社会開発調査部報告書

THE STUDY OF ENGINEERING MANPOWER DEVELOPMENT PLANNING IN THE REPUBLIC OF INDONESIA

MARCH 1996 JICA

JAPAN INTERNATIONAL COOPERATION AGENCY

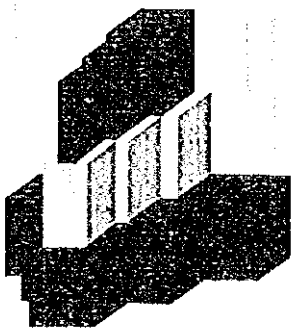
BUREAU OF MANPOWER AND JOB OPPORTUNITY DEVELOPMENT
NATIONAL DEVELOPMENT PLANNING AGENCY(BAPPENAS)

IN COOPERATION WITH MINISTRY OF MANPOWER(DEPNAKER)

REPUBLIC OF INDONESIA

THE STUDY OF ENGINEERING MANPOWER DEVELOPMENT PLANNING IN THE REPUBLIC OF INDONESIA

FINAL REPORT



March 1996

CRC Research Institute, Inc

Daiwa Institute of Research Ltd.

CURRENCY EQUIVALENTS

March 1996	Currency Equivalent
	2,220Rp / US$ 1.00
	¥105.0 / US$ 1.00

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct the study of Engineering Manpower Development Planning in the Republic of Indonesia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Indonesia a study team headed by Mr. Mayuki Takeno and composed of members of CRC Research Institute, Inc. and Daiwa Institute of Research Ltd. from March, 1994 to March, 1996.

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

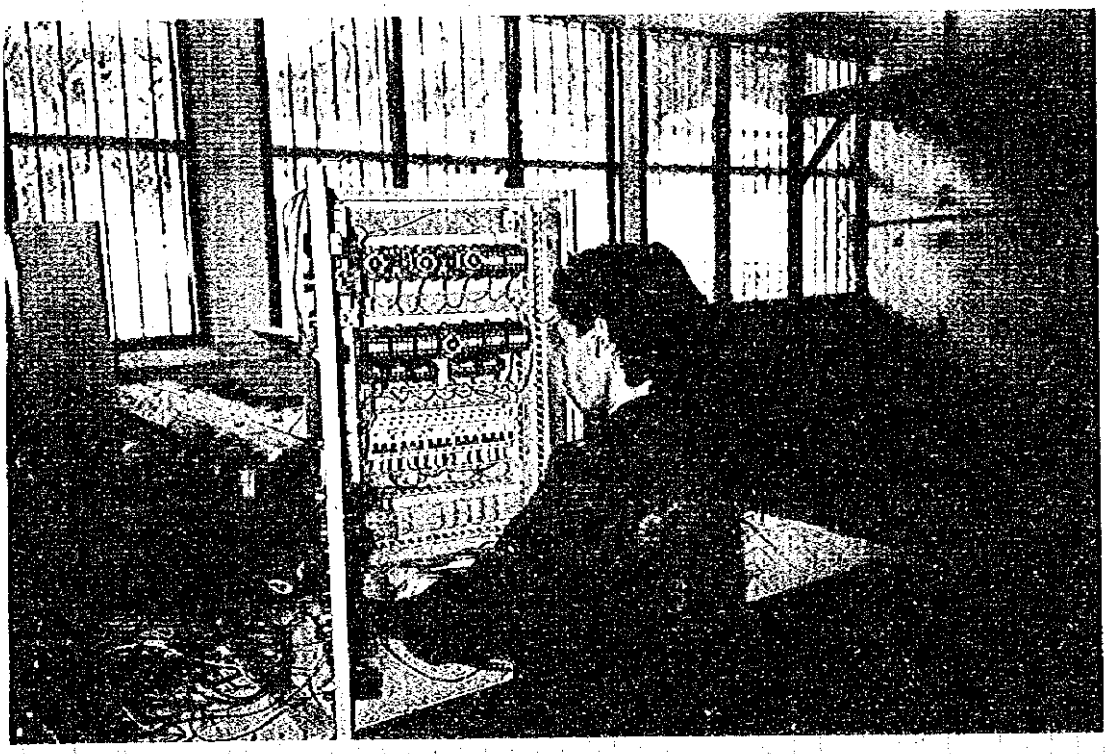
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

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

March 1996

Kimio Fujita
President
Japan International Cooperation Agency

— Workshop in Politeknik Samarinda —



CONTENTS

FIGURE CONTENTS

TABLE CONTENTS

LIST OF ABBREVIATION

BAPPENAS	Badan Perencanaan Pembangunan Nasional/National Development Planning Agency
BKPM	Badan Koordinasi Penanaman Modal/Coordinative Agency for Investments
BLK	Balai Latihan Kerja/Vocational Training Centre
BPPT	Badan Pengkajian dan Penerapan Teknologi/Agency for the Assessment and Application of Technology
BPS	Biro Pusat Statistik/Central Bureau of Statistics
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CEVEST	*Center for Vocational and Extension Service*
D3	Diploma-3(Akademi)/Diploma-3(Academy)
DEPNAKER /MOM	Departemen Tenaga Kerja/Ministry of Manpower
EM	Engineering Manpower/Tenaga Kerja Engineer
EBTANAS	Evaluast Belatar Tahap Akhir Nasional/National Final stage Evaluation of Study
PDB/GDP	Produck Domestik Bruto/Gross Domestic Product
HRD	Human Resource Development/Pengembangan Sumberdaya nanusia
HRDF	Human Resources Development Fund/Dana Pengembangan Sumberdaya Nanusia
HIP	Hubungan Industri Pancasila/Pancasila Industrial Relation
IC	Integrated Circuit
ICVE	*Indonesian Certificate of Vocational Education/Serkfkat Sebolah Kejuruan Indonesia*
IHSC	Higher School Certificate/Ijazah Sekolah Renengah
ILO	International Labor Organization/Organisasi Buruh Internasional
PT.INTI	P.T.Industri Telekomunikasi Indonesia/Indonesian Telecommunication Industry Ltd.
IPTN	Industri Pesawat Terbang Nusantara/National Aircraft Industry
ISCO	International Standard Classification of Occupation/Standar Klasifikasi Jabatan Internasional
ITB	Institut Tehnologi Bandung/Bandung Institute of Technology
JICA	Japan International Cooperation Agency/Badan Kerjasama Internasional Japang
KLUI	Klasifikasi Lapangan Usaha Indonesia/Industrial Classification in Indonesia
LCE	Lower Certificate of Education/Ijazah untuk Pendidikan Renadah
DEPDIKBUD /MOEC	Departemen Pendidikan dan kebudayaan/Ministry of Education and Culture
DEPERONDAG /MOI	Departmen Perindustrian dan Pesdagargan/Ministry of Industry and Trade(since 1995)
M/M	Notulen Rapat/Minutes of Meetings
NEM	Nilai Evaluasi Rurid/Student's Evaluation Score

NIES	Newly Industrial Economics/Ekonomi Industri Terboru
NIC's	Newly Industrial Countries/Negara-Negara Industri Baru
NVTC	National Vocational Training Center/Pusat Pelatihan Ketranpilan Nasional
OJT	Pelatihan di Tempat Kerja/On the Job Training
POSCO	Pohang Iron & Steel Co. Ltd
PT	Perseroan Terbatas/Private Limited
PTJPTEC	Perseroan Terbatas Perkebunan /Private Plantation Limited
R&D	Research and Development/Penelitian & Pengembangan
REPELITA	Rencana Pembangunan Lima Tahun/Five Years Development Plan
SAKERNAS	Survei Angkatan Kerja Nasional/National Labor Force Survey
S1	Strata-1/Strata-1-equal to Bachelor degree
S2	Strata-2/Strata-2-equal to Master degree
S3	Strata-3/Strata-3-equal to Doctoral degree
SLTA	Sekolah Lanjutan Tiugukat Atas/Upper Secondary School
SLTP	Selolah Lanjutan Tiugukat Pertama/Lower Secondary School
SSTC	Specialized Skill Training Center/Pusat Pelakhan Ketrampilan Khusus
STM	Sekolah Tehnik Menengah/Technical/Vocational High School
SX	(Ijatah/Serttkat pendidikan baru yarg diusulkan/Newly introducing educational certificate)
TQC	Total Quality Control/Pengendalian Kualitas total
VET	Vocational Education & Training/Pendidikan dan Pelatihan Kejuruan
VSIA	Vocational Standards Implementation Agency/Badan Penerapan Standar Ketrampilan/Bank Dunia
WWW	World Wide Web

EXECUTIVE SUMMARY

1. BACKGROUND

Indonesia is now at an economic take-off point, with the objective of changing from a labor-intensive economy to a high technology economy.

Like in PJP-I and Repelita V, PJP-II and Repelita-VI emphasize the importance of improving Indonesia's manpower resources for boosting economic growth and employment opportunities.

With these objectives in mind in late 1989, the Indonesian Government requested co-operation from the Japanese Government regarding development plan of engineer manpower (EM: engineer, technician and skilled worker) planning. The preparatory study and an additional study were done in September and December, 1993. The Scope of Work was agreed upon and signed on December 7, 1993 between Japan International Cooperation Agency (JICA) and Counterparts of this study in Indonesian Government. The Bureau of Manpower and Employment Creation, National Development Planning agency (BAPPENAS), and the Ministry of Manpower (DEPNAKER) are responsible for the Indonesian Government's part in the Study, and are full Counterparts for the Study. The study team was organized by elevan staffs of CRC Research, Inc. and Daiwa Institute of Research, Ltd., both assigned by JICA. The study was commenced in March, 1994 and expected to complete in fiscal year 1996.

2. STUDY OBJECTIVES

The study has the following objectives;

(1) To undertake EM development planning based on the estimation and forecast of present and future EM supply and demand.

(2) The enterprise manpower survey methodology and the supply & demand forecast model for EM by engineering and occupational classification will be transferred to Indonesia for its future utilization.

3. STUDY COVERAGE

(1) Engineering specializations covered by the Study are those in the fields as chemical, civil, electrical, industrial, mechanical, metallurgical, mining & petroleum, aeronautical, electronics, nuclear, biotechnological, information & computer, and architecture.

(2) The study will primarily investigate engineers, technicians, and also seek data on skilled workers.

4. TASKS IN THE STUDY

The study comprises of six main tasks - Macroeconomic Research, EM Development Organization Research, Evaluation of Industrial Technologies, Research of Other countries in Asia – Malaysia, Korea and Japan, Establishment Survey, Forecasting Future EM Supply and Demand.

These six tasks can be divided into two categories. Field research done in Evaluation of Industrial Technologies, EM development organization Research, and Research of other countries in Asia will be concluded in analysis of Indonesian status quo of EM development. Establishment Survey also prepares initial values for EM supply & demand forecast.

On the other hand, Macroeconomic Research and Forecasting future EM supply & demand will present future vision of circumstances surrounding EM in future Indonesia.

Issues extracted from these status quo and future analyses will be materialized as future EM Development Plans.

5. THE FUTURE SOCIAL FRAMEWORK AND ENGINEERING MANPOWER DEVELOPMENT (PART I)

(1) Future social framework

According to the National Development plan PJP-II (1993/94～2018/19), the economy is projected to grow at an average annual rate of *7.1%* from 1993/94 to 1998/99, and *6.6%* per year from 1998/99 to 2003/04. (Italics are used here to make clear the figures in PJP-II.)

Indonesia's 1994 per-capita GDP is *1,188,000* RP (US$*676*). Over the next ten

years, per-capita GDP will increase to *1,908,000* RP (US$*995*). In 2018 per-capita GDP is projected to grow to *5,046,000* RP (US$*2,631*).

Working from the framework of PJP-II and using the Study Team's model, we broke down GDP growth and analyzed it by its demand components.

In order to safely reach the economic growth targets put forward in PJP-II, a somewhat higher forecast regarding employment numbers is needed. By doing so, private spending growth for the second half is built in, and high economic growth forecasts become more realistic. On the other hand, if economic growth targets are adjusted to reflect the projected increase in employment in PJP-II, the economic growth rate forecast for 2018/19 would probably be almost 2% lower. The Study Team examines how much of an increase in employment would be required in order to safely achieve the economic growth targets of PJP-II (see Table 1).

Table 1 Adjusted Employment Forecast Based on PJP-II GDP Growth Rate

[Unit: %]

Year	1993/1994	1998/1999	2003/2004	2008/2009	2013/2014	2018/2019
GDP	8.3	7.1	6.6	6.8	7.7	8.8
Increase in employment	2.3	2.5	2.7	3.0	3.0	3.3

Source: The Study Team

(2) Present Situation of EM in Indonesia

In Indonesia, the technology introduced by local companies or brought home by exchange students is not adequately disseminated to other sectors of industry.

In addition, nearly all of the engineering students who study abroad at government expense return home to be employed by BPPT, one of 10 strategic companies, or some other government-run company, and in fact many end up being assigned to clerical posts in such companies. As a result, the advanced technology which they were fortunate enough to bring back to Indonesia is not being utilized.

In Indonesia, on the other hand, workers with higher educations tend to take a dim view of the factory, and younger science and engineering graduates shy away from working on production lines. Further, society as a whole readily accepts this way of thinking as natural.

(3) Outlook for EM Supply

Within the Second Long-term Development Plan (PJP-II), the focus is being shifted to higher education, and the plan's 25-year goal is to bring the advanced education enrollment rate up to 25% by the year 2018/19. Projections of the future supply of EM are presented in Table 2.

Table 2 EM Stock Projections (1998-2018)

[Unit:1000 persons]

Year	1994	1998	2008	2013	2018
Senior High School Graduates	14,429.6	17,602.6	26,859.8	31,770.5	36,715.8
Polytechnic Graduates (technical)	140.8	175.4	407.5	593.1	816.0
University Graduates (technical)	192.6	348.1	1,001.9	1,457.9	1,983.8
Total EM	14,763.0	18,126.1	28,269.2	33,821.5	39,515.6

Source : Complied using the Study Team estimates, based on BPS statistics 1994.

Based on analysis of Part I, the following goals should be established for Indonesia's future engineer and technician development.

- Engineering manpower must be developed to meet the needs of growth targeted in PJP-II.
- PJP-II plans economic growth which eliminates the "dual economy", boosts exports, expands and spreads industrial technology, and strengthens Indonesian application of technology.
- But there are many problems with the both the suppliers and users of EM. These problems must be resolved for Indonesia to meet its development goals.

6. EM SUPPLY AND DEMAND (PART II)

(1) Introduction

In Part II, those problems, analysed in Part I, are verified by the results of the 1994 establishment survey and estimates using forecast model and then, specific issues are extracted out of them, which will be reconsidered in Part III in order to plan for development of EM resources.

In the text to follow, engineers graduating university, technicians graduating polytechnic, and skilled workers graduating high school are indicated in

italicized letters like *engineers*, *technicians* and *skilled workers*.

(2) Present Condition of EM at Business Establishments

The Study Team conducted an establishment survey, which was the first attempt in Indonesia to conduct a nationwide survey covering all types of industry sectors.

Based on the list of establishments which is prepared using reports that every company is obligated to do to the Ministry of Manpower (DEPNAKER) in accordance with Presidential Regulation No. 7, the Study Team picked up establishments by stratified random sampling and obtained valid responses from 3,156 establishments throughout the country. Samples were stratified by industry sectors, scales, and regions. One half of the establishments selected were those in the manufacturing sector that was considered to hold a large proportion of EM. As for scale, establishments were divided into three groups in terms of the number of employees: "large" (100 persons and more), "medium" (20 to 99 persons), and "small" (5 to 19 persons). Almost equal number of samples were picked up from each of the three groups. The distribution of establishments by region was decided according to ratio of DEPNAKER lists.

Inquiries were made to each of the establishments about the hiring, employment, training, technical evaluation, etc., of its employees, mainly university graduates majoring science/engineering, polytechnic graduates, and ordinary high school/vocational high school graduates and junior high school graduates engaged in 10 or more years in technical field work. The data showing correlation between EM academic career, EM engineering specialization, and job classification at the company were also requested.

The major findings are summarized below.

- There is not much demand for *engineers*, except in a few large corporations.
- The correlation between the field of specialization at school and the job assignment at company is strong, and the technology demanded of engineers lacks in diversity.
- At many companies, *engineers* are guaranteed with much higher salaries than *technicians*, which seem to be paid regardless of *engineers'* performance.
- Share of technicians is inproportionally small. This tendency is intensified as

establishment size gets smaller.

- There is tendency that the demand for technicians is met, by "vertical gap". This tendency is especially conspicuous at large establishments (university graduates as technicians) and small establishments (high school graduates as technicians).
- The correlation between the field of specialization at school and the job assignment at company is strong, and the techniques demanded of technicians lack in diversity.
- Only small proportions of small and medium-sized manufacturing companies provide in-house training for technicians.
- Dominating portion of EM demand in number of persons is occupied by skilled workers at present. This tendency is intensified as establishment size gets smaller.
- Many of *skilled workers* earn much less than *technicians*.
- The in-house training for *skilled workers* is less popular than that for *engineers* and *technicians*. And, the smaller the company scale, the less is the opportunity for *skilled workers* to be given in-house training.

(3) Outlook for EM Supply and Demand

The first purpose of the EM supply/demand forecast is to clearly indicate the volume of EM employment in the total employment. The second purpose of the EM supply/demand forecast is to indicate future problems relating to EM supply and demand. The forecasting method is meaningful only as a tool for detecting problems within the framework of PJP-II. It is, therefore, assumed that the forecasting method shall be continually validated as the forecast premises will change in the future. The total demand for the three classes of EM is estimated to reach 24 million persons (1.2 times of the 1994 figure) in 2003/4 and 44 million persons (2.1 times of the 1994 figure) in 2018/19.

(4) Extracted Issues

In terms of quantity, university graduates as EM are already oversupplied. With the increase in ratio of students going on to universities in the future, the supply-demand gap (oversupply) is expected to widen further. This situation is ascribable to the high ratio of students going on to universities–higher than the

demand level–and the low levels of technical requirements of industry that cannot catch up with the volume of manpower intended to embrace high level of technology.

The general problems concerning *engineers* are whether or not the existing supply system and plans can effectively respond to the sophistication of technical requirements of industry and what the EM can do to promote the improvement of technical levels of the whole industry. These problems must be grasped with due consideration given to the growing trend of oversupply of university graduates.

The major problem concerning *technicians* is how to increase the supply and improve the capacities of technicians who will become undersupplied in absolute terms in every sector of industry in the future. In view of the supply-demand situation of engineers and skilled workers and the importance of technicians, the above problem should be positioned as the most important one in the present study. Solving this problem will call for a comprehensive policy which is consistent to measures to solve the problems concerning *engineers* and *skilled workers.*

The major problems concerning *skilled workers* are, therefore, improving the capabilities of *skilled workers* and formulating a comprehensive industrial technology policy which is closely linked to measures to foster engineers and technicians. The former problem is specifically the task of fostering skilled workers at small and medium-sized manufacturing companies, which are now providing insufficient in-house training for skilled workers despite the fact that the skilled workers account for a large proportion of the employment.

The problems described above are those which have been extracted from analytical studies of "supply-demand gap." From the viewpoint of further pushing through the basic concept of EM development in this study, the EM supply and demand in the manufacturing industries which does not manifest itself as a specific gap can be a problem.

One of the problems involved in EM development should be what the EM can do for the manufacturing industries to achieve a value added as sufficient as to

bring about large employment exceeding the improvement in labor productivity. Promoting the improvement of overall capabilities of engineers, technicians, and skilled workers to free the machinery industry from dependence on foreign production technology can be a specific issue.

(5) Measures Extracted

The following four measures extracted from the results of the establishment survey and EM supply/demand forecast are proposed as fields where countermeasures will reside:

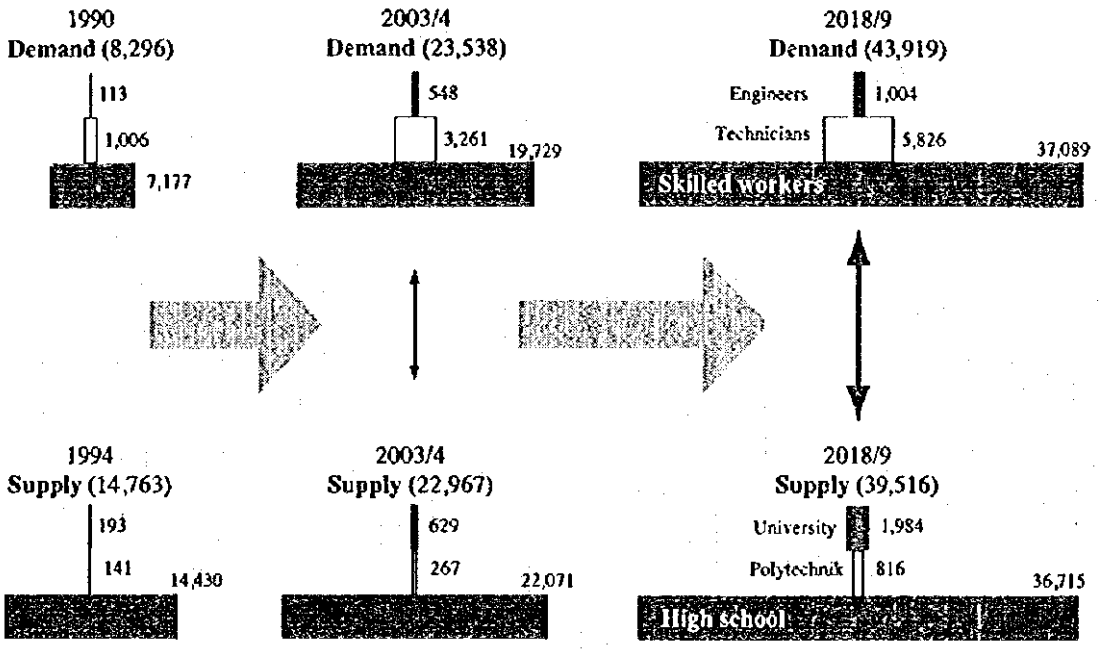
- Measures to cope with the shortage of *technicians* in absolute terms.
- Measures to cope with the expanding oversupply of *engineers* in terms of quantity and with the shortage of *engineers* in terms of quality.
- Positioning the fostering of *skilled workers* in a comprehensive industrial technology policy.
- Measures to improve the overall capabilities of EM for the development of manufacturing industries, mainly the machinery industry.

7. STRATEGY AND ACTION PROGRAMS FOR FOSTERING EM (PART III)

(1) EM Fostering Strategy

It is expected that the total supply of EM will fail to meet the total demand for EM in the future as shown in Figure 1. While university graduates as candidates for engineers are rapidly increasing in number, polytechnic school graduates as candidates for technicians remain absolutely deficient in number and technical high school graduates as candidates for skilled workers too remain inadequate in number. These trends, which are the result of an uneven distribution of human resources, are a serious problem which can impede the future growth of Indonesia.

When EM is grasped as a group of human resources having different academic careers, restraining the current movement toward a society of higher academic career or improving the level of industrial technology may be considered as a means to solve the above problems. However, neither of these can be a realistic solution. The future EM fostering program must be based on the premise that



Source : The Study Team

Figure 1 EM Supply & Demand in Future

Indonesia continues to move toward a society of higher academic career.
It can hardly be expected that the industrial technology of Indonesia will develop so fast that it will be capable of absorbing all the EM having higher academic career. What must be recognized at this point is that all the problems can be traced back to the rigid old paradigm that assumes university graduates as engineers, polytechnic graduates as technicians, and high school graduates as skilled workers. The truly effective solution for the problems is, therefore, to strive to expand the total size of EM while establishing a new paradigm for the fostering of EM. It is "Practical Paradigm" and "Networking" that are the strategic goals for solving the above problems.

A new paradigm for the fostering of EM must be capable of responding flexibly to any change on the EM demand side. It is essential for the new paradigm to assure that the EM supply side always supplies EM that is really needed by the demand side. This strategic goal shall hereinafter be referred to as (the establishment of) Practical Paradigm.

When a good number of small and medium-sized enterprises in Indonesia succeed in improving their production techniques and growing to become the base of Indonesia's supporting industries, the competitiveness of the country's whole industry improves and the level of its industrial technology becomes sophisticated accordingly. To that end, it is indispensable to foster EM specially adapted to the needs of small and medium-sized companies.

The support for the fostering of EM, mainly for small and medium-sized companies, effected through the activation of the above exchange to realize a linkage between different industrial structures, shall hereinafter referred to as (the propulsion of) Networking. Networking is not a concept which is confronted with the concept of Practical Paradigm.

(2) EM Fostering Plan

The ideal image of EM fostering of the future to be aimed at in the effort to attain Practical Paradigm and Networking under the conditions assumed in the present study is as follows: 1) "by implementing Practical Paradigm, the problem of distribution of EM resources is dissolved into a labor market problem which is confined within each individual company", and 2) "by propelling Networking–the other strategic goal, competent EM will develop mainly in a large number of small and medium-sized companies".

(3) Future EM fostering plans – Five Proposals

As the results of the Study, the Study Team made five proposals: the Reform in the Education of EM, the Developing EM Job Organization Models, the Structuring a New Scheme of In-House Training, the Reformation of BLKs (Public Vocational Training Centers), and an EM Supply-Demand Information System

Outline of the Proposals as follows:

1) Reform in the Education of EM

This reform would have to keep in perspective not only training institutions

other than those such as BLK under the jurisdiction of the Ministry of Education and Culture but also in-house education and training programs of corporations.

To improve quality of academic education to be provided by the fundamental education system as well as to promote vocational education and training to be made available by the institutions to educate and train EM manpower other than the fundamental education system would constitute the essentials of the educational reform to be explored.

2) Developing EM Job Organization Models

The new paradigm (practical paradigm) within a business enterprise refers to formulating the functions of EM as a job organization without regard to academic career. Each individual enterprise is supposed to create its own optimum EM job organization by modifying the model presented by the government.

The government's proposal must be so full of realities and advanced ideas that private enterprises are willing to adopt it. It must also incorporate compulsory and non-compulsory qualification systems, such as a licensing system, so as to positively induce even indifferent enterprises into action.

3) Structuring a New Scheme of In-House Training

To improve the situation, a new scheme which enables the demand side to activate its in-house training and the EM to be furthre reinforced is called for.

The new scheme of in-house training shall be addressed primarily to small and medium-sized companies, whereas large companies shall be encouraged to update and improve their own in-house training while supporting the scheme. The objective of in-house training is to improve productivity and secure delivery dates through establishment of a quality assurance system for products and services. From the above requirements, the new scheme the Study Team proposes comprises measures to help the demand side upgrade their in-house training and measures to positively promote the in-house training from outside with the ideas entrust training to other companies or establishing leading companies.

4) Reformation of BLKs (Public Vocational Training Centers)

In order to cope with the predicted shortage of skilled and semi-skilled workers and technicians, the existing BLKs shall be restructured into training institutes which foster skilled and semi-skilled workers and candidates of technicians and which pave the way for hard-working trainees to become technicians. They shall not only train their trainees but also re-educate and train more EM of companies than before. In this way, they should be able to help dissolve the problem of shortage in the future.

Since all the BLKs scattered throughout the country cannot be reformed at a time in view of budget, it is advisable first to designate several model BLKs (say, 2 large-sized BLKs, 2 medium-sized BLKs, and 2 small-sized BLKs) and reform them and then to spread the reformation gradually to the remaining BLKs during 10 years while monitoring the conditions of the model BLKs.

5) EM Supply-Demand Information System

The EM Supply-Demand Information System proposed here supplies information for supporting the human resources development that conforms to the new paradigm of EM education and meets the real needs of enterprises and information for supporting entrepreneurs who should become the core of Indonesia's unique technology-oriented companies in the future.

The EM Supply-Demand Information System offers an environment which makes it possible to easily utilize and exchange information supplied from the EM demand side, EM supply side, and intermediary.

INTRODUCTION

1.1 Background of the Study

There are a number of issues Indonesia must face to continue its high rate of economic growth. One of the major issues is the shift away from petroleum and gas exports to manufactured goods. In 1987, exports of petroleum and gas related products fell below 50% of total exports for the first time since 1971. This is an important achievement, but most manufactured exports are low value-added products like textile and lumber products.

Indonesia is now at an economic take-off point, with the objective of changing from a labor-intensive economy to a high technology economy.

Like in PJP-I and Repelita V, PJP-II and Repelita-VI emphasize the importance of improving Indonesia's manpower resources for boosting economic growth and employment opportunities.

With these objectives in mind, in late 1989, the Indonesian Government requested co-operation from the Japanese Government regarding engineering manpower development planning . The preparatory study and an additional study were done in September and December, 1993. The Scope of Work was agreed upon and signed on December 7, 1993. The Bureau of Manpower and Employment Creation, National Development Planning agency (BAPPENAS), and the Ministry of Manpower(DEPNAKER) are responsible for the Indonesian Government's part in the Study, and are full Counterparts for the Study.

1.2 Study Objectives

The Study has the following objectives:

(1) To undertake engineering manpower development planning based on the estimation and forecast of present and future engineering manpower supply and demand.

To produce a mid-term (2003/2004) and long-term (2018/2019) forecast of supply & demand of engineers, technicians and skilled workers (hereinafter referred to as "Engineering Manpower: EM") broken down by type of engineering specialization and occupational classification. Detailed forecasts will be reported until 2003/2004, with an outline of our forecasts from 2004/2005 until 2018/19. Based on this forecast, the Study will undertake manpower development planning for meeting Indonesia's demand for EM.

(2) Technology transfer

The team will pursue technology transfer to the Indonesian Counterpart personnel in the course of the Study. The enterprise manpower survey methodology and the supply & demand forecast model for EM by engineering and occupational classification will be transferred to Indonesia for its future utilization. The team will work with the Counterpart to prepare a program for Indonesia to update the data and model in the future by its own ability.

1.3 Study Coverage

(1) Engineering specializations covered by the Study are those in the following fields:

- Chemical
- Civil
- Electrical
- Industrial
- Mechanical
- Metallurgical
- Mining & Petroleum
- Aeronautical
- Electronics
- Nuclear
- Biotechnological
- Information & Computer
- Architecture

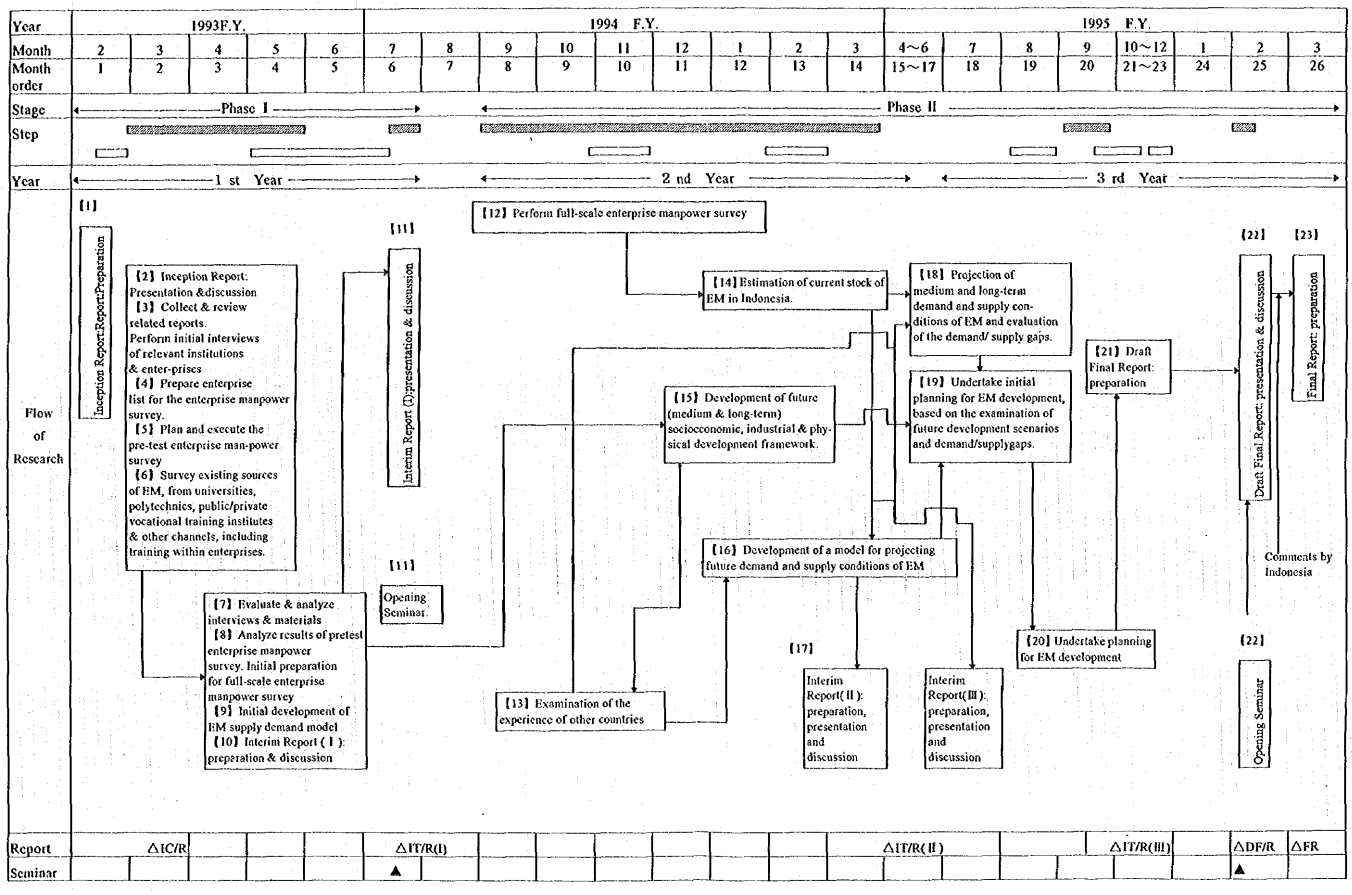
(2) Occupational classifications covered by the Study

The study will primarily investigate engineers & technicians, and also seek data on skilled workers. (Calling here after "EM")

1.4 Outline and procedure of the Study

The flowchart of the Study is shown in FIGURE 1-1

Phase I (1st year) was performed from 2/1994 to 7/1994. Phase II(2nd/3rd years) has been carried out from 9/1994 to 2/1996



In Indonesia in Japan

FIGURE I-1 FLOW CHART OF RESEARCH

PHASE I (1st year)

In Phase I, the Study performed:

- Collection, review, and analysis of relevant existing data
- Preparation of enterprise manpower survey
- Research on technical education and training institutions
- Initial development of EM supply & demand model

Steps (1) to (11) described below are performed in Phase I of the Study.

(1) Inception Report: preparation

This report established the process, flow, schedule, and basic policies of the Study.

(2) Inception Report: presentation & discussion

Presented full explanation to the Indonesian officials concerned and had discussions.

(3) Collect, review, and analyze related reports. Perform initial interviews of relevant institutions and enterprises.

Collected, reviewed, and analyzed information from the Indonesian government and other sources.

Information to review:

- Outline of macro economy.
- Import/ export statistics (Focus on product exports, raw material imports, and machine tool imports).
- Information on industrial structure.
- Reports on national policy in the fields of education, science/ technology, and industry.
- National development plan. (PJP-Ⅱ, REPELITA-VI)
- Manpower market, present supply & demand of EM and skilled workers.
- Regulation of manpower and education.
- Skill/ technology level of enterprises in each field.
- Skill/ technology level of EM in each field.

Performed initial interviews of education institutions and enterprises to prepare for steps 5 and 6.

(4) Prepare enterprise list for enterprise manpower survey

Selected enterprises which employed EM related with the 13 engineering specializations. Selected the enterprises from appropriate industries, specifying the industries by industry classification code numbers (KLUI: 5 digit) .

Utilized the list of enterprises provided by the Indonesian Ministry of Manpower.

The team planned to primarily utilize the list of enterprises which was kept in the Indonesian Ministry of Manpower (approximately 140,000 offices).

The team broke the list into sub-lists of small, medium, and large enterprises, in the selected industries, in the regions to be studied. Then the team selected enterprises from within each sub-list.

Classification of districts and industry was set on the base of the Indonesian official industrial classification (KLUI). The team worked together with the Counterpart to prepare the list.

(5) Plan and execute pre-test manpower survey

Conducted 50 interviews in cooperation with the Counterpart, by using a questionnaire. This pre-study was vital for preparation for the full-scale study of approximately 3,000 enterprises.

(6) Survey existing sources of engineer, technician, & skilled workers.

Our objective was to clearly understand the technical education and training system and find out what improvements could be made. The team researched universities, polytechnics, secondary schools, and public/private educational organizations. The team's research included statistics on engineering & technical students and graduates, curriculum, and issues for educating EM in the future. The team studied the quality of science & mathematics facilities and education for pupils in primary and secondary schools. The team was careful to interview teachers, not just education administrators, to get an accurate view.

(7) Evaluate & analyze results of interviews & materials received

Reviewed results of interviews and collected materials and information from the Indonesian Government, enterprises, and institutions. Utilized this information to understand issues which need to be faced in the study.

(8) Analyze results of pre-test survey & prepare for full-scale survey

Utilized results of pre-test enterprise manpower survey to improve survey methodology in preparation for full-scale enterprise manpower survey of approximately 3,000 enterprises.

(9) *Initial development of EM supply & demand model*

Developed a plan for the EM supply & demand model using results of input-output tables and pre-test enterprise surveys.

(10) Interim Report (I): preparation

Described process and results of the Study up until this point.

(11) Interim Report (I): presentation and discussion

Submitted interim report to the Indonesian government. Explained, discussed, and held a seminar at the same time. The team invited about forty relevant officials of the Counterpart, Ministry of Industry, BPPT, and BPS to the seminar and explained examination results obtained in PHASE I.

PHASE II (2nd/3rd years)

In Phase II, the Study performs:

- Conducts field surveys
- Forecast supply & demand conditions of EM.
- Undertake EM development planning.

Steps (12) to (23) described below have been performed in Phase II of the Study.

(12) Perform full-scale enterprise manpower survey

Utilized experience from the pre-test survey of 50 enterprises to improve survey procedures. Conducted the full-scale enterprise manpower survey of 3,156 enterprises. The Study Team worked together with the Counterpart and local consultants to perform the full-scale survey by using the questionnaire which was compiled in appendix.

(13) Examination of experiences of Malaysia, Korea, and Japan

The team researched how Malaysia, Korea, and Japan performed human resources planning and had developed their economies through developing skilled human resources. This information was useful for forecasting future manpower demand in Indonesia and for evaluating existing supply sources of engineers, technicians, and skilled workers. The examination process included research of documents and also visiting and interviewing enterprises and relevant government agencies in each country. The team evaluated technical levels, technical education, and in-house training in each country.

(14) Estimate current stock of EM.

Used research of enterprises and educational institutions to make current estimates by industry and occupation, and by engineering specialization and occupational classification.

(15) Framework and scenario

Referring to PJP-II Indonesia's development plan, REPELITA-VI, forecast

future industrial, economic, and population framework and forecast the scenario for 2003/4 & 2018/19.

(16) Develop supply & demand forecast model for EM.
Developed supply and demand forecast prototype model for EM by industry and occupation, and by engineering specialization and occupational classification.

(17) Interim Report (II): preparation, presentation, and discussion.
Prepared, presented, and discussed the process and results of Study until this point.

(18) Forecast gap between supply & demand of EM.
Formulated basic policies for resolving supply/ demand gap.

a) Forecast medium and long-term supply & demand conditions of EM. Evaluated supply & demand gaps.
Information from research of Malaysia, Korea, and Japan was used to improve the forecast.

b) Based on the supply & demand gap found in step 18 (a), and based on industry needs for EM & skilled workers formulated basic policies for education and training planning.

(19) Undertake initial manpower development planning
When the above steps were complete, discussions with the Indonesian Government were held to produce guidelines for manpower development planning.

(20) Undertake EM development planning
Reviewed future economic trends, industrial structure, technology, and future supply & demand gap for EM. Used this information to undertake education and training planning for EM.
The team considered the following points when undertaking planning:

- Listed up difficult issues and described deficiencies with the current system and plans for educating EM.
- Considered policies and strategies to solve problems with implementation of the plan.
- Proposed necessary measures for EM development.
- Measures to resolve the mismatch between future supply & demand of EM resources

- Measures by specialization and occupational classification
- Numbers of EM required
- Legal and regulatory support
- Required education and training facilities
- Rough cost estimate for constructing training facilities

Interim Report (Ⅲ)was prepared and presented to the Counterpart prior to compiling Draft Final Report. The team got several valuable views form the Counterpart and took them into account when Draft Final Report was made.

(21) Draft Final Report : preparation

Reported process and results of the Study up until this point. Prepared a full report for the overall Study.

(22) Draft Final Report : presentation and discussion

Present a draft final report to the Indonesian Government and hold discussions. Open a 2nd seminar and explain the Study results to relevant officials. Indonesian Counterpart provides commentary on the draft within 30 days.

(23) Final Report : preparation

After examining comments on the Draft Final Report from the Indonesian government, compile Final Report making necessary changes.

1.5 Member list of the Study Team

TAKENO Mayuki	· Team Leader Human Resource Development
ENDO Aiichiro	· Sub Leader Technical education & training development
SAITO Shusei	· Macro economy & industry
YANAGISAWA Mitsuyasu	· Manpower supply and demand
NARITA Hiroatsu	· Industrial technology evaluation I (industrial machinery & factories)
MASANO Satoru	· Industrial technology evaluation II (metals, energy, information systems)
WATANABE Masato (PHASE I) IMAI Takehiko (PHASE II)	· Industrial technology evaluation III (construction, electric power, electronics)

MASUYA Hitoshi	· Computer system development
SHINKAJI Hiromitsu	· Enterprise survey (A)
SAIB, David	· Enterprise survey (B)
TAKEUCHI Jimi	· Project Support

CURRENCY EQUIVALENTS

Fiscal Year	currency equivalent	Rp/Us$1.00
1987	1650.0	
1988	1731.0	
1989	1797.0	
1990	1901.0	
1991	1992.0	
1992	2062.0	
1993	2110.0	
1994	2200.0	
1995	2258.0	

Remark:

1. Currency equivalents: Rp/Us$1.00
2. Fiscal year: Fiscal Year: April to March 31
3. Currency equivalent in 1995, shows Average of (1st quarter to 3rd quarter)

Source: IMF-International Financial Staticics

PART I: THE FUTURE SOCIAL FRAMEWORK AND ENGINEERING MANPOWER DEVELOPMENT

In Part I, at first a framework which is a major premise in laying a scheme for development plan of engineering manpower (EM, i.e. engineers, technicians and skilled workers) is established and then in order to orient a mission of future development plan of EM, present situation of fostering EM in education/industry of Indonesia is described including the comparison with in other countries in Asia.

1.1 Indonesia's Future Economic Framework and Development Path

(1) Future Framework According to the Second Long Term Development Plan (PJP-II)

(The following italic text in Part I is the view taken by PJP-II. Italics are used here to make clear the figures in PJP-II.)

1) Economic Growth

According to the National Development plan PJP-II (1993/94～2018/19), the economy is projected to grow at an average annual rate of *7.1%* from 1993/94 to 1998/99, and *6.6%* per year from 1998/99 to 2003/04.

Indonesia's 1994 per-capita GDP is *1,188,000* Rp (US$*676*)[1]. Over the next ten years, per-capita GDP will increase to *1,908,000* Rp (US$*995*). In 2018 per-capita GDP is projected to grow to *5,046,000* Rp (US$*2,631*).

The PJP-II projections exceed even the PJP-I (1967/68～1992/93)forecast of *6.8%* average annual growth, a figure which was already high by international standards.

2) Total Population and Labor Population Trends

PJP-II projects that Indonesia's population will grow from an estimated *189* million people in 1993, to *219.4* million by the year 2003/04, and *258* million by

[1] Based on PJP-II. Indonesia's 1994 per capita GDP is the same level as Japan's per capita GDP in 1962-63.

the year 2018/19. These figures correspond to a population growth rate of *1.37%* per year through 2003/04, slowing to just *0.9%* by the year 2025.

On the other hand, because the labor population is expected to continue growing, by 2003/04 the labor population is likely to swell to *104* million, *27* million more than the 1992/93 level of *77* million (est.). Furthermore, by 2018/19 the number is expected to hit *149* million people, nearly double the current labor population. In the same period, the average life expectancy is estimated to rise from 67.2 years to 70.6 years. On the other hand, the birth rate is expected to decrease from *1.66%* to *0.88%*.

3) Structure of Industry and Employment in the Future (2004/05, 2018/19)

Indonesia is blessed with a wealth of natural resources, including oil and lumber, and is well known internationally for its textile and other light industries. Looking at the make-up of 1993 GDP by industry, agriculture accounted for *17.6%* of total GDP, mining *13.9%*, manufacturing *21.1%*, services/others *47.4%*. In other words, the weight of agriculture and mining in the economy is relatively high in Indonesia. In addition, light industries account for *57%* of total manufacturing. PJP-II predicts GDP and employment by industrial sector.(See **Table 1.1**)

Table 1.1 GDP Composition, Growth Rates, and Employment by Industry Sector

	Share of GDP [%]			Avg.Annual Growth Rate [%]		Employment [millions]		
Year	1993	2004	2019	2004	2019	1993	2004	2019
Agriculture	17.59	15.90	8.30	5.1	4.1	37.03	41.22	40.44
Mining	13.86	7.40	6.10	-0.1	3.8	0.85	1.25	1.75
Manufacturing	21.10	26.80	30.10	9.0	8.8	9.68	16.51	28.61
Electricity/Gas	0.73	1.00	1.60	9.8	10.7	0.15	0.42	0.44
Construction	6.60	7.30	7.60	7.5	7.9	3.53	6.75	12.85
Commerce	16.37	17.90	20.50	7.4	8.3	11.45	16.61	25.25
Transportation /Communica-tions	5.94	6.50	7.20	7.4	8.1	3.07	4.57	11.68
Financial Services	7.50	8.60	9.50	7.9	8.3	0.77	1.35	2.19
Other Services	10.31	8.60	9.10	4.5	6.7	10.30	15.16	26.28
TOTAL	100.00	100.00	100.00	6.4	7.3	76.83	103.80	149.48

Source : BAPPENAS, DEPNAKER

a. Agricultural Sector

The agriculture sector is likely to grow at an annual rate of *5.1%* through the year 2004, while its share of GDP drops from *17.59%* to *15.9%* over the same period. The number of workers employed in the agricultural sector is projected to jump to *41.22* million people, *4.2* million more than in 1993, accounting for the largest share of employment in the economy.

Rapid industrialization will cause the agricultural sector's share of GDP to fall to *8.3%* by the year 2019, and although the number of workers employed in this sector will decline, it will still remain the economy's largest employer.

b. Manufacturing Sector

Through the year 2004 the manufacturing sector will grow at an annual rate of *9.0%*, outpacing the growth of the overall economy, and its share of GDP will climb from *21.1%*[1] to *26.8%*. The number of workers employed in the sector is also expected to grow by *6.8* million to a total of *16.51* million people. The manufacturing sector can be expected to play an even larger role through 2018/19. The sector is expected to grow at an annual rate of *8.8%* through 2019, and its share of GDP may climb to *30.1%*, compared to only *21.1%* in 1993. Employment in the manufacturing sector is likely to jump to *28.61* million workers from *9.68* million.

c. Service Sector

The service sector (commerce, transportation, financial services, other services) is likely to grow at an annual rate of *6.8%* through 2003/04, with its share of GDP rising slightly from *40.12%* to *41.6%*. The number of workers employed in service industries is expected to grow by *12.1* million to a total of *37.69* million people, approaching the number of people employed in agriculture. The number of workers employed in the trade sector is projected to grow by *5.16* million.

As the service sector's share of GDP grows from *40.12%* to *46.3%*, employment in the sector is expected to grow by *39.5* million to a total of *65.3* million workers through 2018/19.

(2) Considerations Regarding the Process of Growth

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[1] Indonesia's agricultural production totals 83% of its manufactured production, which is the same ratio as Japan's in 1950.

1) Indonesia's Current Stage of Development

The case where the economy of a single country begins to undergo rapid growth after it achieves productivity improvements in its agricultural sector simultaneously with increased employment capacity in its industrial sector has often been seen in the development pattern of many of the world's advanced industrialized countries[3]. The present stage of development of the Indonesian economy is considered to be a "dualistic structure" where an agricultural sector adopting very traditional production methods, exists side by side with an industrial sector with many modernized fields.

Although the economy is on par with that of advanced industrialized countries in terms of the manufacturing sector's share of GDP, the level of industrialization is still rather low in terms of the employment structure of the economy. An extremely poor class still exists in the farming villages, and they have formed an informal sector of workers who have flooded the cities seeking employment. Including this informal sector, the real unemployment rate in Indonesia has reached 38%, much more than the industrial sector has the capacity to absorb.

Nevertheless, from now on the economy is expected to take a path of development where the more productive industrial sector continues to expand, absorbing more of the excess workers from the less productive agricultural sector, and thereby boosting productivity in the agricultural sector to some extent.

2) Scrutiny of the Necessary Preconditions for Development

a. Boosting Productivity in the Agricultural Sector

Because a strong agricultural sector ultimately plays a major role in the progress of industrialization, agricultural development is an extremely vital topic. Within PJP-II, agro-industry is considered one of three priority industry groups.

Promotion of agricultural mechanization, large-scale use of domestically produced chemical fertilizers, improvement of the agricultural infrastructure (irrigation, roads, electricity, experimental farms) and other methods of advancing farming technology are important for boosting productivity in agriculture. Increased productivity and crop diversification will raise farmer incomes, and the resulting spending increase in farming villages will provide a tremendous boost to overall economic growth.

Another important point is the nurturing of industry in farming villages. This is

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[3] Duality Economic Model

because the most effective way to eradicate rural poverty is to boost the level of non-agricultural income. By nurturing development of labor-intensive industries like farm produce processing, woven textile products, hand-crafted items, etc., the lifestyles of farmers will be stabilized.

b. Deregulation

In order to improve economic efficiency and compete with neighboring countries, further deregulation must be promoted. Genuine deregulation includes privatization of government-owned companies. Privatization will improve the operating efficiency of these companies, and will also help develop healthy capital markets, make company management more transparent, and raise the general public's level of interest in the economy. On June 23, 1995, the Indonesian government announced to cut or abolish its import tariffs on 6,030 articles, aiming to express publicly its willingness to liberalize trade and induce foreign capital. This policy conforms to the plan to accelerate the establishment of free trade zones in the country. The government plans to reduce the import tariff on completed passenger cars from 276% to 200% soon and further down to 90% by the year 2003.

c. Enticement of Foreign Capital and Reinforcement of Local Companies

In the late 1980s Indonesia began efforts to attract foreign capital, and in June 1994 dramatically liberalized by allowing 100% foreign ownership of companies. Foreign capital investment (excluding investment in the oil, gas, and financial sectors) approved by the Investment Coordinating Board (BKPM) jumped from 329 cases and just US$8.1 billion in 1993, to 491 cases and US$23.7 billion in 1994. By region, Java accounted for 60.6% (80.5% in 1990), Sumatra 23.2% (10%), Surawesi 6.1% (1.6%), and others 10.1% (7.9%). This trend promised to accelerate in 1995, with foreign investment during the first six months of the year already totaling 373 cases and US$20.03 billion.

In addition to attracting foreign capital, from now on the transfer of technology and management resources to local companies will also be promoted, and an effort to acquire technology and development of supporting industries is to be encouraged.

d. Labor Supply and Wages

Plentiful labor supply exceeding demand will continue. Although labor-intensive light industries and quickly growing heavy industries will absorb some excess labor supply from the agricultural sector and informal sector, it is very unlikely that this

will squeeze the labor market[4]. Consequently, as any upward pressure on manufacturing wages is likely to be very limited with minor exceptions, low labor costs in Indonesia will still be a comparative advantage.

As the economy moves toward heavy industry, higher industrial product manufacturing skills will be required. As the status of skilled labor rises, wages, working conditions, and other benefits will gradually improve, and the salary discrepancy between engineers and skilled laborers is likely to narrow over time. As this happens, skilled laborers will gain a stronger desire to work, and product development at factories where skilled laborers and engineers work together as a team will become widespread. This phenomenon is very common in other countries in the region where industrialization has progressed. When this happens, the Indonesia's heavy industries are likely to display a further stage of growth.

e. Improving Education

Although the primary education attendance rate is already quite high, full implementation of a 9-year compulsory education system is planned for completion by the end of Repelita VIII. Boosting the quality of early secondary education has been shown to be the best way to improve cost effectiveness when these students later receive vocational training.

Progress of industrialization is closely linked to educational levels, and since the late 1980s there has been a sharp improvement in the secondary education attendance rate in Indonesia. Over the course of PJP-II, a sharp increase in school attendance and a steady improvement in labor quality are expected (See **Table 1.2**).

3) Upgrading the Export Structure

Based on the survey of other countries in Asia, the Study predicts that when

Table 1.2 Current and Projected School Attendance

[Unit:%]

Indices	Term of Study (year)	Repelita V	Repelita VI	Repelita VII	Repelita VIII	Repelita IX	Repelita X
Primary School	(6)	92.4	94.3	94.6	94.6	97.5	98.0
First Middle Level	(3)	53.6	66.9	82.4	98.0	98.0	98.0
Upper Middle Level	(3)	34.8	40.0	51.0	60.0	71.0	80.0
Higher Level	(4)	10.5	13.1	15.0	19.0	21.0	25.0

Source : BAPPENAS

[4] Refer to (3) 2)

Indonesia enters the "take-off stage", it will end its dualist economy and boost exports".

a. Trading Structure Transition

Over the years the trade development pattern of Indonesia, which is based on the comparative advantage of its natural resources, has seen its primary exports change from raw materials, to processed raw materials, to manufactured goods produced for export and import substitution.

Trading structure changes are closely linked to fluctuations in the manufacturing ratio (share of manufacturing sector in GDP, which indicates the industrialization level). In 1993 the manufacturing ratio in Indonesia was 21%. Light industries (foods, textiles, lumber, pulp and paper, etc.) account for 57% of total manufacturing, substantially more than heavy industries (steel, non-ferrous metals, chemicals, machinery, electronics, etc.), which account for the remaining 43%.

On the other hand, over the process of five separate five-year economic plans, the trade development pattern of Indonesia has undergone a transition, based on the comparative advantage of its natural resources, as described below.

- Raw material exports
  - Goods such as petroleum, palm oil, lumber, textiles, etc.
- Value added processing of raw materials
  - Plywood, rattan products, leather goods, processed oils, etc.
- Export items produced in factory transplants
  - Export of products manufactured in plants built with Japanese, NIES, and other foreign capital to take advantage of low-cost labor. Woven goods, sports shoes, rubber gloves, toys, leather shoes, etc.
- Import substitution
  - Items imported in the past, but now produced in Indonesia for the domestic market. Urea fertilizers, cement, paper products, steel, machinery and machinery parts, metal products, glass products, ceramics, cloth products, etc.

With this transformation process, Indonesia successfully met its goal of increasing exports of non-petroleum products, and by 1987 exports of textiles, lumber, pulp and paper, rubber, palm oil, plywood, coffee, prawns, fabric and clothing, tea, and other light industrial products accounted for more than half of total exports.

b. Shortening Import Substitution Time by Improving Social Capabilities

Although Japan required about 40 years to achieve import substitution for heavy

industrial products such as capital goods and consumer goods, Korea and Taiwan were able to complete import substitution for such products in a much shorter period of time. One reason for reduced import substitution time was faster absorption of advanced technologies imported from advanced industrialized economies.

The jump to the development stage is generally seen as being sparked by a spurt of capital investment spending. When this happens, social capability is boosted to a higher level, providing support as the economy moves into a growth phase. Social capability is defined as the ability to introduce and copy advanced technology from industrialized economies. This ability is acquired through education, training, and learning by exercise. All of the countries in the region, without exception, perceive the improvement of human resources as the key to economic development, and they have been able to boost their social capability through the collective efforts of individuals, government, businesses, and human resource training institutions.

c. Considerations Regarding Progress of Industrial and Export Structures

According to the dualistic economic development model, once the turning point is surpassed, increased labor costs create a transition to a capital-intensive industrial structure. When this happens, it is important that industries be selected which are both internationally competitive and are capable of absorbing a huge new labor population. Because Indonesia enjoys a comparative advantage in terms of natural resources and low-cost labor, it would be best served by pursuing a strategy of bolstering its agro-industries (processed foods, lumber processing, leather products, rubber products, pulp and paper), and labor-intensive industries (textiles, woven goods). These, with advanced capital goods and basic materials industries (metals and machinery, chemicals), will form the three pillars of Indonesia's industrialization.

(3) Assumptions of the Study Regarding Future Growth

1) Opinions of the Study Team Regarding PJP-II Macroeconomic Projections

The beginning of this report discussed the PJP-II plan, but here the report will further analyze PJP-II.

The Study Team found it necessary to use a simple quantitative macroeconomic model comprised of 12 endogenous variables to forecast the final demand component of GDP, which was not released in PJP-II. The 12 endogenous variables

are GDP, the GDP components (private-sector consumption, government purchases, gross capital formation, inventory investment, gross exports, gross imports), employment, population, government revenues, wages and business income, and capital stock. On the other hand, 9 exogenous variables are Rupiah-denominated net direct investment, depreciation of capital stock, export prices, import prices, world export prices, GDP deflator, Rupiah-denominated exchange rate, time trend (1970=1, ... , 1991=22), and dollar-denominated foreign currency reserves.[5]

Working from the framework of PJP-II and using the Study Team's model, we broke down GDP growth and analyzed it by its demand components. Since 1989 and Repelita V, the share of private consumption has declined while the share of gross fixed capital formation has risen to 27-28%. In other words, economic growth during this period was led by capital investment. Currently the largest share of GDP is occupied by private consumption (51.9%). This is followed by gross capital formation at 30.1%. Net exports account for 8.6%, with exports at 30.3% and imports 21.5% (deducted). Both the export ratio and import ratio are relatively high (See Table 1.3).

In considering an economic growth scenario for the period through fiscal year 2003/04, given the present condition of low per-capita GDP and large labor oversupply, it is very unlikely that private consumption will continue to grow sharply and provide the engine for rapid economic growth.

A more likely scenario is that development of the manufacturing sector in the coming years will result in the growth of exports and private capital investment, and this will in turn breed strong economic growth. As is typical during the developing phase of most economies, these two categories are expected to show continuous growth throughout the period covered by PJP-II. Likewise, since imports of industrial raw materials and components would generally be expected to increase sharply during the early stages of industrialization, we should also see growth in imports during the PJP-II period, and therefore the import ratio is likely to remain high.

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[5] For exchange rates we are assuming, like PJP-II, that the Rupiah will remain around its current level (1994 average: 1 US Dollar = 2,160.8 Rupiah). The following assumptions were made regarding exogenous variables other than the exchange rate. Growth in Rupiah-denominated net direct investment is assumed to slow gradually, from 15% annual growth in 1993, to 7% in 2018. Depreciation of capital stock is assumed to continue at the 1993 annual growth rate of 13%. Export prices, import prices, and world export prices are assumed to grow at annual rates of 4%, 4.5%, and 2% respectively. Annual growth in the GDP deflator is assumed to slow gradually from the 1993 annual rate of 8%, to just 5.5% by 2018, and dollar-denominated foreign currency reserves will grow at the rate of 6% per year.

Table 1.3 Economic Growth and Employment Projections for Indonesia

[Unit:%]

	1993/1994	1998/1999	2003/2004	2008/2009	2013/2014	2018/2019
Private consumption	9.8(51.9)	6.5 (50.7)	7.0(51.7)	7.0(52.1)	8.3(52.8)	9.0(53.3)
Gross capital formation	6.0(30.1)	7.9 (31.4)	6.1(30.7)	7.7(31.9)	9.3(33.9)	11.0(37.5)
Government purchases	5.3(9.2)	5.1 (8.4)	6.2(8.2)	6.2(8.0)	6.8(7.6)	8.4(7.4)
Export	10.2(30.3)	7.7 (31.2)	7.3(32.3)	6.4(31.5)	6.5(29.5)	7.2(27.4)
Import	12.7(21.5)	7.2 (21.6)	7.7(22.8)	7.5(23.5)	8.2(23.7)	10.5(25.7)
GDP	8.3(100.0)	7.1(100.0)	6.6(100.0)	6.9(100.0)	8.0(100.0)	8.8(100.0)
Increase in employment	2.3	2.6	2.5	2.4	2.3	2.0

(Notes) 1. The economic growth rate and increase in employment are the average rates for the five-year period ending with the fiscal year at the top of each column.
2. Shares of total are indicated in parentheses.

Source : The Study Team

After that, with per-capita GDP expected to rise and the job market likely to improve, private consumption, in addition to the two categories discussed above, can also be expected to show a steady increase, boosting that component's contribution to the economic growth rate. In addition, the share of gross fixed capital formation is expected to eventually top 30%.

2) Economic Growth Estimate of the Study

The frank opinion of the study team is that it is slightly difficult to explain the gap between the PJP-II figures for economic growth rates and increases in numbers of workers.

In order to safely reach the economic growth targets put forward in PJP-II, a somewhat higher forecast regarding employment numbers is needed. By doing so, private spending growth for the second half is built in, and high economic growth forecasts become more realistic. On the other hand, if economic growth targets are adjusted to reflect the projected increase in employment in PJP-II, the economic growth rate forecast for 2018/19 would probably be almost 2% lower. The Study Team examines how much of an increase in employment would be required in order to safely achieve the economic growth targets of PJP-II (See Table 1.4).

Table 1.4 Adjusted Employment Forecast Based on PJP-II GDP Growth Rate

[Unit: %]

	1993/1994	1998/1999	2003/2004	2008/2009	2013/2014	2018/2019
Private consumption	9.8(51.9)	6.8(51.1)	7.0(52.2)	6.9(52.2)	7.7(52.0)	8.8(52.0)
Gross capital formation	6.0(30.1)	7.5(30.8)	7.3(31.9)	9.1(35.4)	9.7(38.8)	10.9(42.7)
Government purchase	5.3(9.2)	4.8(8.2)	5.4(7.8)	5.3(7.2)	6.5(6.8)	8.4(6.7)
Exports	10.2(30.3)	7.8(31.4)	6.5(31.4)	5.8(29.9)	6.4(28.0)	7.0(25.8)
Imports	12.7(21.5)	7.2(21.6)	8.1(23.2)	8.3(24.8)	8.6(25.7)	10.0(27.2)
GDP	8.3(100.0)	7.1(100.0)	6.6(100.0)	6.8(100.0)	7.7(100.0)	8.8(100.0)
Increase in employment	2.3	2.5	2.7	3.0	3.0	3.3

(Notes) 1. The economic growth rate and increase in employment are the average rates for the five-year period ending with the fiscal year at the top of each column.
2. Shares of total are indicated in parentheses.

Source : The Study Team

1.2 Significance and Present Situation of Engineering Manpowers (EM) in the Growth of Indonesia

(1) Process of the Economic Growth and Industrial Technology

1) Present Situation of Industrialization and enlargement of Industrial Technology

Since gaining its independence, Indonesia has relied on its abundance of oil and other natural resources in its efforts to achieve a full-set type of industrialization. While economic development transformed dramatically from petroleum-centered to manufacturing-centered over the course of the 1980s, the primary catalyst of this transformation was non-durable consumer goods, with heavy industrial products and high-tech goods contributing very little. This is still true, an advanced industrial technology remains almost exclusively in the hands of government-run industries, conglomerates, and foreign-owned companies. Although there are numerous other small companies and businesses, their technical relationships with these big corporations are minimal. Because large companies almost never transfer technology to smaller firms, supporting industries are not nurtured.

In both Japan and Korea, the nurturing of subcontractors by large corporations has contributed to successful industrialization. In Malaysia as well, it was recognized that real industrialization could not be achieved as long as it involved only simple assembly work, and therefore a program to nurture supporting industries was launched around 1990.

In contrast, large companies in Indonesia, in the name of maintaining the level of quality of their products, have a tendency to either import all of the major components and materials, or manufacture them internally. As a result, at the present time there is almost no dissemination of technology to small, local companies. However, as Indonesia seeks to achieve a full-set type of industrialization, it is absolutely vital that supporting industries be nurtured, and it is therefore very important that the government immediately begins to seriously implement policies and programs to promote the development of such supporting industries. This is because the nurturing of supporting industries will not only raise the level of self sufficiency, but through the transfer of skills and technology it will also lead to an increase in employment opportunities.

In the growth process described above, the promotion of industrialization of Indonesia needs to grow up together with the growth of supporting industry, which is inseparable relation with the enlargement toward supporting industry of the

industrial technology.

During the second half of PJP II, certain sectors are expected to conclude the import substitution phase, and enter the export substitution phase, in which the export of heavy industrial products is emphasized. However, in order to accomplish this transition, the past experience of advanced industrialized countries shows that a dramatic spurt in private capital investment along with the development of supporting industry is essential preconditions.

The small companies which shoulder these supporting industries must survive and grow amid the competitive mechanism and increasing entrepreneurism, and this depends on the diffusion of production technology appropriate for these small companies.

2) The Growth stage of Industrial Technology and Engineering Manpower(EM)

When a developing country proceeds with industrialization, it generally begins by implementing import substitution by introducing foreign capital and technology in order to produce its own those products which it has been importing. This is called the technology introduction stage. Next, it begins to apply the basic technology to make products which meet the specific needs of its own domestic and overseas markets. This is the technology application stage. Finally, it proceeds to develop its own technology. This is the technology development stage.

The majority of Indonesia's manufacturers, with the exception of the government-owned aircraft manufacturer IPTN and a small number of other firms which are on the verge of entering the application stage, are still in the early to middle stages of the technology introduction stage. This is clear from the fact that all firms, both public and private, rely on imports for nearly all of their principal machine components and high-grade materials, as well as the fact that on-site manufacturing is directed by the nearly 18,000 foreign engineers in Indonesia.

In order for the economy to progress through the technology introduction, application, and development stages, it is necessary to nurture EM who have tremendous ambition and initiative.

Nevertheless, recognition of the need in the Indonesian government, enterprises, and EM is still low.

The fact that the aspiration and initiative of EM are indispensable for any country to attain industrialization is exemplified here by the iron and steel industries of Malaysia and South Korea.

With the cooperation of Japan's iron and steel industry, Malaysia's Malayawata

started production of crude steel in the late 1960s and South Korea's POSCO, in the early 1970s. Today, however, the two companies differ markedly in the state of development. For example, Malayawata is still concentrating on the production of bars and long wire rods which the company was producing in the early stages of establishment, whereas POSCO has already shifted the weight of production to high-grade steels, such as plates and hot- and cold-rolled sheets (flat types), and special steels, such as stainless steels. It may be said that the reason for this difference lies in the difference in attitude of EM toward the development of their own technology. In the early stages of operations, both companies had Japanese engineers train their workers in the field and dispatched their EM to steelmakers in Japan for on-the-job training.

In the case of Malayawata, the EM who had received the above training in Japan apparently neglected the efforts to brush up the techniques they had acquired. As a result, the company is still unable to manufacture plates, hot- and cold-rolled sheets, special steels, etc. Therefore, even today, Malaysia depends almost entirely on imports for those high-grade steels.

By contrast, the EM of POSCO were willing to assimilate, accumulate, and refine the techniques they had introduced and acquired in the early stages of production operations. This has enabled the company to manufacture high-grade products which have become important export items.

In South Korea, there is a general social recognition that it has been EM who have promoted industrialization and boosted the status of the country. In Malaysia as well, personnel development funds and other incentives are available to companies which provide internal training for employees, and steps are being taken to improve the development and status of EM who work at the plant level. As the results, self-supporting ratio of parts and/or components manufactured by Malaysian EM is gradually increasing. Science and engineering graduates in Japan and Korea generally spend the first 5-10 years of their careers at the plant level manufacturing their companies' products. By gaining an understanding of the production process, quality, etc. of their companies' products, they develop the ability to come up with new ideas and methods to improve the products, implement more effective quality control, or boost productivity.

(2) Meaning and Role of EM

1) Meaning of EM

Meaning of engineers, technicians, and skilled workers, i.e. EM, described in this section is essential and ideal posture required of themselves respectively and doesn't follow the status based on academic career and experience.[6]

2) Role of EM

The followings are the qualifications generally required of EM, in the growth process of Indonesia and the future evolution of industrial technology.

a. Engineers: Must perform the role of introducing basic technology from abroad, and assuring that it becomes rooted in application technology and development technology. Specific requirements include:

- Must have sufficient educational training to grasp the technical data provided. For instance, mechanical engineers must also have knowledge of such fields as electrical and electronics, chemicals, metallurgy, etc. in order to develop more advanced devices and equipment.
- Must be able to learn the provided technology, and the design, trial production, and production of products satisfying the required specifications and the maintenance of production technology.
- Must have sufficient technical expertise to plan, develop, design, and manufacture new products.
- Must have the capability to convey the learned technology to technicians.

b. Technicians: Must perform the most vital role of applying the acquired technology to the production line and establishing and expanding a modern production system.

- Must assist the engineers and precisely execute technical operations.
- Must also have the ability to share in some of the duties of the engineers. For instance, must be able to produce a design based on specifications stipulated by the engineer.

c. Skilled workers: These are the EM who "bring about" modern production. Skilled workers are essential existence to lead export-oriented industrialization successfully.

- Must be able not only to operate lathes and other precision equipment, but also

[6] Definition of ILO's International Standard Classification of Occupation (ISCO) and definition used in other sections of this Study report with reference to EM are shown in APPENDIX 3.

to reliably repair such equipment.

- Must possess the ability to accommodate design, testing, and production according to the required specifications.
- Must have the ambition to acquire training necessary to become a technician.

In summary, Indonesia is striving to accelerate economic growth and stimulate domestic demand, and at the same time become an export-oriented economy. In order to hold its own against global competition, Indonesia must establish its foothold where it has a "comparative advantage", such as its wealth of natural resources and low labor costs. For example, agro-business and other forms of vertical integration utilizing natural resources can only be accomplished by improving the cost performance of engineers and technicians. And this also requires the skilled worker qualifications described above.

(3) Present Situation of EM in Indonesia

1) The Incompleteness of Disseminating Technology:

In Indonesia, the technology introduced by local companies or brought home by exchange students is not adequately disseminated to other sectors of industry. Technology introduced by companies (particularly government-owned companies) should be disseminated to academic societies and related industry groups, so long as such dissemination does not conflict with confidentiality agreements between the company and the country providing the technology.

In addition, nearly all of the engineering students who study abroad at government expense return home to be employed by BPPT, one of 10 strategic companies, or some other government-run company, and in fact many end up being assigned to clerical posts in such companies. As a result, the advanced technology which they were fortunate enough to bring back to Indonesia is not being utilized. The dissemination of technology will boost the industrial power of the country, as well as provide a base for the nurturing of supporting industries, and is necessary for the advancement of industrialization.

2) Trendency of Underrating the Manufacturing Sites:

EM of Japan and Korea, for example, attach great importance to the manufacturing sites. In Indonesia, on the other hand, workers with higher educations tend to take a dim view of the factory, and younger science and

engineering graduates shy away from working on production lines. Further, society as a whole readily accepts this way of thinking as natural. As a result, many companies which receive the transfer of technology from abroad are not able to fully use the technology on their own, and they are forced instead to rely on foreigners to provide direct leadership on the production lines. Consequently, in order for Indonesia to achieve industrialization on its own, social perceptions in this regard must be changed.

3) Necessity for Obtaining of Indonesian Own Technology

Since the 1994 announcement of a major relaxation of restrictions concerning foreign capital, the resulting influx of foreign capital has been accompanied by a tremendous increase in the number of foreign engineers and technicians entering Indonesia. This is due to the fact that the introduction and deployment of new technology requires that the supplying country or company also provide instruction and guidance during the start up period, and therefore this is a natural phenomenon when new technology is introduced into a country. However, when extending operations into a foreign country, every foreign company does so according to its own business strategy. Accordingly, as soon as Indonesia loses its attractiveness as a consumer market or as a base from which to produce goods for export, many companies are likely to withdraw.

If these companies withdraw from Indonesia, leaving behind nothing in terms of technical know-how, this could be a tremendous loss to Indonesian companies and to the country as a whole. In order to prevent this, and at the same time take steps toward establishing industrial independence, it is essential that Indonesia accelerate the process of nurturing Indonesian EM who possess the qualifications described above.

(4) Measures to Promote Small and Medium-Sized Enterprises in other countries in Asia – Focus on Fostering of EM

Any countries recognize that promoting small and medium-sized enterprises contributes much to the development of industry and the creation and expansion of employment opportunities.

Based on the results of its investigations conducted in several countries and subsequent studies of literature in Japan, the Study Team shall describe below several measures to promote small and medium-sized enterprises, with focus on the

fostering of EM, which should be of help to Indonesia.

1) Malaysia

a. Fostering of EM by cooperation between the government and enterprise

On Penang Island where there are many foreign-based IC and semiconductor companies, a group of affiliated companies has started employee education with the cooperation of Malaysia's federal and provincial governments. Lecturers dispatched from the member companies and outside lecturers introduced by the governments provide the employees of the member companies with education and training at places offered by the governments.

This is a new attempt of companies of a specific sector to train their employees in cooperation with the government. The federal government expects that this type of employee education will spread throughout the country.

b. Vendor Training Program

In Malaysia where the government is shifting the weight of its industrial policy toward the promotion of supporting industries, emphasis is placed more on increasing the technical strength of small and medium-sized local companies (parts manufacturers in particular) than on newly inviting foreign-based enterprises.

In this country, a good number of small and medium-sized companies are growing in such fields as plastic molding and metal press forming. For example, individual Japanese-based makers of home electric appliances are establishing a system which will enable almost all of their parts, excluding the key components, to be procured locally in the near future.

The "Vendor Training Program" is a kind of subcontractor fostering policy which plays the leading role in the development of small and medium-sized enterprises. Modeled after Japanese "keiretsu," this program aims to improve the level of subcontractors by asking the big businesses and multinationals operating in Malaysia to provide local subcontractors with opportunities to receive orders and technical support in cooperation with the government and financial institutions.

For example, some big businesses are providing the EM of their subcontractors with training in their plants in the production processes, handling of the equipment and devices, etc. This enables subcontractors with the help of obtaining loans for purchasing necessary equipment and devices under the program to establish a system whereby their own EM can use the equipment and devices to manufacture their products.

As of April 1995, 42 big companies and 71 local subcontractors were involved in the program. The number is expected to increase dramatically in the future.

c. Human Resources Development Fund

The Human Resources Development Fund (HRDF) was established in 1992 with the aim of backing business managers who are fostering their own EM that can take advantage of the increasingly sophisticated industrial technology. The HRDF was put into effect on January 1, 1993.

The outline of the HRDF is given below.

- The owners of manufacturing companies with 50 or more employees (up until January 1995) and 10 to 49 employees (after February 1995) are required to register at the HRD Council and participate in the HRDF.
- Each owner contributes 1% of the sum of monthly wages of his employees to the HRDF. At the same time, the government contributes a subsidy equivalent to twice the above contribution to the HRDF. Thus, if a certain company contributes 5,000 Malaysian ringgits (MR5,000) to the HRDF, the government contributes MR10,000. In this case, therefore, the company can spend a total of MR15,000 on employee education.
- It is stipulated that the above 1% contribution from each company shall be made from the corporate funds, not from the payroll.
- The proportion of the government's subsidy is reviewed every five years.

2) South Korea

a. Skill Saint System

In South Korea, where much importance is attached to the academic career of individuals as in Indonesia, the "Skill Saint System" has been established with the aim of heightening the will of employees with junior high school or high school training to acquire higher techniques. This system has proved effective to heighten the will to work of those employees, whereby it has produced remarkable results.

Under the Skill Saint System, employees with junior high school or high school training who have served their company for 15 years or more and who have seven or more years of work experience in the field are qualified to receive a prescribed written examination and skill test in their specialized field, and those who have passed them are given a certificate of Skill Saint or Assistant Skill Saint depending

on the scores.

The incentives afforded to Skill Saint and Assistant Skill Saint are as follows.

- Within the company, each Skill Saint is treated as a general manager and each Assistant Skill Saint, as an assistant general manager.
- Though the ordinary retirement age is 55 years, Skill Saints are allowed to work until the age of 65 and Assistant Skill Saints, until the age of 60.
- The children of Skill Saints/Assistant Skill Saints are awarded scholarships from the company till they graduate from college. In addition, the company guarantees that it will employ those children (if they wish) in the future.
- If any Skill Saint or Assistant Skill Saint goes independent in the future, the company acknowledges his new enterprise as one of its subcontractors.

b. Intern system

Under this system, any company hoping to recruit brilliant graduates can, through the student affairs section or professors of universities, ask any of prospective graduates to work as "interns" in its plant for a certain period (say, three or six months).

If the company finds any prospective graduates it wants, it makes an interview with them and hires them temporarily with reasonable remuneration.

This system enables any business enterprise to previously examine the abilities and character of students so as to pass the final judgment on whether or not it should hire particular students on a permanent basis. On the part of students, they can, during the period of temporary employment, measure the growth potential of the company and judge whether or not the company is worth working for. Thus, the intern system is said to benefit both parties.

At present, however, it is mainly big companies that utilize this system.

3) Japan

a. Small-group activities

Generally speaking, the employees of any company are given different levels of training as they rise in position within the company, from the newly employed to group leader to section manager to department manager. In the case of the newly employed, on-the-job training and classroom lectures within the company constitute the main part of employee training. The employees of manager class receive not only intracompany education programmed for managers but also

suitable education and training offered by outside research institutes. When the company has production bases overseas, it also provides its employees with education in the necessary foreign language inside or outside the company. Apart from the ordinary education mentioned above, many enterprises carry on small-group activities. Namely, small groups of persons formed by section or team at production sites discuss measures to cut costs, increase productivity, eliminate waste and defects in products and production processes, improve the operation procedure and working environment, etc. and make useful suggestions to the company.

In small-group activities, efforts are made to develop the originality and ingenuity of each individual group member, promote the cooperation of members within the group, and encourage mutual enlightenment among the members, as well as give each employee the sense of satisfaction and achievement in the execution of his job. As a result, the small-group activities contribute to the improvement of productivity, the smoothing of superior-subordinate relationships in the field, and the betterment of employee education (i.e., the transfer of technology and skill from the experienced to the inexperienced).

Employees who have come up with original and effective suggestions are, as excellent performers of the year, awarded a special bonus and other incentives, such as an inspection tour to the company's overseas plant.

In Japan, small-group activities serve not only to improve the knowledge and the level of technology and skill of all field workers but also to uplift their mental attitude and will to work by making the employees feel that they are participating in management through the uplifting of their morale and the execution of cooperative work. There are many companies which position small-group activities among the important elements of employee education.

b. Re-education of EM in Small and Medium-Sized Companies

There are not a few small and medium-sized companies which recognize the need to re-educate their employees in light of the increasingly sophisticated industrial technology but which cannot afford to do so for themselves. Those companies dispatch their employees to some of the industrial research institutes or vocational training centers which belong to the central or local government or to some outside training courses so that they can receive the desired education and training. In some cases, the association of companies in the same trade invites outside lecturers for joint employee education.

When specific testing, education, or training requires advanced equipment or device which is extremely expensive, many companies utilize industrial research institutes in the areas, such as Hokkaido, Kyushu, Shikoku, etc. covered by the Ministry of International Trade and Industry or in prefectures where the required equipment is available. In particular, the prefectural industrial research institutes have equipment and devices which are needed by local industries, hence they serve to foster small and medium-sized companies which make up supporting industries.

4) United Kingdom

In May 1995, the British Ministry of Trade and Industry published a white paper titled "Competitiveness--Steady Advance."

This white paper points out that making investment for the development of human resources of small and medium-sized companies which play the most important role in creating employment opportunities is the key to the growth of our economy on a long-term basis.

The government has newly installed a "Loan for Development of Human Resources of Small and Medium-Sized Companies," which provides loans for employee education in small and medium-sized enterprises.

The government positively encourages small and medium-sized companies not only to utilize the education and training programs offered by each local government, etc. but also to develop and implement their own employee education and training programs (in cooperation with other companies if necessary) by making the most effective use of the new loan system and "business link"[7]. In particular, the government places emphasis on the development of employee education and training programs by individual enterprises. As an example, the government has decided to hold a contest named "Education and Training

[7] In the United Kingdom, business services have been offered separately by local governments and business organizations. According to the present white paper, it has been decided that under the leadership of BMTI, those organizations shall form a new network to provide comprehensive business services mainly to small and medium-sized companies. In concrete, the new network will offer by electronic mail, etc. all-around business information, including business inquiries at home and abroad, advice on the export business, technology development, design, and patents.
May 1995 a "Business Link Center" was opened in eight major cities, including London and Manchester. Ultimately, a total of 100 Business Link Centers are planned to be established throughout the country.
Budget: 100 million pounds (15 billion yen).
Business advisors: 200 persons (technology development, design, export counseling).

Programs for Small and Medium-Sized Enterprises" co-sponsored by the BMTI and employers starting this year. The total amount of prizes is 5 million pounds (approximately 750 million yen).

1.3 Fostering Engineering Manpower – Present Conditions and Problem Areas

(1) Prologue

The common factors which were used to judge the state of human resources concerning skills and technology and the state of production/services in industry are the following:

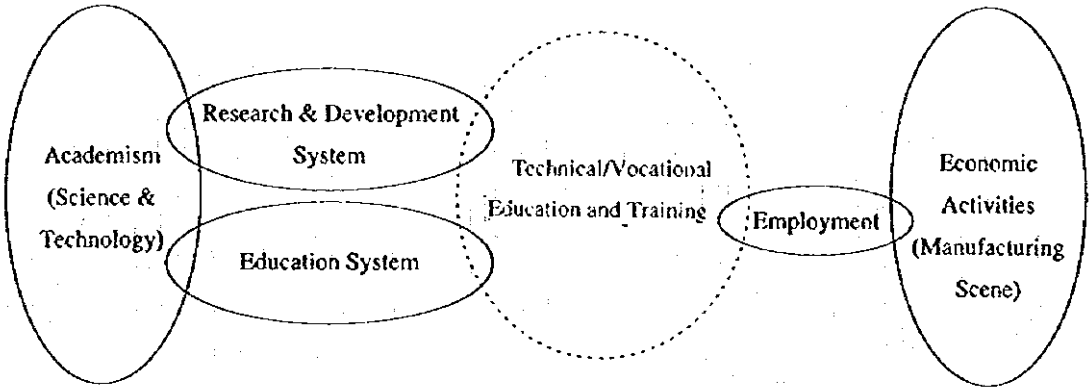
- If the following points are progressive and sufficient:
  technology information, introduction/accumulation of knowledge, research and development
- If the adopted technology is applied effectively and appropriately on the spot of production or services.
- If continued efforts to absorb and improve knowledge or technology is made both on individual and organizational basis.

Three words can be used to describe the three factors mentioned above: *"Head"*, *"Hand"* and *"Heart"*.

- *"Head"* describes information and knowledge, which are developed accumulated or instructed, mainly via universities (academic).
- *"Hand"* describes training of skills. Opportunities for obtaining skills are offered mainly through post-secondary education or vocational training.
- *"Heart"* describes motivation. This largely depends on the personality of each person. It can, however, be driven by enlightenment or encouragement of leaders at organizations of education/training or production/services.

Technology and vocational education play an important role in bridging academism and businesses. Technology, vocational education, and training must be discussed not only in the framework of the education system. They must be considered from the perspective of the needs of production spots and industrial growth. (Figure 1-1)

Appropriate technical/vocational education and training bring about improvement in on-the-spot technology, which boosts international competitiveness of industries, and thus, contributes to the acquirement of foreign currency.



Source : The Study Team

Figure 1.1 Position of Technical/Vocational Education and Training

(2) Supply of Engineering Manpower (EM)

Human resources involved in the fields of engineering and technology (EM) receive training at three types of human resource development institutions – advanced educational institutions such as universities and polytechnics, vocational high schools (STM) and other types of technical post-secondary educational institutions, and Public Vocational Training Centers (BLK), which are under the jurisdiction of Indonesia's Ministry of Manpower (DEPNAKER).

The relationship between academic record and job status is usually fixed, at least from the standpoint of the human resource development institutions. In other words, according to ITB (Institute Technology Bandung) documents, students who advance to university and earn a bachelor's degree (Sarjana) are treated as engineers by their employers. Those who earn a diploma, which does not count as a degree, are given the status of technician. Those who graduate from vocational schools are considered skilled workers. For convenience, the Study Team proceed with analysis on the premise that this relationship can be expressed as university graduates = engineers, polytechnic graduates = technicians, and vocational school graduates = skilled workers.

According to the most recent data available, these three types of training institutions graduate a combined total of about 160,000 EM per year. Of this

number, graduates of universities and polytechnics, those likely to become engineers and technicians, total only 44,000. Relative to Indonesia's population and the number of EM necessary to achieve full-scale industrialization of the economy, this number is very low compared to Indonesia's southeast Asian neighbors.

1) Advanced Educational Institutions

Training of engineers is conducted at universities and technical colleges or institutes. There are a total of 49 state-run universities in Indonesia, and several of these are prominent schools with international-level academic programs. In addition, there are also 1,027 private universities, but the majority of these are questionable in terms of their academic quality.

49% of all science and engineering students major in engineering, 19% in agricultural science, 8% in medical science, 5% in animal husbandry, 4% in architecture, 4% in physical science, 3% in forestry, 3% in mathematics/computing, 2% in data communications, 2% in fisheries, and 1% in technical arts. While a relatively large share of students still major in agricultural science, few major in fields such as mathematics/computing and data communications, fields in which the needs of industry are growing rapidly.

2) Polytechnics

In 1980, six polytechnics were established in Indonesia as institutions of higher learning designed to foster the development of technicians. Today there are a total of 26 polytechnics. Some of these are two-year institutions, and some are three-year. Coursework, which includes such courses as civil engineering, machinery, electrical and electronics, etc., focuses on technical subjects. Curriculums emphasize practical study rather than classroom science, and the polytechnics have gained increased respect from industry in recent years. Job placement for polytechnic graduates is generally quite smooth due in part to industry demand for personnel who can be effective immediately. However, at around 5,500 per year, the number of polytechnic graduates is still quite small.

3) Technical / Vocational Education in Upper-Secondary Educational Institutions

The principal source of skilled workers is technical/vocational senior high schools. After graduating from junior secondary school, students who desire technical and vocational training advance to vocational high schools. There are a total of 209 public technical vocational high schools throughout the country, and

these schools have a combined enrollment of 511,000 students. 153 of these schools are industrial high schools, and the majority of the remainder are agricultural high schools. A total of 150,000 students are enrolled in the 153 industrial schools, approximately 34,000 graduates/year.

Curriculums of industrial high schools focus on architecture, electronics, electrical engineering, machinery, automobiles, industrial equipment, etc. Industrial high schools are all equipped with workshops.

According to the Ministry of Education and Culture, upon graduation 15% of industrial high school graduates enter private companies, 8% pursue higher education, 6% become entrepreneurs, 3% become public servants, 15% pursue other courses, and the fate of the remaining 53% is unknown. The problem is that since the social positions of more than 50% of the industrial high school graduates are unknown, the results of the education that is provided by the industrial high schools cannot be measured accurately.

4) Vocational Training Institutions

Public Vocational Training Centers (BLK), which are run by Indonesia's Ministry of Manpower (DEPNAKER), are human resources development institutions designed to nurture semi-skilled workers in the industrial sector. These public vocational training centers, which number 153 throughout the country, offer basic technical training programs to job seekers.

Only about 70~80 thousands persons receive training in these centers each year, and therefore actual utilization of the centers is generally far below capacity. Although students need only to have completed compulsory education (primary school) in order to enroll, in reality about 80% of students are high school graduates. Whereas workers who join companies immediately after graduation from junior secondary school are treated as semi-skilled workers, most of the students who graduate from high school and then complete programs at the vocational training centers are put on the production line as skilled workers.

The primary industrial training programs available at these centers are automobile, electrical, machinery, and architecture, and these training programs typically last from 4 to 6 months.

(3) Outlook for EM Supply

1) Educational Policies and Future Programs

Indonesia's First National Long-term (25-year) Development Plan (PJP-I) resulted in a dramatic improvement in the country's educational system, particularly with regard to primary and secondary education.

Within the Second Long-term Development Plan (PJP-II), the focus is being shifted to higher education, and the plan's 25-year goal is to bring the advanced education enrollment rate up to 25% by the year 2018/19 (see Table 1.2).

2) Outlook for EM Supply

Projections of the future supply of EM are presented in Table 1.5. These projections are based on estimates of future population derived from BPS statistics, school enrollment forecasts from PJP-II, and historical school completion trends. According to these projections, in 25 years the supply of EM is likely to be 2.7 times the current level.

(4) Examples of EM Development in other countries in Asia

1) Malaysia

It was in the 1980s that Malaysia shifted the weight of its educational policy from middle-level education to higher education. Then, with growing social recognition of the importance of engineers in the background, the number of science and engineering students began to increase rapidly. Looking at the recent change in specialization of the faculty of technology, mechanical and industrial technology courses specializing in high-tech fields of mechanical electronics and flexible manufacturing systems (FMS) have been increasing at a two-digit rate annually, outpacing the GDP growth. Electronics courses too have been increasing rapidly.

Today, in Malaysia, it is of urgent necessity to increase technicians. Especially, in the fields of electric power and electronics, the shortage of technicians is expected to become serious. Therefore, the government is planning to increase polytechnics considerably.

2) South Korea

Formerly, in South Korea, the social status of technicians and engineers was not high. As a result, a shortage of engineers has become a serious problem. In recent

Table 1.5 EM Stock Projections (1998-2018)

[Unit:1000 persons]

	1994	1998	2008	2013	2018
Senior High School Graduates	14,429.6	17,602.6	26,859.8	31,770.5	36,715.8
Polytechnic Graduates (technical)	140.8	175.4	407.5	593.1	816.0
Architecture	14.6	15.2	20.4	24.5	29.1
Physical Sciences	1.5	4.0	20.1	33.1	48.8
Medical Science	19.4	23.9	53.7	77.6	106.3
Forestry	7.3	8.0	12.3	15.8	19.9
Mathematics/Computer	5.2	5.3	6.4	7.2	8.1
Fisheries	1.1	1.3	3.0	4.3	5.9
Agricultural Science	12.2	16.6	45.7	69.0	97.1
Carpentry	5.5	7.0	17.1	25.2	34.9
Animal Husbandry	0.3	1.7	10.7	18.0	26.8
Engineering	73.7	92.4	218.1	318.4	439.1
University Graduates (technical)	192.6	348.1	1,001.9	1,457.9	1,983.8
Architecture	7.2	16.5	55.6	82.9	114.7
Physical Sciences	17.5	25.7	59.8	83.5	110.5
Medical Science	37.9	59.7	151.0	214.5	287.2
Forestry	3.7	6.0	15.5	22.1	29.6
Mathematics/Computer	4.4	5.9	11.9	16.0	20.7
Fisheries	3.9	9.3	32.2	48.1	66.7
Agricultural Science	30.1	73.5	256.4	384.5	533.3
Carpentry	0.8	3.2	13.1	20.1	28.2
Animal Husbandry	6.1	12.2	38.1	56.2	77.1
Engineering	81.0	136.1	368.3	530.0	715.8
Total EM	14,763.0	18,126.1	28,269.2	33,821.5	39,515.6

(Note) Complied using the Study Team estimates, based on BPS statistics 1994.
Source : The Study Team

years, however, the country is changing into a technocratic society as cultural sciences which were formerly cherished most have been gradually decreasing in relative importance.

In the 1940s and 1950s, South Korea's education was such that it could not fully meet diverse needs of its industry. In the 1960s through 1980s, the growth of industry outpaced the development of education. At last, in the 1990s, the level of technical and vocational education has caught up with the level demanded by the industrial world.

With respect to measures to improve the level of education in the future, the government plans to develop curriculums, expand investment in education, and

improve the legal system in a balanced manner as shown below.

① Reinforcing the field training system for science and engineering faculties.

② Encouraging the cooperation between industry and academy and enhancing the functions of the cooperative system.

③ Improving the Industry Promotion Act and reinforcing the industry-academy cooperation system.

3) Japan

Japanese enterprises do not expect universities to make their students acquire technical skill through practical training. Rather, they expect that the university students will develop their thinking power which enables them to be engaged in higher research and development activities in the future. Because of this, the weight of instruction in universities is on theory rather than practice.

In the background lies the fact that at the high-tech production sites in Japan, high-level engineers are strongly demanded to have capacities as R&D-type brain workers. On the other hand, Japanese companies are eager to secure not only R&D engineers but also engineers who are able to refine production technology and improve productivity at the production sites. Those two types of engineers have worked together to improve operations of the production department, such as by product planning and design which permit products to be manufactured efficiently, and thereby contributed much to the improvement of quality and the cutting of cost. Each individual engineer who has received university education strives to improve the level of technology of the company with the aid of instruction and on-the-job training provided by their managers and superiors. Thus, the industry's policy of placing importance to the production scene, where the engineers, technicians, and skilled workers make concerted efforts to manufacture a product, has been maintained.

The strategy to be adopted by higher educational institutes includes the following:

① Priority allocation of budget to postgraduate courses.

② Making the faculties of science and engineering more attractive to the students.

③ Developing high technologies from a long-range viewpoint through the cooperation between industry and academy.

④ Treating doctors of science and engineering favorably.

⑤ Integrating courses to foster multitalented personnel.

⑥ Improving the quality of education by treating teachers more favorably,

providing adequate research facilities, and so on.

(5) Problems Regarding the EM Development in Indonesia

Through visits to human resource training institutions and interviews with school authorities, we learned of a number of problems in the technical and vocational training system. Specific problems confronting these human resources training institutions are discussed below.

1) Problems Confronting Universities

a. Insufficient Education Budget

Hindered by inadequate education budgets, universities are faced with a shortage of good teachers, dilapidated facilities, and a generally low academic quality. This also creates inefficient educational productivity. Other Asian countries provide generous subsidies so that schools can carry out educational activities, but Indonesian schools are continually forced to find educational financing on their own, which is a major reason for the neglect of education in Indonesia. Indonesia's attitude regarding the importance of education can be seen in the amount of public expenditures on education compared to the overall scale of the economy (See **Table 1.6**). Improvement of the educational system has consistently been the highest priority category in Malaysia's long-term development plans.

From these figures it is clear that educational expenditures in Indonesia are much too low in relation to the scale of the country's economy. These other countries did not suddenly boost their education-related expenditures to current levels just in the

Table 1.6 Educational Expenditures as a Percentage of National Budget and GDP

[Unit:%]

	Indonesia	Malaysia	S. Korea	Japan
Educational Expenditures/National Budget	4.0	16.3	23.4	16.6
Educational Expenditures/GDP	1.0	5.1	3.7	4.7

(Note) Figures for Japan and Malaysia are from FY 1991, figures for S. Korea are from FY 1993. Figure for Indonesia are 1994/95 projections based on REPELITA VI.

Source : REPELITA VI and Educational Statistics of Malaysia 1991, Statistical Yearbook of Education in Korea 1994, School Basic Survey in Japan 1993.

last few years. They have been enjoying the investment returns of this high level of spending for a considerable amount of time. For Japan, the trend has remained largely unchanged since FY1955, the year that marked the beginning of rapid economic growth. In Malaysia as well, these ratios remained extremely steady throughout the high-growth years of the 1980s. For the past 30 years, South Korea's educational investment spending has consistently been higher than the average spending level of other developing countries in the same income bracket.

b. Widening Gap Between Public and Private Universities

There is a marked reference in the academic levels of national universities and private universities. One of the factors behind this trend is the existence of systemic inadequacies which tolerate the establishment of tremendous numbers of poor quality universities. In Japan, strict criteria regarding the establishment and certification of universities has been established and is enforced by the Ministry of Education. All universities in Malaysia are national universities, and a high level of academic performance is required for enrollment. South Korea witnessed a dramatic increase in university establishment during the 1980s.

c. Lack of Link & Match

Because the needs of industry are not adequately reflected in university curriculums, there is a significant gap between what universities produce and what companies demand. This problem is exacerbated by the fact that industry contributes little in terms of involvement and advice to universities. One of the reasons for this is the lack of concern for industry on the part of the universities. In Korea, on the other hand, a system of cooperation among industry, government, and education has been firmly established, and these three sectors often work together in closely. For example, it is very common for corporations to donate such things as laboratory equipment to universities. In Japan as well, there are many cases where major corporations sponsor universities' research in advanced technological fields.

d. Lack of Concern Regarding Student Job Placement

Universities demonstrate a lack of concern regarding student job placement in a number of ways, such as failing to keep a current list of graduates, and so on. One of the reasons for this may be the fact that job hopping is quite common. If graduates change jobs frequently and the whereabouts of many become unknown

after just a couple of years, there is little incentive to produce such lists. Indonesia has no system like that in Japan where university job placement centers advise students on job opportunities, or alumni groups are organized to recruit qualified students into the appropriate companies. Students must rely completely on community or kinship relations, or locate jobs through advertisements, resulting in poor external efficiency.

e. Lack of Fundamental Academic Ability

Lack of fundamental academic ability in primary and secondary education is an impediment to post-secondary education. It is particularly important that the questions of students at the middle school level be answered accurately. Teachers who gloss over unclear points or refuse to respond politely and fairly to students' questions must not be tolerated. The Study Team have seen several cases where the educational system is being obstructed by teachers of questionable quality.

f. Teaching Profession is Unattractive

Because of the relatively low social status of teachers, there is a severe lack of excellent candidates for teaching posts. Extremely low teacher salaries are a major concern. Perhaps the most severe problem with regard to teachers is the absolute shortage, both in quantity and quality, of teachers qualified to teach students about high-tech fields such as mechatronics, optoelectronics, medical electronics, and so on. As for other countries in the region, high social status tends to compensate for benefits which are somewhat less attractive than those of the private sector, making it possible to maintain a sufficient number of quality teachers.

g. Need for Early Gifted Education

In order to foster talented researchers at universities and postgraduate schools, it is indispensable to provide bright young students with special education from an early stage. Partly because of the lack of competent teachers, an early gifted education system is nonexistent in Indonesia. In South Korea, which strongly felt the need for encouraging the development of gifted students beginning at the upper secondary education level, science high schools were established during the latter half of the 1980s.

h. Small Number of Specialists in Advanced Fields of Industry

Another concern is the relatively small number of specialists in advanced

technological fields (mathematical science, computing, data communications, etc.) compared to conventional fields of technology. There are few teachers qualified to provide instruction in advanced technologies, areas in which the needs of industry are growing daily. To become qualified, such teachers must study abroad in technically advanced countries. The problem is that there is in fact a shortage of teachers with overseas academic experience. In Malaysia and South Korea, on the other hand, there are large numbers of young teachers who have obtained advanced degrees from western universities, and such teachers have paved the way for the utilization of advanced technology.

i. Social Emphasis on Academic Career

Although social emphasis on academic career is not unique to Indonesia, in most other countries society naturally demands that this be backed by scholastic performance. In Indonesia, however, the problem is that once a person has obtained an advanced-level academic career, the actual performance is hardly emphasized. While steps should be taken to end the excess emphasis on academic career, there is little chance that the system of academic career-based selection will be eliminated any time soon. The result is inefficiency in terms of operating a job qualification system which links both academic record and qualifications.

j. More Emphasis on Practical Training is Needed

Because curriculums tend to focus more on classroom education than on practical training, graduates are not of immediate value to companies. One of the primary reasons for this is a lack of adequate instructional equipment. Because there is not enough of such equipment, time spent on practical training is reduced, and students are forced to waste time in the classroom. Furthermore, the little instructional equipment that is available is outdated and of poor quality compared to that in neighboring countries, and therefore the time spent in practical training is relatively unproductive.

k. Engineering Still not Popular

Because few of the best students elect to pursue science and engineering degrees, there is justified concern that there won't be enough advanced engineers in the future. One of the main reasons for this is society's lack of recognition of the vital role played by engineers.

Not long ago in Korea, civil service was considered the superior career and

engineers were not regarded highly. However, the importance of engineers became clearer as Korea's economy developed, and today more than half of all university students are enrolled in engineering courses.

2) Problems Concerning Polytechnics

Polytechnics face many of the same problems faced by universities, including a shortage of quality teachers, a lack of lab equipment and supplies, and so on. In addition to problems in common with universities, the following are problems and concerns unique to polytechnics.

a. Low Academic Quality of Enrollees

Despite a high level of entrance competition, many persons associated with polytechnics indicated that the academic quality of new enrollees is quite low. Although polytechnics are institutions of higher learning, entrants tend to be of a lower academic level than those entering universities due to the fact that polytechnics are inclined toward vocational education. The principal problem here is that the quality of secondary education is low, creating wide discrepancies in scholastic ability.

b. Recognition of Necessity Remains Low

Despite the vital role of polytechnics in terms of preparing technicians for jobs in industry, the relatively low number of graduates and vague role has kept the social recognition of the importance of these schools low. Nevertheless, this recognition is gradually improving in the industrial sector.

c. Compensation Gap With University Graduates

There is a wide gap in the compensation levels of polytechnic graduates and university graduates. This of course goes back to society's emphasis on academic career rather than performance. In the case of Malaysia, only those students who successfully pass rigorous exams proceed on to college, and because these are the most able students, there is little difference between academic career and actual ability. Consequently, there is propriety in academic selection forming the basis for vocational selection, and even those who are not university graduates will still find it possible to advance later on by their own efforts and abilities. In Japan and Korea, academic career and occupation still exhibit a certain degree of linkage, but in practice there is very little difference in actual wage levels.

3) Problems Concerning Skilled Worker Training Institutions

Training of skilled workers is conducted at technical vocational high schools and vocational training centers. As is the case with advanced educational institutions, inadequate education budgets mean that these schools also face shortages of equipment and supplies, as well as a low level of quality among instructors.

Enrollment demand at technical vocational high schools is much lower than at regular senior high schools. And because vocational training centers do not offer training programs adapted to the needs of the specific region, supply and demand mismatches often occur. At the present time, the system to nurture skilled workers, the fundamental base of support for industrialization, is inadequate. Furthermore, internal training is provided by only a small portion of large corporations, and therefore the situation shows little sign of improving.

The following is a list of problems associated with technical vocational high schools and vocational training centers. The principal cause of each problem is indicated in parentheses.

a. Problems Concerning Technical Vocational High Schools

- Tracking surveys of graduates are inadequate, and therefore the status of graduates is unclear. (Cause: no close correspondence neither school nor graduates)
- Large-scale training facilities are badly distributed in large cities. (Cause: insufficient education budget).
- Vocational senior high schools are unpopular. (Cause: There are many students who prefer to receive higher levels of education in basic studies.)
- Increased educational burden on private institutions due to insufficient capacity at public institutions. (Cause: inadequate education budget)

b. Problems Concerning Vocational Training Centers

- Slow improvement in the quality of instructors. (Cause: low teacher's salary)
- Training period too short. (Cause: there is no guarantee of job placement even if long training course is completed)
- Concerned government agencies have not cooperated in establishing a unified vocational training program certification system or vocational licensing system. (Cause: interagency sectionalism)

- Dilapidated facilities and lack of new equipment and supplies. (Cause: insufficient education budget)
- Should be geared more toward "re-trainees" who have previously received technical training, rather than just "job seekers". (Cause: poor training facilities)
- Insufficient control and supervision of private vocational training centers. (Cause: lack of legal regulations)
- Curriculum focuses on academic lecture rather than practical exercising. (Cause: poor training facilities)
- Mismatches arise because training programs are not adapted to local needs. (Cause: centralized control)

4) Problems Associated With Internal Corporate Training

- In other countries in Asia, there is already a shortage of EM in the manufacturing operations of the automobile, consumer electronics, and semiconductor industries. In order to correct this problem, companies in each of these countries are taking steps to nurture EM in various fields internally. For instance, companies such as Malaysia's national automobile manufacturer or Korea's largest electronics producer maintain well-equipped research laboratories and curriculums, and these are used not only to train their own employees, but employees of affiliates and other related companies as well. Such training is provided for employees and outside personnel at research laboratories in Indonesia as well, particularly in strategic industries. However, the level of the facilities and equipment, in both quantitative and qualitative terms, is inferior to that in other countries in Asia.
- Through the establishment Survey conducted in 1994 in Indonesia, the Study Team found that only 50% of companies in Indonesia's manufacturing sector provide internal training and education programs for their employees. Further, the majority of those that do offer such training are large corporations. Indeed, small and medium-sized companies find that insufficient funds and a lack of qualified instructors inhibits them from developing more skilled human resources via such internal training.

1.4 Concluding Remarks of PART I

Based on analysis of Part I, the following goals should be established for future development of engineer and technician in Indonesia.

- Engineering manpower must be developed to meet the needs of growth targeted in PJP-II (see 1.1(3)2) of this report).
- PJP-II plans economic growth which eliminates the "dual economy", boosts exports, expands and spreads industrial technology, and strengthens Indonesian application of technology.
- But as described above, there are many problems with both suppliers and users of engineering manpower. These problems must be resolved for Indonesia to meet its development goals.

PART II: EM SUPPLY AND DEMAND

In Part I, various problems relating to engineering manpower (EM-engineers, technicians and skilled workers) in Indonesia were identified through studies of literature and interviews on the macroeconomics survey, industrial technology surveys, and survey of manpower educational institutions. In this Part II, those problems are verified by the results of the 1994 establishment survey and estimates using forecast model and then, specific issues are extracted out of them, which will be reconsidered in Part III in order to plan for development of engineering manpower resources.

2.1 Present Condition of EM at Business Establishments

(1) Outline of the Establishment Survey

1) Purpose of the Survey

At present, the existing distribution of EM – human resources indispensable for the future development of Indonesia – can only be roughly estimated from household surveys, such as the National Census (every five years) and the Manpower Survey (twice a year), or from industrial surveys, such as the Industrial Statistics (every year). With the aim of obtaining more detailed information about the present condition of employment of EM on a nationwide basis, the Study Team conducted a survey of EM at business establishments (hereinafter simply called as Establishment Survey). This Establishment Survey was the first attempt in Indonesia to conduct a nationwide survey covering all types of industry sectors[1].

2) Method of the Survey

Based on the list of establishments which is prepared using reports that every company is obligated to do to the Ministry of Manpower (DEPNAKER) in accordance with Presidential Regulation No. 7, the Study Team picked up

[1] BPS, which conducts an Economic Census every five years, is going to cover a considerable proportion of service industries for the first time in its 1995/6 survey.

establishments by stratified random sampling and obtained valid responses from 3,156 establishments throughout the country. Samples were stratified by industry sectors, scales, and regions. One half of the establishments selected were those in the manufacturing sector that was considered to hold a large proportion of BM. As for scale, establishments were divided into three groups in terms of the number of employees: "large" (100 persons and more), "medium" (20 to 99 persons), and "small" (5 to 19 persons). Almost equal number of samples were picked up from each of the three groups[2].

The respondent establishments are distributed as shown in **Table 2.1.**

Table 2.1 (1) Distribution of Establishments surveyed
– by Industry and by Size

Industrial Sectors		Size in terms of Employment (no. of employees)			Total
KLUI code	Sector name	Large (• 100)	Medium (99-20)	Small (19-5)	
10	Agriculture	42	11	6	59
20	Mining	5	6	0	11
30	(Total	(678)	(501)	(375)	(1,554)
31	Food	120	156	144	420
32	Textiles	202	96	37	335
33	Timber & Woods	110	69	65	244
34	Pulp & Paper	26	22	10	58
35	Chemical	84	51	11	146
36	Ceramics & Potteries	37	50	70	157
37	Basic Metals	15	15	14	44
38	Machinery	76	40	21	137
39	Other Manufacturing	8	2	3	13
40	Utilities	7	5	0	12
50	Construction	71	103	60	234
60	Trade	174	245	323	742
70	Transportation	55	57	33	145
80	Finance Services	88	174	73	335
90	Other Services	11	23	30	64
Total		1,131	1,125	900	3,156

Source: the Establishment Survey

[2] The distribution of establishments by region was decided according to ratio at DEPNAKER lists.