Table 2.1 (2) Distribution of Establishments surveyed
– by Industry and by Region

	Sumatra	Java	Kalimantan	Sulawesi	Others	Total
10 Agriculture	24	22	10	0	3	59
20 Mining	4	5	2	0	0	11
30 Manufacturing	251	1,156	63	40	44	1,554
40 Utilities	4	8	0	0	0	12
50 Construction	72	102	20	16	24	234
60 Trade	159	401	44	72	66	742
70 Transportation	31	92	8	8	6	145
80 Finance	57	225	18	12	23	335
90 Other Services	15	36	8	4	1	64
Total	617	2,047	173	152	167	3,156

Source : The Establishment Survey

3) Contents of the Survey

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[3], and ordinary high school/vocational high school graduates[4] engaged in field work. The data showing correlation between EM academic career, EM engineering specialization, and job classification at the company were also requested. The questionnaire was designed in such a way that extensive and detailed information about the present condition of EM employment in Indonesia could be obtained.

In order to avoid confusion in the establishments survey, engineers were limited to graduates of science and engineering universities, technicians to graduates of polytechnic schools, and skilled workers to graduates of high schools and those workers who have 10 or more years of work experience. In this report, the above three classes of EM are shown in italics to discriminate them from the general EM names without regard to academic careers.

(2) Major Results of the Establishment Survey[5]

[3] Defined as those persons who have diploma D1, D2, or D3.

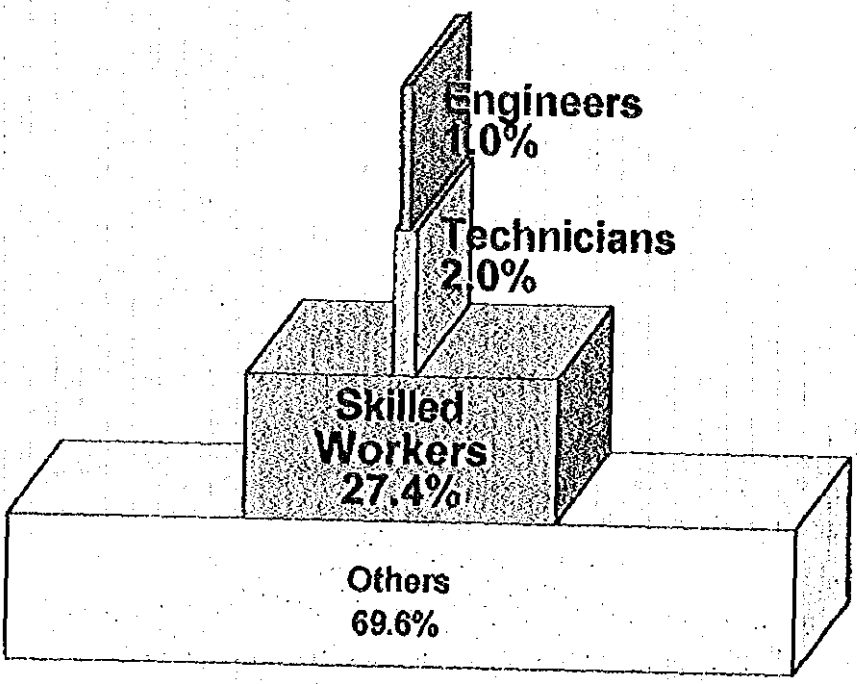
[4] Defined as SLTA/SLTP graduates who handle machinery and equipment and who have at least 10 years of experience in the technical field.

[5] This section was presented by the Study Team at International Seminar on Training Restructuring and the Labor Market in Indonesia (organized by DEPNAKER and tne World Bank at Jakarta on November 7 - 9, 1995).

1) Distribution of EM

The respondents fall in only 0.10% of total population of establishments in Indonesia at the end of 1994[6]. However, due to intentional weighting on establishments of large size and manufacturing sector, the result can show a whole picture of status quo of EM in Indonesia.

According to weighting samples to represent the total population, approximately 700,000 engineers, 1,000,000 technicians and 19,000,000 skilled workers are estimated to be on work at present. Total number of EM defined in this Study is close to 21 million, which occupies 30.4% of total employment[7] (see **Figure 2.1**).



"Others" represents employees other than EM (manages, clerks, unskilled workers etc.)

Source : The Establishment Survey

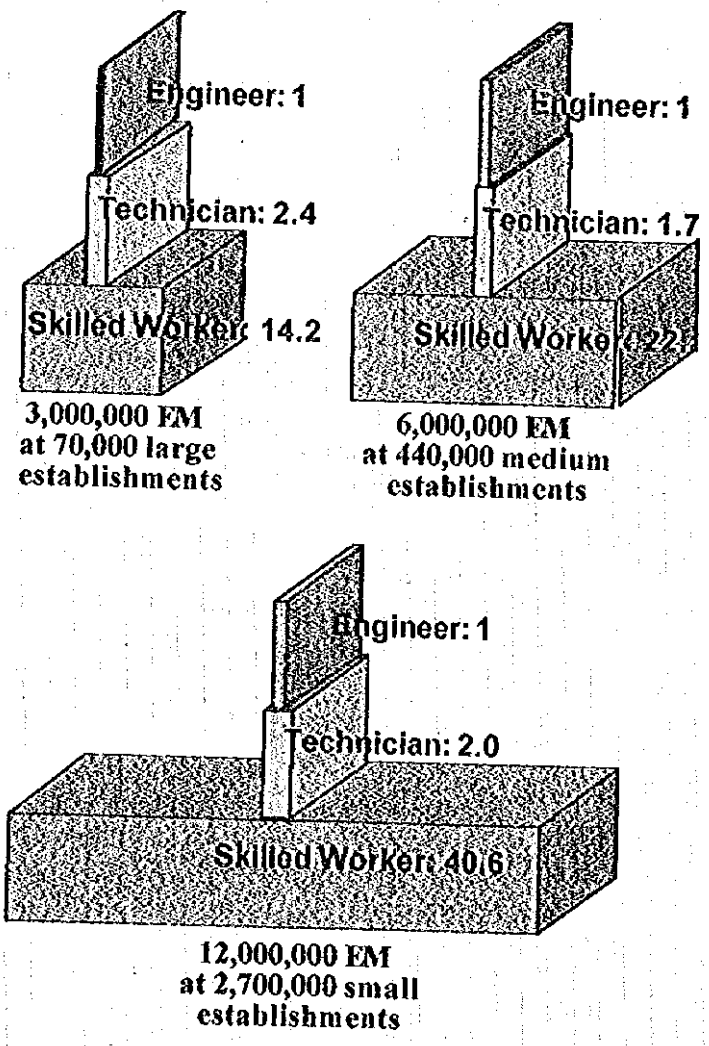
Figure 2.1 Present constitution of EM in total employment

[6] With assistance of BPS staffs, the Study Team estimates the total population of establishments as 3,256,067.

[7] Total employment estimated by the weighting samples is 69,153,000 which falls in resonable ranges compared to 64,589,327 estimated by SAKERNAS in February, 1993 (excluding self employed workers).

EM of more or less 30% in total employment is reasonable compared to other countries, however, the distribution of engineers, technicians and skilled workers seems very unique. Namely, in average, proportion of technicians is too small[8]. Consequently, major part of present Indonesian EM is dominated by skilled workers.

This tendency of small proportion of technicians and large proportion of skilled workers gets intensified as size of establishment is smaller (see **Figure 2.2**).



Figures next to "Technician" and "Skilled Worker" represent each proportions per one Engineer in each size of establishments.

Source : The Establishment Survey

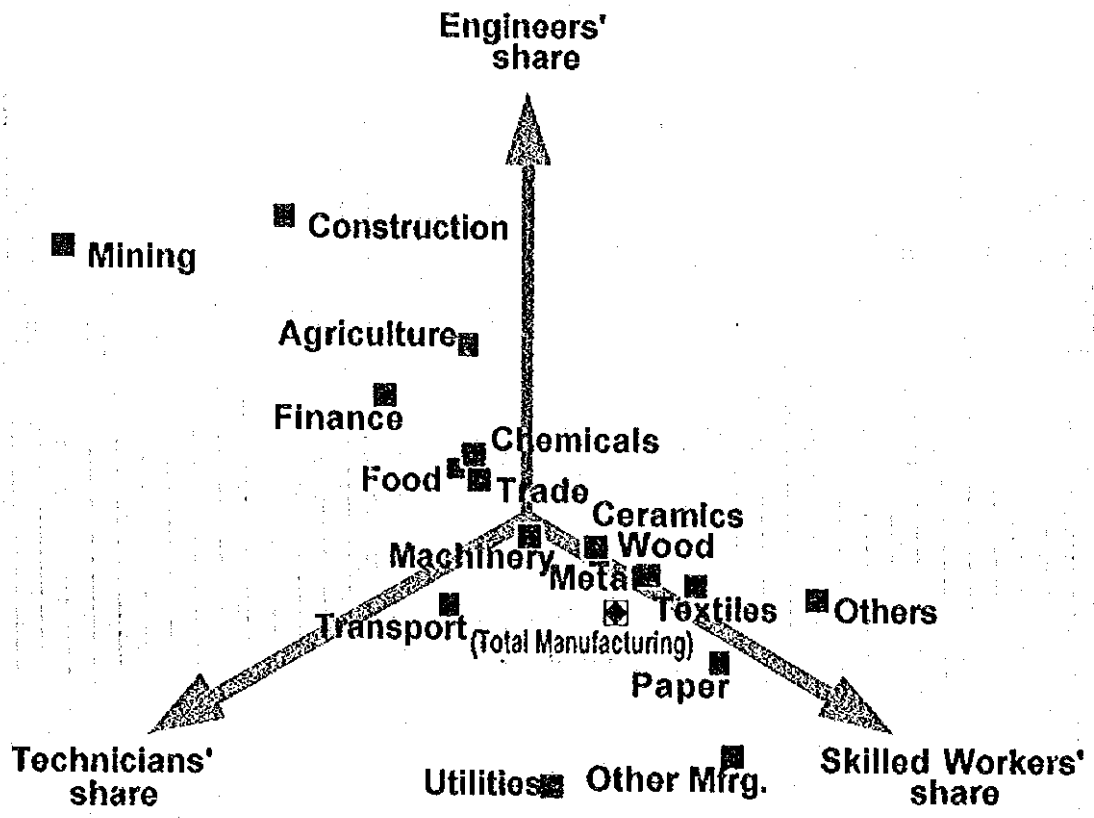
Figure 2.2 Average EM Configuration per establishment size

[8] Oridinarily 5 to 10 technicians work per one engineer in developed countries.

Focusing proportion of engineer, technician and skilled worker at each industrial sector, it is found that many manufacturing sectors are not engineer intensive in terms of number (see **Figure 2.3**). And generally speaking, present Indonesian industrial sectors range between engineer / technician intensive (construction, mining etc.) and skilled worker intensive (other manufacturing, utilities etc.)

It can be seen that the manufacturing industries as a whole are not engineer-intensive, but skilled worker-intensive.

From the viewpoint of manpower distribution, the findings in 1.2 that present



17 industrial sectors are plotted in three dimensions which represent deviations of every EM's share of each sector from average of whole industries (measures are normalized with total average as zero).

Source : The Establishment Survey

Figure 2.3 Distribution of industrial sectors in average shares of EM

level of Indonesian industrial technologies is not so advanced, is affirmed, because:

a. share of skilled workers in EM is extremely high as **Figure 2.1** although EM in total occupies appropriate portion of employment,
b. number of technicians is not enough compared to engineers as **Figure 2.2**, and
c. even at manufacturing industries which should lead innovation of industrial technologies, the portions of engineers and technicians are less than average figures of all industries.

2) Vertical and Horizontal Matching

Generally speaking, most *engineers* graduate in science/engineering from universities and most *skilled workers* graduate from high schools. In particular, the latter correspondence is universally found over the establishments surveyed, regardless of establishment sizes and industrial sectors. The former correspondence (engineer – university graduate) is relatively weak in every small size establishments and the trade and service sectors[9]. The correspondence between *technicians* and polytechnic graduates is generally weak. Characteristically, it is not very strong even in the manufacturing industries[10]. Considerable number of university graduates are employed as technicians in large establishments and major part of technicians in small establishments graduate from high schools. In sector-wise, agriculture, construction and finance employ large number of university graduates as technicians[11].

The "vertical mismatch" is especially noticeable in the relationship between university graduates and technicians. Nevertheless, few establishments say they find it difficult to secure adequate numbers of university graduates majoring in science/engineering, polytechnic graduates, and high school graduates.

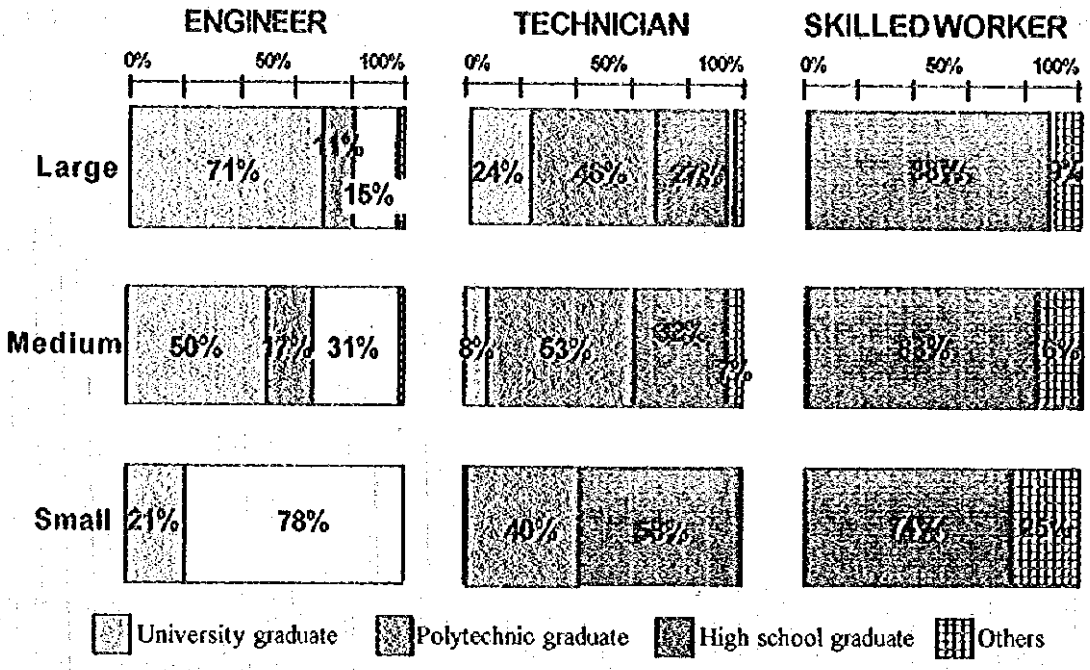
Therefore, the distribution of EM and the vertical mismatch described above, may be interpreted as reflecting that the current level of technical requirements for EM in Indonesia's industrial world is not high. Namely, industrial world can

---

[9] Proportion of university graduates in engineers is approximately, only 10% at service sectors, while the proportion at all other sectors is over 70%..

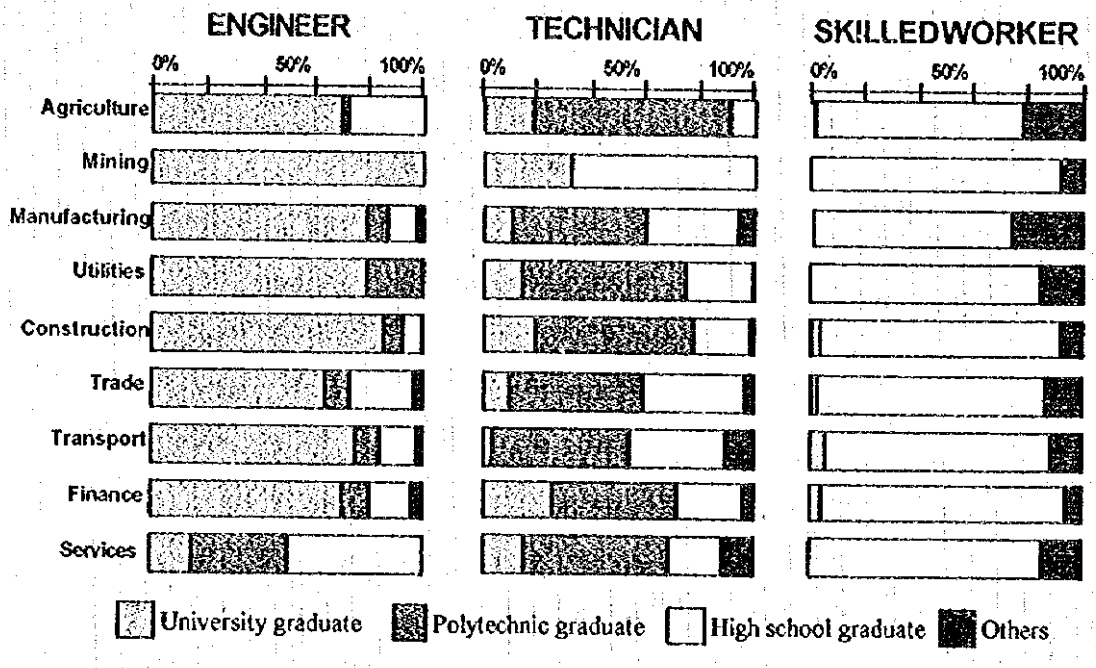
[10] Only 10% of technicians graduate from polytechnics in manufacturing sector, which is similar to technicians in trade sector and second lowest of all sectors.

[11] More or less 20% of technicians in these three sectors graduate from universities.



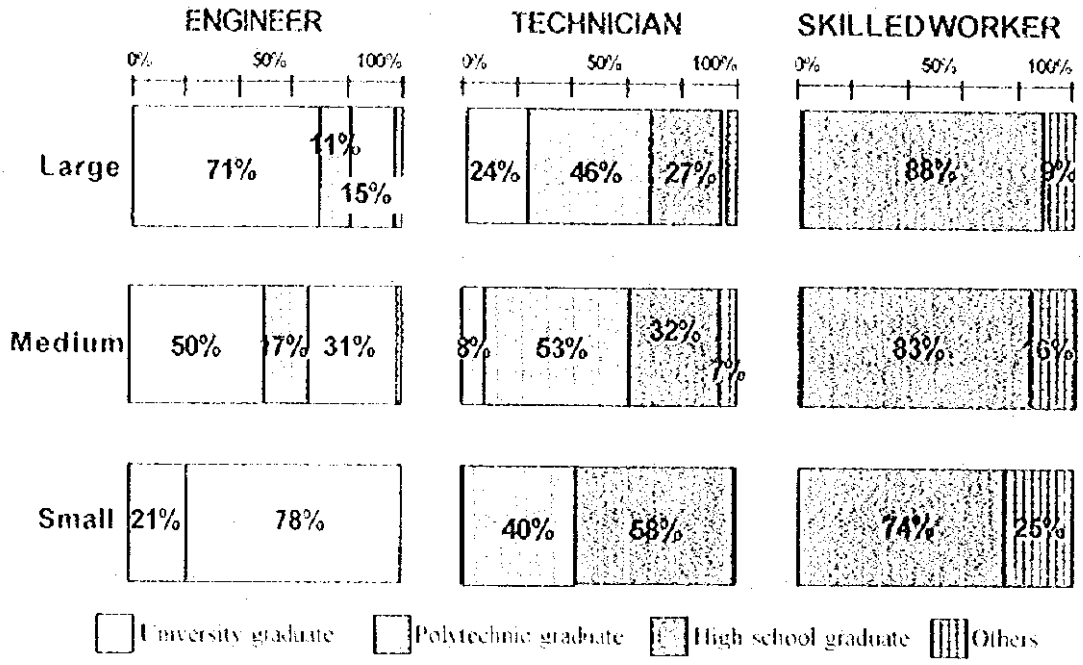
(Source : The Establishment Survey)

Figure 2.4 Supply source of EM per establishment size



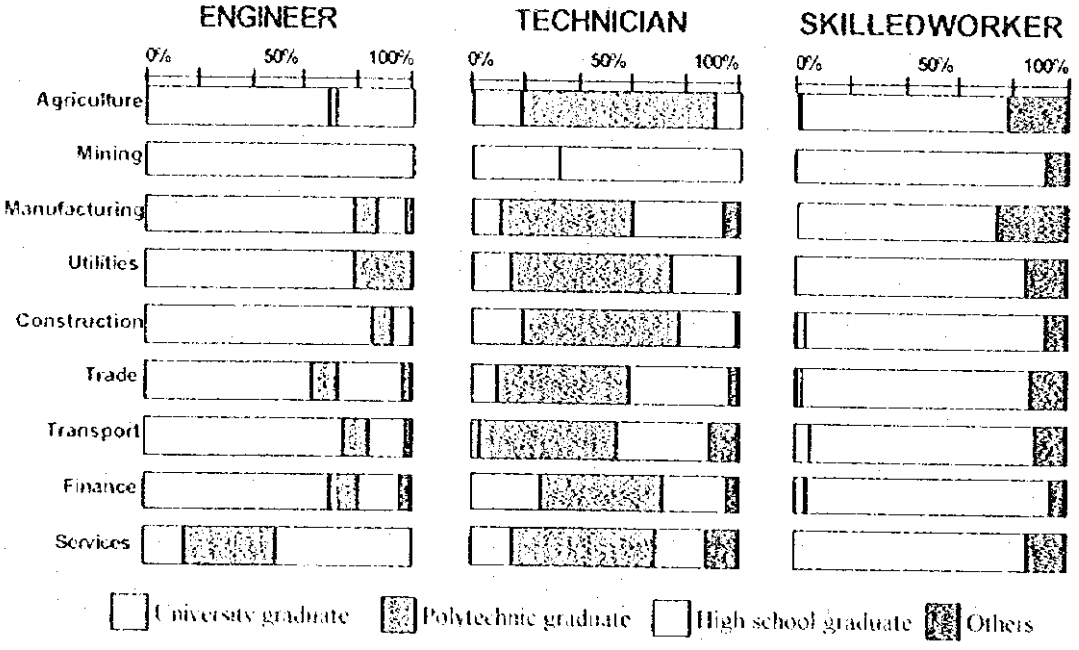
Source : The Establishment Survey

Figure 2.5 Supply source of EM per establishment sector



(Source : The Establishment Survey)

Figure 2.4 Supply source of EM per establishment size

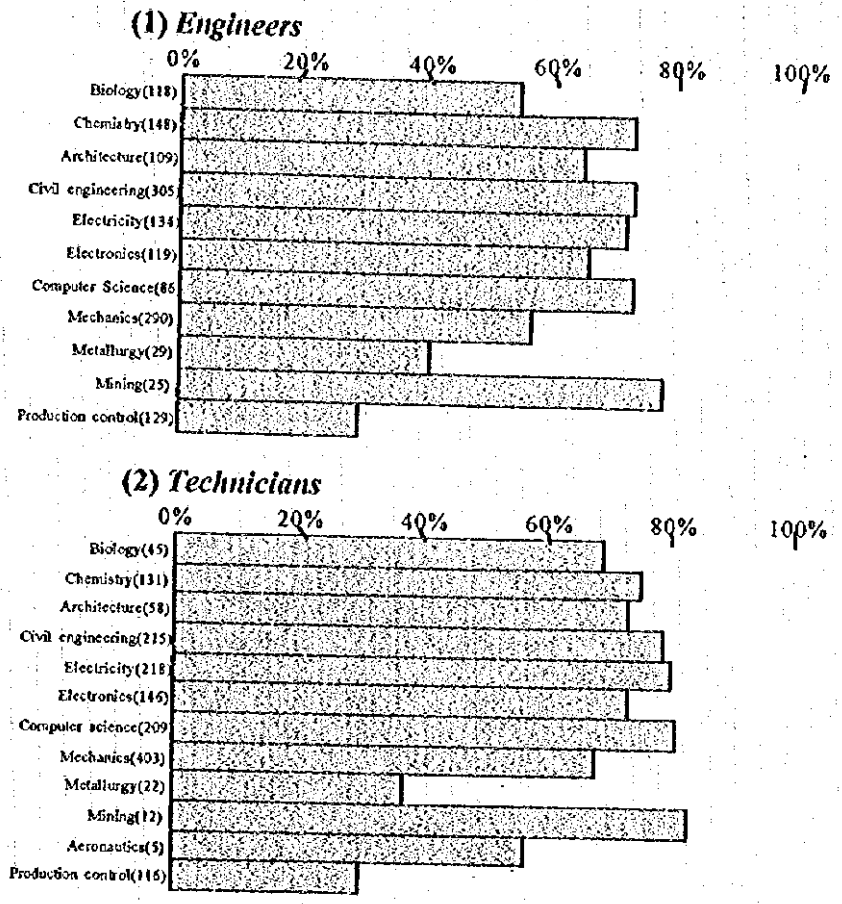


Source : The Establishment Survey

Figure 2.5 Supply source of EM per establishment sector

merely require a level of technician to the university graduates substantially provided with quality of *engineer*.

At "large" and "medium" establishments, the technical backgrounds of *engineers* and *technicians*, respectively, nearly match the contents of jobs they are doing, except in the fields of metals and production control[12]. Thus, it may be said that the degree of "horizontal mismatch" is small (see **Figure 2.6**).



Source : The Establishment Survey-Unweighted samples

Figure 2.6 Correspondence between Major and Job of EM

Remarks: Bars in Figure 2.6 represent proportions of *engineers* and *technicians*, respectively, whose fields of specialization match the present jobs assigned to them (e.g., university graduates who majored in mechanics and are working as mechanical engineers). Figures in parentheses at the right of field of specialization indicate numbers of establishments where personnel with such specialization work, in which the match ratio is averaged.

[12] According to data aggregated by industrial sector categories, the perfect matching between technical background (field of specialization) of EM and job assigned to EM is found in 96% of *engineers* and 92% of *technicians* at "large" establishments and in 100% of *engineers* and 80% of *technicians* at "medium" establishments.

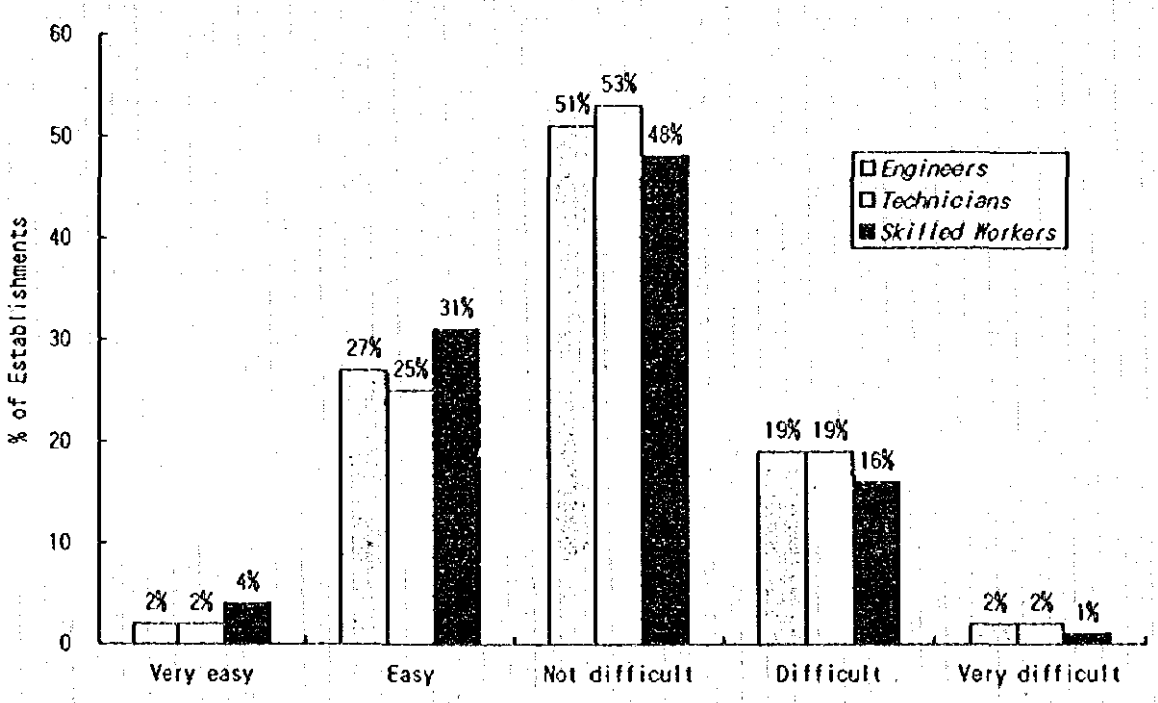
Behind the above close correspondence between major and actual job of *engineers*, there would be a fact that university graduates are being oversupplied and employers can easily find persons with required titles. Once assigned to the job, *engineers* and *technicians* would not be relocated, since the required technical fields still lack in diversity and flexibility reflecting not so high level of technical requirements at present.

3) Recruit

Most of establishments surveyed find no problem in hiring any class of EM as shown in **Figure 2.7**. This indicates that the establishments surveyed find no problem in hiring any class of EM.

Many employers say that they are quite satisfied with the levels of technical education that newly employed technical and engineering personnel received at their schools. This may be ascribable to the overestimation of academic career

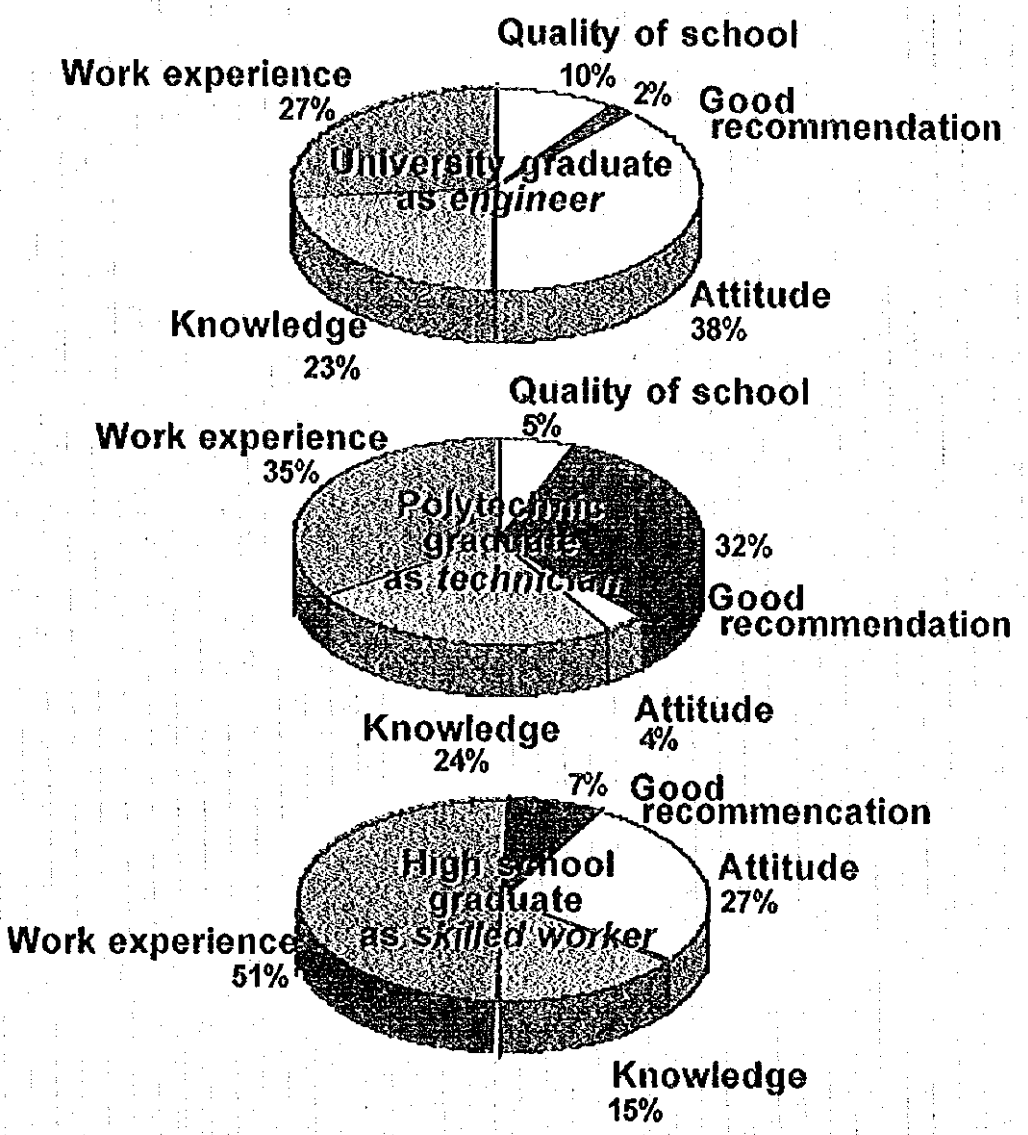
[Unit: Enterprise]



Source : The Establishment Survey

Figure 2.7 Conditions concerning recruitment of employees in sufficient quantities

and there is tendency that excessive emphasis is placed on "alma mater" and some qualifications which have little to do with the practice of business. This tendency is especially strong when it comes to recruiting *engineers* (see **Figure 2.8**).



Average for all establishments which recited relevant students last year.

Source : The Establishment Survey

Figure 2.8 Points to see at recruiting new graduates

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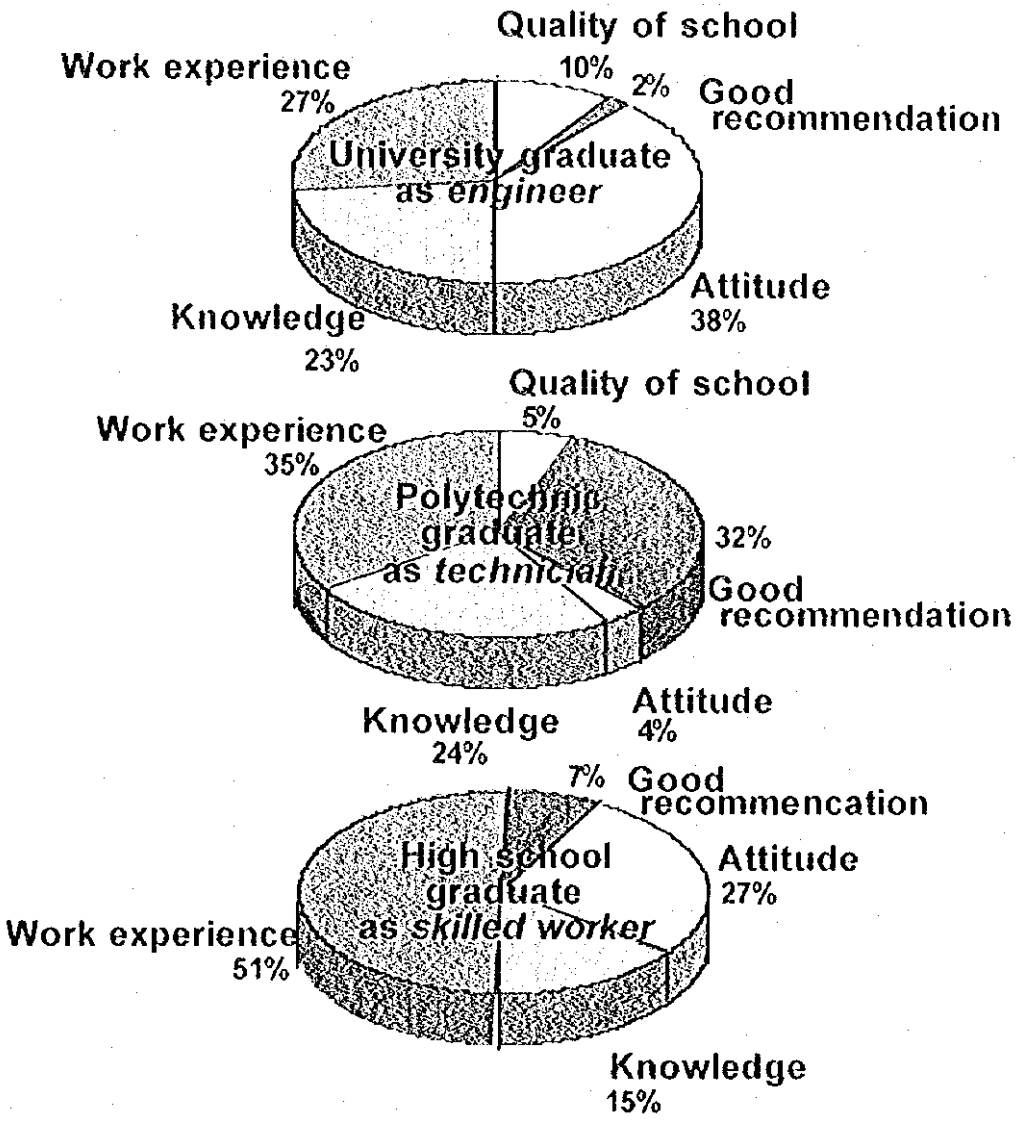


Average for all establishments which recited relevant students last year

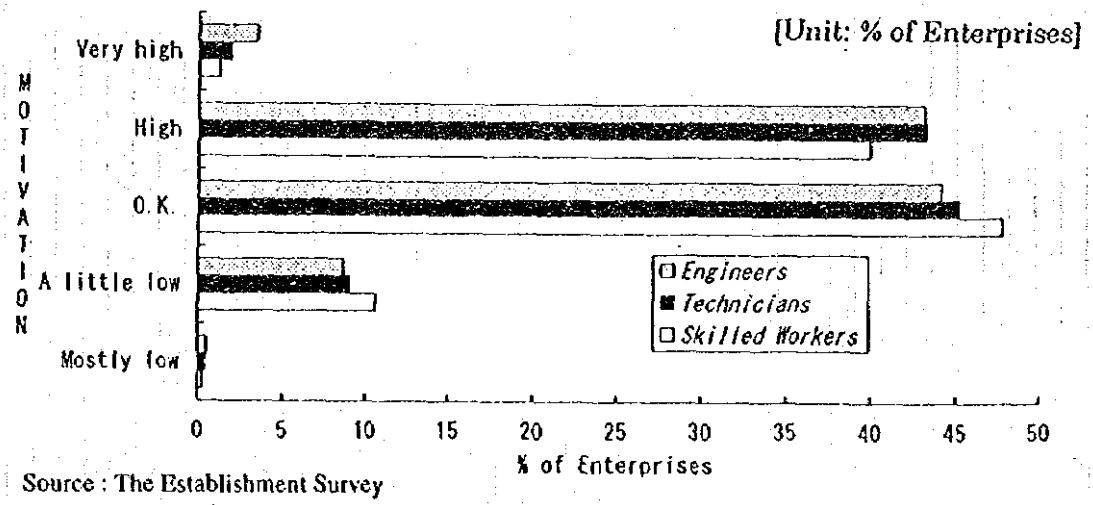
Source : The Establishment Survey

Figure 2.8 Points to see at recruiting new graduates

The average age of newly employed *engineers* and *technicians*, respectively, is higher by several years than the standard age at which they should graduate universities and polytechnics[13]. This suggests that in the case of *engineers* and *technicians*, the so-called external efficiency is not high. Namely, the knowledge and experience they have acquired are not effectively utilized. Besides, in the meantime, the level of technology which comprises the knowledge and experience of university and polytechnic graduates might decline. Thus, the total loss is substantially great.

Most of the establishments surveyed are satisfied with the levels of skill and technology of their employees: 88% for *engineers*, 90% for *technicians*, and 92% for *skilled workers*. Probably, this reflects the fact that the levels of skill and technology needed are not so high. In other words, there might not be much incentive for the improvement of technology. In many cases, establishments recruit technical and engineering personnel through help-wanted ads or personal contacts. In any categories of EM, the ratio of persons who find jobs with the help of their schools is small.

Incidentally, there are not many establishments which will recruit employees at other companies[14].



Source : The Establishment Survey

Figure 2.9 Establishment satisfaction with employee motivation

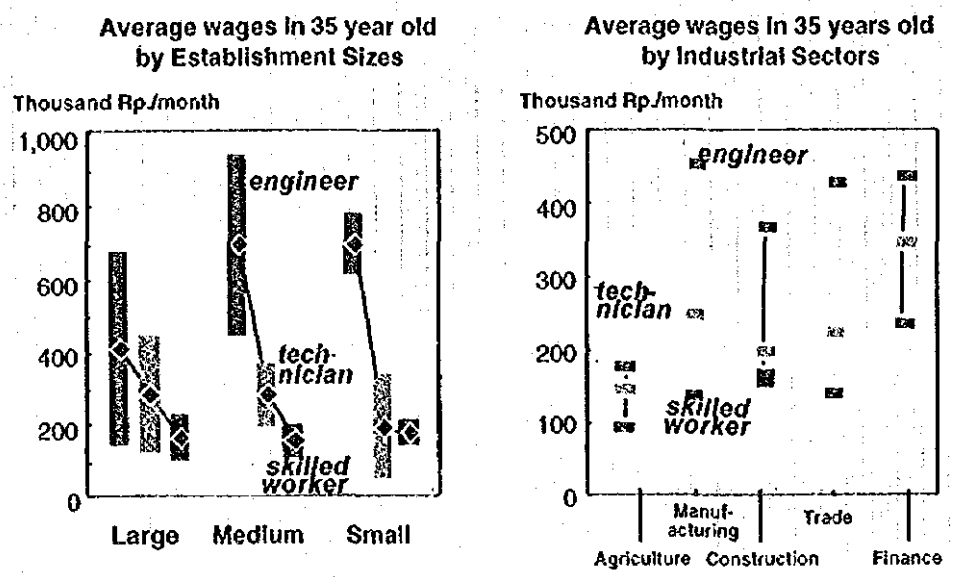
[13] The average age of newly employed *engineers* is 27, and that of newly employed *technicians* is 25.

[14] In any industrial sector and region, not more than 10% or so for *engineers* and *technicians*. In the case of "skilled workers," the percentage is still smaller. This denies the views given in 1.3(5)1)d. Namely, the low degree of interest the universities show in helping their graduates to find jobs (e.g., the graduates' list is not maintained) seems to be attributable to universities' own problem.

As seen in Figure 2.9, 40% of establishments stated that their EM have "high" work motivation, and 45% of establishments stated that their EM have "OK" motivation. In interviews with personnel managers, the Study Team learned that management of most enterprises do not have very demanding expectations of EM. This may be one of the reasons that EM receive mostly high and "OK" evaluations. Referring to our study results in other countries in Asia, Indonesia needs EM with high motivation. Though Indonesian employers would have to require their EM to be more eager to work i.e. improving productivity or quality assurance and being diligent from the stand point of company's performances in Indonesia, the survey result could not always show the level of their motivation is high.

4) Wage

It is not uncommon that *engineers* earn twice as much as *technicians*, who in turn earn twice as much as *skilled workers*. A wage gap like this exists at all sizes of establishments (see **Figure 2.10**). Except that wages of all EM in agriculture sector are noticeably low and those of *technicians* in finance sector are high, generally speaking, the wage gap by industry is small for every class of EM.



Wage does not include bonus or other fringe benefit. Diamonds in the left chart represent average of each EM's wage for every size of establishments and bars behind diamonds show its statistical variation.

Source : The Establishment Survey

Figure 2.10 Average Wages of EM at age of 35

The results shown above restate the problem of difference in treatment of EM that has been pointed out in Part I[15].

5) Placement and R&D

The present condition of job assignments of engineers and technicians is shown in **Table 2.2**. The smaller the scale of establishment, the more conspicuous is the trend of the parting of *engineers* and *technicians* from the production scene. This is especially true with manufacturing industries. It is conceivable that at small establishments, *engineers* who are generally small in number have to take care of more than one department.

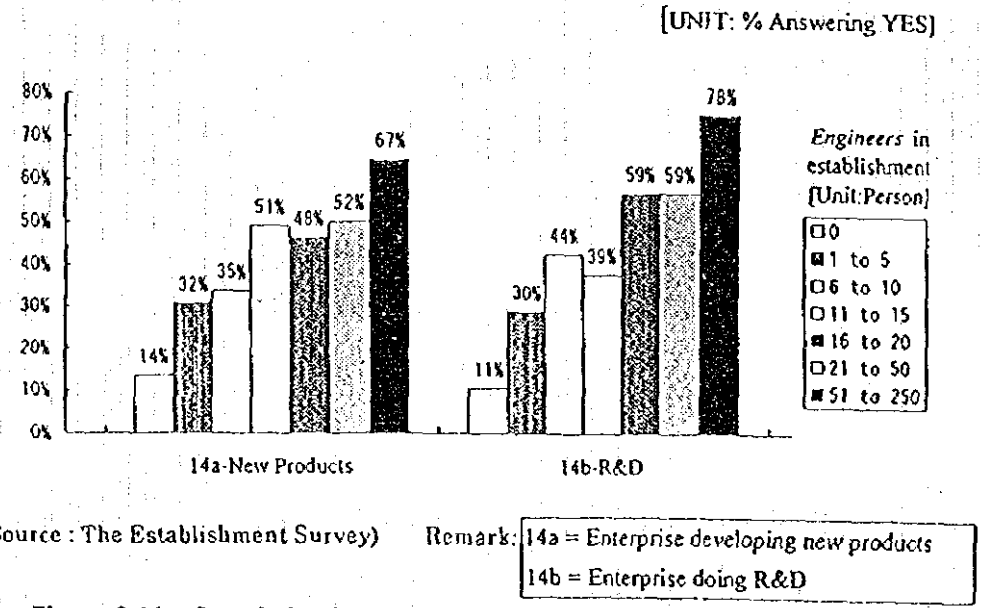
Table 2.2 Assignment of *engineer* and *technician* by department

[Unit: %]

Department	*Engineer*		*Technician*	
Planning/Design	23.7	(42.9)	14.2	(28.2)
Production	38.2	(10.3)	51.5	(11.8)
Purchasing	1.4	(2.4)	3.4	(5.3)
Marketing	11.3	(28.6)	5.5	(8.2)
Other	25.4	(15.9)	25.4	(46.5)

(Note) Figures in parentheses are those for small and medium-sized enterprises.

Source : The Establishment Survey



(Source : The Establishment Survey) Remark: 14a = Enterprise developing new products
14b = Enterprise doing R&D

Figure 2.11 Correlation between number of *engineer* in establishment and developing new products or doing R&D

[15] Part I 1.3 (5)2)c [Page I-35].

However, it is small and medium-sized companies that really need production technology and engineering on the production scene. The fact that considerable proportions of engineers are engaged in design and sales suggests that the engineers are making insufficient contributions to the improvement of productivity and technology.

Of the establishments surveyed, 80% are not developing new products for themselves and 84% are not conducting research and development. (See **Table 2.3** and **Table 2.4**)

Backing the recognition that the development of new products and R&D activity are the responsibility of engineers, the proportion of establishments which conduct product development and R&D is higher among those which hold more than 50 *engineers* (See **Figure 2.11**).

Engineers are also playing an important role in introducing new technologies from industrialized countries and in cooperating with human resources development agencies. Only 13% of the establishments surveyed are cooperating with human resources development agencies. (See **Table 2.5**)

Table 2.3 The enterprises develop new products

[Unit: Enterprises]

Value	Frequency	%
YES	604	19.1
NO	2,552	80.9
TOTAL	3,156	100.0

Source : The Establishment Survey

Table 2.4 The enterprises conduct research & development

[Unit: Enterprises]

Value	Frequency	%
YES	530	16.8
NO	2,626	83.2
TOTAL	3,156	100.0

Source : The Establishment Survey

Table 2.5 Cooperation with educational institutions

[Unit: Enterprises]

Value	Frequency	%
YES	408	12.9
NO	2,748	87.1
TOTAL	3,156	100.0

Source : The Establishment Survey

6) In-House Training of EM

In-house training for EM is implemented at about one-half of the establishments. Generally speaking, however, the smaller the establishment size, the lower is the rate of implementation. Compared with *engineers* and *technicians*, *skilled workers* are given less in-house training (see **Table 2.6**).

Table 2.6 Implementation of In-House Training for EM

	Engineers			*Technicians*			*Skilled workers*		
	Large	Medium	Small	Large	Medium	Small	Large	Medium	Small
30 Manufacturing	53%	44%	17%	57%	41%	10%	51%	25%	17%
50 Construction	57%	34%	26%	60%	45%	27%	53%	34%	21%
60 Trade	58%	68%	38%	70%	69%	32%	59%	43%	24%
70 Financial Services	79%	71%	75%	66%	70%	56%	76%	61%	57%
(Average)	56%	50%	40%	60%	52%	31%	55%	38%	25%

Source : The Establishment Survey– unweighted samples

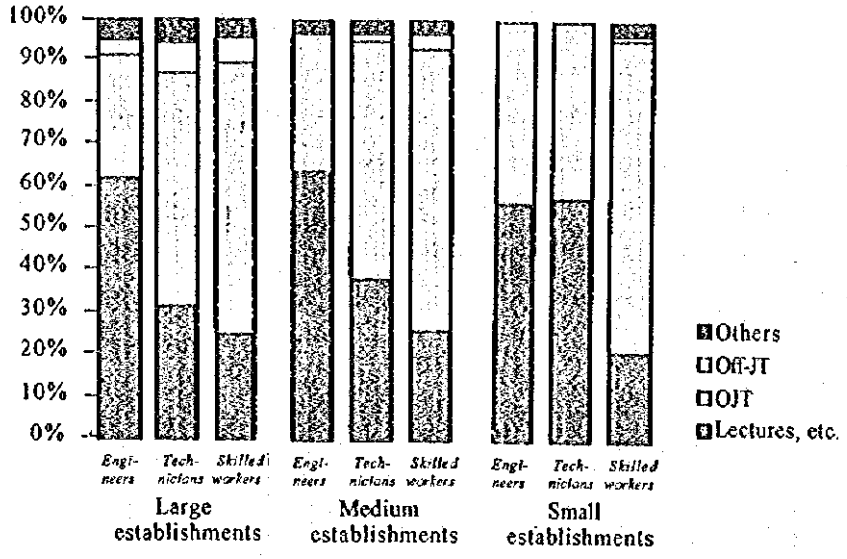
[n=737(engineers), 756(technicians), 2,235(skilled workers)]

The in-house training for *engineers* consists mainly of classroom studies, including lectures. In the case of *technicians* and *skilled workers*, by contrast, OJT accounts for larger proportions of in-house training (see **Figure 2.12**).

(3) Present Condition of EM Supply and Demand found at Establishment Survey Results

The major findings at the establishment survey about the present condition of EM in Indonesia are summarized below.

1) Engineers



Source : The Establishment Survey– unweighted samples
n=375(engineers), 408(technicians),
1,359(skilled workers)

Figure 2.12 Contents of In-House Training by Establishment Size

a There is not much demand for engineers, except in a few large corporations.
b. 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.
c. At many companies, *engineers* are guaranteed with much higher salaries than *technicians*, which seem to be paid regardless of *engineers'* performance.

2) Technicians
a. Share of technicians is inproportionally small. This tendency is intensified as establishment size gets smaller.
b. 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).
c. 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.
d. Only small proportions of small and medium-sized manufacturing companies provide in-house training for technicians.

3) Skilled workers

a. 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.

b. Many of *skilled workers* earn much less than *technicians*.

c. 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. At small and medium-sized manufacturing companies, in particular, in-house training for *skilled workers* is seldom implemented.

2.2 Outlook for EM Supply and Demand

(1) Method of EM Supply/Demand Forecast

1) Purpose of Forecast

In this study, in place of the total employment projected in PJP-II, the future employment estimated by the Study Team shall be assumed[16]. The future employment was estimated as an essential prerequisite for achieving the economic growth planned in PJP-II through the prescribed course of development. The first purpose of the EM supply/demand forecast is to clearly indicate the volume of EM employment in the total employment.

In a sense, the EM development plans and policies are measures to eliminate both the actual and predictable impediments to achieving the assumed economic growth under the above scenario. The second purpose of the EM supply/demand forecast is to indicate future problems relating to EM supply and demand.

2) Outline of Forecasting Procedure

As a tool for estimating future EM demand from the macro conditions of the above scenario, an input-output model is used. Using the future final demand and input coefficients[17] as exogenous variables, the output and value added by industrial sector are obtained, which is multiplied by the labor input coefficients, leading to the forecast number of EM required in the future by industrial sector and by occupation. By comparing the forecast results with the EM supply by academic career planned in PJP-II, an EM supply-demand gap[18] in the future is detected and at the same time, an attempt is made to extract growth impeding and promoting factors as problems to tackle.

The forecasting process is schematically shown in **Figure 2.13**.

3) Limitations of Forecast

The forecasting procedure used in the present study involves several problems, such as (1) the problem of reliability of forecast over a period as long as 25 years, (2) problems inherent in input–output model[19], and (3) problems arising from

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[16] See **1.1(3)2) [Page I-10]**.

[17] Explained later. See **2.2(2)1) [Page II-20]**.

[18] The "supply-demand gap" detected by this forecast model does not necessarily reveal concrete problems, such as unemployment. Rather, it is a reference in identifying possible problems (see **2.3(1)1) [Page II-29]**.

[19] They consist of two questions. One is whether or not the change in technology can be accurately

(to be continued)

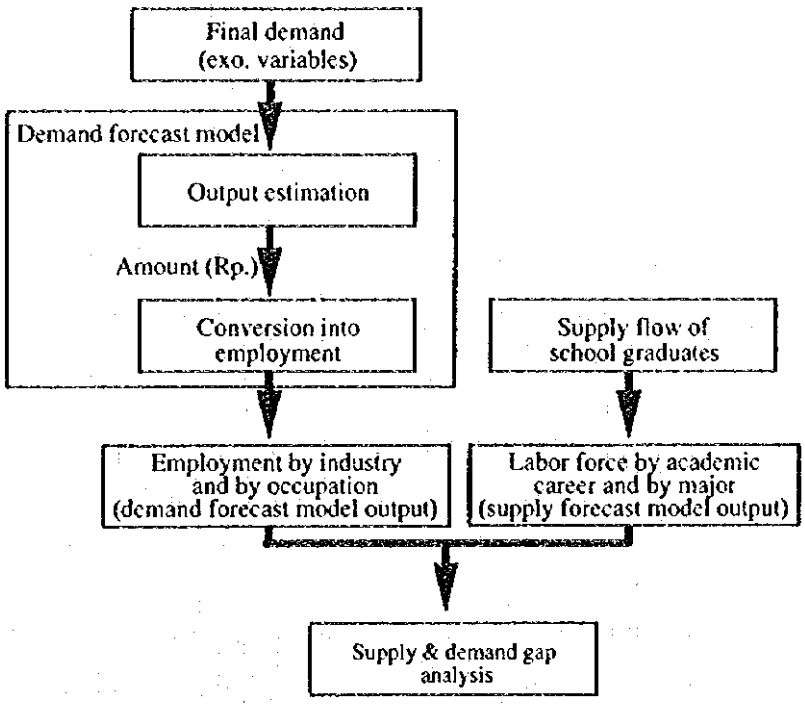


Figure 2.13 EM Supply-Demand Forecasting Process

incomplete data[20] used in the forecast. Thus, 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.

(2) Premises and Parameters for Demand Forecast

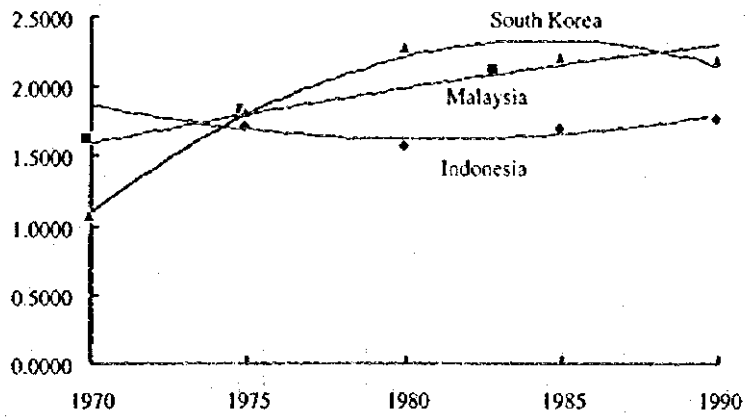
1) Input Coefficient

Of the past decade, Indonesia's economic-related structure has deepened very slowly but consistently even after the departure from the oil-dependent economy during 1980-1985 (see **Figure 2.14**).

It is true that, due to the underdeveloped supporting industries, etc., the inter-

(continued)
represented by the input coefficient, which is a price model, not a quantity model. The other is the validity of assuming the complete utilization of resources. With respect to the former question, price which is substantiated using as many price indexes as possible shall be substituted for quantity. As for the latter, there is no solution but to study the possibility of the interruption of multiplier effect and reflect the study results in evaluating the forecast value.

[20] In Indonesia, dependable time-serial statistics about capital stock and wages are unavailable. (The existing capital stock statistics are based on estimates; wage statistics are gathered every year, but they are also based on estimates from survey results of some 200 samples.)



Source : Each countries' input-output statistics processed by the Study Team

Figure 2.14 Transitions in Total Output Induction Coefficients[21] In Indonesia, Malaysia and South Korea

industry relations in Indonesia are weaker than in other countries. But, the Indonesian ndustrial structure is showing sophistication at a stable pace, starting from this low level.

Therefore, it is possible to emulate the transitions in the past by projecting the trend of input structure[22]. When the structural change in input coefficients of Indonesia's industry is projected along this consistent trend, the inter-industry structure after 2013/4 comes close to those of Malaysia and South Korea at the time when the two countries are considered to reach its economic turning point (see Figure 2.15). In line with the macroscopic understanding of PJP-II in this study, the extended structural change in the past input coefficients in Indonesia is used as a parameter in the EM demand forecast.

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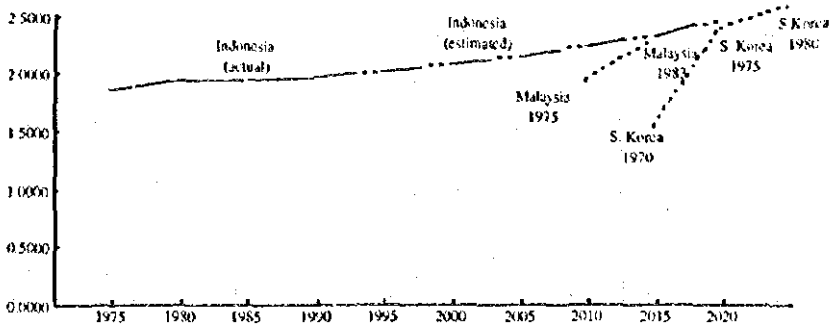
[21] Coefficient indicating how much output (multiple of 1) the final demand of 1 (composition by industrial sector is expressed in %) brings about through the multiplier effect of the interindustry-relations structure of a country. It is determined by two factors-production inducing coefficient by industry and final demand composition by industry. The trend lines in the diagram are approximation by a quadratic curve.

[22] To check the explanation of structural changes in the past, an RAS estimation was made with a nonsquare matrix containing a value-added section. (The RAS algorithm at the time of IR II was modified accordingly.) The input coefficient matrix was estimated as follows. The values obtained by R vector (n+k rows) and S vector (n columns) were proportionally changed so that the sum of each row became 1. An attempt was also made to estimate the matrix using the RECRAS method (developed by Japan Development Bank's Equipment Investment Research Institute) which always gives 1 as the sum of row. However, when data about Indonesia was input, the most important "value added coefficient" reacted excessively. Because of this, the modified RAS method produced better results of emulation

(to be continued)



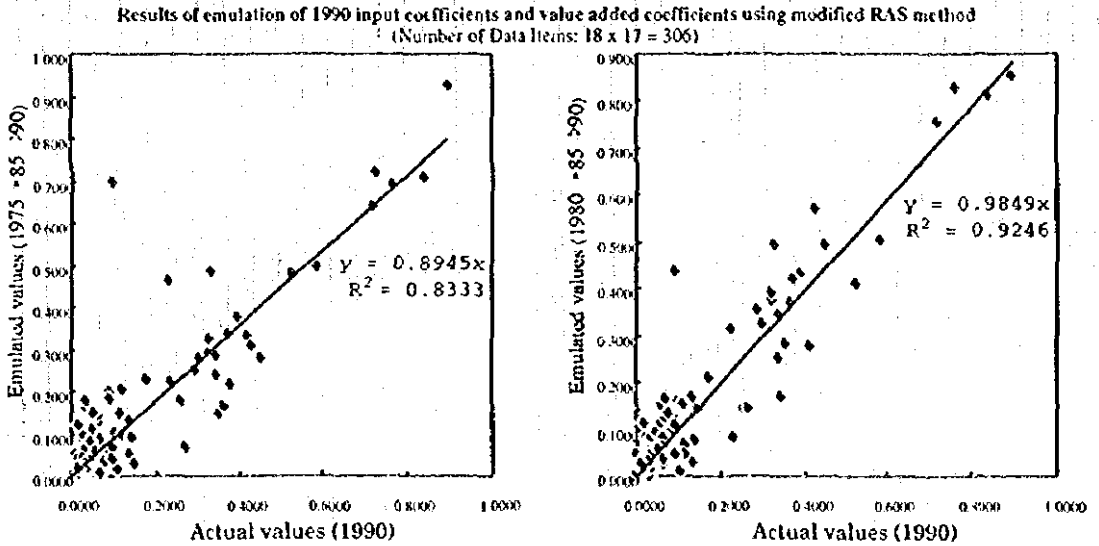
Source : Each countries' input-output statistics processed by The Study Team

Figure 2.15 *Trend of Multiplier Effect*[23] *of Indonesia's Industrial Structure*

2) Labor Coefficient

With the exception of mining and construction, all the industries of Indonesia have continued to improve in labor productivity (amount of value added per number of labor = average labor productivity) (see **Table 2.7**). The improvement of labor productivity is especially conspicuous in the wood products, chemical, and machinery industries. It should be noted that the marked improvements in labor productivity in those industries are attributable to the fact that capital investments producing a high value added which outpaces the employment

(continued)



[23] The average of production inducing coefficients of the individual industries (the sum of columns in an inverse matrix table), or the reference "influence coefficient," was used as the indicator of the degree of industrial structure growth.

growth have been made. It is not that any increase in GDP is directly reflected in the employment. The Study Team estimates the 2018/9 employment to be 2.0 times of the 1993 employment, meanwhile GDP is planned to become sixfold (on 1993 price basis). This indicates that the average labor productivity rises 2.9 times in that period[24].

The trend of average labor productivity[25] by industry and occupations corresponding to engineer, technician, and skilled worker[26] was calculated on the basis of Indonesia's employment table data. It can be projected to obtain an labor input coefficient as the multiplicand for the amount of value added[27].

Table 2.7 Transition in Average Labor Productivity in Indonesia

(GDP per employee: 1 billion rupiar)

	1980	1985	1990	Annual growth rate
Agriculture	0.93	0.96	1.09	1.64%
Mining	80.28	49.76	36.72	-7.52%
Manufacture: Food	3.20	3.45	4.45	3.37%
Textiles	1.17	1.65	2.48	7.76%
Timber etc.	0.78	1.19	2.37	11.68%
Pulp&Paper	3.89	3.78	8.88	8.60%
Chemicals	8.28	29.84	23.47	10.98%
Ceramics etc.	1.49	2.47	2.00	2.98%
Basic Metals	10.61	13.20	18.03	5.44%
Machinery	3.36	5.28	8.71	9.99%
Other Mfrg.	0.54	2.23	0.57	0.49%
Utilities	9.39	6.26	10.88	1.48%
Construction	4.19	4.43	4.11	-0.21%
Trade	2.49	2.41	3.16	2.38%
Transportation etc.	2.81	4.28	5.20	6.34%
Financial services	20.96	62.55	45.03	7.95%
Other services	1.84	2.03	2.14	1.49%
Average	2.16	2.30	2.80	2.61%

Source : Employment Table and Input-output table statistics processed the Study Team (on 1990 constant price)

[24] Based on PJP-II, the employment growth estimate of which is more conservative, the improvement in average labor productivity during the period under consideration becomes 3.1 times.

[25] To derive subsequent results, it was assumed that the average labor productivity for each of the jobs be projected in a geometric series. It seems that in PJP-II too, a decline in labor productivity (increase in employment) in the construction sector is forecast.

[26] Here, the Study Team decides on the jobs of engineers, technicians, and skilled workers.

[27] For process of estimating the coefficients, see APPENDIX 11.

3) Correlation with Academic Background and Technical Field of Specialization

It should be noted that the demand for engineers, technicians, and skilled workers by industrial sector obtained by the above forecasting process is valid only for specific occupations. It cannot be directly compared with the actual supply, that is, the manpower stocks divided into categories of academic background and technical field of specialization. Identifying a supply-demand gap is work involving subjective judgment, and the establishment survey results should provide information which serves as a standard of judgment[28]. By multiplying the EM academic background composition by industry, shown in **Figure 2.5** (Page **II-8**), and the specialization field composition (only for *engineers* and *technicians*), shown in **Table 2.8** below, by the EM demand for each specific job, it is possible to obtain the figures that can be compared directly with the supply of EM.

Table 2.8 Composition of EM by Industry and by Major

(Average figures for ***Engineers*** and ***Technicians***)

	10 Agri-culture	20 Mining	30 Manufac-turing	40 Utilities	50 Const-ruction	60 Trade	70 Transpor-tation etc.	80 Financial services	90 Other services
Biology	65%		9%	11%	1%	6%	7%	10%	50%
Chemistry	2%		15%	9%	1%	6%	3%	2%	13%
Architecture		6%	3%		10%	7%	13%	7%	
Civil eng.	2%	13%	10%	26%	69%	10%	27%	30%	
Electricity			6%	40%	6%	8%	23%	3%	
Electronics	1%		7%		1%	5%	2%	4%	13%
Computer		4%	3%			13%		7%	
Mechanics	7%	3%	25%	8%	6%	21%	15%	7%	6%
Metallurgy			2%		1%	1%			
Mining		67%			1%	1%		3%	13%
Aeronautics		8%							
Production	2%		12%			9%	3%	6%	
Nuclear power									
Others	20%		8%	7%	3%	12%	7%	20%	6%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: the Establishment Survey

[28] A conditional base of judgment, e.g., "*If the present condition of overqualified employment is allowed to continue, then so-and-so gap can occur.*"

(3) Results of Forecasts

1) Demand Forecast

Table 2.9 Forecast EM Demand in Indonesia by Industry and Occupation

(1) 2003/4

	(A) Value added (trillion Rp.)	(B) Average labor productivity (inversed figures to extention of Tab.2.3)			(A) x (B) EM Demand (thousand persons)		
		Engineers	Technicians	Skilled workers	Engi-neers	Techni-cians	Skilled workers
Agriculture	58,742	0.0006	0.0121	0.0038	33	697	222
Mining	38,992	0.0009	0.0024	0.0043	33	93	164
Manufacture: Food	40,491	0.0004	0.0035	0.1248	14	138	4,966
Textiles	7,048	0.0005	0.0048	0.1904	4	34	1,319
Timber etc.	6,172	0.0001	0.0016	0.1329	1	10	806
Pulp&Paper	13,864	0.0007	0.0031	0.0429	10	42	584
Chemicals	41,157	0.0004	0.0013	0.0102	17	52	413
Ceramics etc.	2,798	0.0011	0.0063	0.4544	3	17	1,249
Basic Metals	16,216	0.0004	0.0024	0.0332	7	39	528
Machinery	16,330	0.0015	0.0072	0.0315	23	115	506
Other Mfrg.	308	0.0332	0.1668	1.6759	10	51	508
Utilities	5,946	0.0025	0.0235	0.0059	14	138	35
Construction	20,668	0.0036	0.0005	0.2853	72	9	5,795
Trade	56,617	0.0001	0.0012	0.0044	8	64	247
Transportation etc.	31,806	0.0030	0.0050	0.0028	94	156	86
Financial services	80,179	0.0001	0.0044	0.0006	11	345	51
Other services	39,621	0.0050	0.0324	0.0577	194	1,262	2,248
Total	476,956				548	3,261	19,729

(2) 2018/9

	(A) Value added (trillion Rp.)	(B) Average labor productivity (inversed figures to extention of Tab.2.3)			(A) x (B) EM Demand (thousand persons)		
		Engineers	Technicians	Skilled workers	Engi-neers	Techni-cians	Skilled workers
Agriculture	93,484	0.0005	0.0118	0.0035	39	936	274
Mining	111,020	0.0006	0.0017	0.0030	55	158	279
Manufacture: Food	123,649	0.0003	0.0028	0.1008	30	295	10,540
Textiles	17,341	0.0003	0.0023	0.0908	4	34	1,330
Timber etc.	22,409	0.0000	0.0004	0.0370	0	8	701
Pulp&Paper	113,066	0.0003	0.0013	0.0182	29	126	1,736
Chemicals	156,423	0.0001	0.0004	0.0031	17	52	413
Ceramics etc.	6,618	0.0010	0.0059	0.4273	6	33	2,390
Basic Metals	101,006	0.0003	0.0016	0.0219	24	136	1,867
Machinery	48,211	0.0005	0.0025	0.0110	21	102	450
Other Mfrg.	132	0.0450	0.2264	2.2744	5	25	254
Utilities	26,801	0.0012	0.0117	0.0030	28	265	67
Construction	34,872	0.0054	0.0007	0.4306	159	21	12,691
Trade	126,168	0.0001	0.0005	0.0043	8	54	456
Transportation etc.	100,855	0.0016	0.0030	0.0017	135	253	148
Financial services	320,913	0.0000	0.0030	0.0002	12	810	48
Other services	78,644	0.0065	0.0379	0.0518	433	2,518	3,445
Total	1,481,613				1,004	5,826	37,089

Source: Processed by the Study Team

The EM demand in each of 2003/4 and 2018/9, forecast using the parameters described above, is as shown in **Table 2.9**. 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 2018/9.

2) Comparison with Supply Estimate (1) – "Vertical Mismatch"

Based on the educational plan of PJP-II, the numbers of graduates in science/engineering from universities, polytechnics, and vocational/ordinary high schools in the future were estimated. The total number will be 18.1 million in 1998/9, 22.967 million in 2003/4, and 39.5 million in 2018/9 (2.0 million university graduates, 0.8 million polytechnic graduates, and 36.7 million high school graduates)[29]. Thus, in terms of total number of EM, it is expected that the supply and demand will become nearly balanced in 2003/4 and then, an undersupply will occur in 2018/9.

Judging from the above supply forecast that assumed the current supply capacity of polytechnics as the starting point (for forecasting the number of polytechnic graduates), it is polytechnic graduates – the assumed prime supply source of technicians – that will become extremely undersupplied (the demand for technicians will be 12.2 times of the supply in 2003/4 and 7.1 times of the supply in 2018/9). On the other hand, assuming that the ratio of students who go on to universities will increase dramatically and the labor productivity in industry will improve appreciably, graduates in science/engineering from university – the assumed prime supply source of engineers – will become extremely oversupplied (the supply will be 1.1 times of the demand in 2003/4 and 2.0 times of the demand in 2018/9). With respect to the supply-demand of high school graduates and skilled workers, they will be close to be balanced in 2003/4 (taking into account the decline in labor force participation rate in the future) and be undersupplied in 2018/9.

As seen in **Table 2.2**, 51% of technicians work directly on production, compared to 38% of engineers. Large numbers of engineers are assigned to positions away from production, like planning, design, and marketing. If there is a large gap in the supply of technicians in the future, this will have a direct negative impact on manufacturing production in Indonesia.

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[29] See **Table 1.5** in Part I, **1.3(3)2)** [Page **I-29**]. The amount of future stock (on population composition basis) was estimated by adding the future supply flow sequentially to the amount of existing stock, following the PJP-II plan to improve the rate of students who go on to schools of higher grade.

3) Comparison with Supply Forecast (2) – "Horizontal Gap"

Assuming that today's relatively simple correlation between job assignment and field of specialization of *engineers*[30,31] continues to hold true in the future, the future demand for engineers by field of specialization can be obtained as **Table 2.10** by multiplying the forecast demand by the EM composition by industry and by field of specialization shown in **Table 2.8**.

Comparing this demand with the amount of manpower stock[32] by academic background and by field of specialization obtained by assuming that the present trend of technical specialization continues in the future, it is expected that even with university graduates being oversupplied, *engineers* in the fields of construction, civil engineering, and computer science will become extremely undersupplied[33]. In particular, engineers in construction and civil engineering are

Table 2.10 Estimated *Engineer* Demand by Sector and Major

– 2018/19 –

[Unit: 1000 persons]

	10 Agri-culture	20 Min-ing	30 Manu-facture	40 Utility	50 Const-ruction	60 Trade	70 Trans-port	80 Fin-ance	90 Others	(Total)
Biology	24		12	2	2		6	1	51	98
Chemistry	1		20	2	2		3		52	80
Architecture		4	4		16		11	1	18	54
Civl eng.	1	8	13	6	112	1	24	3	18	186
Electricity			8	9	10	1	20		18	66
Electronics			9		2		2		52	65
Computer		3	4			1		1	18	27
Mechanics	3	2	33	2	10	1	13	1	34	99
Metallurgy			3		2				18	23
Mining		44			2				52	98
Aeronautics		5							18	23
Production	1	1	16			1	3	1	18	40
Nuclear power			0	0					0	0
Others	7		11	2	5	1	6	2	35	69
(Total)	37	66	133	23	163	6	88	10	402	928

Source : Estimated by The Study

[30] It is already evident that technicians will become absolutely undersupplied. Therefore, the supply-demand forecast comparison for technicians has been omitted in this report.

[31] This premise itself needs to be re-validated in a detailed study of the macroscopic scenario.

[32] The forecast amount of stock used in this report is the one used in IR-II. Since the correspondence between the 14 fields of specialization used in the establishment survey and the present fields of specialization has not been completely verified yet, it shall be tested in the future analysis of the e stablishment survey results.

[33] The forecast demand for *engineers* in construction and civil engineering in 2018/9 is 240,000 persons, while the estimated stock for *engineers* specializing in architecture is 114,700. Similarly, the forecast demand for *engineers* in computer science in 2018/9 is 27,000 persons, while the estimated stock for *engineers* specializing in mathematics and computers is only 20,700 in 2018/9. See Table 2.10 in Part II, 2.2(3)3) [Page II-27] and see Table 1.5 in Part I, 1.3(3)2) [Page I-29].

characterized by a high degree of specialization because of the qualification system. It may, therefore, be said that the short supply of engineers in those two fields can hardly be covered by any other EM.

2.3 Supply-Demand Gap and Issues for EM Development planning

(1) Viewpoint of Evaluating EM Supply-Demand Gap

1) Implication of Supply-Demand Gap

In the present study, attention is paid to "supply-demand gap" as a clue for formulating measures to develop EM resources. It should be noted, however, that "supply-demand gap" is not an actual gap but a conceptual gap as described below.

The information obtained from the establishment survey gives the present condition of the EM that has been realized as the actually employed. It does not directly indicate the existing EM supply-demand gap quantitatively. Even so, based on the understanding of the present condition of EM supply (described in detail in Part I), quantitatively expressed condition of EM at the place of demand can be interpreted as indicating "supply-demand gap" in the background. For example, the fact that polytechnic graduates account for a relatively small proportion of technicians (quantitatively expressed condition of the demand side, see **Figure 2.4**) suggests that the supply of polytechnic graduates is small (quantitative present condition of supply). Thus, it is understood that there is a supply gap in terms of polytechnic graduates – *technicians*.

Qualitative opinions advanced from the establishment survey are also used as indicators to interpret the conceptual "supply-demand gap". For example, the opinions that it is not difficult and even easy for above 80% of establishments to recruit EM (see **Figure 2.7**) and that around 90% of establishments are satisfied with the technical qualifications of their EM (see II-13) suggest the oversupply of EM to the present level of qualitative EM demand.

The "supply-demand gap" as a quantative difference between supply and demand which is derived from the forecast model used in the present study cannot occur in reality. Any input-output model is based on the assumption that a certain amount of employment is secured, which reflects the appropriate supply-demand adjustment made by the current labor market. If a substantial supply-demand gap which cannot be adjusted in the labor market occurs, it calls for modification of the input-output model itself as it indicates an impediment to the economic growth or innovation in production system. Namely, a shortage of manpower prevents sufficient production to meet the existing demand, thereby causing the economic growth to slow down. And, to cope with the shortage of manpower,

labor-saving equipment is introduced. As a result, the input coefficient itself changes. Thus, it follows that as long as a static state where a certain input-output model is valid is assumed, no quantitative "supply-demand gap" can exist. The latent "supply-demand gap" in the labor market before adjustment manifests itself in the form of "overqualified employment" or wage gap only after the appropriate adjustment is made in the labor market.

As described above, in the present analysis of the establishment survey results and in the estimation of future EM supply and demand using a forecast model, the "supply-demand gap" is an ideal concept not accompanying any real phenomenon. Formulating measures based on "supply-demand" gap is, therefore, using the ideal "supply-demand gap" as a reference to extract issues and study measures to solve them with intention.

2) Implication of "Issues"

EM is an important factor in the development and dissemination of industrial technology and the fixing of field-based technology which are both indispensable for economic growth. It is the mission of the EM Development Plan and Policies to achieve the PJP-II based growth that is assumed as the framework of the present study (see the Concluding Remarks in Part I).

Therefore, in the future, there must not be the possibility of "supply-demand gap" in which the conceptual demand in the above context is greater than the supply. This is because the short supply (whether it be quantitative or qualitative) can impede the economic growth and let go the employment opportunity.

Similarly, neither the balanced supply-demand condition nor the oversupply condition should be lightly disregarded because it may suggest that the available resources are not utilized in optimum way. In this case, it is necessary to analyze the condition so as to determine whether or not there are ways to further promote the economic growth and employment.

As described above, the "issues" as preconditions for the formulation of policies manifest themselves in a different manner according to the content of "supply-demand gap." A policy is formulated as a collection of measures to cope with those "issues" and suitable measures are selected taking into consideration the consistency over them.

(2) Extracted Issues

1) Issues Concerning *Engineers*

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.

Today's relatively high ratio of advancement to universities is due, at least in part, to the generous treatment exemplified by the unusual wage gap guaranteed to university graduates.(see **Figure 2.10**) It may be said that the favorable treatment offered to university graduates has been formalized by overevaluation of academic career, which paradoxically reflects the tendency to make light of technical qualifications for *engineers*. It means that the demand side tends to evaluate *engineers* by the formal academic titles rather than substantial technical qualifications.[34]

Nevertheless, the Indonesian industrial structure has one definite direction of sophistication even without waiting for extra spurt in demand growth. The structural change consists in the complication of domestic input relations. This is the process of diversification and sophistication of specific technologies needed by an industrial sector or business enterprise. Therefore, the essentially low levels of technical requirements for *engineers*[35] have to be improved sooner or later.

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.

One of exceptional problems concerning *engineers* is construction *engineers*, who are expected to be extremely undersupplied in the future despite the growing oversupply of university graduates in general. The construction industry which takes on the development and maintenance of economic infrastructure has enormous multiplier effect and employment creating power with its diverse input structures. In this context, if the shortage of *engineers* in construction becomes a

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[34] See page **II-11**, **Figure 2.8** points to see at recruiting *engineers*, show that non-technical qualifications (quality of school, recommendation, attitude) account for relatively high ratio, approximately half of them.

[35] See Page **II-9**

bottleneck and breaks up the linkage of multiplier effect, it will significantly impede the future development of Indonesia.

2) Issues Concerning *Technicians*

Due to the undersupply of graduates of polytechnics which are supposed to play the leading role in supplying technicians, and to the low levels of technical requirements of industry, the posts of technicians have become the major place of "overqualified employment" of university graduates. As long as the existing supply capacity of polytechnics is assumed, the above "supply-demand gap" (overdemand) may regrettably reach a critical point in the future.

Here again, the present low levels of technical requirements of industry[36] are held responsible, at least partly, for the poor social recognition of polytechnics and the weak demand for technicians in the manufacturing industries. Probably all this gives *engineers* authorities which have nothing to do with the economic value of technology and the economic principles (e.g., productivity), helps promote the formal treatment gap between *engineers* and *technicians*, and can impede the future increase of supplying technicians.

Technicians play the role of interface between engineers and skilled workers by applying introduced technology in the field[37]. The short supply of technicians in this key post can break up the microeconomics linkage of industrial technology, which in turn impedes the development of domestic production in macroeconomics.

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*.

3) Issues Concerning *Skilled Workers*

The supply of candidates for skilled workers is being nearly complemented by

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[36] See **2.1(2)1) [Page II-4]**.

[37] See **1.2(2)2)b [Page I-15]**.

graduates of technical/vocational senior high schools and general high schools through efforts of the Indonesian government to improve the level of middle-class education. With the increase in ratio of students going on to universities, the supply of graduates from those high schools will become somewhat tight in the future. Even so, it may be said that the quantitative supply-demand gap will be less severe than that of *engineers* and *technicians*.

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.[38] This problem is also related to the vision of industrial policies aimed at modernization of the vertical industrial structure, that is, fostering the effective production linkage between the small and medium-sized companies and the large companies. Fostering skilled workers at small and medium-sized companies founds technical background to develop the supporting industries for large modern corporations and helps reinforce the linkage between industries.

The position of *skilled workers* in the above comprehensive industrial technology policy for developing EM will be decided in relation with *technicians* who will probably be undersupplied in absolute terms in the future. The practice of coping with the shortage of *technicians* by promoting *skilled workers* to technicians internally should be considered at the same level of internal promotion of non-skilled workers to skilled workers.

4) Issues in Manufacturing Industries

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.

At present, it cannot be said that the manufacturing industries are playing the

[38] See Table 2.6 (Page II-16).

central role in absorbing EM[39]. As shown in **Figure 2.3**, the manufacturing industries are not absorbing a significant proportion of the EM. At present, the manufacturing industries are still not technician-intensive, much less engineer-intensive. Probably this accounts for, again, the relatively low levels of technical requirements of industry at present. The fact that the production technology currently required by Indonesia's manufacturing industries is simple as a whole is attested to by the low level of multiplier effect of the input structure. With the exception of some state-owned companies and foreign capitals, the great majority of manufacturing companies are still not in the stage of introducing advanced production technology for themselves. Besides, supporting industries for large corporations have not been fully developed. The understanding that the demand for advanced and complicated technologies is small at present because of the weak linkage of the whole industry is considered applicable especially to the manufacturing industries.

Though Indonesia's manufacturing industries will have to play the leading role in the process of economic development in the future, their employment creating power has been kept low by an appreciable increase in labor productivity. Therefore, 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. This problem is applicable especially to the machinery industry which has been slow in progress despite the fact that it has potential to emerge as the key industry for modernization of the manufacturing industries with its outstanding multiplier effect and employment creating power. Thus, promoting the improvement of overall capabilities of engineers, technicians, and skilled workers in the machine industries can be a specific issue.

[39] See Figure 2.3 [PageII-6].

2.4 Concluding Remarks of PART II

To conclude Part II, the following four measures extracted from the results of the company survey and EM supply/demand forecast are proposed as fields where countermeasures will reside:

(1) Measures to cope with the shortage of *technicians* in absolute terms.

(2) Measures to cope with the expanding oversupply of *engineers* in terms of quantity and with the shortage of *engineers* in terms of quality.

(3) Positioning the fostering of *skilled workers* in a comprehensive industrial technology policy.

(4) Measures to improve the overall capabilities of EM for the development of manufacturing industries, mainly the machine industries.

PART III: STRATEGY AND ACTION PROGRAMS FOR FOSTERING EM

First, through discussions on the four problems that have been isolated in Part II, strategic goals for fostering EM in the future shall be set in 3.1. Then, in 3.2, various requirements for attaining the goals shall be discussed and a framework of EM fostering plans shall be established. Based on this, concrete proposals on the fostering of EM in the future shall be made in 3.3.

3.1 EM Fostering Strategy

The Study Team considers the meanings of the four problems isolated from the results of the survey concerning to EM in current condition. The forecast of EM supply and demand in Part II in the light of the mission of the present study (i.e., fostering EM for economic growth on the PJP II base) set in Part I. It then derives therefrom two major strategic goals–"practical paradigm" and "networking"–as the basis of future EM fostering plans. These strategic goals are validated by negating the conventional definition and notion of EM. Therefore, the definitions of EM and its constituents (engineer, technician, and skilled worker) in the review of the problems isolated in Part II (3.1.(1)) are different from those in the subsequent discussions. Namely, in 3.1.(1) the definitions that are based on the academic career[1] classification presented in Part I are used, whereas in the succeeding discussions, the definitions that are based not on academic career[2] but on the contents of jobs, mentioned in the analysis of the establishment survey results in Part II, are used. To distinguish between them, the terms "Engineer," "Technician," and "Skilled Worker" by the former definitions are shown in italics as they were in Part II.

(1) Background of the Four Problems

1) Problem Structures

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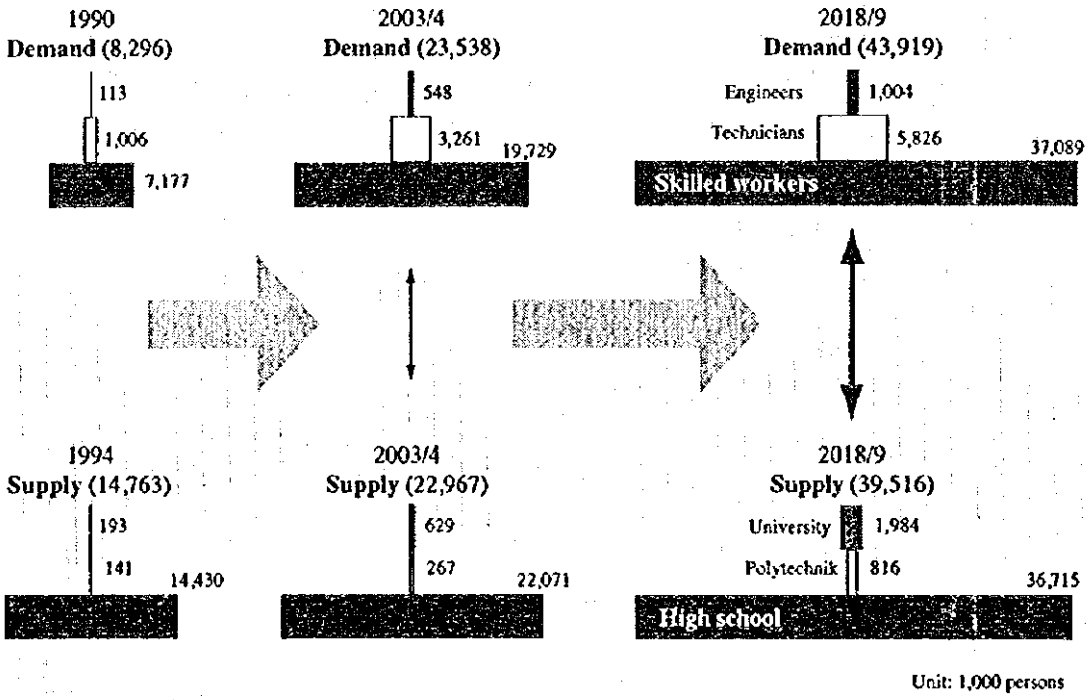
[1] See Part I, 1.3(1) (Page I-24).
[2] See Part II, footnote 11. (Page II-7)

In the background of the four specific problems[3] isolated in Part II lie other complicated problems which impede the future growth of Indonesia as described below.

a. 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 3.1. 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.[4]



Source : The Study Team

Figure 3.1 EM Supply & Demand in Future

[3] They refer to the four persistent trends mentioned in Part II, 2.4: (1) absolute shortage of technicians, (2) oversupply of engineers, (3) shortage of skilled workers, and (4) weak demand for EM in manufacturing industries.

[4] This assertion and the numbers in Figure 3.1 are based on the projections (Part II, 2.2(3) [Page II-25] made assuming the scenario (Part I, 1.1(3) [Page I-8] set in Part I.

As long as the "polytechnic graduates = technicians" relationship is assumed, the shortage of technicians in absolute terms in the future is unavoidable. If the interface function[5] that technicians should perform in the application of industrial technology does not work properly, there is fear that Indonesia's industrial development in the future should be impeded on a micro-level.

With the exception of a few fields of specialization, university graduates (= engineers) will be oversupplied. The excess of engineers is too large to maintain demand and supply of other EM in balance (i.e., shortage of technicians and skilled workers).[6]

Skilled workers play a vital role in industrialization.[7] Since skilled workers account for the majority of EM in employment,[8] they also shoulder much of the responsibility for an economic growth supported chiefly by domestic demand[9]. The expected shortage of skilled workers in the future, based on the assumption that technical high school graduates = skilled workers, will impede both the industrial development and economic growth of Indonesia. The shortage will not be liquidated even if BLK is added to supply source of skilled workers.

b. The uneven distribution of EM resources is attributable largely to the growing number of persons who seek higher academic career, which brings higher incomes in a growing economy.[10] Excessive social emphasis on academic career might accelerate the increase of those who seek higher academic career.

People's preference in their own higher academic career will be intensified in accordance with economic growth. This is commonly found phenomena in many countries and also necessary to improve overall human capital in the nation. In PJP-II too, it is recommended that the primary education be made compulsory and that the higher education be promoted.[11]

Nevertheless, the progress toward a society of higher academic career, supported by the excessive emphasis on academic career without regard to the actual condition of the labor market, must be a problem from the viewpoint of

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[5] See Part I, 1.2(2)2)b [Page I-15].
[6] See Part II, 2.2(3)2) [Page II-26].
[7] See Part I, 1.2(2)2)c [Page I-15].
[8] See Part II, 2.1(2)1) [Page II-4]
[9] See Part I, 1.1(3) [Page I-8].
[10] See Part I, 1.3(2)2) [Page I-26].
[11] See Part I, 1.3(2)1) [Page I-26].

optimum distribution of human resources. Under the present condition of Indonesia, the optimum distribution of EM resources is really jeopardized.[12]

c. On the other hand, some may argue that the uneven distribution of EM resources should be attributed in part to the fact that the development of industrial technology is not so fast that it cannot absorb all the EM that is sent out to the society.[13] This reflects the fourth problem that the demand for EM in manufacturing industries is relatively weak. At present, manufacturing industries doesn't seem to request a large number of talented engineers whom production site should have demanded, and the number may not increase enough to absorb future university graduate stock.

Improving the international competitiveness of Indonesia's economy by developing technology-intensive industries underlies the technological policy in PJP-II. However, even in manufacturing industries, the potential demand for engineers is not so large.[14]

Therefore, with the present pace of development of industrial technology, the ever increasing number of candidates for engineers will not be able to be completely absorbed. This means that the uneven distribution of EM resources will be aggravated in the future.

d. The above problems that underlie the four specific problems isolated in Part II might be locked in a vicious circle as illustrated in **Figure 3.2** due chiefly to the excessive social emphasis on higher academic career and the slow pace of development of industrial technology. Ultimately, they can impede the economic growth of Indonesia in the future.

2) Direction to Take to Solve the Problems

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.

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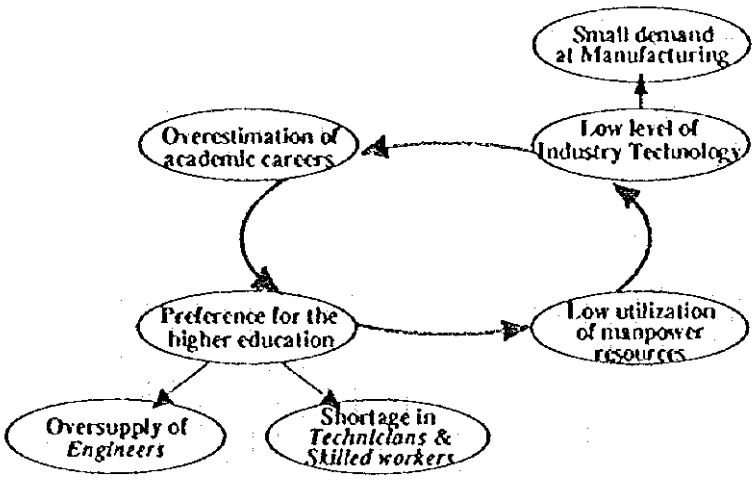
[12] See Part II, 2.1 [Page II-1]

[13] See Part II, 2.2(2)1) [Page II-20].

[14] See Part I, 2.2(3)1) [Page II-25].



Source : The Study Team

Figure 3.2 Foreseen Vicious Circle of EM Development in Future

a. For one thing, it is impossible to stop the current movement toward a society of higher academic career. For a second, any attempt to correct the uneven distribution of EM resources by reducing the number of universities or some other method is unrealistic. Seeking higher academic career in itself should be positively promoted from the viewpoint of reinforcing a nation's human capital.[15] In any democratic society, the right of its members to receive education must not be violated. Therefore, the future EM fostering program must be based on the premise that Indonesia continues to move toward a society of higher academic career.

b. The level of Indonesia's industrial technology has been improving steadily. Macroscopically, however, 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.[16]

An industrial society which is based on advanced technology-intensive industries and supported by many engineers cannot be built in a day. As exemplified by highly industrialized countries, successful achievements of labor-intensive industries are essential prerequisite to build a technology-intensive society.[17]

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[15] See Part I, 1.1(2)2)e [Page I-6].
[16] See Part II, 2.2(2)1) [Page II-20].
[17] See Part I, 1.1(2)3)c [Page I-8].

Therefore, in order for the Indonesian economy to "lift off," it is indispensable to further increase employment opportunities, mainly in the labor-intensive industries.[18] Even in this case, the above problems remain as impediments in the preliminary stage toward technology- based industrialization.

c. Thus, any of the above approaches will not lead to an effective solution for the problems. 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.

If the problem of uneven distribution of EM resources cannot be dissolved by correcting the excessive emphasis on academic career or improving industrial technology, it is necessary to question the validity of the existing paradigm that governs EM (university graduates = engineers, polytechnic graduates = technicians, and high school graduates = skilled workers).

Today in Indonesia, the above paradigm is deep-rooted not only on the EM supply side but also on the EM demand side.[19] However, assuming that the current trend toward a society of higher academic career will continue, it is evident that the existing paradigm will lead to nowhere in the future.

Considering the future EM supply and demand without regard to the above paradigm, the problem of uneven distribution of EM resources[20] (i.e., the oversupply of engineers and the undersupply of technicians and skilled workers) apparently disappears, leaving only the problem of inadequate size of EM. It may, therefore, be said that the right approach to the above problems is to define a rational relationship between academic career and job by a new paradigm for the fostering of EM and strive to expand the total size of EM.

(2) Setting of Strategic Goals

It is "Practical Paradigm" and "Networking" that are the strategic goals for solving the above problems.

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[18] See Part I, 1.1(3)1) [Page I-8].
[19] See Part II, 2.1(2)3) [Page II-10].
[20] See Part II, 2.2(3)2) [Page II-26].

1) Establishing a new paradigm for the fostering of EM = Practical Paradigm

a. The correspondence between university graduates and engineers, between polytechnic graduates and technicians, and between high school graduates and skilled workers, respectively, is a concept held by the EM supply side in the early stages of economic growth. It is unsuitable for the future development of Indonesia which is going to be industrialized under the leadership of private enterprises.

In the early stages of industrialization in which the spontaneous demand for EM in the private sector is not very large, it may be necessary for the government to define EM and expand the supply of EM in a planned way so as to develop human resources which shoulder the economic development.

However, as the market economy expands and the economic development is propelled by modern private enterprises, the real demand for EM becomes dependent on logic of those private enterprises. As a result, logic of the EM supply side will lose much of its significance.

The problem is that any social recognition established once will remain unchanged for some time even after the conditions as the basis of that recognition have changed. Though the prime mover of Indonesia's economy is now gradually shifting to private enterprises, the old paradigm–logic of the EM supply side–remains in effect steadfastly. Unless positive efforts are made to establish a new paradigm which really suits the economic development, it is possible that the old paradigm persists, causing the problem of uneven distribution of EM resources to get more complicated.

b. Nevertheless, any rigid correspondence which replaces the one based on the old paradigm will fail to respond effectively to structural changes in the long run. This is because the relationship between the educational system which should remain stable and the demand for EM which should change can hardly be defined on a universal basis.

Human resources development organizations in a country, especially the key educational system (primary school– junior high school–high school–university), have the mission of expanding and improving the general human capital of that country. They should be managed in accordance with a long-term plan

formulated by the government and should not be restructured carelessly.

By contrast, each individual business enterprise (EM demand side) is naturally required to mobilize its resources dynamically in order to survive the market competition. The contents and composition of EM required by the demand side should also change year by year. It must be said, therefore, that any paradigm which is based on a rigid relationship between static educational institutions and dynamic business enterprises cannot meet the needs of the EM demand side on a lasting basis.

c. Namely, 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.

2) Support for Sophistication of Industrial Technology = Networking

a. Needless to say, along with the efforts to attain the above strategic goal, ceaseless efforts must be made to further improve the level of industrial technology so as to enable shifting the weight from labor-intensive industries to technology-intensive industries. From the viewpoint of human resources development, the support for those efforts consists of developing high-quality EM which has more than what is needed to meet the ordinary needs of the demand side.

b. 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.

Concerning the present industrial structure of Indonesia, the problem of so-called "hollow middle" is attracting public attention. With a wide gap between a great number of small labor-intensive companies and a handful of big businesses which are powerfully propelling technological integration with the support of national and foreign capital, the position of the small and medium-sized companies in terms of the distribution of industrial technology has remained ambiguous.

Due to the absence in Indonesia of supporting industries which can meet the technical requirements of those big businesses, imports of raw materials and parts increase, dwarfing the contribution of domestic manufacturing industries to Indonesia's economic development. Though this problem is dissolving gradually, it needs to be eliminated more speedily.

To that end, it is considered indispensable to make standard industrial technologies (i.e., production techniques rather than R&D capabilities) take root in the small and medium-sized enterprises. This calls for suitable EM fostering measures, including those to activate the exchange of personnel and information between the small and medium-sized companies and other bigger companies and EM development agencies.

c. 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. As a matter of fact, the fostering of EM by a network which covers mainly small and medium- sized companies helps materialize the concept of Practical Paradigm for the fostering of EM for the whole industry of Indonesia.

3.2 EM Fostering Plan

First, the ideal image of fostering of EM to be aimed at in the effort to attain the two strategic goals–"Practical Paradigm" and "Networking"–is presented. Then, obstacles to the materialization of the ideal image are isolated based on the findings in Part I and Part II. To get rid of those obstacles, suitable objectives of an EM fostering plan are set. In line with the set objectives, five proposals as the concrete contents of the EM fostering plan are made.

(1) Ideal Image of EM Fostering of the Future

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[21] 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.

a. Indonesian companies of the future which are free from the old paradigm of EM will have their own EM fostering standards that place less emphasis on academic career.

Because of a gap between EM supply and EM demand, many of university graduates will be employed as candidates for technicians, except in certain R&D institutes[22]. This does not mean "overqualified employment" in the old paradigm. Those university graduates can become technicians who are equipped with human capital useful to the company only after they go through suitable in-house training, etc.

Polytechnic graduates too are included in the candidates for technicians. Since brilliant polytechnic graduates are already equipped with practical knowledge and skill, the companies which employ them might be able to form better human capital at less educational cost. Polytechnic graduates can also be

[21] Refer to the scenario described in Part I and the forecast results described in Part II.
[22] See Part II, 2.2(3)2) [Page II-26].

candidates for skilled workers who will be required to have higher levels of knowledge in the future.

Vocational high school graduates who are already equipped with a certain level of skill can become skilled workers having human capital appropriate to the field work only after they go through certain types of training inside and outside the companies that employ them.

In addition to the fostering of EM by the above initial training, individual persons are encouraged to accumulate knowledge and skill through many years of job experience and lifelong education so as to qualify themselves for the right posts regardless of their academic careers. Even polytechnic graduates can become engineers if qualified by EM fostering standards of the company. In view of the expected deficiency in total EM supply[23] in the future, it will become necessary to positively promote even graduates of junior high schools and ordinary high schools to skilled workers or technicians when they are qualified for those positions.

b. Both the individual constituents of EM and the EM supply side will understand that the treatment of EM at the demand side depends upon the qualifications and efforts of the individual persons. This understanding will eventually be fixed as a social recognition.

The market economy will continue to grow in terms of both quality and quantity, and the compensations for EM will come to reflect the economic principles of business enterprises[24]. Because of relatively low costs of initial training, polytechnic graduates as candidates for technicians will get higher starting salary (or at least the same pay as) than university graduates as candidates for technicians. Similarly, as candidates for skilled workers, vocational high school graduates will get higher pay than ordinary high school graduates.

As the economy keeps growing, technicians and skilled workers will become undersupplied[25]. As a result, brilliant graduates of polytechnics and vocational high schools will become highly valued. As polytechnics and vocational high

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[23] See Part II, 2.2(3)2) [Page II-26].

[24] At present, the economic principles of business enterprises are not fully reflected in the compensations for EM. See Part II, 2.1(3)1) [Page II-16].

[25] The forecast in Part II. See Part II, 2.2(3)1) and 2) [Page II-25,26].

schools will receive higher social recognition and those who wish to enter them will increase in number, they will become able to send out a larger number of brilliant graduates to the society[26].

Under a condition in which any university graduates cannot become R&D engineers without passing an extremely difficult examination[27], going on to a university will no longer promise favorable treatment on that account in the future. Namely, learning at a university will become nothing but a preparation for the long promotion path. Over a short term, selecting a polytechnic will become more economical for many students. Any person who has entered a polytechnic school should be allowed to re-enter a polytechnic university if he wishes. Truly brilliant R&D engineers can come from among those who have ultimately selected a university[28].

2) By propelling Networking–the other strategic goal, competent EM will develop mainly in a large number of small and medium-sized companies. As they form supporting industries, the competitiveness of the whole industry of Indonesia will improve.

a. Not only large companies but also small and medium-sized ones will become able to make the most effective use of resources and information available for the fostering of EM. As a result, the cooperation in the fostering of EM between the EM supply side and demand side, between EM development agencies, and within each company will become closer.

The cooperation between EM development agencies and companies will no longer depend entirely upon human relations. Each educational institution will install a vocational advisory section[29] to which any business enterprise can have access.

By expanding the network between the EM supply side and demand side, special educational institutions, such as polytechnics and vocational high schools,

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[26] At present, they are not highly recognized by society or have not so many applicants. See Part I, 1.3(5)2) and 3) [Page I-35, 36].

[27] The demand for engineers in the true sense of the word is limited. See Figure 1 this Part III.

[28] For an example at a university, see Part I, 1.3(3)2) [Page I-28].

[29] For a detailed explanation of this point, see Part I, 1.3 (3)1) [Page I-27].

will be able to constantly grasp the needs of the EM demand side[30] and reflect them in their curriculums. The cooperation between EM supply organizations too will be promoted. As a result, it is possible that the know-how of vocational education in the educational institutions will be implanted in public training institutions.

The network at the EM demand side works when resources available for the fostering of EM are mutually transferred between large companies and small and medium-sized ones or between small and medium-sized companies. Large companies will be able to benefit from the supporting industries by providing training in their production techniques to EM of small and medium-sized companies.

b. Technology-oriented entrepreneurial small and medium-sized companies will also come into being outside the framework of large companies. By involving themselves in the above network, those enterprises too will be able to secure required EM and enter the market.

(2) Obstacles to the Implementation of Practical Paradigm

In pursuing the ideal image of EM fostering, there are two major obstacles to the implementation of Practical Paradigm. They are the lack of information at the EM demand side and the rigidity unique to the educational system.

1) Lack of Information at the EM Demand Side

a. The current tendency to place excessive emphasis on academic career is attributable in part to the fact that companies whose industrial technology is still at a low level have nothing but academic career as the standard of judgment of EM. [31]

In industries whose technology is generally still at a low level (in those industries shown "***skilled worker* intensive**" in **Figure 2.3**) the needs for EM of

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[30] At present, industrial circles have inadequate knowledge of polytechnic schools (Part I, 1.3(3)2) [Page I-28]), and the training provided in vocational high schools is not completely suited to real needs of industrial circles (Part I, 1.3(3) [Page I-27]).

[31] A typical example of this is that a horizontal mismatch occurs infrequently. See Part II, 2.1(2)2) [Page II-7].

individual companies can hardly be defined clearly.

It is an undeniable fact, however, that many of those companies have nothing but the old paradigm linked to academic career as their standard of judgment of EM[32]. It is possible, therefore, that even when they need the intrinsic qualifications of EM other than the authority, reputation, and management ability associated with academic career, they cannot but follow the old paradigm unless suitable information about the criterion for EM is available.

b. Many of the small and medium-sized companies and labor- intensive companies are apparently unable to establish their own criteria for EM in place of academic career. It is, therefore, possible that the excessive emphasis on academic career will persist.

At the level of Indonesia's future industrial technology, there is fear that companies might not have any internal motivation to create their own criteria for EM.

Creating such criteria requires investment for improving the existing training system, collecting suitable information, etc. If many of the Indonesian companies cannot do that for themselves in the future, it is necessary first to enlighten them and provide them with information needed to make the above investment.

c. For that purpose, it is indispensable to establish a system which [1] diffuses a new EM qualification system not linked to academic career and [2] supports the formulation of an EM fostering plan fully reflecting the real needs of industrial circles.

2) Rigidity Unique to Educational Systems

a. The fundamental educational system (primary school–junior high school–high school–university) is not intended to develop EM alone. Therefore, it can hardly be adapted quickly to the drastically changing demand for EM.[33]

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[32] See the results of the preliminary study based on the establishments survey and the evaluation of industrial technology (omitted in this report).

[33] Part III, 3.1(2)1)b [page III-14].

b. On the other hand, the existing EM development systems are not completely effective. Because of this, the fundamental educational system shoulders a heavy burden in the development of EM.

The polytechnics have a limited capacity[34], the vocational high schools remain not so attractive to many students[35], and BLK and other public vocational training institutes are out of fashion[36]. Besides, in-house training is seldom provided, especially in the small and medium- sized companies[37].

Under those conditions, there is growing expectation for the development of EM at universities and ordinary high schools. These educational institutions are, however, intended primarily to reinforce the general human capital of the country. They have many tasks to tackle for their primary purpose[38].

c. Therefore, it is necessary to [3] review the relationship in EM supply between universities/ordinary high schools and polytechnics, vocational high schools, and other training institutes and [4] have the EM demand side reinforce its in-house training of EM.

(3) Obstacles to the Implementation of Networking

In implementing Networking--the other strategic goal, the industrial technology environment of private enterprises and the lack of a unified view about the management of educational/training institutes can be major obstacles.

1) Industrial technology environment of private enterprises

a. In the manufacturing sector, there are not a few companies (even in the future) which do not develop product technology and conduct research & development for themselves. [39]

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[34] Part I, Table 1.5 [Page I-29].
[35] Part I, 1.3(3)3)a [Page I-36].
[36] Part I, 1.3(3)3)b [Page I-36].
[37] Part I, 1.3(3) [Page I-28] and Part II, 2.1(2)6) [Page II-16].
[38] Part I, 1.3(3)1)a [Page I-36].
[39] By establishment survey, more than 80% of establishment do neither develop new products nor conduct Research & Development.(See Table 2.3, 2.4) [Page II-15].

It is possible that the foreign-based companies which entrust technology development to their parent companies overseas and some of the large companies which can develop technology for themselves will become unable to depend much on business transactions (procurement of raw materials/sales of products) with Indonesian companies[40]. Therefore, it cannot be said that supporting only those companies in the development of technology is very effective for the growth of Indonesian industry as a whole.

The current trend is that few companies are willing to develop technology for themselves. This is because many companies can significantly save the time and money required for technology development by introducing advanced technologies from outside[41].

b. With the expansion of economic scale, a potential domestic market for intermediate goods comes into being[42]. Then, companies which manufacture intermediate goods for large companies are needed.

If the small and medium-sized companies remain unable to develop techniques required to manufacture intermediate goods, large companies will have to procure more and more of intermediate goods from abroad. In such an environment with weak interindustry linkage, any effective network for the fostering of EM cannot be built between the large companies and small and medium-sized companies.

As a result, the small and medium-sized companies may be cut off the main business transactions with the large companies and sources of advanced technical information. Even so, the small and medium-sized companies cannot be expected to try building a network for the development of EM with the human resources development agencies with the aim of improving their production techniques for themselves[43].

On the other hand, new small and medium-sized technology-oriented entrepreneurial companies which can emerge with the progress of Practical Paradigm should be protected and fostered as the leading players in the development of

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[40] Part I, 1.2(1)2) [Page I-13].
[41] Part I, 1.1(2)3)b [Page I-7].
[42] Part II, 2.2(2)1) [Page II-20].
[43] Part III, 3.2(2)2)b [Page III-15].

Indonesia's own technology[44]. In the above unfavorable environment, however, the growth of those new enterprises may well be impeded in terms of the fostering of EM.

c. Therefore, it is important to provide [5] support for the development of technology to small and medium-sized entrepreneurial companies and [6] support for the fostering of EM in production technology to those small and medium-sized companies which now constitute the "hollow middle."[45]

2) Lack of Unified View about Management of Educational/ Training Institutions

a. The organizations responsible for the fostering of EM are now placed under the jurisdiction of DEPNAKER (public vocational training centers: BLK), MOEC (universities, polytechnic schools, vocational high schools, etc.), and other government agencies[46].

b. MOEC is going to advance a new concept of flexible vocational education systems. With respect to its response to the EM demand side, however, there is still room for discussion. At DEPNAKER, an attempt is being made to define the position of BLK.

The main point of the vocational education policy being discussed by a task force of MOEC is to place vocational education/training in parallel with academic education, improve the quality of the former, and provide a linkage between them to manage them flexibly. It should be noted, however, that the concept has not been completed as a new paradigm which gives due consideration to the EM demand side[47].

On the other hand, the position of BLK which is under the jurisdiction of DEPNAKER has not been clearly defined. Some go as far as saying that the historic mission of BLK has already been finished[48]. Nevertheless, the resources of 153 BLKs located throughout the country are valuable ones for the fostering

[44] See PJP-II (explanation has been omitted in this report).
[45] See **Table 2.6 [Page II-16]**.
[46] See Part I, 1.3(1) [Page I-24].
[47] The concept of VET is described in 3.3(1) [Page III-22] of this report.
[48] View of the World Bank, etc. about the handling of BLK (description has been omitted in this report).

of EM which is ever increasing in importance. It is considered necessary, therefore, to restructure BLK based on a new concept.

c. Taking needs of the EM demand side into consideration, it is necessary to [7] effectively implement the development of human capital which should be pursued by the educational systems. In addition, [8] the resources of BLKs located throughout the country should be effectively utilized for the fostering of EM in the future.

(4) Future EM Fostering Plan–Five Proposals

In order to eliminate the obstacles to the implementation of EM fostering as it should be, the above items (1) through (8) shall be pursued. Concrete measures to attain them are described below in the form of five proposals.

1) Political Assumptions for Execution of EM Fostering Plan

Any long-range EM fostering plan must be pushed through under the leadership of the government. In view of the present situation of Indonesia, in particular, the role of the government is enormous. In formulating an EM fostering plan, however, it is necessary to recognize the deficiency in public resources and the prevailing trend of deregulation as factors common to all plans of this sort.

a. Deficiency in public resources

Indonesia's educational budget has been small[49]. In the future, it is possible that any increase in public spending on the fostering of EM will be covered by an increase in government revenues corresponding to economic growth. As far as the present educational budget is concerned, however, it should be considered inadequate.

The EM fostering plan should be such that it makes the most effective use of overseas development aids and distributes available resources largely to those fields which give high cost-effectiveness so as to prevent any of the desired functions to be invalidated due to the deficiency of Indonesia's public resources.

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[49] See Part I, Table I-6 [Page I-31].

b. Deregulation

As the stage of infrastructure improvement for economic growth under the leadership of the government is apparently over, deregulation has become a keyword of the Indonesian government[50]. Though due consideration should be given to the scope and degree of deregulation, the government must avoid excessive intervention in the private economy in any future plans.

Privatizing public companies as part of the deregulation should help reduce the government's burden in the fostering of EM. In this respect too, the EM fostering plan must be such that it really benefits the market.

2) Five Proposals for Attaining the Strategic Goals

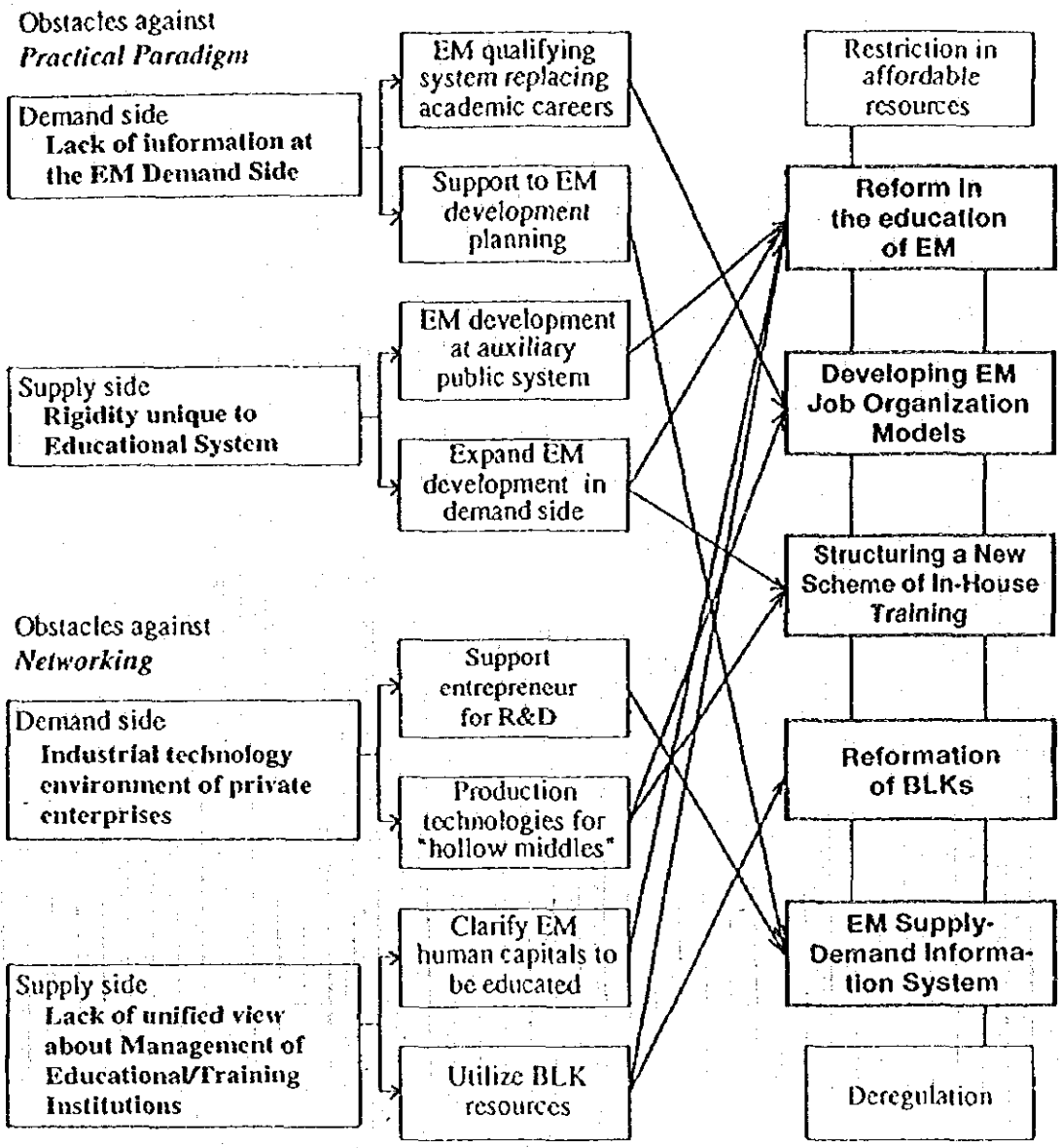
Figure 3.3 shows correlation between two strategic goals and five proposed plans.

a. First of all, it is necessary to establish a new EM education/training system <1>, with consideration given to the development of EM by the demand side itself [4] and positive use of the resources of BLK [8], while striving to effectively implement the formation of human capital to be pursued by the educational system [7] and flexibly manage the polytechnic schools, vocational high schools, etc. [3]. In this case, consideration must be given to a short-term deficiency in needed resources.

b. On the other hand, a new EM qualification system not linked to academic career <1> which can be diffused mainly in the "hollow middle" [6] is materialized in the form of a new job organization model for each company <2>. This, together with <1>, constitutes the new paradigm of EM fostering. The job organization model, which reflects the current trend of deregulation, is a non-compulsory model. Even so, it must be linked to a realistic qualification system so that the companies are willingly introduce it.

c. In connection with <1> and <2>, it is necessary to execute new measures to promote in-house training <3> so as that the EM training by the demand side itself [4] will take root in companies, mainly the "hollow middle" [6]. In view of the

[50] Views of the World Bank, etc. and PJP-II (not discussed in this report).



Source : The Study Team

Figure 3.3 Two Strategic Goals and Five Proposed Plans

current trend of deregulation, the new measures to be executed too must be realistic ones conforming to the economic principles of business enterprises.

d. Also in connection with <1> and <2>, it is important to attach a new meaning to the EM fostering function of BLK <4> so as to positively utilize the existing resources of BLK [8]. New BLKs should meet needs of local industries pursuing

function to liquidate future shortage in skilled worker supply.

e. In order to promote the exchange of information really needed by companies between the EM supply side and demand side [2] and help improve the level of industrial technology of small and medium-sized entrepreneurial companies [5], the development and maintenance of an EM information network <5> is called for. Unlike the public employment security office, the network which reflects the current trend of deregulation is an open system in which EM information belongs to both the supply side and demand side.

3) Correlation of the Five Proposals

a. The reformation of EM education <1> and job organization model <2> show in a concrete form the new paradigm of EM fostering at the EM supply side and demand side, respectively. They constitute the backbone of future educational/ training plans and present EM fostering measures which can be implemented in Indonesia on a stable basis over a long term.

b. The new scheme of in-house training <3> contains particulars of <2>. It is a proposal to be executed over a medium-term.

c. The restructuring of BLK <4> has to do with <1>, <2>, and <3>. It is a proposal to make the most effective use of the existing resources of BLK to solve the pending problems.

d. The EM supply-demand information system <5> constitutes the infrastructure for all the other four proposals.

3.3 The proposals concerning the upbringing of EM

(1) Reform in the Education of EM

1) Background

Planning and recommendations concerning the development of EM underlying the survey conducted this time is originated in the recognition that to correlate strongly between academic career and job opportunities within the technological and technical field as has pervasively permeated into the society of Indonesia (conventional paradigm) would be reduced to mere skeleton sooner or later and would impede future development of Indonesia in terms of manpower development. Under the new paradigm to supersede the conventional one, it would be imperative that manpower to meet substantial requirements of EM demand side of Indonesia would be developed (substantiation) and in this regard there must be exchange of resources outside the framework prevailing under the convention social system (networking). The role to develop manpower flexibly to meet substantial demand of EM side for many years to come would have to be shared ultimately by the demand side when variations in the dynamic demand for manpower is to be taken into considerations. The Study Team has defined that specific educational institutions such as polytechnics or vocational high schools would have to supplement in the formation of EM manpower capital in general. From such a perspective, reform in the education is inevitable in order to ensure that formation of manpower capital would be effectively promoted by universities (science and engineering department)/polytechnics/vocational high schools. 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 Manpower but also in-house education and training programs of corporations.

2) Outline of the proposals

In order to materialize as expected the development of EM within the fundamental education system[51] (university-high school-junior high school-primary school), it would be necessary to perfect science and engineering education while overcoming various tasks[52] as have been pointed out. On the other hand, weakness

[51] See Part III, 3.2(2)2)a [Page III-14].
[52] See Part I, 1.3(5) [Page I-31].

of the EM development systems other than the fundamental educational system is already well taken note of[53] and in order to overcome this problem, the most urgent task would be to promote vocational training and education which is obliged to be content to remain in the lower status.

Development into industrialized nation would be made possible only after EM manpower has been made available from the fundamental education system as well as from sources other than the fundamental education system. Accordingly, 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.

The method to explore and to implement measures to improve those educational issues which are closely related to the nucleus of the nation as proposed by the Study Team is to institute EM educational reform committee (hereinafter referred to as "the committee"). The committee will be held responsible to communicate with and discuss thoroughly with parties concerned with regard to [the improvement quality of the academic education] and [the promotion of vocational education and training].

Details of the task to reform education to be implemented by the EM educational reform committee will be presented as follows.

3) Educational reform to be explored

a. Improvement of the academic education

Weight of education related outlay in the public finance in Indonesia is not quite high enough.[54] It would be necessary to augment education related outlay of public finance up to the level comparable with the related countries and to allocate pointedly resources to the area with higher cost versus effect ratio together with the effective utilization of overseas development aids.[55] Measures to be given top priorities to develop EM by universities with regard to the academic education to be made available by the fundamental education system would be the qualitative

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[53] See Part III, 3.2(2)2)b [Page III-15].

[54] According to the survey of other countries in Asia by the Study Team, weight of education related outlay in the public finance is 4% in Indonesia against 16.3% in Malaysia, 23.4% in Republic of Korea, 16.6% in Japan.

[55] See Part III, 3.2(4)1)a [Page III-18].

improvement of education.

For this purpose, with emphasis on advanced technology fields including electronics, electricity/telecommunications, mechatronics, FMS, bio-technology and so forth, ① to secure excellent science and technology teachers with high academic career, ② to invite teachers coming from abroad who have learned state-of-the art technology, ③ to enrich curriculum, ④ to renovate as quickly as possible experimental equipment/facilities, ⑤ to implement measures such as increase of the highly qualified management staff. In particular, enrichment of curriculum would have to encompass not only special subjects of study but also to intensify learning of science and technology related basic courses of study such as mathematics, physics, dynamics, chemistry and so forth from the improvement of basic scholastic ability point of view as well as to pay more attentions to the linguistic ability of English language which is vital in the introduction/digestion of foreign technology.

With regard to regular high school education, ① to increase hours of learning physics and mathematics, ② to establish institutions to educate talents for science and technology would have to be examined and implemented.[56] In order to allow student to be familiarized with science and technology related courses of study from young ages onward, measures ① to organize curriculum to allow students to be familiarized with science and technology, ② to incorporate topics and educational materials into the course of native language and/or history, ③ to reinforce science and technology courses of study would have to be implemented.

b. Promotion of vocational education and training

Reinforcement of education in practical technologies in the universities

(science and engineering department)

The universities shall, while continuing to focus on the education in basic studies for the fostering of research and development engineers, reinforce the education in practical technologies and the off-the-campus training to make their students equipped with knowledge of work on the industrial scene.

With the development of industry in the future, the jobs of technicians will increase in importance. With respect to technicians who are involved in the

[56] In 1984, a science high school with a curriculum with emphasis on physics, mathematics was established in the Republic of Korea and has been increased ever since to 18 in total. This is the talent education institution and middle school graduates with top 1% school achievement only will be qualified for admission.

development of production technology, they will be called "production engineers" responsible for management, production, and services. At the same time, the concept of advanced technicians – a more detailed classification of EM – will become popular (see "Developing EM Job Organization Models" in 3.3(2)).

Under those conditions, the EM job organization will be associated with multiple academic careers, and the university graduates will continue to play a vital role not only as candidate R&D engineers but also as sources of production engineers, senior technicians and technicians in the future.

Review of vocational education and training system

Measures to deal with the issue of polytechnic

In order to enrich vocational education and training curriculum, four years polytechnics curriculum would have to be fully executed. By the enrichment of curriculum associated with the transition into four years polytechnic curriculum, it would be made clear that polytechnics would play central role in the vocational education and training.

By graduating from four years polytechnic curriculum, the new degree based on technique/technology (Provisionally called "SX") will be conferred to the graduates. Those who have completed the four-year polytechnic course and who have been qualified by a test, etc. shall be conferred with a new degree (tentatively named "SX") based on technique/technology. SX degree shall be equivalent to university bachelor degree (S1). By establishing this new degree, rigid old paradigm would be reduced to mere skeleton[57] and both of engineers and technicians would be made available from S1 and SX degrees.

Conceptual diagram to represent overall flow of EM vocational education and training/academic education and occupations is shown in **Figure 3.4.**

A path shall be provided for the transfer of those who have completed the three-year polytechnic course to a specialized course of a university and for their obtaining an S1 there.[58] In addition, graduates from four years polytechnic

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[57] Job opportunities for EM would be more diversified into multiple layers of research and development engineer, practical engineer, senior technician, multiple skill workers as the result of the change in the role to be played by EM associated with the transition from the period to introduce foreign technology to the period to apply introduced technology. EM manpower will be made available by relinquishing old paradigm and constructing flexible education system based on the new paradigm.

[58] Reform of education system in Japan of 1993 under which transfer of national college of Technology graduates to the third year of universities was allowed or bachelor degree can be conferred by instituting within the same colleges in a specialized course may be referred to.

curriculum (SX) would be allowed to advance to the post graduate course and to be conferred with S2 and S3 degrees afterward.

Advancement to polytechnics shall be as a general rule from vocational high schools. Coherent vocational education and training system to cover from basics till applications as implemented by the industrial college in Japan[59] is considered quite successful and reference shall be made to this system. As the result, vocational high school will be positioned as such to be identified more clearly as [basic vocational training educational institution with advancement to polytechnics as the basic rule]. By reinforcing the path to advance to polytechnics from vocational high schools, it would be expected that number of applicants to polytechnics would increase and vocational high school would be deemed to be more prestigious.[60] For those students who have adequate scholastic ability but who have to give up going on to a higher school for economic reasons, a system which provides scholarships preferentially to them for their entry into a vocational high school through their graduation of a polytechnic school shall be established.

In accordance with the enhanced appreciation by the industrial community of vocational training program and/or upgrading of status, degrees of D1, D2, D3 and diploma will be abolished gradually when degree of SX has acquired social recognition.

New educational qualifications will be introduced.

Existing graduation tests[61] will be dissolved into the educational qualifications to be newly introduced which would have stronger compelling power with respect to the advancement to higher educational institutions. The new educational qualifications are necessary for those students who would desire to advance either literal art courses or to science and technology courses. Students who do not meet designated level of learning power would not be allowed to advance to higher educational institutions. However, students would be allowed to challenge as often as they would wish to including drop-out. Intent of the new educational qualifications is to screen students more severely by their learning powers so that manpower would be

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[59] National college of Technology in Japan has five years carriculum begining in the first year of high school.

[60] As the result of the field survey, it was made clear that there exists a tendency to prefer entry into regular high schools in general and prestige of vocational high school is considered to be relatively lower.

[61] In Indonesia, graduation test called EBTANAS is conducted in May every year by primary school, junior high school and high school. Achievement thereof called NEM is used as the data to determine advancement to next stage of education.

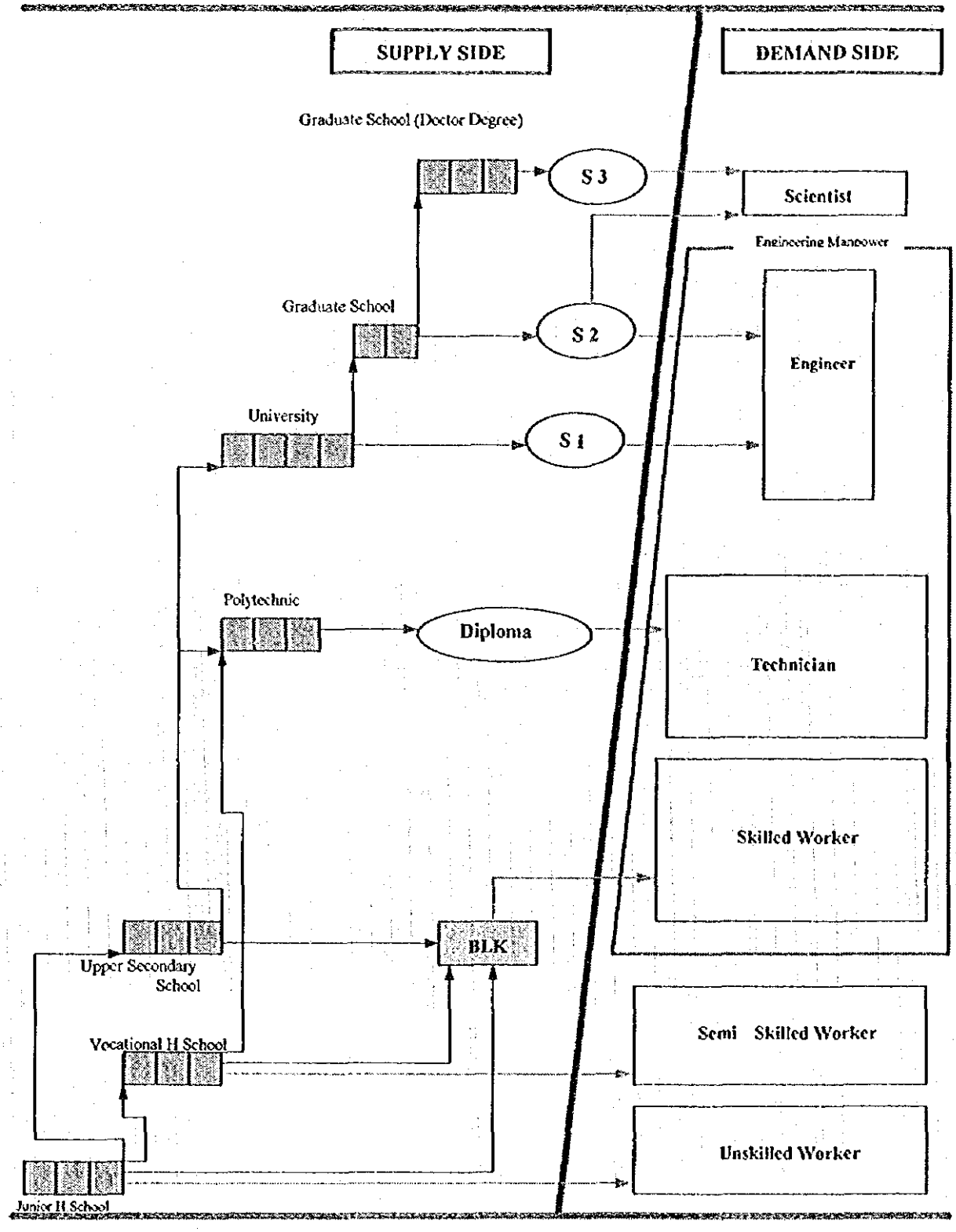

Figure 3.4a Flow chart of EM supply and demand based on old paradigm - Present

Note
1. Box means educational institutions.
2. One box in manpower educational institutions shows one grade year.
3. Circle indicates educational certifications.
4. Gray dotted line indicates that graduation from an educational program leads to candidacy for a position as EM

Source: The Study Team

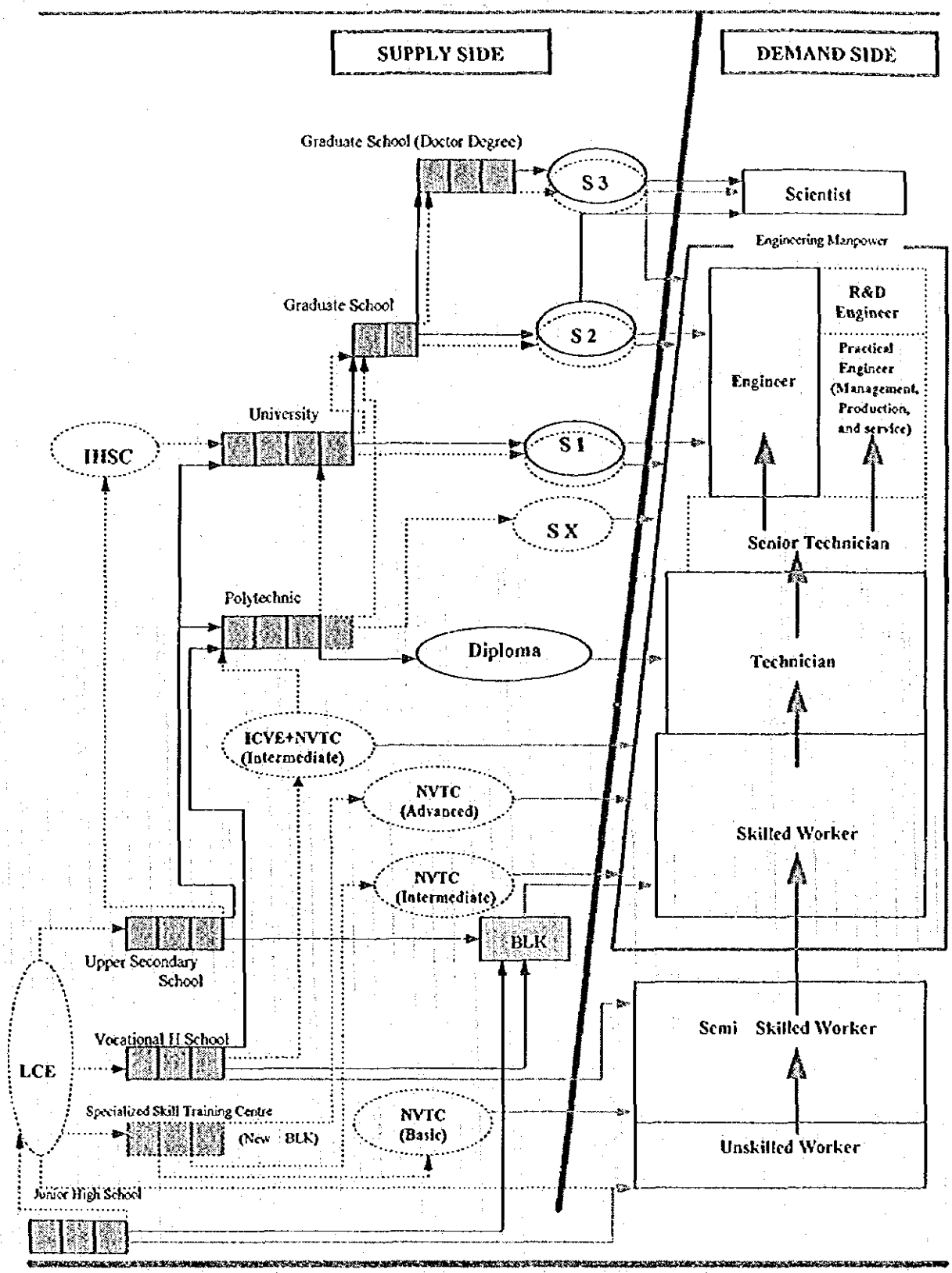

Figure 3.4b Flow chart of EM supply and demand at a transition period to practical paradigm - Intermediate

Note
1. Solid lines indicate path of Old Paradigm and dotted lines show path of Practical Paradigm.
2. Dotted circle means educational certifications based on Practical Paradigm.
3. Abbreviation indicates following meanings.
   LCE : Lower Certificate of Education, ICVE : Indonesian Certificate of Vocational Education,
   IHSC : Indonesian Higher School Certificate, NVTC : National Vocational Training Council
   SX : Newly introducing educational certificate based on Practical Paradigm

Source : The Study Team

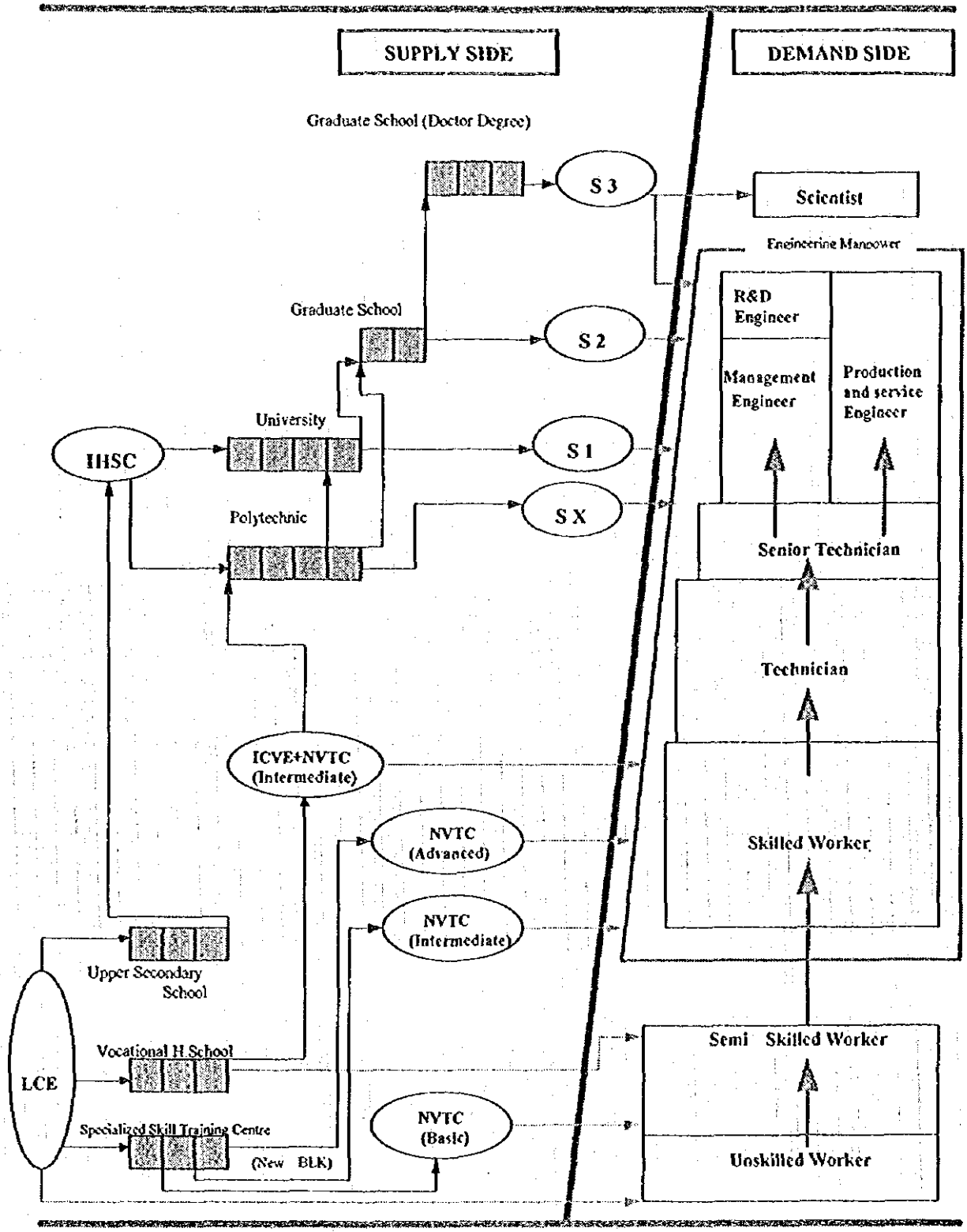

Figure 3.4c Flow chart of EM supply and demand based on practical paradigm - Future

Note All the ordinary high school graduates going on to universities represents an extremely simplified model. Actually, it is quite possible that some of them enter polytechnic according to their choice, aptitude, etc.

Source : The Study Team

allocated more efficiently.[62] This system may be explained as follows by referring intentionally to the actual examples of Malaysia for easier understanding.

For example, all graduates from middle schools will be subject to the test of Lower Certificate of Education (LCE). In accordance with the points gained and aptitude, each student may choose his path of advancement carefully to any of high school, vocational high school, BLK. (See **Figure 3.4**)

Graduates from vocational high schools would advance to polytechnic and would be obliged to acquire NVTC Intermediate to be explained later in addition to the acquisition of points of Indonesian Certificate of Vocational Education (ICVE) in excess of the designated level as shown in Figure 3.4.

Advancement from high schools to universities would be allowed only to those who have acquired points of Indonesian Higher School Certificate (IHSC) in excess of the designated level at the time of graduation from high schools. Similarly to the system of advancement to universities in Malaysia, promising manpower will be severely screened so that they would be educated to become the candidates for scientist and/or engineers by the post graduate course (By having been conferred S2, S3 degrees).[63]

Certified skill qualification system will be introduced.

Acquisition of certified skill qualification is the proof of "*Hand*" qualification in contrast to "*Head*" qualification acquired by educational qualifications as aforementioned.[64]

In prior to the enforcement of certified skill qualification system, NVTC (National Vocational Training Council) which would have authority and compelling power to implement certified technique qualification will be established through the cooperations by and between government agencies, academic community, industrial community and men of learning and experiences.

NVTC which is modeled after the example in Malaysia would have to rest on the basis of the recognition that industrial community is the largest beneficiary with regard to the manpower development and would be in charge of pin-pointing details of the types of skill as may be required by the industrial community for the

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[62] [Correlations between education and job opportunities in Malaysia] in the survey of the other countries in Asia by the Study Team, are referred to in the recommendations concerning the introduction of educational qualifications and certified skill qualifications. See APPENDIX 9.

[63] Research and development engineer is borne in mind in representing the engineer referred to in this case.

[64] For the terms of "*Head*" and "*Hand*", refer to Part I 1.3 (1) [Page I-24].

type of industry concerned. Next, NVTC will establish certified skill qualifications for each type of skill. Certified skill qualifications will be classified into three grades of NVTC Basic, NVTC Intermediate, NVTC Advanced by taking into consideration level of skill, age and so forth.

Details of vocational education and training would have to be standardized in prior to the introduction of certified skill qualification system and it would be essential that curriculum will be accredited mutually by and between NVTC and industrial community. In this case, structuring of curriculum which would reflect industrial needs in islands would have to be contemplated also.

BLK will be reorganized.

Those students admitted to BLK would be skill-trained under the Specialized Skill Training Center (New BLK) to be recommended in the chapter to follow as a new function of BLK and/or would acquire afore-mentioned certified skill qualifications and would continue to hone their skill as semi-skilled and skilled workers respectively.

New BLK would accept full entry of junior secondary school graduates. (See **Figure 3.4**) Those who would desire to enter would have to determine whether to do so or not by checking LCE points acquired and/or one's aptitude.[65] Thorough vocational training for juvenile generation would be significant in the sense that it would prevent drain-out of the juvenile generation manpower into informal sector.

Those who have graduated from junior high schools, entered into New BLK and have acquired NVTC Basic grade after having completed one year curriculum[66] would be the candidates for semi-skilled workers. If NVTC Intermediate grade has been acquired after having completed two years curriculum, they would be the candidates for skilled workers. If NVTC Advanced grade has been acquired after having completed three years curriculum and having acquired high level skill, then they will be automatically treated as skilled workers by industry for the time being.

However, they would have opportunities to be upgraded to EM in future as the manpower capable of adjusting themselves to the skill level required by

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[65] Junior high school graduates to seek job oportunities immediately will be automatically classified as unskilled workers, thus opportunities for them to be upgraded to EM in the future would be significantly reduced.

[66] In this report, one curriculum is assumed to last for one year. In reality however, because of its nature as an auxiliary educational institution, the period to complete a curriculum would be flexible depending on how the fundamental educational system would be improved and how vocational education and training would be promoted.

corporations. Those few who may excel in terms of "*Hand*", "*Head*", and "*Heart*"[67] would have an opportunity to be upgraded even to technicians.

4) Method and schedule to implement

a. Establishment of EM educational reform committee

The Study Team would propose establishment of the EM educational reform committee as afore-mentioned in order to solve diverse problems associated with the development of EM.[68] The committee would propose reform of academic education to develop EM candidates of high quality in line with [the educational reform to be explored] as afore-mentioned in chapter 3 and would be held responsible to upgrade vocational education and training which is being obliged to content itself to rest in lower status in comparison with the academic education.

Management of the committee will rest primarily in the hand of BAPPENAS being assisted by Ministry of Education and Culture, and DEPNAKER. 50% of the committee members will be delegated from BAPPENAS, Ministry of Education and Culture and DEPNAKER while remaining 50% will be delegated from industrial community, other government agencies associated with the development of EM (such as BPPT, Ministry of Industry and Trade and so forth), economic group and scholars.

b. Schedule

The committee will be located within BAPPENAS as an independent bureau. Time of establishment would have to be as soon as possible in view of the needs to develop manpower which would have to become the nucleus within 25 years.

In order to be well under way, the committee would have to arrange frequent opportunities to discuss in order to appeal externally through mass-communications at least 5 years from the establishment and would have to tackle diversified

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[67] See Part I 1.3 (1) [Page I-24].

[68] Similar recommendations have been presented already by the Ministry of Education and Culture and the work to summarize those recommendations by the Working Committee in charge is under way under the name of VET (Vocational Education & Training for Industry Growth). It is recommended that an organization in charge of implementing VET should be established under the name of VSIA (Vocational Standards Implementation Agency) function of which however covers vocational education as a whole. When compared with the recommendations which focus on the development of EM manpower by the Study Team, focal point of those recommendations is somewhat blurred. Also, insofar as the contents of VSIA are concerned, reference to the concrete participation by the industrial community limited to a minimum.

problems positively. Course of committee management will be reviewed and revised officially in every five years in line with the national planning. The committee would continually monitor requests voiced by industrial community which is the principal user of EM manpower and would have to present recommendations to contribute to the upgrading of the level of vocational education and training to EM manpower development institutions and government agencies concerned.

(2) Developing EM Job Organization Models

1) Background

a. Significance of job organization model

In Indonesia where an EM evaluation standard which is linked closely with academic career (old paradigm) has already been deep rooted, there is fear that the old paradigm should persist and thereby prevent optimum distribution of the EM resources unless an alternative paradigm (practical paradigm) which really meets the needs of industry is established and promoted positively[69].

The prospect of development of industrial technology in Indonesia is not very bright. Besides, there is not much inducement for Indonesia's industry to build a new paradigm for itself. Therefore, it is meaningful for the government to take the initiative in establishing and propelling a new paradigm[70].

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.

b. Purpose

Establishing the above job organization is primarily the responsibility of each individual enterprise. Therefore, the government's support recommended in this report should be interpreted as a model intended primarily for enlightenment. Namely, 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

[69] See Part III 3.2(1)1)a [Page III-10].
[70] See Part III 3.2(1)1)b [Page III-11].

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.

c. Relationship with Other Proposals

It is private enterprises that should play the leading role in the future EM development plan discussed in this report. As a rule, educational institutions are only concerned with general human capital of EM (though the polytechnics are somewhat more active in human capital formation than the universities), leaving the formation of special human capital to private enterprises (the formation is not always implemented through intracompany education and training).

How the EM that is supplied to the EM demand side should be treated within enterprises is one of the subjects to be discussed in the present proposal. Namely, the reform on EM education proposed in (1) and the job organization model in the present proposal can be demarcated as the supply side versus the demand side, the external labor market versus the internal market, and general human capital formation versus special human capital formation. They define in detail the practical paradigm proposed in the present study.

In-house training is the principal means of intracompany promotion of EM assumed in the present proposal. Building a new scheme of in-house training described in (3) is intended to support enterprises, mainly small and medium-sized ones, which cannot afford to provide sufficient in-house training. It should be implemented as early as possible in line with the concept of the present proposal.

2) Outline of the Proposal–Installation of Job Organization Model Propulsion Committee

The job organization model that is recommended in the present proposal is not intended for a particular industry, size, or region. It must be realistic so that enterprises will be willing to adopt it. An excessively abstract model is not acceptable. Therefore, building job organization models appropriate to particular conditions of individual enterprises, such as industry, size, and location, requires a considerably long preparatory period.

When the proposed job organization models are built, they should be publicized, disseminated, and periodically reviewed by a permanent organ.

Here, the Study Team recommends that all the above work be executed by a public committee tentatively named the Job Organization Model Propulsion Committee

(hereinafter simply called the Committee). From the viewpoint of keeping the job organization model realistic and spreading it throughout the country, the Committee must be managed jointly by the government and industry in a manner to meet the objectives of networking (described later) and the conditions for deregulation.

The work to be executed by the Committee is building, disseminating, and reviewing job organization models. The building of a job organization model consists of three tasks–setting up a basic job organization; providing a career path linked with the educational and training system; and reviewing the existing qualification systems.

3) Tasks of the Committee

a. Setting up EM model job organization

In Indonesia, EM is generally classified simply into three categories–engineer, technician, and skilled worker. This classification is closely associated with the academic career of EM (at least in the minds of top managements and personnel managers)[71]. However, the composition of EM should be diversified according to industry type, scale, and stage of development of individual enterprises, and each enterprise must develop its own useful human capital for itself. In order to disseminate the above conception and present a job organization to be pursued by enterprises, the Committee shall create a model job organization appropriate to a particular industry, scale, and region.

Though the model job organization can vary in contents according to the category of enterprise, it must contain a career path within the enterprise. For example, even in France which seems more authoritarian than Japan, a career path model as shown in **Figure 3.4** is said to be popular with the enterprises. By disseminating such a career path in Indonesia too, the importance of in-house training related to the promotion of EM will be re-recognized and the expectation for practical qualifications, rather than those related to academic career, will rise inside and outside the company.

[71] This will be presented at later date as the press study to survey enterprises and as the result of the assessment of industrial technology.

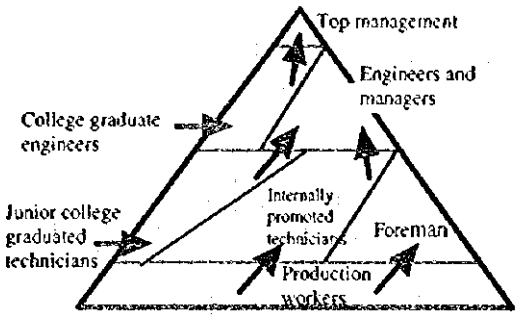

Figure 3.5 Technician/Engineer Career Path in Typical French Enterprise (Reference)

Source : "Social Creation of Categories of French Engineers"
(article contributed by H. Nohara to the September 1992 issue of "Japan Labor Research Magazine").

The names "Engineer," "Technician," "Skilled Worker," etc. and the classification of EM should also be reviewed. In particular, technicians are the promoter of industrial technology on the production scene and supposed to play the most important role in the development of Indonesia's economy in the future. From the viewpoint of improving the social recognition of technicians who will be in seriously short supply in the future, it is commendable to give a special name, say, "Production Engineer" as used in Japan, to technicians who are involved in the development of production technology. "Production Engineers" are those who perform engineering functions production control, quality control, materials control, production technology development at the sites of manufacturing and services, as discriminated from the other engineers who are engaged in design, development, planning, sales services, etc. Namely, production engineer means the engineers who work "production management", "quality control", "developing production engineering" and is divided from other engineers who work "designing and developing", "planning", and or "business and service". Though this can also vary in contents according to the industry type, scale, and development stage of each individual enterprise, a new EM classification as shown in **Figure 3.6** may be considered.

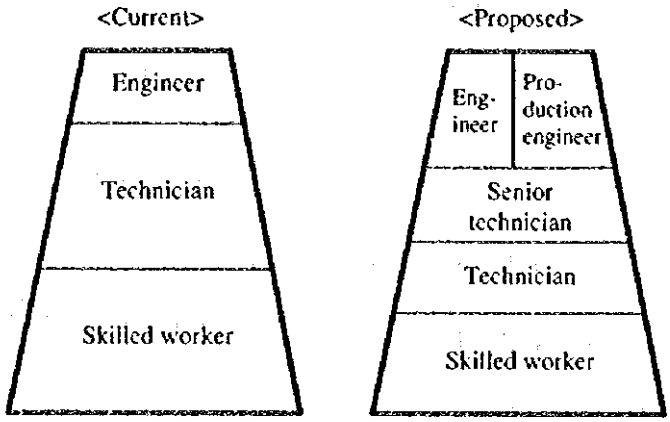

Figure 3.6 Current and Proposed EM Job Organizations (EM Names Are Tentative Ones)[72]

Source) : The Study Team.

b. Study of Flexible Path to Educational and Training System

Though the general human capital of EM will be improved by propelling the educational reform described in (1), it is impossible to establish a fixed correspondence between academic career and EM job organization because of the difference between circumstances of individual employers and abilities of individual employees[73]. In the EM job organization model for each industrial category, each class of EM will be associated with more than one class of academic career and the EM job-academic career relations will be made more flexible by the career path.

Not a few private enterprises cannot afford to make an adequate investment in in-house training of their employees. These private enterprises who cannot carry out in-house training may be different from enterprises who can afford sufficient in-house training and offer career paths due to their recruiting structure of EM. Therefore, setting up a path to the educational system associated with the model job organization can be a guide to each enterprise in recruiting new EM.

To those enterprises which cannot afford to provide adequate in-house training that determines a suitable career path, the Committee must present an alternative plan for training by an outside organization which is interlocked with

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[72] A tentative plan of the Study Team. Using such names as "production engineer" and "advanced engineer" should help improve the image of the position of engineers. The same effect will be obtained by applying the name "engineer" to highly experienced workers.

[73] See Part III 3.1.(1)2)b) [Page III-5].

the new scheme of in-house training proposed in (3) and the BLK reform proposed in (4). The career path in the model job organization must incorporate such a flexible training system.

c. Review of EM Qualification Systems

In order to effectively promote the implementation of a career path by in-house training and training by outside organizations, it is desirable to sanction the capacities associated with individual careers as qualifications. From the standpoint of the present study which assumes that the responsibility for fostering special human capital of EM rests with each individual enterprise, those qualifications should basically be confined within individual enterprises. For the purpose of enlightening the enterprises and diffusing those qualifications among them, however, the certification of those qualifications by an outside organization is considered a possible choice.

Associating qualifications with the job organization has already become common practice in Japan and other countries which attach importance to the in-house training of manpower. In South Korea, there are even some special qualifications, like "Skill Saint" whereby the government recognizes the contributions of qualified persons within their companies.[74] In Indonesia, it is necessary first to make publicly known the presence of qualifications associated with the EM career path in enterprises.

Those qualifications must be differentiated from the various qualifications that exist institutionally but that are not functioning in reality (e.g., DEPNAKER certificate of completion of training). The practicality of the new qualification system can be increased by positively incorporating the existing qualifications that are actually in effect (e.g., the qualification for architectural engineers). Namely, in order to disseminate the new qualification system, it is necessary to make a thorough review of the existing EM qualification system[75] for each category of enterprises.

The new qualification system also serves as a means to diffuse the model job organization among the enterprises. Therefore, it must be so appealing that Indonesian enterprises will be willing to adopt it. In this respect, it is considered effective to make the new qualifications comparable to those of advanced

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[74] Examples of qualification systems of the countries surveyed, described in Appendix 9.

[75] An example of the list for qualifications is given in Appendix 9.

nations (e.g., Japan's consultant engineer, South Korea's skill saint, and France's cadre) so that they will receive international recognition. Therefore, negotiations with various foreign organizations which certify qualifications are included in the tasks of the Committee.

d. An organization model, having a flexible path with educational and training system, is specifically shown in **Table 3.1**.

Table 3.1 Organization model

	Production- Management Course							Technology Course	
Engineer	Department Manager	[10]	▲	▲	▲	D10	E10	F10	Manager
	Assist. Dep. Manager	[9]	⋮	⋮	C9	D9	E9	F9	Senior Engineer
	Manager	[8]	⋮	B8	C8	D8	E8	F8	Research EngineerII
	Section Chief	[7]	A7	B7	C7	D7	E7	(F0)	Research Engineer-I
Technician	Group Leader-I	[6]	A6	B6	C6	D6	E6		
	Group Leader-II	[5]	A5	B5	C5	D5	E5		
Skilled Worker	Foreman	[4]	A4	B4	C4	D4			
	Skilled Worker-I	[3]	A3	B3	C3				
	Skilled Worker-II	[2]	A2	B2					
	Skilled Worker-III	[1]	A1						
Worker	Worker	[0]	A0	B0	C0	(D0)	(E0)		
		[Grade]	Jr.Hi-School	High School	Voc.Hi-School	Poly-technic	Univ.	Doctor Master	

Remarks: A0 to F0 are new recruits of each schools. Posts in brackets are just in short time or optional.

Source : The Study Team

4) Contents of Activities of the Committee

a. Preparations

This is the stage in which the Committee builds the first model job organization to be diffused and a qualification system associated with it. This stage consists of a field investigation and discussions based on its results.

The Committee shall first carry out a field investigation to pursue the ideal job organization for enterprises. Depending on circumstances, a priority investigation on a nationwide basis needs to be carried out before the field investigation. After problems and enterprises to be studied are decided by the priority investigation, the Committee proceeds with the field investigation based mainly on in-depth interviews with the enterprises of different categories. The investigation will cover about 100 enterprises selected based on a classification by industry[76], scale, region, capital, etc. For the purpose of the investigation, it is possible to utilize the system that is built on the Proposal for EM Supply-Demand Network in (5).

Based on the results of the above investigation, the Committee builds a model job organization for each category of enterprises referring to job organizations in advanced countries (enterprises). It is necessary that each model job organization fully reflect the contents of the human capital of EM to be formed by the EM Educational Reform in (1). Therefore, the Committee is required to work in close cooperation with the Committee for EM Educational Reform.

Through a review of the current qualification system of Indonesia and a study of qualification systems of foreign countries, the Committee shall study a new EM qualification system at the same time. The method of diffusing the job organization models, including the new EM qualification system, shall be fully discussed.

b. Diffusion

This is the stage in which the Committee publicizes and diffuses the job organization models and new qualification system it has built as described above. Since it is an essential prerequisite that they be voluntarily adopted by private

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76 By the experience in the pre-study based on an establishments survey (50 companies), the work will be completed in half a year. The total number of divisions comes to 102–17 industry sectors (KLUI 1 2-digit coded manufacturing) x 3 sizes (large, intermediate, small) x 2 areas (Java and another area).

enterprises, the Committee should carefully plan ways to diffuse them effectively.

It is indispensable for the Committee to secure the cooperation and understanding of large enterprises and commercial and industrial associations. To this end, the Committee should reflect opinions of those industrial circles in its activities from the stage of preparations described above. Positively introducing an incentive system which offers tax benefits and other incentives to enterprises which have improved their performance is also considered effective to some degree.

To provide correct information for enlightenment of the enterprises, it is helpful to increase the opportunities for exposure of the Committee activities through the mass media. The information communication through the EM Supply-Demand Network described in 3.3.(5) "EM Supply-Demand Information System" can also be used for the purpose.

c. Review

The model job organizations that have been publicized and the new qualification system that has been put into effect need to be reviewed periodically to determine whether or not they are compatible with the development of industry. On the premise that information necessary for the review is collected continually, it is considered realistic to completely revise the models and qualification system once every five years when various fundamental statistics are compiled and major economic plans are formulated.

The enterprises that have adopted any of the model job organizations and the number of persons qualified by the new qualification system need to be monitored from time to time. For this purpose too, the EM Supply-Demand Network should be able to be utilized effectively. Based on the results of the monitoring, the Committee reviews and revises (if necessary) the models and system every year.

At the time of complete revision (every five years), the Committee performs the above items a. (preparatory work) and b. (dissemination work) again. Since the necessary information must have been accumulated by this time, the work should take much less time than was required to build the model job organizations and new qualification system. Therefore, the work should be carried out without delay.

5) Committee Composition and Activity Schedule

a. Composition

Ministry of Education and Culture (MOEC)

The MOEC participates in the Committee to ensure that the first model job organizations and new qualification system to be built are compatible with the EM educational reform. It is possible that the certification of some of the new qualifications shall be entrusted to any of the agencies that are under the jurisdiction of the MOEC.

Ministry of Industry (MOI)

As the principal authority concerned, the MOI is expected to play an active role in the building, diffusion, and review of model job organizations and new qualification system.

Ministry of Manpower (MOM)

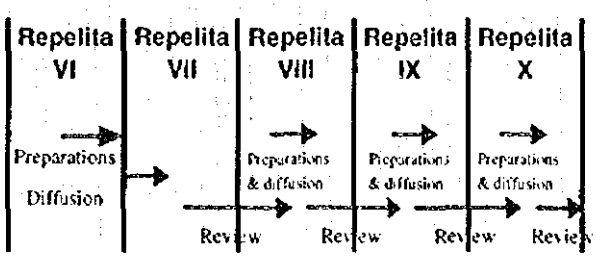
The MOM participates in the discussions about the new qualification system in the stage of preparations from the standpoint of the authority responsible for certifying the existing qualifications. In the training of skilled workers in BLK (the commissioning of in-house training to an outside institution), the MOM can be the certifying agency even under the new qualification system.

Representatives of industrial circles and persons of learning and experience

Personnel managers of the most influential enterprises and representatives of the Chamber of Commerce and Industry shall be invited among the main members of the Committee from the very beginning to secure their understanding and increase the publicity effect.

b. Implementing Schedule

The Committee shall carry out its activities according to the schedule shown in **Figure 3.7.**



Source : The Study Team

Figure 3.7 Schedule for Activities of Job Organization Model Propulsion Committee (Example)

(3) Structuring a New Scheme of In-House Training

1) Background

In order to accomplish the task of improving the levels of technology and skill of human resources, it is an essential prerequisite to establish the fundamental scholastic ability that underlies technology and skill and to make ceaseless efforts to improve the level of education and training at the sites where technology and skill play a vital part. Namely, as long as the human resources that are sent out from human resources development institutes to society to become engineers/technicians are equipped with adequate scholastic ability in science and engineering, the demand side that employs them should be able to have each of them improve his skill while performing the job assigned to him.

True, in-house training is implemented at companies (demand side) in Indonesia. But, there is tendency that in-house training is neglected in the so-called "hollow middle," that is, small and medium-sized companies, especially small ones, which are expected to improve their own technology and techniques but which are not showing any marked signs of improvement.[77]

Over the long term, as the EM educational reform described in (1) will be executed and the job organization model described in (2) will be diffused, the contents of in-house training will be enriched and changed for the better. Over the medium term, however, steady efforts of the demand side and suitable government measures to support them are needed. The in-house training implemented by the demand side itself consists in EM training with weight on on-the-job training, and the minimum requirement for that is securing competent instructors. At present, less than half of the companies surveyed have competent instructors in their staff.

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

2) Outline of Proposal

[77] % of establishment is as follows (having a training program). Also see Part II 2.1.(2)6 [Page II-16].

[Unit:%]

	Large	Medium	Small
TO *ENGINEER*	56	50	40
TO *TECHNICIAN*	60	52	31
TO *SKILLED WORKER*	55	38	25

Source : The Establishment Survey

In view of the above background, 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. To that end, EM must be trained in terms of 3 H's ("*Head*," "*Heart*," "*Hand*"). In addition, the new scheme of in-house training must enable human resources fostered by educational institutions to be developed–in line with the Practical Paradigm–into EM who are equipped with technology and techniques which the demand side expects of the EM.

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. The former consists of providing the demand side with a financial support for the fostering of EM and dispatching key persons (instructors and coordinators) to companies which need them, and the latter consists of specific measures to develop and maintain the in-house training environment, including the introduction of new systems, such as a consignment training system, and the expansion and improvement of outside training facilities, such as establishment of teaching companies.

Of them, "in-house training by the demand side itself" shall be discussed first from the viewpoint of encouraging both the management and labor to give higher priority to in-house training. In view of the importance of training of "*Heart*"–one of the three elements (3 Hs) of in-house training, the Study Team proposes the "consignment training system" and "establishment of teaching companies," both of which offer a favorable environment for "*Heart*" training.

3) Three Measures to Promote In-House Training

a. Support for in-house training by companies themselves

- Basic concept

The basic form of in-house training is such that each company on the demand side has its EM acquire technology and techniques appropriate to the production of its products (supply of its services) and at the same time, trains the EM to become aggressive in improving their technology and techniques for themselves. Thus, it does not depend upon outside training institutes. Therefore,

the basic objective of the new scheme of in-house training is to eliminate obstacles to the implementation of effective in-house training by the demand side.

There are two major obstacles to effective in-house training on the demand side. One is the deficiency in time and money for the in-house training, and the other is the absence of competent instructors. The former is an obstacle common among companies on the demand side, and the latter is especially noticeable in small companies, most of which cannot find able instructors within themselves[78]. The basic solutions the Study Team conceives are a government-led financial support for the former problem and the dispatch of instructors, mainly from economic organizations, for the latter.

- Financial support

  Establishing a fund for improvement of technology and techniques of small and medium-sized companies

  In order to enable small and medium-sized companies to implement in-house training, the government is requested to appropriate in its budget reasonable funds for the education and training in technology and techniques. Uses of those funds should be formulated by advisory staff of the government after hearing individual small and medium-sized companies about their plans for the improvement of technology and techniques. The advisory staff of the government must also help those companies formulate suitable education and training plans. (It is considered that most of small and medium-sized companies are unable to formulate plans like that for themselves. The involvement of government staff should make it easier for the government to follow up the plans.)

  The uses of the above funds shall include:

  1. Expenses of education by instructors
  2. Coverage of loss of profits expected in the immediate future due to the time spent on education and training
  3. Expenditures on educational/training materials within certain limits (includes books and other publications purchased)
  4. Fees for qualifying examinations.

[78] See footnote 75.

Fund of federation of small and medium-sized companies

A cooperative association of small and medium-sized companies shall be formed by industry sector to establish a fund by contributions from the member companies. Government subsidies shall be included in the fund. The order of priority for use of the fund among the member companies shall be decided based on specific conditions of the individual companies. Companies which have used the fund shall refund as soon as possible. The uses of the fund for the improvement of technology and techniques mentioned above shall apply to this fund too.

- Dispatch of instructors in in-house training

  Dispatch of instructors from designated companies

  Companies designated by the government shall select instructors from among their staff based on qualifications or years of experience in EM training and dispatch them to specified companies. Instructors to be dispatched shall be selected by industry sector and field of specialization.

  Dispatch of instructers trained by a newly established in-house training counseling association (or foundation)

  An in-house training counseling association having a staff of instructors in in-house training shall be established to train instructors (unlike CEVEST, the association shall provide EM of engineer/technician class with training in production fields) and dispatch them to companies which need them.

b. System of "Entrust Training to Other Companies"

- Basic concept

  As the environment of in-house training, importance is often attached to physical conditions, including instructors and training facilities. More important, however, is the environmental factor in the fostering of "*Heart*" (enthusiasm and interest in one's job = INITIATIVE).

  EM motivation or *"Heart"* is possibly the most important factor for technical development. As seen in **Figure 2.9**, 40% of establishments stated that their EM have "high" work motivation, and 45% of establishments stated that their EM have "OK" motivation. This may appear to be satisfactory, but Indonesia should require highly motivated EM with mettled to absorb foreign

technology and compete with imported manufactured products.

Generally speaking, employees of a company with outstanding business showings have a respectable mental attitude toward their jobs. If it is a manufacturing company, for example, the elements of production technology which depend on "*Heart*" are at admirably high levels and also discipline is great. In other words, the company is producing high quality products on a stable basis and showing superb safety records. It is certainly important for some companies to invite competent instructors from outside to train their EM. It is, however, more important for those companies to dispatch their engineers, technicians, and skilled workers to training facilities having a better environment. By so doing, they can not only benefit from the better facilities but also increase the effect of in-house training in terms of all the 3 Hs thanks to the favorable environment for the fostering of "*Heart.*"

The favorable environmental conditions in terms of "*Heart*" bring about much better effect when supplemented by good facilities and high levels of technology and techniques. (Many of companies whose employees have admirable "*Heart*" demonstrate that those employees also have respectable "*Head*" and "*Hand.*") The basic objective of this system is, therefore, to augment the effect of in-house training in terms of all the 3 Hs.

- Procedure of "Entrust Training to Other Companies"

Within groups of affiliated companies in Japan, it is not uncommon that subordinate companies dispatch their engineers, technicians, and even skilled workers to make them learn the "*Heart,*" as well as higher technology and skill. In Indonesia, this can hardly be implemented by the efforts of individual company alone.[79] Therefore, the economic organizations and industrial associations must play an active role as intermediaries so that those companies can improve the levels of technology and skill of their EM through outside training.

An executive committee for outside training shall be formed for each industrial sector to organize a group of companies which receive outside trainees.

In view of the fact that highly competent engineers nurtured by BPPT have been dispatched to many state-owned companies in various industry sectors

[79] This practice is often observed in the automotive and shipbuilding industries in Japan.

through-out the country, these state-owned companies which receive outside trainees shall be selected and designated for the purpose. With these companies as the core, groups of consigning companies shall be formed. At the same time, consignment of training to receiving companies shall be publicly invited by industry and by region.

- Preparation of guideline for outside training

The government, industrial associations, and other related organizations shall make the following preparations to establish a guideline for implementation of in-house training and furnish the guideline to each of the companies training engineers, technicians, and skilled workers of other companies.

After making the following preparations, member companies of the individual industrial association shall be guided to receive outside trainees.

- Standardization of in-house training by industry sector (industrial associations).
- Preparation of a standard OJT manual by industry sector (industrial associations)
- Establishment of an in-house training execution procedure (industrial associations)
- Establishment of an intracompany training qualification system (government, especially MOI and BPPT)
- Preparation of funds for subsidies to companies receiving trainees from other companies (government, especially MOI and BPPT)
- Formulation of an execution plan for the T.Q.C. activity linked with the national quality assurance system (government, especially MOI and BPPT)

Note: Organizations in parentheses are those responsible for the appropriate work.

c. Establishment of teaching companies

- Basic concept

In developing countries, it is extremely difficult for most companies to implement intracompany education according to a program. In Indonesia too, there are few companies which can afford to implement EM training for themselves, though many companies understand the importance of developing their human resources. When a particular company only needs training in simple techniques (welding, machining, etc.) as in the past, it can turn to a vocational

training center for the purpose. However, because of limited budget, time, etc., the trainees there will only be able to acquire techniques which can be applied in simple operations. Besides, those techniques are extremely limited in applicability. In Indonesia which must further propel industrialization to improve the productivity and increase the amount of import substitution, it is necessary to upgrade the overall production technology, especially in the manufacturing and services sectors, mainly through on-the-job training.

The teaching company is different from the vocational training center in that it is actually a production plant which provides training while manufacturing a certain product which should be sold as a merchandise. Namely, as shown in **Table 2.3 & Table 2.4**, an ability to develop new products or an incentive to conduct Research and Development seem to be quite weak all over the establishment. And the salient characteristic of the teaching company is that it provides training not only in production technology and techniques including to develop new products, but also in production control technology within the plant in productive operation.

Thus, the teaching company provides training in "production technology" using OJT as the main tool.[80] For each type of manufacturing industry, a teaching company having a model production plant shall be established to raise the levels of production technology and techniques in the production design and manufacturing departments (the sales and materials departments are excluded). Each of the teaching companies shall provide the above technical training while manufacturing certain marketable products.

In short, each teaching company is a manufacturing company, the main objective of which is to train engineers, technicians, and skilled workers. Aiming at a self-supporting accounting system, it is a training institute which, with minimum financial support of the government, should contribute significantly to the development of Indonesian technology and techniques. In addition, each teaching company is expected to serve as a model plant for entrepreneurs.

- Training procedure
  - Trainees

    Engineers, technicians, and skilled workers of companies which find it difficult to implement in-house training; university, polytechnic, and vocational high

[80] This is a common practice of Japan's automotive and shipbuilding industries.

school graduates who are not yet in employment. The trainees shall be engineers, technicians, and skilled workers who need re-education.
(In addition to the above trainees, persons having work experience shall be separately employed for the production operations.)

- Technology and techniques taught

Production technology:

quality control,
cost control,
process control,
labor management,
safety & hygiene control,
materials control.

Techniques: (examples for the machinery industry are given bellow)

Welding, sheet metal working, machining, machinery fabrication, precision machining, gas cutting, casting & forging, electrical wiring, pipe drawing, heavy weights transporting, etc.

- Trainers (includes supervisors)

Trainers and supervisors shall be selected from among the company's engineers, technicians, and skilled workers having rich experience. In addition, field supervisors who coordinate the field training shall be selected from among the most experienced skilled workers. It is important that each field supervisor be of noble character and placed in the key position in field training.

The results of the establishments survey show a very weak link between industry and academy[81]. In order to promote the cooperation between them, it is necessary to consider positively inviting professors of universities and polytechnics as lecturers at the companies.

Professors at universities and polytechnic shall participate as lecturers in the training of production control in the field. By teaching the necessity and know-how of technical training linked directly with the field (e.g., training in production control technology) on the production scene, those professors are expected to have better understanding of the practice of activity in front line.

As shown in **Table 2.2** (data in parentheses,) only 10% of engineers and 12%

[81] See Table 2.5 [Page 2-16].

of technicians in small and medium sized companies work on production. This is a large waste of human resources. Therefore, it is very important that a teaching company avoids an overly academic approach. The teachers should emphasize training on the actual production site of these small and medium sized companies to transfer practical skills.

- Products to be manufactured (Products selected from those manufactured by supporting industries. Example for the machinery industry are given below.) Building components, fittings for vessels, instruments for civil engineering, ladders, pipes & tubes, unit baths, automotive parts, valves, air trunks, high pressure tubes, plastic molding dies, pipe joints, hydraulic machine parts, switchboards, terminal boxes, etc.

- Training procedure (Only the main points are given below. A detailed procedure shall be formulated as a national standard by a committee formed separately.)
  Training shall be provided in the production plant and at the site of servicing. For each type of industry, new companies shall be established for the purpose, or a suitable company of high standing shall be selected as the production plant and servicing site. The basic objective of training is to make the trainees acquire skill in quality control through "improvement activity" (OJT to heighten "*Heart*," "*Head*," and "*Hand*." Special emphasis is placed on discipline and safety & hygiene measures which contribute to the heightening of "*Heart*.")
  Trainees shall be posted in the field and engaged in production operations (direct work).
  As a rule, the training period shall be half a year to one year.

d. Implementation plan

With respect to the outside training system and teaching companies, they shall be established on a step-by-step basis taking into consideration the specific conditions of individual areas. For each subject, a particular area shall be designated and incorporated in a medium-term plan. Implementing the outside training system requires certain types of preparatory work with the big and medium-sized companies which are to receive outside trainees. Each teaching company requires about one year to build and complete necessary preparations.