, 1988)	(1) The first investigation on "Higher Education Development Support" Project, which was proposed by Indonesian Government as a Japan-USA joint project. (2) Investigation and collection of information and/or data on "Higher Education Development Support" Project. (3) Study of possibility of Japanese Technical Cooperation and Grant Aid for HEDS through discussion with Indonesian Government and USAID.	(1) Discussions with DGHE, BAPPENAS, USAID and Survey for UNSRI, Univ. Bunhatta, Univ. Ekasaki, UNAND, UNSYIAH, Univ. Riau, USU, UNILA, Univ. Bandar Lambung, Inst. Pertanian Bogor, ITB, Univ. Pelangkaraya, Univ. Mulawaruman. (2) Interviews and discussions on 1) Position of Higher Education Sector on Repelita V. 2) Significance of HEDS on Higher Education Development Programs 3) DGHE's thoughts on Japan-USAID joint project 4) Requirement for Japanese assistance.
2. Second Project Formation Survey (Nov. 1, 1988 - Nov. 18, 1988)	(1) Hearing on Details of Cooperation of USAID for HEDS project (2) Hearing on Indonesian Government's Request for Japanese cooperation for the HEDS. (3) Hearing on Selection of Target Universities.	(1) Details of USAID's cooperation for upgrading of lecturers' in seven target Universities in the North Sumatera and Kalimantan were clarified:- 1) Reception of 183 teaching staff for degree acquisition 2) Implementation of In-country Seminars and Workshops 3) Assistance for improvement of University Management (2) Proposals for HEDS of Japanese cooperation and of target universities were requested by DGHE.
3. Project-type Technical Cooperation Scheme, Preliminary Study for Higher Education Development Support in Indonesian Government (Aug. 30, 1989 - Sept. 27, 1990)	(1) Detailed discussions on concrete aspects of Japanese cooperation scheme at ITB with DGHE and ITB and Discussions on selection of target universities.	(1) Discussions with DGHE, SEKTAB, BAPPENAS, USAID. Survey of UNILA, UNSYIAH, USU, NOMMENSEN, UNSRI, and ITB. (2) Establishment of Project management office relating to the HEDS project was agreed. (3) Target 11 Universities were selected. (4) Agreement signed on Sept. 12th 1989
4. Detailed Survey for HEDS (Jan. 21, 1990 - Feb. 27, 1990)	(1) Investigation and Collection of basic information on list of teaching staff, available equipment, and equipment requested.	(1) Target 11 Universities and ITB were surveyed and list of teaching staffs and list of available equipment were prepared. (2) Submission of List of requested equipment was required from each department of 11 target universities.
5. Implementation Survey on HEDS project (Apr. 1, 1990 - Apr. 15, 1990)	(1) Discussions on Project-type Technical Cooperation Scheme for HEDS with DGHE, BAPPENAS, USAID and ITB (2) Agreement with DGHE on Cooperation Scheme on HEDS project.	(1) "Record of Discussion Between Japanese Implementation Survey Team and The Authorities Concerned of The Republic of Indonesia on Japanese Technical Cooperation for the Higher Education Development Support Project" was agreed and signed. (April 12, 1990) (2) Establishment and Organization among Japan-USALD-Indonesia, and scope of department for the 11 target Universities was agreed.

Table 2-4(1) Details of Japan - USAID Cooperation Scheme for HEDS

Item	Details of Japanese Cooperation	Details of USAID Cooperation	Remarks
1. Objective of Assistance	1-1. The purpose of the Project is to enhance the quality of engineering education of the target universities in Sumatera and Kalimantan regions through provision of opportunities of in-country postgraduate studies at selected host training institutions in Java for academic staff of engineering departments of the target universities and through provision of equipment for smooth and effective implementation of the Project.	1-1. The purpose of the project is to provide mechanism by which professional staff can build on their academic and technical skills to formulate, initiate, and carry out qualitative improvements in their programs and to provide an environment which supports professional diligence and excellence.	
2. Target Universities	2-1. Target universities of the following 11 universities in Sumatera and Kalimantan regions. 1) University of Syiah Kuala (National, Banda Ache) 2) University of North Sumatera (National, Medan) 3) Nommensen University (Private, Medan) 4) Dharma Agung University (Private, Medan) 5) University of Medan Area (Private, Medan) 6) The Islamic University of Sumatera Utara (Private, Medan) 7) Andalas University (National, Padang) 8) University of Sriwijaya (National, Palembang) 9) University of Lampung (National, Bandar Lampung) 10) University of Tanjungpura (National, Pontianak) 11) University of Lambung Mangkurat (National, Banjarmasin)	2-1. Target universities consist of the following nine universities in addition to those 11 universities for target universities as included in the Japanese cooperation. 1/ 12) Univ. Riau 13) IKIP Medan 14) IKIP Padang 15) Univ. Jambi 16) Univ. Palangkaraya 17) Univ. Banchapakati 18) Indonesia Secondary Economic School 19) Univ. Bengkulu 20) Univ. Ahumadyani	1/ Target Universities will be decided later.
3. Target Faculties and Departments	3-1. Field of Engineering Education 3-2. Target departments consists of the followings of the engineering faculties. 1) Dept. of Civil Engineering (Including Architectural Engineering) 2) Dept. of Mechanical Engineering 3) Dept. of Electrical and Electronic Engineering 4) Dept. of Chemical Engineering 5) Dept. of Industrial Management 6) Dept. of Mining	3-1. Field of Basic Science Education 3-2. Mathematics, Basic Science and University management 1) Mathematics 2) Chemistry 3) Physics 4) Biology 5) Engineering Management	
4. In-Country Postgraduate Study	4-1. The purpose is to assist in-country post graduate studies at host training institutions for relatively younger academic staff of engineering departments of 11 target universities	4-1. 175 participants for scholarships in the field of mathematics, Basic science and engineering management will be selected among lecturers in the target 20 universities. 2/	2/ Details will be decided later

Table 2-4(2) Details of Japan - USAID Cooperation Scheme for HEDS

Item	Contents of Japanese Cooperation	Contents of USAID Cooperation	Remarks
	4-2. DGHE shall take necessary measures to provide scholarships for participants in S2 and S3 courses which is funded by OECF loan. 4-3. 240 Participants for scholarships are planned during six years.		
5. Short Course training	5-1. In-country seminars and workshops concerning to current engineering topics, technology, pedagogy, educational policy and university management etc. will be provided.	5-1. In-country seminars and workshops concerning to organizational design, policy science, job placement for graduates etc.	
6. Overseas Training	6-1. Non-degree short-term training program in Japan will be provided for the selected participants who have completed a degree of S2 or S3 at the HTI.	6-1. 175 participants for S-2 or S-3 degree who are expected to contribute to solve various problems generating in the educational levels. Field should be Mathematics, Chemistry, Physics, Biology and Industrial Management	
7. Provision of Equipment	7-1. Research equipment for HTI will be provided for relevant departments.		
8. Dispatching of Short/Long Term Experts	8-1. Five Japanese long term experts and short term expert will be dispatched.		

2.3.2 Details of the Request

(1) Aims

In addition to issuing its Scheme for Action in the Development of Higher Education in 1988 with the aim of upgrading the quality of higher education, the government of Indonesia has planned and is at present carrying out multilateral and bilateral support schemes. In particular, the joint Japanese-American HEDS scheme for the upgrading of higher education in the regions outside of Java is currently being implemented. This scheme is a program of support for the acquisition of higher degrees by the teaching staff of 11 universities of the Sumatera and Kalimantan. The Project is to complement this scheme for upgrading the quality of the 11 universities concerned through a reinforcement of experimental equipment for S-1 grade student use. This will further practical engineering expertise in line with the economic and social requirements of the regions and permit training in analytical capacities for engineering technology to be carried out. In this way the project will serve to upgrade the quality of higher education in the region.

(2) The Executing Body

The DGHE, which supervises institutions of higher education encompassing both national and private universities in Indonesia, is to be the executing body. It will also carry out the maintenance and running of the scheme after the implementation of the Project is completed. Further, the PMO set up as the central executive organ for the implementation of the HEDS project, signed between Indonesia and Japan on April 12, 1990 is already operating within the DGHE. It is expected that the PMO organized as shown in Fig. A-13-5 in Appendix-13 will play the central role in the implementation of the Project for the DGHE even in the event of a cooperative undertaking on a grant aid basis being adopted.

(3) Details of the Project

The Project concerns the reinforcement of experimental equipment for S-1 grade student use in the 35 departments of the 11 target universities as shown in Table 2.5.

Table 2-5 Target Department of Target Universities

Universities		Classification	Civil	Mechanical	Electrical	Chemical	Mining	Industrial
Sumatera								
1. UNSYIAH	Banda ache	National	○	○	-	○	-	-
2. USU	Medan	National	○	○	○	○	-	○
3. NOMMENSEN	〃	Private	○	○	○	-	-	-
4. UMA	〃	Private	○	○	○	-	-	○
5. UDA	〃	Private	○	○	○	-	○	○
6. UISU	Medan	Private	○	○	○	-	-	○
7. UNAND	Padang	National	○	○	-	-	-	-
8. UNSRI	Palembang	National	○	○	○	○	○	-
9. UNILA	Bandar Lampung	National	○	-	-	-	-	-
Kalimantan								
10. UNTAN	Pontianak	National	○	-	○	-	-	-
11. UNLAM	Banjarmasin	National	○	-	-	-	-	-

CHAPTER 3. DETAILS OF THE PROJECT FOR THE PROVISION OF EDUCATIONAL EQUIPMENT TO 11 TARGET UNIVERSITIES

CHAPTER 3 DETAILS OF THE PROJECT FOR THE PROVISION OF EDUCATIONAL EQUIPMENT TO 11 TARGET UNIVERSITIES

3.1 Objectives

This project aims at the upgrading of the higher education level in Sumatera and Kalimantan as a part of the higher education development programme of Indonesia. The master plan for this project is the Higher Education Development Support programme drawn up as an Japanese-American joint project. The HEDS project aims to upgrade the quality of engineering education in Sumatera and Kalimantan through training the teaching staff of engineering departments of the 11 target universities at an appropriate institution in Indonesia, enabling them to acquire higher degrees there, inviting them to Japan for a short term training, organizing workshops and seminars on engineering education methods and recent topics in science and technology, and sending Japanese experts to Indonesia.

Complementary to the HEDS project, this project aims to provide engineering departments of the 11 target universities with equipment for S-1 grade student experiments since lack of educational equipment at these universities prevents them from providing students with engineering education which meets the requirements from industry and the society.

3.2 Review of the Request Details

3.2.1 Needs of the Project

As mentioned above, the Project aims to expand equipment for experiments of S-1 grade at the 11 target universities as a part of an overall program to improve the quality of science and engineering education in Indonesia through the upgrading of the teaching staff quality.

In order to upgrade the quality of engineering education, it is important to improve curricula, especially the quality of experimental practices. To this end, (1) expansion of educational and research equipment, (2) to ensure sufficient quantity and quality of teaching staff, (3) to ensure a minimum level of funds, (4)

establishment of a maintenance system, and (5) individual administration of curricula are considered to be critical elements. None of these can not be neglected. With all the elements being combined, the engineering education may be improved effectively.

As shown in Table 3-1, the DGHE has programs for each element listed above. Therefore, combined with these DGHE's programs, this grant aid project is expected to produce satisfactory results achieving the objectives of the overall project.

The expected results of this grant aid project are:

(1) Direct beneficiaries of the Project are about 650 teachers and 12,000 students of the engineering departments of the 11 target universities. Sumatera and Kalimantan will be benefitted through having 1,500 better trained graduates every year.

(2) Most of the graduates from the engineering departments of the 11 target universities except the graduates from one department (the mining engineering department of University of Sriwijaya) will get a job in the public sector and the private sector in Sumatera and Kalimantan. Therefore the Project will contribute to the promotion of industry in Sumatera and Kalimantan.

Table 3-1(1) Needs of the Project

Needs of the Project	DGHE's Counter measures	Effect and Justification
I. Strengthening of Management System in the Higher Education Sector I-1. Demarcation of Economic and Social Requirements in Higher Education Sector	1) Analysis and Improvement of curriculum. 2) Promotion plan for means of linkages between the universities and the business community. 3) Planning of seminars and workshops concerning current technology. 4) Improvement of educational and Laboratory Equipment for Engineering Education. 5) Implementation of tracer study of graduates from the universities. 6) Strengthening of open university functions. 7) Strengthening of science and technology education and research and development at the national level and also in line with the regional development needs.	1) Improvement of quality of engineering and scientific man power to meet long-term economic and social needs through various policy reform as described the left. 2) Direct and/or indirect contribution to effective utilization of inherent resources, increase of export of high value-added product and creation of job-markets etc. will be achieved.
I-2. Expansion of opportunities and improvement of quality of education in the regional islands other than Java.	1) In-country study at HTI and study in Japan for teaching staff from 11 target universities in Sumatera and Kalimantan. 2) Provision of opportunities for seminars and work-shops for teaching staff of regional universities. 3) Provision of in-country training at post graduate university. 4) Extension of the student loan scheme and expansion of the scholarship program for teaching and research staff, particularly in the area of science and technology.	1) Increase of role as an antenna to regional industries 2) Expansion of technological contribution to the regional industries for improvement of quality, production efficiency, effective utilization of inherent resources and creation of jobs etc.
I-3. Improvement of efficiency of education through strengthening of management capability for higher education.	1) Reform in management of higher education to handle an increase of post graduate students, numbers of drop-out and repetion rates at the national and institutional levels.	1) Improvement of essential efficiency of national budget by an increase of students numbers. 2) Improvement of efficiency by decreasing gap among universities and unification of the system.

Table 3-1(2) Needs of the Project

Needs of the Project	DGHE's Counter measures	Effect and Justification
	2) Provision of opportunity of in-country study and training in Japan for management staff in 11 target universities. 3) Provision of opportunities for seminars and work-shops on university management. 4) Expansion of communication between universities and between state and private universities, and promotion of sharing of facilities among them. 5) Establishment of MIS System for all state universities.	
I-4. Improvement of quality of educational levels in Private Universities	1) Deregulation of tuition fees and indirect subsidization such as tax credits. 2) Extension of the student loan scheme to private university students. 3) Gradual commencement to be renewed and adjusted to the development of science and technology for the core curriculum of private higher learning institution will be achieved within Repetita V. 4) Upgrading of quality of Lecturers in the Private Universities.	1) Private universities which supply ca. 60% of total graduate students in Indonesia, are direct beneficiaries of the project.
II. Provision of required numbers and Improvement in quality of teaching staff	1) Expansion of the scholarship program for teaching and research staff, particularly in the science and technology. 2) Increased provision for teacher honoraria. 3) In-country study at HTI and training in Japan for teaching staff of the 11 target Universities. (180) 4) Provision of seminars and Workshops for teaching staff and management of the target universities.	1) Improvement of cost-effectiveness and quality of education through decrease in teacher-student ratio from 1:15 to 1:10 2) Increase of academic staff holding MS or PhD degrees.

Table 3-1(3) Needs of the Project

Needs of the Project	DGHE's Counter measures	Effect and Justification
III. Upgrading of educational facilities and equipment III-1. Improvement of higher education budget	1) Reform of provision of higher education budget at national and institutional levels. 2) Continued increases of student fees to absorb the burden of recurrent costs on the country's financial resources. 3) Deregulation of tuition fees and indirect subsidization such as tax credits. 4) Encouraging state universities to seek additional sources of finance to supplement the funds received from student fees and government budget.	1) Actual increase of higher education budget. 2) Increase of internal efficiency through establishment of initiative of individual universities.
III-2. Lack of educational facilities	1) Staged expansion of building, general facilities and research facilities.	1) Improvement of efficiency though upgrading of educational infrast-ructures.
III-3. Lack of educational equipment	1) Deregulation of importation of scientific books and journals, as well as their reproduction and distribution throughout Indonesia at low costs. 2) Upgrading of educational equipment for S-1 grade. 3) Establishment of Technical Service Center for procurement and maintenance of equipment in Indonesia.	1) Diversification of information on current science and technology. 2) Increase of Engineers to meet industrial fields. 3) Expansion of open university functions. 4) Expansion of services for testing and certification, technical consultancy for business field.
III-4. Deficiency of maintenance cost	1) Establishment of Technical Service Center for Laboratory equipment in Java and other regional islands. (3 places) 2) Increase of Budgetary allocations ofor maintenance costs for educational equipment.	1) Continuous and effective use of equipment minimizing shut down of educational equipment through timely technical services and self-repair of equipment avoiding relianbce on overseas maintenance services for equipment.

3.2.2 Review of Implementation and Operation Plan

The target departments in this project are all the existing ones and no new laboratories and courses under contemplation are not included.

University of Syiah Kuala are to receive some equipment from an assistance program of Germany. University of North Sumatera and University of Sriwijaya are constructing a new campus by an ADB loan. However, all of these universities are general universities of a high level in Sumatera and since budgetary measures in recent years are considered adequate eventual problems of maintenance and administration are considered unlikely. In any case, the Project is on the assumption of the existing personnel structures and so there are no factors necessitating the increase in the personnel expenses incurred for teaching staff, technical assistants or administration personnel.

It is difficult to differentiate the expenses of materials and services necessary for the student experiments from the research expenditures of the teachers. A rough data is shown in Table 3-2. The budget of the faculty of engineering of the 11 target universities remain on the almost same level in recent years without a growth. However, in the Repelita V the funds for purchasing spare parts of equipment for student experiments and for the maintenance of equipment are reserved in the higher education action program of the DGHE. However, the equipment provided under this project is for S-1 grade student experiments and does not consume much electricity, water and other form of energy. An increase of consumption of energy by the new equipment is considered to be quite little.

Table 3.2 Training Expenses of 11 Target Universities

Units: Rupiahl,000

	National Universities :A Group(Local Univ.)	National Universities : B Group	Private Universities (4 universities)
Expenses for Student's Experiment	10,000	15,000	15,000
Expenses for Research	10,000	45,000	20,000
Total	20,000	60,000	35,000
Remarks			
Expenses for Field Training	500	1,000	700
Expenses for Experiment on Graduation	2,000	7,000	15,000
Expenses for Manpower on Experiments	10,000	18,000	20,000

3.2.3 Relation to Other Multilateral and Bilateral Assistance Programs

The higher education sector has received much assistance in loan and grant aid from international organizations such as the World Bank and ADB as well as from Germany, U.K., Netherlands, Australia, U.S.A., Japan and so on. Of these assistance programs, the ones which are related directly or indirectly to the present grant aid are as follows:

(1) University of Syiah Kuala

Educational and/or research equipment will be procured through a loan of Germany (GTZ) for the Mechanical Engineering Dept. and Chemical Engineering Dept. of the Engineering Faculty. These equipment will be delivered and their installation is to begin at early of 1991.

The equipment to be provided is directly related to the present grant cooperation, and it is necessary to avoid any duplication of the equipment in the Basic Design of the Project.

(2) University of North Sumatera

The construction of the Engineering Faculty buildings with a loan from the ADB is almost completed, and the transfer to the new buildings is scheduled to take place between March and June of 1991.

Part of the equipment for the Mechanical Engineering and Chemical Engineering Departments has already been delivered and received.

(3) University of Sriwijaya

The construction of buildings is in progress with an ADB loan and equipment is scheduled to be purchased by the 5 departments concerned. The final choice and specifications of the equipment is to be decided towards the end of October, 1990.

Detailed arrangements were made to avoid duplication with equipment provided by the ADB.

(4) Andalas University

Equipment was purchased with a loan from the World Bank for the Faculty of Mathematics and Natural Sciences, the Faculty of Animal Husbandry, the Faculty of Agriculture and Faculty of Economics, but the Faculty of Engineering was not included in the scope of the World Bank project.

(5) University of Lambung Mangkurat, University of Tanjungpura

The Development and Rehabilitation Project for Six Universities is in progress currently and UNTAN and UNLAM are included in this. However, the project is largely concerned with building facilities and equipment involved is minimal.

3.2.4 Review of Requested Equipment Details

During a survey carried out between January 21 and February 27, 1990 a list of equipment requested from the 11 target universities was submitted. However, there was some misunderstanding on the nature of equipment to be provided by this project and also priority given to items in the list was not yet clear. Moreover, a large number of over sophisticated equipment or equipment whose maintenance would involve restrictive costs was remarked among the items of equipment requested for the experimental equipment of the various departments. As remarked previously, the emphasis has been placed on basic experimental equipment required for experimental use by S-1 grade students. The Basic Design Study Team has confirmed that the equipment to be provided is for student experiments at S-1 grade level in faculty of engineering and is the one which is required in the curricula of each department. The guidelines for the evaluation of requested equipment are as follows:

(1) Evaluation was carried out on the current curricula for practical training, the topics of experimental courses and the model for departmental activities (cf details of model), and on the departmental basis of these evaluation an equipment selection was made.

The following should be noted in regard to the "Details of Model".

Experimental equipment normally required in an engineering faculty of universities consists of the following cases of experimental and research equipment, (i) for S-1 grade student experimental use, (ii) for research use by students of postgraduate level (M.Sc. or Phd. level) or by teaching staff, (iii) for use in joint research with industry. Further, experimental and research equipment in cases (ii) and (iii) varies according to the level of research and/or scope of research involved. The present study report is only concerned with case (i) above. However, it is recommended in the interests of upgrading overall experimental and research equipment/facilities that the engineering faculties of Indonesian universities also consider expansion in accordance with models (ii) and (iii) in the future.

(2) Practical work and experiments which are actually conducted at these universities were collated with the model mentioned above and experimental subjects required expansion were selected.

(3) Equipment which exists at the laboratories and/or is to be provided through other projects such as those of ADB, Germany etc. was studied and identified to avoid unnecessary duplication.

(4) Therefore, equipment to be provided to the 11 target universities in the Project shall be, in principle, equipment defined by (1) above excluding the equipment identified in (3), but in practice because of budget restriction for the Project, the final equipment selection is to be limited to that for courses as defined by (2).

Requested equipment includes equipment to improve university administration as well as experimental equipment for civil, mechanical, electrical, chemical, industrial and mining engineering. All the target universities are using personal computers or minicomputers for university administration. In the universities which are using minicomputers the memory and storage capacities are at present sufficient to process data presently available. However, the maintenance cost of a minicomputer amounts to 20 to 30 million Rupiah per year and is a heavy financial burden on the university. A microcomputer is easier to operate and to maintain. Its maintenance cost is negligible compared with that of a minicomputer. Now the performance of microcomputers is not inferior to, becoming even

better than minicomputers. The only advantage of a minicomputer is that it has a better data security. For these reasons, especially to reduce the maintenance cost, the Project will introduce microcomputers with memories of around 300 M bytes to University of Syiah Kuala and University of Lampung for their university administration. Both universities are using at present minicomputers for university administration and have experiences of the development of a computerized university administration system. It is expected that other universities will consider the introduction of a university administration system using microcomputers, stimulated by these examples.

DGHE is considering the introduction of a MIS into all national universities in the future. To materialize this idea, it is necessary to study carefully the present administration system of universities and to formulate a master plan on the introduction of a MIS. In the circumstances it is considered not proper to expand the provision of "microcomputers for administration" beyond the above two universities under the present project. On the other hand it is necessary to provide the engineering departments of the target universities with microcomputers which can be used by teachers and students in engineering studies. So far microcomputers introduced by DGHE to universities are mainly being used for administrative jobs and there are only few microcomputers for the use by teachers and students in engineering studies (except for the industrial engineering department of the University of North Sumatera).

Equipment which is not suitable for experiments by students or requires high maintenance costs was excluded since the purpose of this project is to provide equipment essential for S-1 grade student experiments. Since DGHE/PMO requested to evaluate the practice courses and to list necessary equipment items in engineering education in Indonesia, the survey team prepared material to that effect under many restrictions due to a short survey period. The evaluation of individual departments are as follows.

(1) Study of Equipment for Civil Engineering Departments

Table A-8-1 in Appendix-8 shows the curricula of the civil engineering departments of the 11 target universities. Table 3-3 shows a model design for practice courses and equipment necessary for these practices in civil engineering. Table 3-4 lists the courses taught currently in the universities concerned.

All the target universities have a civil engineering department and it is larger and has a longer history than other departments in the university. The faculty of engineering of two of the target universities has only one department and it is a civil engineering department. This is one of the features of engineering education in Indonesia and indicates the particular importance attached to civil engineering in Indonesia.

Civil engineering is technology of a pronounced public nature, and so tends to develop a particular structure under the influence of the national political, economic and natural environment. It is not necessarily the case therefore that the formation and development of civil engineering experiences in other countries will be the best for Indonesia.

However, while this is so for application sectors, as far as the basic know how is concerned, it would seem reasonable to assume it common to most countries. Basic courses in civil engineering are land surveying, material mechanics, hydraulics, soil mechanics, material and concrete engineering and sanitary-environmental engineering. Practical training and experimental courses should be prepared to handle and cover these areas. For example, courses for surveying practice, material testing, hydraulics experiments, soil testing, structure experiments, sanitary engineering experiments, and drawing/design are needed. Looking at actual curricula of these universities, we find that almost all the target universities have made provision for lecture courses in these fields, with the exception of sanitary and environmental engineering which are comparatively weak.

Of the 11 target universities, USU is best equipped having laboratories for surveying practice, hydraulics, soil mechanics, concrete

testing, road experiment and drawing/design, and is considered to be rather complete for an undergraduate course. In general only a few universities have a drawing/design room. In view of relatively low frequency of use, equipment for a drawing room will be given a low priority. A hydraulics laboratory in many of the target universities is rather poor, perhaps because of the high cost of the equipment involved. As irrigation works and river improvement works are especially important civil engineering tasks, it is important to provide a hydraulics laboratory for the training of sufficient hydraulics engineers. There is a strong interest in road testing laboratories and facilities. This is a characteristic of Indonesia generally and not only confined to the 11 target universities. As a road testing laboratory is a laboratory of applied technology, it would seem better to leave acquisition of technical expertise after students have entered on the job. However, in the course of this survey, many teachers emphasized that in Indonesia university graduates are in the position to supervise and instruct technicians and workers on the site, so it is necessary to train the students in this field too. Since road construction is the construction work most frequently carried out, it is considered necessary to equip a road testing laboratory to some extent.

Based on these observations, it is considered to be appropriate to group the 11 target universities into three classes: A group (University of Andalas, University of Lampung, University of Tanjungpura and University of Lambung Mangkurat), B group (University of Syiah Kuala, University of North Sumatera and University of Sriwijaya) and C group (Nommensen University, Dharma Agung University, University of Medan Area and Islamic University of North Sumatera).

In the A group, University of Andalas and University of Lampung have similar laboratories to those of the B group universities, but the equipment is inferior to them. These universities have relatively a small number of laboratories as the national universities in Kalimantan. University of Tanjungpura and University of Lambung Mangkurat in Kalimantan have only laboratories for surveying, concrete testing and soil testing. There is neither hydraulics laboratory nor road experiments laboratory. No equipment at all for

hydraulics and road experiments. Since there are many big rivers and a large area of marshlands in Kalimantan, it is important to have well equipped hydraulics and road laboratories and to train engineers to work for the construction of infrastructures for economic development of Kalimantan. University of Lampung and University of Lambung Mangkurat have only a civil engineering department in its faculty of engineering. It is desired to set up a mechanical engineering or electrical engineering department to arouse emulation. As civil engineering is progressing toward more mechanization, use of robots and information technology, the existence of electrical or mechanical engineering departments is also important to develop civil engineering itself.

The universities of B group have a larger number of teaching staff and the facilities are better than other groups. In this group, University of North Sumatera is the largest in the number of teaching staff and the best in equipment and facilities. However, it will be better to increase the number of standard surveying instruments (theodolites, levels etc.) in view of the large number of students. In University of Syiah Kuala and University of Sriwijaya, it is necessary to expand the hydraulics laboratory.

The C group consists of four private universities in Medan. In general they lack hydraulics and road laboratories. Of these, Nommensen University is relatively well equipped with laboratories for surveying, soil testing and concrete testing. As to Dharma Agung University and University of Medan Area, equipment is old and small in quantity. It is necessary to better equip surveying, soil testing and concrete laboratories and to set up a road laboratory in the future. Islamic University of North Sumatera has no laboratories and is necessary to be equipped with laboratories of at least similar level to those of Dharma Agung University or University of Medan Area.

It is noted that the private universities are inferior to the national universities in terms of equipment. However, there is good cooperation between departments and a strong unified desire to upgrade levels. It is therefore expected that a provision of equipment will result in considerable improvement and expansion of activities.

(2) Study of Equipment for Mechanical Engineering Department

The Government of Indonesia is promoting machine industries in Sumatera. Eight universities of the 11 target universities have a mechanical engineering department. They are all in Sumatera. A university which provides students with experiments adequate for S-1 grade is only USU. Besides this, UNSYIAH, UNSRI and Nommensen are only capable of arranging a certain amount of experimental training. However, all the universities showed a strong desire to amplify and expand practical training and all have plans for a future expansion.

At present both UMA and UISU in the Medan area which is characterized by strong demands for machine industries, and UNAND in Padang at the center of West Sumatera rely on the mechanical engineering departments of other universities to provide practical training to their students. It is necessary to rectify this situation urgently.

1) Curricula of the Mechanical Engineering Departments

Table A-8-2 in Appendix-8 shows the curricula of the 8 universities concerned. There are some topics which reflect the particularities of regional industry but in general all the universities have the same overall curriculum.

2) Table 3-5 indicates the practical courses and required equipment of the mechanical engineering departments. This table includes also practice courses which are not given at these universities but are considered necessary for S-1 grade. It was prepared for equipment selection purposes and shows a minimum requirement. For UNSRI and UNSYIAH it is necessary to take into consideration other bilateral and multilateral programs in the selection of equipment.

3) Current S-1 Grade Practical Training Courses

Table 3-6 tabulates the practical courses of the individual universities. These are roughly divided into; 1. fluid mechanics experiments, 2. internal combustion engine experiments, 3. drawing and machine elements, 4. materials experiments and 5 machine tools experiments. Further, leaving aside the pros and

cons involved, there is a trend for certain universities to undertake experimental courses relating to advanced technological fields. Given the fact that practical training and experiments in the five areas above indicated are insufficient at present, except in the case of USU, it is considered essential to ensure that the equipment for basic experiments has priority in the selection.

(3) Study of Equipment for Electrical Engineering Department

The role of an electrical engineering department in Indonesia is to produce electrical engineers who can contribute to achieve three main objectives: 1. the supply of electricity throughout Indonesia, 2. the assurance of the electricity supply required by industry and 3. the establishment of a communication network covering the linking the large number of islands which make up the archipelago. At present, in Sumatera and Kalimantan priority is placed on the supply of electricity. Therefore, the universities in these regions give emphasis on electric power systems for generation, transmission and distribution of electricity together with high voltage technology. However, there is a strong desire to set up courses in electronics and telecommunications in many universities. Three private universities included in this project have a larger number of courses related to electronics in their curriculum than in national universities.

1) Curriculum

Table A-8-3 in Appendix 8 shows the present curricula of 7 universities which have an electrical engineering department. The method for structuring courses differs according to university. For example, in one university there are courses, mathematics I, II, III, IV which cover all necessary areas, whereas elsewhere there are separate courses for mathematics and differential equations. It is therefore not possible to assume that simply because a certain course is not indicated in the table that it is not taught. In overall terms the contents of curricula are much the same, but Nommensen University has more courses relating to computer science and telecommunications than others as can be seen from the Table A-8-3.

2) Present Experimental Courses

The experimental courses in each university curriculum are shown in Table 3-8. All the universities provide more or less basic courses for electrical engineering, namely experiments on electric circuits, the handling of measurement instruments, measurement of various electrical quantities, practice on electric energy conversion machines such as transformers, electric motors, generators, high voltage technology experiments, transmission and distribution experiments, electronics experiments, telecommunication experiments, computer systems (logic circuits) experiments, control systems experiments etc. However, equipment is inadequate in many cases and so the experimental courses in each field seem to be chosen in accordance with the equipment available for use. Despite the emphasis accorded to high voltage technology and transmission & distribution as mentioned above, shortage of equipment in these field in University of Sriwijaya and University of Tanjungpura necessitates the students of both universities to send to Institute of Technology Bandung for training in these fields.

The Islamic University of North Sumatera is almost completely without experimental facilities and its students are trained in experiments at University of North Sumatera.

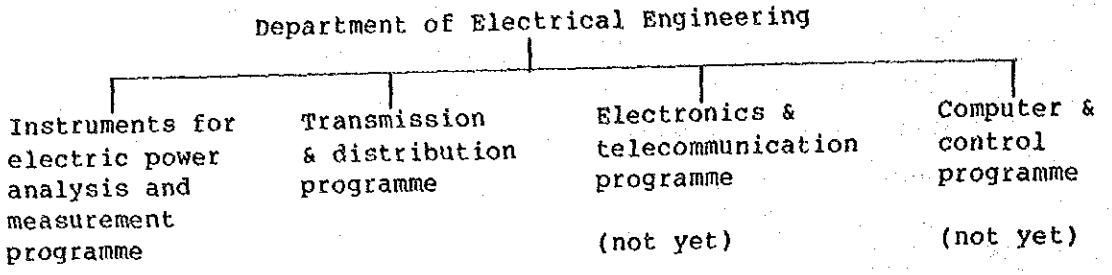
3) Practice Courses and Required Equipment in Each University

a. University of North Sumatera

The Department places emphasis most on high voltage technology.

Sumatera is planned to be a center of heavy industries in Indonesia and supply of electric power is the most important issue of the electrical engineering in this region. At present the Department has two programmes: 1) instruments for electric power analysis and measurement programme, and 2) transmission and distribution programme. However, it plans to set up two new programmes: electronics & telecommunication programme, and computer & control programme.

Electronics and telecommunication is another priority area in the electrical engineering in Indonesia in view of its vast extension of territory. The number of students is at present 526.



There are nine laboratories: i) Electric circuit, ii) Measurement, iii) Basic electrical engineering, iv) Electric machines, v) High voltage technology, vi) Transmission and distribution, vii) Electronics, viii) Telecommunication, ix) Computer and control. Of these laboratories, four laboratories (i) to iv)) have instruments necessary to conduct basic experiments, but many of them are out of order and must be repaired. Recently some instruments were purchased using an ADB loan for the Telecommunication laboratory, the Computer and control laboratory, the Basic electrical engineering laboratory and Transmission & distribution laboratory. In the Basic electrical engineering laboratory and the Electric circuit laboratory, a number of voltmeters, ammeters, frequency meters, power factor meters etc. remain out of order because the parts are not available to repair them.

In the selection of equipment, priority should be placed on equipment for the High voltage technology laboratory for the following reasons:

(1) the University gives top priority on this field.

(2) the ADB loan did not provide this laboratory with any equipment, while it provided equipment for other basic area.

(3) the Electrical Engineering Department of the University requests provision of equipment for the laboratory from this project.

(4) this laboratory has at present an impulse voltage generator and an insulation testing device. However, this laboratory also trains the students of the Islamic University of North Sumatera and the quantity of equipment is inadequate. The order of priority to be assigned to the particular pieces of equipment for high voltage technology gives precedence first to high voltage silicon rectifiers for D.C. high voltage experiments, measurement instruments and then high voltage generating devices.

Microcomputers should also be given an equal priority to that of high voltage experimental equipment. With the ADB loan a survo mechanism experimental equipment (interfaced with two microcomputers for control) and one microcomputer (RAM 640 K, 2 floppy disk drives) were purchased for the Computer and control laboratory. However, there are no computers which are to be used by students and teachers for computer training (operation of computers, data processing, numerical calculation, programming, interfacing with experimental equipment etc.). At least 5 standard type microcomputers are required.

b. University of Sriwijaya

This university is located in Palembang in the heart of South Sumatera and its electrical engineering department concentrates on high voltage technology for the same reasons given for this focus at University of North Sumatera. However, it intends to transfer its emphasis to electronics in the near future. At present the number of students is

289 and the number of the teaching staff is 26. There are six laboratories: i) circuit, ii) electric power conversion, iii) high voltage and measurement, iv) distribution, v) electronics & telecommunication, and vi) control & computer. However, at present only some experiments on circuits, electric machines and radios are conducted. The teaching staff assembled training kits for these experiments and prepared manuals. The students are required to assemble any simple instrument (e.g. regulator) in the last semester. The presently equipment facilities available are rather poor. But in 1992 new laboratories will be built in a new campus which is now under construction and many pieces of equipment will be purchased by the ADB loan. In the selection of equipment the following two points were taken into consideration. As mentioned before, the Department regards high voltage technology the most important field. However, due to lack of facilities, the students must go to ITB to be trained in practice in this field. Therefore the Department must have equipment at least for basic experiments on high voltage technology. Another point is to avoid unnecessary duplication of equipment with that to be provided by the ADB loan. Priority is placed on some basic equipment for high voltage technology and measurement instruments necessary for basic electricity experiments.

The computer center of the university has 5 microcomputers and the university administration office 4 microcomputers. However, all these computers are being used for university administration. The ADB loan will provide 5-6 microcomputers but they will given to the Faculty of Agriculture. There are no computers which can be used for computer training in the electrical engineering department. The situation is similar to that in University of North Sumatera as mentioned before. Therefore it is necessary to provide the electrical engineering department with at least 5 microcomputers for the same reasons as those in University of North Sumatera.

As the staff of the department is young and active, their training at ITB is expected to promote the creation of a strong and effective departmental team in the future.

c. University of Tanjungpura

This university is located in Pontianak on the west coast of Kalimantan. Kalimantan is a region marked next for the development of heavy industry, and therefore the emphasis in the electrical engineering department is also on high voltage technology. The Department has two programs: electrical engineering and electric power control. There are seven laboratories: i) basic electrical engineering, ii) electric circuits, iii) electrical measurement, iv) energy conversion, v) distribution, vi) high voltage and vii) control system. The practice courses currently conducted are on i) computer programs (usage of application software, BASIC, FORTRAN), ii) electric circuits, iii) electrical measurement, iv) electronics, v) control systems, vi) D.C. and A.C. machines, vii) transformers, viii) power system measurement, ix) power electronics, x) high voltage, xi) system control, and xii) computers. For experiments on electrical measurement, transformers and energy conversion (electric machines) there are training kits provided by an Australian assistance program and these kits are well maintained. However, other facilities are weak.

Top priority was given to equipment related to high voltage technology in the request for equipment. Although the main emphasis is given to high voltage technology, the lack of experimental facilities necessitates the students to go to ITB for training in this field. The expenses for this training must be borne by the students themselves and there are many students who have to work to earn money for this withdrawing from school for a time. The situation is the same as in the case of University of Sriwijaya. It is therefore of paramount priority to equip the department sufficiently to allow for high voltage experiments to be conducted on campus. Next in priority is equipment for

electronics and computer (especially hardware) training. The computer education in this university is the best available in the Department and its teaching staff is very proficient. Therefore, this Department is in an excellent position to train computer engineers. Based on these observations, in the selection of equipment priority is given to basic equipment necessary for high voltage and transmission & distribution technology, and equipment necessary for understanding computers especially hardware.

d. University of Medan Area

Located in Medan, Sumatera this university has recently moved to a spacious new campus and the buildings are new. There are 282 students in the Electrical Engineering Department, and like many other universities in the Sumatera region the emphasis is on high voltage technology studies. However, the department intends to move its emphasis to electronics and electrical communication in the future. Laboratories are i) electrical measurement laboratory, ii) electrical energy conversion laboratory, iii) electrical circuit laboratory, iv) digital and control systems laboratory v) electrical communications laboratory, vi) basic electronics laboratory, vii) electrical machine laboratory, viii) high voltege laboratory and ix) transmission-distribution laboratory. Experimental equipment consists of various kits for each field which were designed and assembled by the staff a central control panel is also assembled. For the construction of the high voltage generator staff members have attempted to use parts from the Public Electric Corporation which were no longer needed. Priority in the equipment requests is given to equipment needed for electrical machine experiments, high voltage technology and transmission-distribution experiments. Therefore the selection was focused on equipment necessary for transmission and distribution experiments such as transformers, artificial transmission lines and measurement instruments, and equipment necessary for electric machine experiments such as generators, motors, and measurement

instruments. As with University of Sriwijaya, the staff members of the Department are young and very active as seen from the fact that they built all the training kits by themselves. With an investment of further training and equipment there is a strong potential for this department becoming much stronger and proficient.

e. Dharma Agung University

The Department has four laboratories: measurement, circuit, basic electronics and basic electrical control. After the completion of the new building, new laboratories such as telecommunication, distribution, control and energy conversion are to be set up.

The size of a class in experimental practice is 100 students on the average and the class is divided into groups consisting of four students each. Since only one set of equipment is available, it takes a lot of time for all students of a class to finish one piece of experiment. For measurement and circuit experiments there is one set each of training kit for the handling of thyristor, oscillator, D.C./A.C. converter, resistor, double beam slide rheostat etc. However, meters to measure the characteristics of these instruments are not enough. Although there is no high voltage technology laboratory, some experiments on high voltage measurement are conducted.

The University considers that priority should be given on the equipment for energy conversion and distribution experiments. However, on the other hand, it is recommended that more equipment necessary for measurement, circuit and basic electronics experiments should be provided since there is not enough equipment for these basic experiments at present.

f. University of Nommensen

There are five laboratories: workshop, electric power machines, electronics & telecommunications, computers, and electronic circuits. The university puts a priority in the

selection of equipment in the following order; the Computer laboratory, the Workshop, the Electric power machine laboratory, and the Electronic circuit laboratory.

g. Islamic University of North Sumatera

This department has almost no equipment for experiments. The students are trained in practice at University of North Sumatera. The teachers plan to conduct experiments on basic electricity, circuits, electronics, communication, logic circuit, electric measurement, distribution, electric machine control, high voltage technology etc. in its own campus. A question remains if this plan could be materialized by themselves only. It is desirable to allocate basic measurement instruments only first and to postpone the provision of other instruments to the second stage while training the staff members at ITB.

(4) Study of Equipment for Chemical Engineering Department

Three universities: University of Syiah Kuala, University of North Sumatera and University of Sriwijaya have a chemical engineering department and request equipment. A university such as University of North Sumatera has the strong intention to expand its chemical engineering department. However, at present chemical engineering experiments for S-1 grade students in these three universities are not adequate. These universities are located in regions where a demand for graduates from a chemical engineering department is high. UNSYIAH is in Banda Ache which has a large industry in fertilizer. USU is in the Medan region where food processing industry and chemical industry are very active and plastics processing industry is expected to develop in the near future. UNSRI is in a region where there is a strong need for carbohydrate such as starch and rubber industries. In these circumstances, the future plans envisaged by the universities to expand their chemical engineering departments are considered to be justified.

1) Present Curricula

The curricula of the three universities are shown in Table A-8-4 in Appendix 8. As seen from this table, about 80% of the courses are common to them while the remaining courses reflect the characteristic features of the individual region where the university is located.

2) Present S-1 Grade Practice Courses

The practice courses of the three universities are presented in Table 3-10. The courses are classified into four groups: i) chemical analysis, ii) chemical engineering experiments, iii) chemical process experiments, and iv) microbiological engineering experiments. Of these, qualitative analysis, quantitative analysis and physical chemistry experiments in Group 1 are mostly conducted in laboratories of other departments than in a chemical engineering department.

UNSYIAH does not have experiments on simple distillation, fractional distillation and drying. Experiments on extraction in USU and experiments on filtration and distillation in UNSRI are not sufficient. In all three universities, experiments on physical properties and handling of fluids which are basis for chemical engineering are inadequate.

3) Chemical Engineering Experiments and Necessary Equipment for S-1 grade

Table 3-9 shows the curricula and themes on experiments currently conducted at these three universities and equipment necessary to conduct these experiments. Experiments which are at present not conducted but considered necessary are also included. The items listed in this table are minimum requirements. The items which are held at present and are to be provided from other bilateral and multilateral assistance programmes are collated with this list in the selection of equipment under this project.

(5) Study of Equipment for Industrial Engineering Department

Four universities: University of North Sumatera, Dharma Agung University, Islamic University of North Sumatera and University of Medan Area have an industrial engineering department. Table A-8-5 in Appendix 8 shows the curricula of these universities. A model of practice courses and equipment necessary for these courses is shown in Table 3-11. Table 3-12 shows the present themes of laboratory work at these universities.

1) Review of Curricula

Most courses are common to the four universities. University of North Sumatera and Islamic University of North Sumatera have standard curricula which are almost the same. Dharma Agung University places emphasis on subjects related to chemical industry and textile industry. University of Medan Area is featured in its emphasis on industrial management.

2) Review of the Practice Courses and Existing Equipment

Except University of North Sumatera the practice courses currently conducted are only on time measurement, plant layout and computer programming. This is partly a result of equipment inadequacy. Therefore the only equipment necessary to be provided at present is stopwatches and drafters.

University of North Sumatera is much better equipped than other universities and has 10 personal computers, two CNCs, two arm robots as well as PH meters, balances, noise meters, stopwatches, thermometers, vibration meters etc. This is the only university equipped with an environmental engineering laboratory. In view of the particular nature of the Medan area, it is desirable to provide projectors and equipment for measuring environment pollution.

It is necessary to select equipment from among the items listed in Table 3-11 to enable them to conduct at least the experiments shown in Table 3-12. In the selection the number of teaching staff and students is also taken into consideration.

(6) Study of Equipment for Mining Engineering Department

Two universities: University of Sriwijaya and Dharma Agung University have a mining engineering department.

University of Sriwijaya is located near to the Lajia oil field and there is a large demand for mining engineers. Much of the existing oil analysis equipment is obsolete and the quantity of equipment is insufficient. Moreover, the equipment is used in common with the chemical engineering department. Therefore emphasis is placed on oil analysis related equipment in the request of equipment. Oil analysis related equipment is maintained better than equipment in other laboratories of the mining engineering department. This reflects the importance attached to oil analysis by this department. Request for oil analysis related equipment may be justified in view that there is a big demand for engineers who can make oil analysis which is needed by the regional industries.

Dharma Agung University is in Medan which is also a region where oil fields and oil refineries exist, and there is a demand for mining engineers in a similar way to University of Sriwijaya. The mining engineering department of this university was founded actually to meet such a regional demand. However, the oil analysis practice which require expensive analysis equipment are not adequately conducted because of lack of proper equipment. There are two majors in the department: geology and mining engineering, and equipment for experiments is used in common. Therefore the department intends to reinforce mineral analysis and basic geology which are common to both majors, rather than one field of oil analysis. Request for equipment in order to expand the practice in rock & mineral analysis and basic geology is considered to be adequate since these two fields are basis of mining engineering and geology.

1) Curricula

The curricula of the two universities are shown in Table A-8-6 in Appendix 8. About 90% of the courses is common to both universities. The difference of the remaining 10% results in the fact that University of Sriwijaya has laboratories better equipped than Dharma Agung University, so the former can provide

more practice than the latter rather than reflects the regional situations. Dharma Agung University gives social science subjects in the remaining 10%.

2) Experiments in S-1 Grade Courses

The experiment subjects at both universities are shown in Table 3-14. Practice and experiments which require expensive facilities are conducted using outdated equipment obtained from factories outside, or are given at factories outside the campus or at ITB. Dependence on outside facilities is more in Dharma Agung University.

The subjects of experiments and practice in both universities are grouped into five categories: i) geological survey, ii) observation and analysis of minerals, iii) mining machinery, iv) mineral dressing and v) mining. The geological survey includes surveying and the mineral dressing includes oil analysis. However, experiments on mining are not given at both universities, only lectures are provided.

In Dharma Agung University, practice of surveying and drawing are conducted using facilities of the architectural department and chemical analysis is performed using facilities of the industrial engineering department.

In University of Sriwijaya, some experiments are done using facilities of the chemical engineering department and civil engineering department.

3) Experimental Themes and Necessary Equipment

Equipment for S-1 grade experiments in Dharma Agung University is extremely poor to the extent that without assistance from factories outside it would be impossible to train the students. There are only two polarizing microscopes and two reflecting microscopes for observation of minerals. The mining engineering department is not worth its name in terms of equipment.

On the other hand, the mining engineering department of University of Sriwijaya is better equipped than Dharma Agung