Continued

Science of Astronomy & Atmosphere	1	60	241	33	17
Astronomy & Meteorology	1	30	142	19	12
Astronomy & Space Science	1	39	211	19	6
Astronomy & Space Science	1	40	212	25	7
Astronomy	1	20	95	11	1
Statistics	37	1,805	8,619	1,224	607
Herb Medicine	1	-	55	9	1
Aviation Administration	1	50	282	25	18
Chemistry	83	4,152	20,412	3,399	1,394
Environment Protection	1	50	280	61	19
Environmental Science	7	329	1,494	200	64
Engineering	870	55,197	274,430	34,334	20,648
Architectural Engineering	54	3,539	18,913	2,857	1,833
Architectural Equipment	1	40	214	17	15
Architecture	14	712	4,032	566	386
Polymer Engineering	13	640	3,537	341	177
High Polyment	1	40	161	-	-
Industrial Management	1	70	242	-	-
Industrial Chemistry	14	728	4,112	517	304
Chemical Engineering Department	1	100	100	-	-
Optical Engineering	1	50	304	34	10
Transportation Engineering	6	279	999	43	23
Structural System Engineering	1	50	149	-	-
Metallurgical Engineering	19	1,239	6,999	1,059	624
Metallic Material Engineering	4	318	1,445	144	83
Mechanical Engineering	49	4,991	26,896	3,962	2,751
Mechanical Engineering Sci & Mech	1	200	226	-	-
Machine Design Engineering	6	380	1,981	282	201
Mechanical Design Engineering	17	959	5,612	579	346
Engine Engineering	3	220	1,124	260	196
Refrigeration Engineering	2	80	495	54	37
Refrigerator & Air Cond. Eng.	1	40	118	-	-
Municipal Planning	-	-	-	45	31
Municipal Plan Engineering	1	50	302	39	22
Municipal Planning Science	2	99	589	66	31
Municipal Engineering	17	707	3,246	322	165
Power & Mechanic Engineering	1	30	88	-	-
Mechatronics Engineering	1	26	85	-	-
Inorganic Engineering	13	708	3,970	445	240
Material & Chemical Engineering	1	50	147	-	-
Micro Biological Engineering	1	50	238	41	26
Semiconductor Engineering	2	110	402	46	26

To be continued

Continued

Semiconductor	2	70	156	-	-
Semiconductor Study	1	30	107	-	-
Fermentation Engineering	1	40	238	44	17
Industrial Engineering	51	3,229	16,671	2,082	1,208
Industrial Mechanical Engineering	1	30	89	-	-
Industrial System Engineering	1	50	50	-	-
Industrial Safety Engineering	6	280	1,136	87	48
Biotechnology	9	400	2,083	220	75
Applied Biology Engineering	1	35	196	14	7
Biolo Resources Engineering	1	40	186	13	6
Biology Chemical Engineering	1	50	145	-	-
Production Mechanical Engineering	5	269	1,360	128	93
Production Automation Engineering	1	46	235	8	3
Naval Architecture	1	40	259	30	10
Naval Arch. & Ocean Engineering	3	194	929	141	85
Textile High Molecule Engineering	1	60	238	32	7
Textile Engineering	12	748	3,806	629	438
Ceramic Engineering	2	150	512	53	31
Software Engineering Studies	1	60	165	-	-
Food Science & Technology	1	70	326	16	7
Food Resource Study	2	69	274	38	23
Food Bionics	1	70	307	58	33
Interior Architecture	1	30	125	-	-
Energy Engineering	1	40	242	32	9
Dying Engineering	1	50	221	36	24
Cosmic Aerial Engineering	2	90	404	31	9
Nuclear Engineering	3	158	942	140	52
Atomic Nuclear Engineering	1	45	176	30	8
Medical Electronic Engineering	2	110	522	47	25
Artificial Intelligence Study	1	50	144	-	-
Automobile Engineering	3	184	566	-	-
Automobile Engineering	1	101	445	40	31
Mining & Minerals Engineering	11	528	3,024	451	171
Material Engineering	29	1,336	7,138	630	301
Material Metallic Engineering	1	35	162	25	4
Electrical Engineering	52	3,597	19,461	2,779	1,746
Electrical Engineering Major	1	80	83	-	-
Electrical & Electro. Control	1	272	775	-	-
Electrical Control Engineering	1	-	234	94	70
Computer Science Engineering	2	80	407	88	62
Electronic Computing Information	6	269	515	-	-
Computer Science Engineering	5	521	2,852	464	221
Electronic Ceramic Engineering	1	60	124	-	-

To be continued

Continued

Computer Engineering	1	100	596	51	41
Electronic Engineering	73	6,322	32,058	4,337	2,589
Electronics & Computer	1	-	16	77	51
Electronical Material Engineering	5	338	1,695	208	118
Electronical & Electrical Engineering	1	45	220	31	3
Group of Electric Elecp. Cont.	1	260	643	-	-
Computer Science Engineering	1	80	340	15	3
Electronical Control Engineering	1	50	320	38	23
Electronic Comm. Engineering	7	412	2,367	336	209
Electric Wave Engineering	12	548	1,406	-	-
Micro Industry Chemistry	1	50	108	-	-
Precision Mechanical Engineering	10	567	3,179	408	260
Information Engineering	5	248	1,164	154	104
Information Industry	1	70	245	10	6
Computerized Information Field	1	200	200	-	-
Information Comm. Engineering	24	1,256	4,403	268	132
Electronic Engineering	2	120	346	-	-
Control & Measurement Engineering	25	1,305	5,559	350	181
Control & Mechanical Engineering	2	80	229	-	-
Ship Building Engineering	3	40	565	111	59
Ship Building & Marine Engineering	3	190	982	110	59
Ship Building & Ocean Engineering	1	120	869	129	75
Molding Engineering	1	30	86	-	-
Computer Science	3	160	828	73	24
Computer Engineering	31	2,071	9,022	856	490
Civil Engineering	56	3,452	20,008	2,884	1,778
Civil & Environment Engineering	2	180	425	44	34
Aeronautical Engineering	2	120	323	-	-
Aerial Cosmic Engineering	3	159	358	41	15
Flight Operation	1	132	794	93	68
Aerial Cosmic Engineering	7	325	1,374	126	49
Flight Operation	1	62	206	35	30
Aero-materials Engineering	1	60	313	18	7
Avionics Engineering	1	80	480	60	46
Aerial Survey Engineering	1	49	49	-	-
Aero Telecom & Inform Engineering	1	71	410	52	41
Harbour & Transportation Eng.	1	40	287	17	9
Marine Engineering	4	160	1,064	136	67
Civil Engineering in Ocean	2	80	377	31	19
Ocean Environmental Eng.	2	69	257	36	14
Chemical Engineering	55	3,391	16,953	2,123	1,293
Environmental Engineering	34	1,894	8,318	857	383
Environment Landscape Arch.	1	40	232	20	17

To be continued

Continued

Agriculture & Forestry	250	9,805	50,364	8,376	3,921
Dairy Chemicals	8	320	1,687	331	154
Agricultural Engineering	10	429	2,361	339	218
Agricultural Biology	12	484	2,501	477	170
Agricultural Machinery Engineering	9	350	2,039	266	150
Agriculture	20	802	4,417	763	348
Agricultural Chemistry	15	613	3,286	513	256
Forestrial Resources Study	12	446	2,107	316	133
Veterinary Medicine	10	450	2,442	337	156
Food Science & Technology	23	964	4,858	773	347
Plant Breeding	25	1,002	4,577	946	380
Other studies in Agric.& Forestry	106	3,945	20,089	3,315	1,609
Other Studies in Science & Technology	192	8,469	34,166	6,590	2,608

Source: Statistical Yearbook of Education in Korea

9.3.7 Specialized Subject Matter of Science High School

Required	Elective
General Mathematics (6-8)	Mathematics III
Mathematics II (16-26)	Advanced Physics
Science I (4-8)	Advanced Chemistry
Physics (6-8)	Advanced Biology
Chemistry (6-10)	Advanced Earth Science
Biology (4-6)	Computer Science II
Earth Science (4-6)	Science Philosophy
Lab Experiment in Physics (4-8)	Readings in Physics
Lab Experiment in Chemistry (4-8)	Electronics
Lab Experiment in Biology (4-8)	Workshop
Lab Experiment in Earth Science (4-8)	Individual Research I
Computer Science I (2-4)	Individual Research II
Science History (2-4)	
Credit hours to be completed 66-110	16-56
Total Credit Hours	82-122

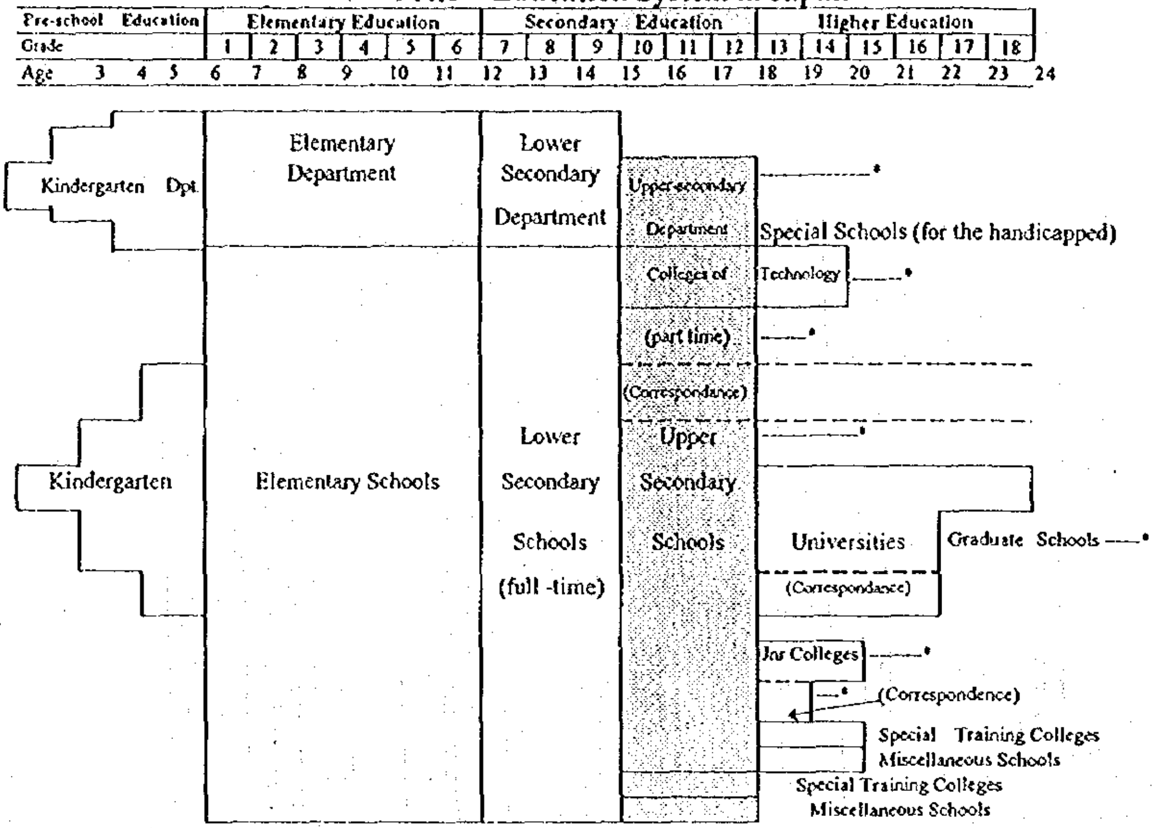
Source: Education in Korea 1993-1994

9.3.8 Standard Types of Skills and No. of Skills Trained in Craftsman's Course in Korea

	Standard Type of Skill	No. of Skill-Type
1	Metal Materials and Manufacture	37
2	Metal Processing	59
3	Transportation Equipment, Construction Machinery	32
4	Electrical	24
5	Electronics and Telecommunications	36
6	Textiles	3 2
7	Construction and Wooden Processing	40
8	Chemicals	35
9	Printing	12
10	Mining	31
11	Craft	29
12	Food Processing	15
13	Others	8

Source: the Ministry of Manpower

9.4.1 Education System in Japan



Note: * = Advanced courses

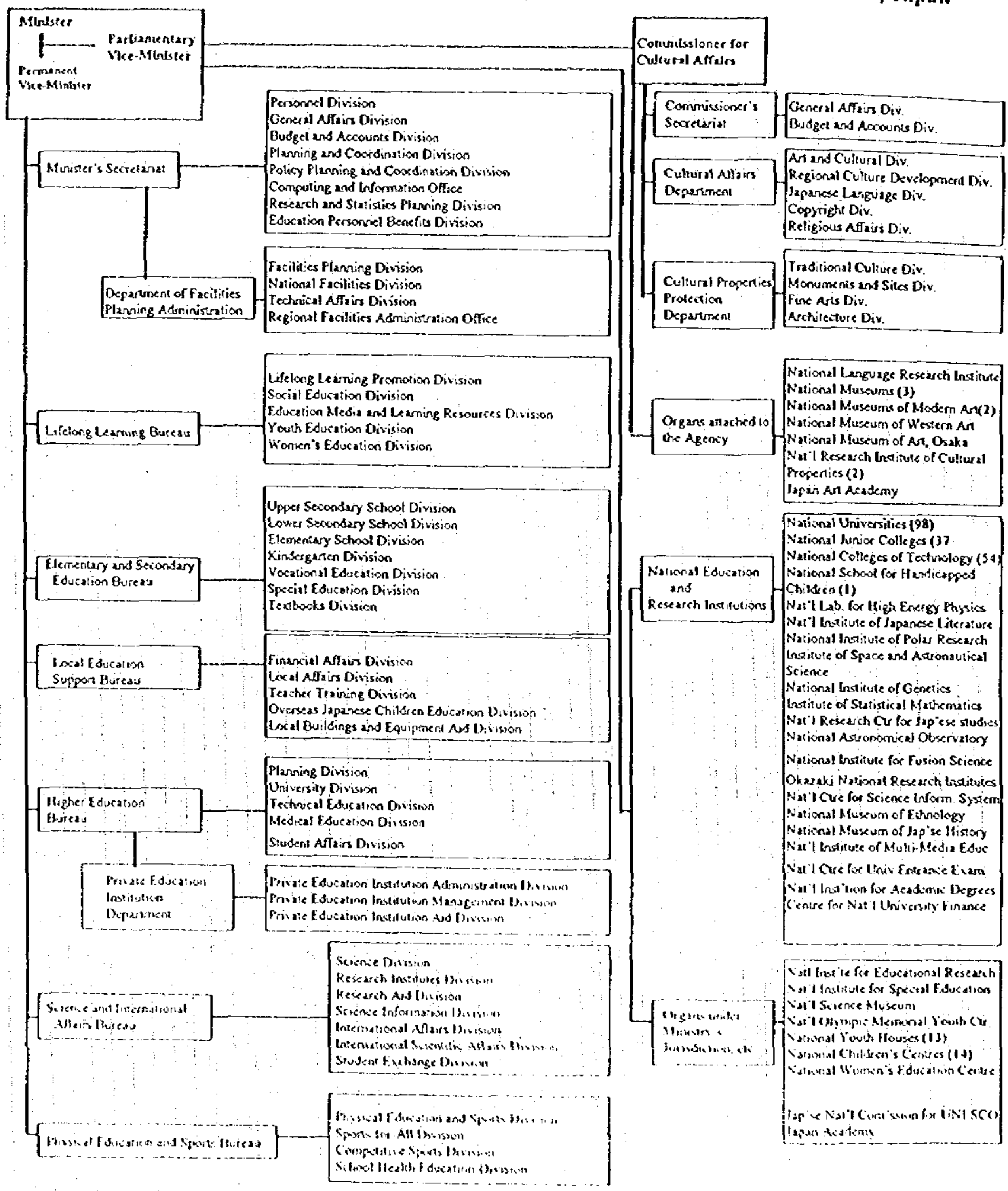
Source: the Ministry of Education Japan

9.4.2 Outline of Higher Educational Institutions in Japan (Academic Year 1993)

	No. of schools	No. of students	No. of students/No. of schools	No. of teachers	No. of students/No. of teachers	No. of staff members
University	534	2,389,648	4,475	235,485	10.15	170,696
(National)	98	561,822	5,733	84,806	6.62	59,991
(Public)	46	74,182	1,613	12,846	5.77	11,063
(Private)	390	1,753,644	4,497	137,815	12.72	99,642
Junior College	595	530,294	891	58,155	9.12	17,906
(National)	37	16,705	451	4,006	4.17	515
(Public)	56	22,802	407	4,736	4.81	1,062
(Private)	502	490,787	978	49,413	9.93	16,329
Colleges of Technology	62	55,453	894	6,644	8.35	3,338
(National)	54	48,053	890	5,939	8.09	3,120
(Public)	5	4,364	873	480	9.09	177
(Private)	3	3,036	1,012	225	13.49	41

Source: Ministry of Education "Schools Basic Research Report (Higher Education Institutions)"

9.4.3 Organization of the Ministry of Education, Science and Culture, Japan



Source: the Ministry of Education, Science and Culture, Japan

9.4.4 Progress of budget under the control of Ministry of Education compared with the national budget in Japan

	Ministry of Education budget amount	Increase rate (%)	Ministry of Education budget/National budget (%)
1981	4,469	4.73	9.6
1982	4,585	2.6	9.2
1983	4,534	D1.11	9.0
1984	4,572	0.84	9.0
1985	4,574	0.05	8.7
1986	4,572	D0.04	8.5
1987	4,574	0.03	8.5
1988	4,577	0.06	8.1
1989	4,638	1.34	7.7
1990	4,799	3.47	7.2
1991	5,056	5.36	7.2
1992	5,320	5.21	7.4
1993	5,427	2.01	7.5
1994 (draft)	5,543	2.15	7.6

Source: Ministry of Education

9.4.5 Number of New Enrollment, Enrollment and Graduates by Majors of Science and Engineering Faculties of Universities (Academic Year 1993)

	Entered	Enrolled	Graduated	Employed (Among the graduates of that year)
Science	19,077	76,736	14,976	9,078
Mathematics	5,115	21,424	4,221	3,187
Physics	3,494	16,175	3,608	1,931
Chemistry	3,477	15,246	3,314	1,909
Biology	1,614	6,754	1,580	690
Physical geology	809	3,693	791	431
Others	4,568	13,444	1,464	930
Engineering	107,564	431,907	87,463	65,432
Mechanical engineering	21,187	87,323	18,487	14,289
Electrical communication engineering	33,114	133,219	26,184	19,717
Civil engineering and construction engineering	20,462	83,815	17,805	14,413
Applied chemistry	11,693	48,654	9,878	6,281
Applied science	979	5,483	1,489	807
Nuclear engineering	275	1,652	358	163
Mining engineering	133	1,043	386	213
Metal engineering	674	3,943	1,333	814
Fiber engineering	374	1,592	462	263
Ship engineering	241	1,173	251	176
Aviation engineering	593	2,918	718	494
Management engineering	5,438	22,458	4,795	4,251
Carpentry, Handycrafts and Industry	656	2,519	514	429
Others	11,745	36,115	4,803	3,122
Agricultural science	16,781	71,000	15,229	10,895
Agricultural science	2,782	11,959	3,083	2,156
Agricultural chemistry	2,421	10,521	2,602	1,727
Agricultural engineering	1,003	4,425	943	765
Agricultural economy	1,484	6,007	1,265	1,046
Forestry	576	2,716	821	603
Forest products science	35	362	157	82
Veterinary science, animal husbandry	2,293	12,005	2,297	1,709
Fisheries science	1,651	7,060	1,603	1,146
Others	4,536	15,945	2,458	1,661
Hygiene	23,399	117,989	21,767	9,087
Medical science	7,508	48,799	8,047	73
Dentistry	2,737	17,971	3,021	1,381
Pharmacology	9,159	38,176	8,614	6,010
Professional nursing	992	2,336	386	345
Specialized medical science group	100	629	98	1
Others	2,903	10,078	1,601	1,277
Science and Engineering Faculties Total	166,821	697,632	139,435	94,492
Gross Total	554,973	2,209,028	445,774	339,884
Ratio of Science and Engineering Faculties (%)	30	32	31	28

Source: Ministry of Education "Schools Basic Research Report"

9.4.6 Number of Students in Engineering Course of All Senior High Schools

[Unit: 1,000 persons, %]

Year	No. of students	Component ratio
1955	237	9.2
1960	324	10.0
1965	624	12.3
1970	566	13.4
1975	509	11.8
1980	475	10.3
1985	478	9.3
1989	489	8.7

Note: The component ratio is the ratio of number of students of Engineering Course of senior high schools to number of students of all senior high schools.

Source: Ministry of Education "Schools basic research report"

9.4.7 Kinds and Contents of Public Vocational Training

Kind of Vocational Training	Training courses	Outline of training	Training institution and total training time	Vocational training facilities
Ordinary Vocational Training	Ordinary courses	Long-term Vocational training offered to those who graduated from Lower Secondary schools or Upper Secondary schools to acquire skill, and knowledge necessary to become workers having diversified capabilities	1 year for those who graduated from upper secondary schools Total training time 1,400 hours or longer 2 years for those who graduated from Lower secondary schools Total training time 2,800 hours or longer	Vocational capabilities development school Vocational capabilities development school for the handicapped
Ordinary Vocational Training	Short courses	Short-term Vocation training offered to trainees who have jobs and workers who left jobs to acquire skills and knowledge necessary for jobs	Up to 6 months Total training time 12 hours or longer	Vocational capabilities development school Vocational capabilities development school for the handicapped job capabilities development promotion center Vocational capabilities development college
Advanced Vocational Training	Professional courses	Long-term Vocational training offered to those who graduated from upper secondary schools or alike to acquire fundamental skill and knowledge necessary to become workers having skill and knowledge for jobs	2 years for those who graduated from upper secondary schools Total training time 2,800 hours or longer	Vocational capabilities development junior college
Advanced Vocational Training	Professional short courses	Short-term Vocation training offered to workers having jobs to acquire skills and knowledge necessary for jobs	Up to 6 months Total training time 12 hours or longer	Vocational capabilities development junior college Vocational capabilities development college Vocational capabilities development promotion center

Source: the Ministry of Labour

Results of on-the-spot research in Manpower Developing Institutions in Malaysia, Korea and Japan

(1) Method

A study team has visited manpower training institutions in Malaysia, Korea and Japan to obtain data from a person-in-charge of technology-related courses at each institution. At the same time, interviews concerning professors, curriculum or facilities were conducted. In addition to the above, facilities such as laboratories, classrooms or libraries were observed.

The following are the questions asked by the study group;

A. General Questions

① Proper name of the institution

② Foundation and history

③ Scale (No. of students or professors/teachers)

④ Characteristics in education

B. Questions Concerning Figures

① No. of new enrollment, existing enrollment, graduates by major in science and technology departments

② Rate of employment and rate of enrollment in higher grade by sector/major

③ No. of credits

④ Annual tuition

C. Questions Concerning Features

① Final academic career of professors/teachers

② Average age of professors/teachers

③ Contents of curriculum by main majors in science & technology departments

④ Educational productivity

⑤ Ratio of academic learning and practical training

⑥ Employment condition

⑦ Facilities of science and technology departments

⑧ Demand and supply in educational facilities and annual expenses for facilities and equipment

⑨ Annual outlay for education budget and condition of government budget

⑩ Scholarship System

(2) Major Institutions Targeted in On-the-Spot Survey

Lower/upper secondary educational institutions as well as public vocational training centers that were visited by the study team numbered 14 in Malaysia, 11 in Korea, and 7 in Japan.

Also visited in the survey were government bodies in charge of education or employment such as the Ministry of Education or the Ministry of Labour. Information on government measures concerning technical/vocational education were collected in the public organizations.

The following are the names of the institutions, interviewees, and dates of the visit.

List of Visited Manpower Educational Institutions in Malaysia & Korea

Date (Malaysia)	Educational Institutions/Related Agency	Interviewee
2/9/94	Ministry of Education	Dr.Abdul Halim Ahmad Principal Assistant Director Educational Planning and Research Division
3/9/94	Ministry of Education	Mr.Lin Bin Husin Assistant Director Vocational Education
5/9/94	Kota Baharu Polytechnic	Mr.Tahir Ahmad Head Training and Visit Unit/Lecturer, Civil Eng. Dept
6/9/94	University Malaya	Dato'Ahmad Nawawi Deputy Vice Chancellor
8/9/94	Vocational Secondary School Sungai Buloh	En. Baharom Bin Endut Principal of School
8/9/94	Technical Institute, Cheras	Awi Bin Ab. Jalil Head of Department of

		Technology
9/9/94	International Islamic University Malaysia	Mr.Fadlulla Wilmot Special Assistant to the Rector
10/9/94	Ministry of Education	Mr. Peng Leong Assistant director technical & vocational
12/9/94	Ungku Omar Polytechnic	Mr.Mohammed Zakaria B. Mond. Noor Head of Department Department Of Electrical Engineering
13/9/94	Universiti Sains Malaysia	Mr.Norpisah Mat Isa Assistant Registrar
14/9/94	Institut Teknologi Mara	Mr. Asiah Abdullah Deputy Dean
15/9/94	Ministry of Human Resources	Dr. Hj. Shafie bin Hj. Mohd. Salleh
15/9/94	Tunku Abdul Rahman College	Mr. Chee Ah Kiow Registrar
16/9/94	The Centre for Instructor and Advanced Skill Training (CIAST)	Mr. Ghazlan Bin Ghazal Director
19/9/94	German-Malaysian Institute (GMI)	Mr. J. Wenze Managing Director
19/9/94	Mara Vocational Training Centre	-
20/9/94	Ministry of Human Resources	Mr. Zabidin B Abo Samad Head of Training Head of Training Management Init
21/9/94	Polytecnic Staff Training Centre	Dr.Zainal abidin Ahmad Director
(Korea)		
23/9/94	Ministry of education	Kim, Wha-Jin Assistant Director

26/9/94	Ministry of education	Kim, Geungho Director, Science & Technology division
26/9/94	Ministry of Labor	Kim, sung- Joong Director Ability Development Division
27/9/94	Economic Planning Board	Soh, Il-Seob Director, Overall Coordination Division
28/9/94	Seoul National University	In, Chong-Duck Assistant Director Planning & Coordi-nation
28/9/94	College of Engineering Korea University	Young H. Paik Dean
29/9/94	Korea Manpower Agency Ministry of Labor	Yi Jung-Woo Director, inter-national cooperation Division
29/9/94	Inchon Industrial Master's College Korea Manpower Agency	Lee, Sang-Joe Dean
30/9/94	Pusan National University	Jung,Dong-Hyeon Dean for Planning & Research
4/10/94	Dong Yang Institute of Technology	Chung, Wan-Sup Chief of Academic Affairs
4/10/94	Yonsei University	Kim, Woo Sik Dean, College of Engineering
5/10/94	Hansung Science High School	Hak Soon Hong Principal
5/10/94	Induk Junior College	Mr. Kim Professor Mechanical Department

6/10/94	Hankuk Aviation University	Hyung Jae Lee President
7/10/94	Kyonggi Mec-Tec. High School	Ok Ryong Chang Principal
10/10/94	National statistical Office	Bureau of Statistics

(Japan)

2/11/94	Ministry of Education	Mr.Muneharu Iwamoto Senior Curriculum Specialist For Industrial Education Elementary and Education Bureau
2/11/94	Ministry of Education	Mr.Masao Homma Director Technical Education Division Higher Education Bureau
7/11/94	University of Tokyo	Mr.Sun-ichi Kobayashi Dean Faculty of Science Mr.Hiroyoshi Suematsu University of Tokyo Professor Department of Physics
8/11/94	Tokyo Institute of Technology	Mr.Toyosaka Moriizumi Professor Faculty of Engineering Department of Electrical and Electronic Engineering
10/11/94	University of Tokyo	Mr.Shigeo Ozono Professor Department of Precision Machinery Engineering Chairman Committee for

		International Cooperation & Exchange
11/11/94	Kyoto University	Mr.Kenjiro Suzuki Professor Department of Mechanical Engineering
14/11/94	Tokyo National College of Technology	Mr. Susumu Masaki Professor Department of Electronic Engineering
16/11/94	Kumamoto National College of	Mr. Hidenori Ohyama Associate Professor Technology Department of Electronic Engineering
18/11/94	Tokyo metropolitan College of Aeronautical Engineering	Mr.Kiichi Yoshida Associate Professor

(3) Results

1) Results of Research at Secondary Schools

a. Educational Productivity

The productivity of education in Malaysia is high; as in Japan, Malaysian universities generally offer four-year undergraduate courses.

For example, educational productivity at non-technological faculties in International Islamic University of Malaysia is at the level between 23 to 25% (Refer to Appendix **9.5.1**). Almost the same productivity level is observed at science & technology departments in other universities.

In Korea, educational productivity is seemingly low. This, however, is attributable to the three-year military conscription mandated during the university years. Excluding this factor, educational productivity in Korea retains the level around 25%. (*College of Engineering Korea University*)

As in Japan, it is common for most students to graduate universities in four years, in real terms.

b. Quality of Professors

Some Malaysian institutions are having difficulty in acquiring professors in leading technological areas. *Politeknik Ungku Omar* cited shortage in professors, especially in the computing area.

To the contrary, Korea was having no problem in retaining professors both in terms of number and quality. Professors at prestigious universities are endowed with high social status.

"There is no problem at all concerning quality of professors. Professors may be paid a little less compared to private sector workers. But that can more than be offset by their freedom to carry out research studies as much as they like, and the brand name called a *professor at Seoul National University*" said a source from *Soul National University*.

As for the background of the professors, *Yonsei University* said all of its professors have acquired Ph.D. in Japan or in the United States. *Hankuku Aviation University* said four of their professors have acquired Ph.D. at technological faculty in notable Japanese universities such as *The University of Tokyo* or *Kyoto University*.

Generally speaking, further the degree of industrialization, greater the number of highly educated professors.

When proficiency of professors are not sufficient enough, some schools even possess the privilege to fire them. (*Hansung Science High School*) It is also pointed out that awards and punishments set against professors are crystal clear .

When asked for a suggestion to improve education in Indonesia, *Collge of Engineering Korea University* said that the quickest way is to invite globally famous professors. *Tokyo Institute of Technology* said that the human resource with the knowledge of leading technology acquired in an industrialized nation may leave Indonesia because they have little opportunity in Indonesia to exercise their proficiency. *Kyoto University* suggested to organize study meetings on mechanics, robots, or measurement control, in order to elevate the quality of Indonesian professors.

Turning to colleges, *Tokyo Metropolitan College of Aeronautical Engineering* said that many colleges have university-level staffers; when inviting an assistant or a lecturer, the competitive rate among applicants usually hit 10 times (meaning there is 1 job offer for every 10 applicants). Moreover, most of the applicants have Ph.D.

c. Contents of Curriculum

Both Malaysia and Korea are mindful about the balance of book learning and practical training from the stage of upper secondary education.

Turning to the curriculum at the electronics department at *Technical Institute, Cheras* (Malaysia's oldest technical high school, which is said to have many brilliant students), 192 hours out of 288 credits are digested in two years. The following breakdown of the 288 credits reflects the practice-orientedness of the curriculum; 132 credits spared for theory and 156 for practical training. (See Appendix 9.5.2)

In Korea also, vocational high schools split curriculum into theory and practice by half. In *Kyonggi Mec-Tec. High School*, practical work experience that last from a month to a year in firms is compulsory.

Hence, vocational education in industrialized countries place importance on practical works from upper secondary education.

On the other hand, *Hangsung Science High School*, which provide concentrated training for science & technology-based students, place 50% of the curriculum on science and the rest of the half on what-they-call "ordinary high school program". This program place emphasis on mathematics and physics.

Classes are at the level equivalent to those sophomores are taught at universities; no ordinary high schools give such high-level classes.

Many of the students educated through the concentrated curriculum hope to advance to electronics, electric telecommunication, or biological technology departments at universities. Number of students that select pure physics are on the increase in recent years as well.

Turning to higher education, Malaysian universities are theory-oriented in general; the ratio of theory and practice stands at 75:25.

Curriculum for freshmen through seniors at electronics technology department in *Tunku Abdul Rahman College*, as shown on Appendix **9.5.3**, puts emphasis on theory and logic.

Korean universities are more flexible; *Seoul National University* revises curriculum in every four years. Mindful of economic changes, each department forms unique curriculum. Ultra importance placed upon mathematics is characteristic as well; *College of Enginnering Korea University* say that Korean students show brilliant performance in mathematics at universities in the United States.

Compared to Malaysia, Korean universities are practice-oriented. For example, *Hankuk Aviation University*, the only specialized college in aviation area, places 54% of the curriculum on specialist course against 46% on general course; of the special course, 62% of the curriculum is spared for practical work against 38% on theory.

General curriculum include national ethics, Korean, history, social studies, Korean geography, mathematics, physics, chemistry, physical education, foreign language, arms drill, art, English, and Japanese. Curriculums at electronics department and mechatronics department at *Hankuk Aviation University* are as follows (See Appendix **9.5.4**);

In *TheUniversity of Tokyo*, Japan, the mechanic information technology Department of Mechano-Informatics in the Faculty of Engineering is the one carrying out studies on leading robot and automatic control areas. This division was originally dubbed vessel mechanic technology department. Nowadays, however, this department concentrate mainly on the area related to mechatronics, auto-translator or software development.

Other than the mechanic information technology department Department of Mechano-Informatics, there are mechanics technology department and industrial mechanics department . Together, they are called "The Three Mechanics

Department". Approximately 10% of the pupils in the technology department are enrolled in the Three Mechanics Departments and each grade consists of about 150 students. Percentage of students who advance to graduate school is high; 70 students in each grade proceed to master's degree course in graduate schools.

Curriculums at technology colleges are comfortable, as the colleges offer 5-year courses. Basics of technology is crammed during the first and the second years followed by differential and integral calculus course of an university-level in the third year.

Teachers alter curriculums putting emphasis on the basic course.

In specialist course, six 50-minute classes are given per week. The number of total credits was lessened to 167 three years ago. *Tokyo National College of Technology* said the Ministry of Education gave instruction to colleges not to impair the student's academic level.

d. Budget Standing

Turning to budget standing, no serious opinions were heard; *International Islam University, Malaysia* said that they have no problem in terms of the budget. *The Ministry of Education, Malaysia* said that they are not worried about the budget for constructing Politeknik although retaining professors is a problem.

According to the Education Ministry, tuition account for only 20% of school budgets and the rest is taken care of by the ministry.

Budgets are tight, however, for universities that are expanding their facilities. For example, breakdown of the budget sources for *Tengku Abdul Rahman College*, which is undergoing construction works for expansion, is as follows; government: 50% , tuition: 40%, and donation: 10%

The total cost for the third-stage construction works is estimated at 20 million Malaysian dollar. Half of the amount is planned to be assisted by the government while donation from multi-sectors is expected to pay the other half.

In such a case, tuition, too, are precious source of fund; annual tuition revenue of the college is 7.8 million Malaysian dollars (per capita tuition; 1,000 Malaysian dollar multiplied by number of students; 7,800)

According to *the Ministry of Education Malaysia*, construction cost per school stands at 80 million Malaysian dollar in average. This figure only shows the cost for the building and related facilities and excludes cost of purchasing land or of construction.

Turning to Korea, educational enthusiasm among parents is helping to make university budgets comfortable. The percentage of students moving on to higher education is distinguishingly high in Korea. "This is a results of eagerness of parents on education. They sacrifice everything for their children's education." say the *Ministry of Education, Korea.* Running university, therefore, is an easy task in Korea.

According to *the Ministry of Education*, government virtually take care of 100% of the budgets in state-run universities while 75% of the running cost of private universities are covered by tuition and 12 % by assistance from foundations. Assistance from the government in private universities accounts for only 3% of the total. This, however, is expected to be expanded to 10%.

Tuition at state universities are cheaper in comparison with private universities. For example, tuition for the state-run *Seoul National University* (Technology department) is 1 million won per semester (dual-semester system is employed; from March to June, and from September to February). State universities depend heavily on government assistance with its running cost; tuition account for only about 20% of the total running cost.

Turning to private universities, tuition at *Yonsei University*, a prestigious private university, is 1.4 million won for undergraduate courses and 2 million won for post-graduate courses. Tuition account for 66% of the running cost and most of the rest are covered by foundation funds, which consist of donations from parents. (See Appendix 9.5.5)

Such "funds" reflects eagerness of parents on education.

The breakdown of the expenditure at *Pusan National University* is shown on Appendix 9.5.6. According to the example, 80% of the budget is spent on salary and construction of facilities.

Hankuk Aviation University, which trains pilots and aviation-related engineers, requires annual running cost of 10 billion won. Of the amount, 60% is spent on running cost and 40% on investment on facilities. The operational expense is covered by tuition, which costs 1.2 million won per semester. (Number of students: 2,405 multiplied by 2.4 million won = 5.77 billion won) The level of tuition is set low; only about 80% of average university tuition. Machinery-related expenditure total 2 billion won per annum. The university owns seven aircraft for practical training. The cost required for maintaining these aircraft as well as cost for purchasing such machines turn out enormous.

In case of technology department at *TheUniversity of Tokyo*, annual outlay for research activities is 80 billion yen and is likely to top 100 billion yen soon. Maintenance cost of apparatuses, however, is burdened upon the university itself. There is little connection between the technology department and the business circle. The amount of donation seems extremely small. A total of 7 billion yen of donation is collected by *The University* of *Tokyo* as a whole. The technology faculty, however, accounts for only 250 million yen of the total donation.

Budget outlay for technical colleges in Tokyo is 2.7 billion yen per annum. *Tokyo National College of Technology* said that of the total, 1.5-1.6 billion yen is allocated for buildings and facilities, while 1.1-1.2 billion yen is spent on personnel expenditures.

New school building for *Tokyo Metropolitan College of Aeronautical Engineering* required 12 billion yen for construction and 2-3 billion yen for facilities.

e. Employment

Among engineers, technicians, skilled workers and non-skilled workers, *the Ministry of Education, Malaysia*, consider that the number of engineers need to be increased most urgently. There is a distinct difference in ability between engineers and technicians. While engineers possess general capabilities, technicians are proficient in specialized skills. When compared in terms of wage, monthly wage of an university-graduated rookie engineer at a prestigious firm is 1,800 ringgit while that of a rookie technician, graduated from Politeknik, is 1,000 ringgit. Engineers with high educational career starts to earn 2,500-2,000 ringgit per month in a relatively early stage as he gains experience.

There is a huge gap in wages between prestigious firms and public sector. The wage level of public workers is low; an engineer graduated from an university can only earn about 1,300 ringgit, and a Politeknik-graduated technician, 700-750 ringgit.

Most of the graduates from vocational secondary schools are employed as trainees; newly graduate's monthly wage, when employed in a small firm, is about 500 ringgit. When employed in a prestigious firm, such as Matsushita Electric Industrial Co. Ltd., their wage is about 780 ringgit. When overtime payments are added, the payment will be about 1,200 ringgit. (*Vocational Secondary School Sungai Buloh*)

In the past, general perception for blue-collar workers was inferior against white-collar workers. Nowadays, however, technical blue-collar workers are paid more compared to clerical workers, say *the Ministry of Education, Malaysia.*

Engineers graduated from universities are elites. Most universities surveyed said that technical students have no problem in finding employment. Many even said that job openings for these students are overwhelming. Students are given wide range of choices as there are many foreign high-tech firms such as Sony and INTEL in operation in Malaysia.

International Islamic University Malaysia said that advantages of its students are their proficiency in English/Arabian languages, high sense of morals, lack of drinking habits, and diligence. The university intend to newly add technology faculty based on its perception that there are enough engineers; it plans to put importance on computer science sector, which is projected to see shortage by the year 2020.

In Korea, too, diversified employment opportunity is open for engineers with high educational background. In the past, graduates from non-technology department was favored. This trend, however, has been reversed and engineers are enjoying dominant standing.

Seoul National University said that many students enter graduate school but they have no problem in finding employment later on. *College of Engineering Korea University* said that about 30% of the students go on to graduate school while the rest are able to find whatever jobs they like.

According to *Yonsei University*, general trend of students' post-graduate direction is as follows; 50% enter businesses, 35% go to graduate schools, and 15% choose to become public sector worker.

On the other hand, *Pusan National University* said that employment situations in local cities are not as good as in Seoul. When compared to *Seoul National University*, students are finding it more difficult to find jobs, especially female students in non-technology departments and students from literature departments.

In two-year-course specialized colleges, percentage of students' successfully finding employment reaches almost 100%. Except for the small number of students who choose to enter a four-year university, most of them become engineers. *Dong Yang Institute of Technology* say it reckons that their students have been employed as "technical engineers", the in-betweens of engi-

neers and technicians. On the other hand, *Induk Junior College* deem that 70-80% became "engineers" and 20-30%, "technicians".
Graduates of *Hankuk Aviation University* first join air force and then become pilots for civil airline companies after about a decade of military service. Other than pilots, graduates of the university are engaged in air transportation, aircraft manufacturing or space development businesses.

Korea is a society in which one's academic career counts a great deal. Therefore, it is difficult to convince parents when a student of vocational high school wish to terminate his educational career on graduation of the high school, according to *Kyonggi Mec-Tec. High School.* But almost 100% of such students are able to secure jobs, it added. Most of the graduates obtain the second degree technician qualification soon after entering a firm. After 3 or more years of job experience, they are allowed to sit for exams for the first degree technician or the second degree engineer qualification.

The connection between the business and the academic circles in Japan is not as strong and as systematic as it is in Korea. This is because Japanese firms have little expectations for universities to bring forth research results that can be turned into immediate use for commercial purposes. Japanese firms consider that the least armor of intelligence is enough for a new graduate, because they intend to provide trainings on their own. Japanese firms do not necessarily appreciate human resource with doctor's degree. This is partly because it is possible to obtain doctor's degree after entering businesses. There are active moves in Japan to strengthen graduate schools and make them main footing of research activities, as it is pointed out that the lack of doctors is causing the weakness in the area of leading technology. *The University of Tokyo* is transforming itself into a graduate-school-oriented academic institution. This is because it is getting increasingly difficult to comprehend what is being taught only by the verbal lessons given during the four-year undergraduate course; practical trainings given in the post-graduate courses substantiate the theory already taught.

Looking at the Science Department at *The University of Tokyo,* 40% of the students obtain doctor's degree and 70% of the doctors become teachers or researchers. Many of the remaining 30% find jobs in electronics-related firms such as research centres of Hitachi, Toshiba or NEC. Students, who majored in physics are especially popular among firms; this is partly because students of physics tend to have flexibility, for physics is a "skill of thinking".

In the meantime, reputation of a technical college, which was first established in 1962 on request from the business circle, is heightening year after year. *Tokyo National College of Technology* attributes the growth of technical colleges to the following; 1) colleges are guiding students to find employment in firms that provide high level of in-house training, and 2) Society as a whole is regarding highly of technical colleges and set high value on them as "engineer-training schools".

Employment situations of technical college graduates have been satisfactory except for years of 1975 and 1976, when the first oil crisis hit the nation. Jobs-to-applicants ratio hit the peak of 40, which means there were 40 job openings for every 10 job seekers, at the time of the so-called bubble economy three years ago. Even in the last year, when the economy was in a stranglehold, the ratio stood at 27, followed by 17 this year.

Almost 100% of the graduates from aviation college secure jobs although slight effect of the bad times in the aviation industry is visible, say *Tokyo Metropolitan College of Aeronautical Engineering.* Graduates of technical colleges become engineers in production, technology or development sectors. Three decades after the first foundation, some graduates have been promoted equally as graduates of universities; some became manager at NTT and other, director at Hitachi.

The percentage of the students' securing job is 100% helped by overwhelming number of job openings, which enable them to enter as development-related engineers to prestigious firms.

Due to the recession, popularity of technical colleges may continue, say *Kumamoto National College of Technology.*

"Graduate schools and technical colleges are good enough, and undergraduate universities are needless ", is an opinion raising from some business sectors in Japan.

f. Facilities

The vast campus with school buildings lined up in order and neat interiors of each facilities at *Vocational Secondary School, Sungai Buloh, Malaysia,* were impressive after observing its wooden buildings, and each workshops of automobiles, mechanics, electronics, electric power, welding, refrigerator/air-conditioner. As for the automobile workshop, it is far more modern compared to *Politeknik* in Indonesia with Hondas and Toyotas available beside Protons.

An automobile per student is provided; the vehicles are installed with fine engines. Six-month training in an automaker is provided making it possible for the students to acquire practical knowledge useful immediately after they enter a firm.

Moreover, a cutting machine is allocated to each student. As for CNC machines, however, the university said that the machines are too complicated for a youth at the age around 16-year-old to handle.

After discussing with department presidents of the chemical, electronics and computer-science departments at *Universiti Teknology Malaysia*, survey on the computer science laboratory, which is said to be the most advanced in Malaysia, was allowed. There, the presence of super-computer cray has been confirmed. The laboratory is installed with abundant computers and all the designing and drafting by students are carried out by computers. In electronic technology laboratory, a made-in-France robot was installed and students were indulged in research of artificial brain.

In Korean universities, many of the facilities and apparatuses in leading areas such as electronics apparatuses and robots came from corporate donations. A 50.8 billion won construction of *Yonsei Engineering Research Center*, a symbol of tie-up between the business and the academic circles, was started in 1994 at *Yonsei University*. Of the total construction cost, 67% or 34.0 billion won came from donations from the business circle and the rest of the cost will be covered by revenues, for example, from the vast parking areas (66,000 square meters).

Half of the space in the "*Yonsei Engineering Research Center*" is used for research activities by employees dispatched from Samsung, Hyundai, Daewoo or Lucky Goldstar. Professors of *Yonsei University* are to invite businesses to the other half, which is about 19,800 square meteres, and to earn rental revenues within three years. The contract is that the corporation is to be shifted to Yonsei University after three decades.

The outline of flight simulator for training pilots at *Hankuk Aviation University* is as shown on Appendix **9.5.7**.

Hansung Science High School was established in 1992 by refoming a former junior-high school. The "science building" on the left hand side is lavishly equipped; each student is allocated with a computerware. The construction fee totaled 4 billion won while 3 billion won was spent on facilities and equipment.

Annual maintenance cost excluding labor cost is 300-million won. All of these are covered by the government. Most of the facilities are not as good as those in universities. Regarding telescope, microscope, gastromat graph, and microcomputer, however, the facilities of the high school is as superb as those found in universities.

2) Results of On-the-Spot Survey at Vocational Training Centres

a. Visit to Vocational Training Centres in Malaysia

(Outline of Interview at Labor Ministry)

Students, who are through with 11 years (6, 3 and 2 years) of elementary and secondary educations, will have 3 options; entering an university, the Politeknik, or a vocational training centre (ITI, IKM).

Of these, guidance for training at vocational training centres is formed by *NVTC* (the *National Vocational Training Council*). Each institution, in charge of vocational training centres, such as the Ministry of Education, the Ministry of Human Resources, the Ministry of Youth and Sports are to follow this guidance.

A total of 15,000 students are training in vocational training centres. There are 11 ITIs, 9 MARAs, and 6 youth training centres operated by the Ministry of Youth and Sports. Furthermore, there are uncertain number of technical colleges and high schools under the management of the Ministry of Home & Welfare or the Ministry of Education.

There is enormous demand for vocational training; 8,000 applicants rush in at the times of subscription in June and December. Craft skills and technical skills are especially popular. Tuition are covered entirely by the government. Most of the students become skilled workers after the graduation.

Teachers at ITI number 7,000. Of them, 60 teachers have been sent abroad to study. As for their academic background, diplomas account for 60% and high-school graduates account for 30%. Average age stands at around 34-35 years old.

Furthermore, there is a system to make the businesses participate in the formation of the curriculum.

(Vocational Training at *CIAST*)

The role of *CIAST (The Centre for Instructor and Advanced Skill Training)* is to contribute to the area of "skills", for which keeping up with the advance-ment of technology is essential. All the trainees are subscribed from businesses. While *NVTC* provide trainings on basic parts of skills through school education, *CIAST* aims its trainee to obtain advanced skills actually in use in businesses. Such skills include EFT, ABS, and automatic-transmission in the auto industry and CAD/CAM, CNC, factory-automation, program logic controller in the machinery industry.

Trainings last for 3 weeks at the longest; shorter, when compared to *CEVEST* in Indonesia. Quorum for one course is 8-12 people. Per capita tuition is about 150 RM per week.

CIAST is eager in inviting students to its courses; newsletters carrying semi-annual training schedules are sent to 3,000 firms within Malaysia. Information such as code numbers that commensurate with the contents of the trainings, identifications of the courses, period of the trainings are included in the newsletters. Potential-trainees are able to select courses based on the newsletters. Changes in the number of participants in the vocational trainings are shown on Appendix 9.5.8.

Triple step system is employed in evaluating vocational capability; skill width, job width and occupational width. This system do not allow trainees to satisfy with the level, at which they have arrived. For skill width, a note book will be sealed with qualification stamp, and for job width and occupational width, module certificate and proficiency skill certificate will be issued respectively.

Looking at the number of teachers shown on Appendix 3.6.9, shortages in teachers are seen in J3, J4 and J5. More than 5 years of time is needed to become a teacher. Of this time, from 9-month to 1-year period is spent in Japan.

(Vocational Training in German-Malaysian Institute)

The parent body of the institute is GTE, an assistance organization in Germany. Half of its operational cost is covered by the assistance from the German government and the other half is covered by tuition from trainees. The number of people hoping to enter the institute is always outnumbering the quorum and that there is a permanent waiting list. Facilities in the institute are compatible with the confident comment the institute has issued; that it has the facility exactly the same as those found in general corporates. German-made leading machines such as discharge machine (worth 20-30 million yen),

three-dimension measuring instrument (50 million yen), wire-cutting machine (50 million yen), and TCM (16 million yen) are lined up in the facility; even a corporate rarely possesses so many leading machines all at once, say a institute source. The construction cost totaled 34 million RM; buildings accounted for 20 million RM and facilities and equipments, 9 million.
Budget outlay for the current year is 6.2 million RM and outlay for five-year running cost, 60 million RM.
The institute say its largest concern is to find excellent teachers in electronics.

(Vocational Training in Mara Vocational Training Centre)
Established in 1974, it is a training institute for Bumiputra.
Its curriculum is almost in line with ITI, the vocational training centres under the management of the Labour Ministry; 70% of the curriculum is spared for practical trainings and 30% on theory. Machine equipments are of new models and are abundant especially in CNC machines and drafting computers.
Trainees are in their youth; they have obtained MCE (Malaysian Certificate of Education) as well as MCVE (Malaysian Certificate of Vocational Education). There are no elderly people in search of re-education.
About 70% of the trainees find employment while distinctively capable ones go on to higher education such as universities. In many cases, graduates are employed as semi-skilled workers; some of them, however, become technicians.
The campus is becoming overpopulated. To build the same facilities, a construction cost of about 6 million to 10 million will be required.
Wage of an instructors is about 1,500 RM per month.
Not only are the trainees free of tuition, they are also endowed with monthly allowance of 200 RM per capita.

b. Results of On-the-Spot Survey on Vocational Training Centres in Korea
(Vocational Training Department, Ministry of Labor)
Vocational trainings in Korea currently centre on technicians including skilled workers. Although skilled workers were oversupplied in the past, today's Korea urgently need to boost the number of technicians and skilled workers in order to strengthen its international competitiveness. Under the name of "technical colleges", the government is eagerly trying to train technicians. The process of forming curriculum is government-oriented; govern-

ment agencies discuss to decide the curriculum.

Gists of government measures toward vocational trainings are 1) To cover the budget allocated for training centres, 2) To assist with the cost involving facilities/equipments and construction that are needed to transform vocational training centres into "technical colleges", based upon promotional fund donated by firms, 3) To maintain general vocational training centres, 4) To assist privately-run vocational training centres.

Many of the applicants to vocational training centres are those who failed to enter an university or those who are hoping to get employment as soon as possible on economic grounds.

Government assistance is extended to trainees except for the table expenses.

Publicly-run training courses last relatively long; most of them are one-year course. On the other hand, in-plant trainings provided by firms last for 3 months. The reason for the relatively-short training is that the purpose of the training is to propel progress in technology. Furthermore, privately-run training centres are often used for re-trainings of the elderly.

Government certificates are issued after trainees take post-graduation exam. This is a partial mirroring of the dual system employed in Germany. Those in possession of the highest level of skills are called "master technicians"; they are followed by the 1st grade and the 2nd grade high level skilled-workers and then assistant technicians. More than 3.7 million people sit for this state examination for a technical qualification. After acquiring the qualification, they become mainstay in businesses. The questions in the exam cover 26 classes and 600 areas given by experts in businesses.

Machinery equipments were replaced to the latest models a few year ago. Improvement in the quality of instructors remains on the agenda to be solved. The centres are also groping the way for providing effective trainings in a short period of time.

(Korea Manpower Agency)

Korea Manpower Agency was founded in 1982. The semi-governmental organization carries out the following duties; 1) To provide training designed by the government, 2) To issue certificates, and 3) To control technology-related human resources.

The duties the agency conducts are equivalent to what *Employment Promotion Projects Corporation* and *Human Resources Development Bureau* do in

Japan. The agency was formed by centralizing the functions that were once separated in the Labor Ministry and Science and Technology Agency. Its budget outlay is covered wholly by the government.
The following are the two functions possessed by vocational training centres under the management of the agency, from which an annual number of 25,000 technicians and skilled workers are provided;

1) 8 two-year technical colleges
Mirroring the craftsmanship system in Germany, the colleges were established with the purpose of training master technicians. Following the inauguration of the first technical college in 1976, the number of colleges totaled 8 by 1992. During 1995 and 1996, 8 more colleges are excepted to be established to double the current number to 16.
In order to enter the master technician's course, a 2nd grade engineer's qualification (after graduating a two-year technical college) plus six-year job experience are required . Many of the applicants, therefore, are in their 30's.
For the 1st - 2nd courses (which is called "craftsman" in Korea; equivalent to skilled-workers' level.), the applicants must have educational career higher than the high-school level. Academic title, qualification and business title are not quite strictly defined. After graduating a technical college, one will have the qualification to enter a four-year university and start from the third year.

2. 32 Vocational Training Centres
The main purpose of the institutions is to train skilled workers. With the background of recent shortage in manpower, 99% of the trainees obtain qualification and almost 100% succeed in getting employed.
The Planning Division?? draw strategy for manpower development mindful of economic structure in coming years. The agency conduct hearing on businesses to find out which sectors are in need of training.

Yardstick-wages for human resources related to technology and skills in Korea are as shown below. The government does not intend to differentiate the wage by job capability. The difference in the wage between university-graduate engineers and technicians stems only from the two-year difference in the academic career. The gap remain the same throughout their business career.

University-graduate	US$1,000 per month
Chief Technician	US$800-900 per month

A gap of US$100-200 between Master Technician, 1st Grade and 2nd Grade technicians exist respectively. In some cases, master technicians earn more than engineers.

skilled Workers	US$700 per month

9.5.1 Educational Productivity at International Islamic University Malaysia

No.	Newly Enrolled Students	Enrolled Students	Students to be Graduated*	Educational Productivity* *
Economic Departments	360	1,345	348	25.8%
Legal Department	317	1,314	306	23.3%

* to be graduated in Mar. 1995
** graduates divided by currently enrolled students
Source : International Islamic University Malaysia

9.5.2 Curriculum at Electronics Faculty at Technical Institute, Cheras

First Semester	credit (theory)	credit (practical training)
1. Introduction	4	2
2. Safety	2	4
3. Tools	2	6
4. Electronic unit	2	0
5. Electronic component	2	0
6. Meter	2	4
7. Circuit (basics)	6	6
8. Alternate Circuit	6	6
Total Credits in First Semester	34	38
Second Semester		
9. Electro magnetics	4	6
10. Transformer	2	2
11. Motor & Generator	8	4
12. Wiring (indoors)	8	14
13. Introductory Computing	8	16
Total Credits in Second Semester	30	42
Third Semester		
14. Semi-conductor	2	0
15. Diode	6	10
16. Transistor	12	10
17. Semi-conductor component	10	10
18. Telecommunication	8	4
Total Credits in Third Semester	38	34
Fourth Semester		
19. Digital electronics	12	10
20 Monitoring	10	12
21. Maintenance	8	20
Total Credits in Fourth Semester	30	42
Total Credits in 4 Semesters	132	156

Note : Four credits, for example, mean 4 × 40 minutes = 160 minutes per week
Source : Technical Institute, Cheras

9.5.3 Curriculum at Electronics Technology Department at Tunku Abdul Rahman College

Freshman

1. Malayal
2. English I
3. Mathematics I
4. Mechanics
5. Materialogy
6. Technological Information Presentation
7. Electronic Technology
8. Technological Computer
9. Electronics
10. Drafting and CAD (electronic technology)
11. Practical Work (electronic technology)
12. Electronic Technology Experiment I

Sophomore

1. Malaya II
2. English II
3. Mathematics II
4. Control Technology, Economics
5. Technological Computer II
6. Electromagnetics and Semiconductor
7. Mechatronics and Operation
8. Electronic System Technology
9. Computer System Technology
10. Industrial Electronics and instrumentation
11. Electronic Technology Experimental Practice II
12. On-the-Job training (during three-month holiday)

Senior

1. The Engineer In Society
2. Break System Technology
3. Physical Electronics and Solid State Devices
4. Telecommunication System Technology
5. Digital System
6. Electric Power
7. Outlook and Composition

Source : Tunku Abdul Rahman College

9.5.4 Electronics-related Curriculum in Hankuk Aviation University

Electronics

Practice courses	Major subjects
electronic instruments	electric theory
electronic circuits	electronics
computer R/TV	micro-computer
electronic application	electronic-instrument
	digital-engineering
	automatic-control

Mecahtronics

Practice courses	Major subjects
CNC machine	workshop practices
automatic control	mechanical materials
CAD/CAM	machine design
mechatronics-application	electronics electric theory
	automatic control

Source : Hankuku Aviation University

9.5.5 Source of School-Running Cost at *Yonsei University*

Total Tuition	6,642,452	(65.7%)
Fund	2,645,641	(26.2%)
Government Assistance	196.478	(1.9%)
Company assistance	619,000	(6 1%)
Total	10,103,571	(100 0%)

Source : *Yonsei University*

9.5.6 Breakdown of Budget (1993, unit: 1 million won)

Salary, Construction Cost	46,326,178 (80.4%)
College	7,632,389 (13.2%)
School	379,1060 (0.7%)
Graduate School	3,159,825 (5.5%)
Laboratory	142,000 (0.2%)
Total	57,639,498 (100.0%)

Source : *Pusan National University*

Appendix 9.5.7 Flight Training Simulator

1. Name: Micro Flight Simulator for a Single Engine Piston Aircraft (MSP-1)
2. Manufacturer: Singer Company, U.S.A.
3. Purchase Time and Price: April, 1986 300 thousand dollars
4. Purpose: To train seniors procedures in flight operation
5. Training Period: 20 lessons for private pilot training course and 50 lessons for commercial pilot training course
6. Authorizing Items: experience in instrument flying and screening in instrument flying
7. Motion System:
   1) Four-Degree-of-Freedom Motion System
      - pitch axis; + 19° to -14° pitch angle

Source : *Hankuk Aviation University*

9.5.8 Change in No. of Participants of Vocational Training

	No. of Participants	No. of courses
1984	112	9
1985	339	48
1986	626	81
1987	693	108
1988	1,032	147
1989	1,175	160
1990	1,101	153
1991	1,461	168
1992	1,855	196
1993	2,435	262

Source : *CIAST*

9.5.9 Number of Teachers (as of August 1994)

Title	Grade (Academic Title)	Monthly Wage(RM)	No. of Enrollment	Quorum	Opening
Engineers	J2 (degree)	4,000	1	1	0
	J3 (degree)	3,000	6	8	2
Instructors	J4 (diploma)	2,000	9	14	5
	J5 (diploma)	1,500	35	45	6 (J5 + J6)
	J6 (certificate)	1,200-1,300	4	0	0
Technicians	J6 (certificate)	1,200-1,300	1	1	0
	J7 (certificate)	800	8	8	0
Tradesmen	R6	600	0	2	2
Supporting Staffs		-	26	29	3
Total			90	108	18

Source : CIAST

Appendix 10

BIBLIOGRAPHY

INDONESIA

- BAPPENAS, Macro Economic Indicators 1993
- BAPPENAS, National Income of Indonesia 1987 - 1992
- BKPM, Indonesia Investment Briefing Book 1994
- BKPM, Investment Deregulation 1993
- BPS, Indonesian Input-Output table, 1975, 1980, 1985, 1990
- BPS, Wages paid on Estates 1990
- BPS, Statistical Year Book of Indonesia 1992
- BPS, Results of 1990 Population Cansus
- BPS, Household/Cottage Industry Statistics 1991
- BPS, Wage Trend of Estate Workers 1987 - 1991
- BPS, Small Scale Manufacturing Industry Statistics 1991
- BPS, Indicator of Manufacturing Industry
- BPS, Regional Income of Provinces in Indonesia 1983 - 1990
- BPS, Industrial Statistics 1990 Vol. 1, 2, 3A, 3B
- BPS, Labor Force Situation in Indonesia 1992
- BPS, Summary of Economic Statistics
- BPS, Distribusi Buruh Menurut Upah 1986
- BPS, Indikator Tingkat Hidup Pekerja 1990
- BPS, Upah Buruh Menurut Jenis Pekerjaan 1991
- BPS, Klasifikasi Lapangan Usaha Indonesia
- BPS, Sektor Industri Pengolahan
- DEPNAKER, Seven Policy Priorities of the Department of Manpower
- DEPNAKER, Labor Force Situation in Indonesia 1993, 1990
- DEPNAKER, Laborers/Employees Situation in Indonesia
- DEPNAKER, Labor Market Information
- DEPNAKER, Human Resources Profile of Indonesia
- DEPNAKER, Manpower & Employment Situation in Indonesia 1992
- DEPNAKER, Computer System in DEPNAKER
- DEPNAKER, Indonesian Manufacturing Employment and Training Vol. III
- DEPNAKER, Perencanaan Tenaga Kerja Nasional Draft I
- DEPNAKER, Analisis Pasar Kerja Triwulan II/1993, VI/1993
- DEPNAKER, Analisis Survey Tenaga Kerja Ahli/Terampil Di Kodya Padang

- DEPNAKER, Balai Latihan Kerja Surabaya 1993
- DEPNAKER, Penyusunan Matriks Tenaga Kerja di Sektor Ekonomi 1993/94
- ISO, International Standard Classification of Development Project 1991
- MOEC, Educational Policy and Planning Project
- MOEC, Data Perguruan Tinggi Negri Tahun 1991/1992
- MOEC, Data Perguruan Tinggi Swasta Tahun 1991/1992
- STAID (BPPT, RISTEK, LIPI), Science & Technology Indicators of Indonesia 1993
- Shafig Danani, Major Findings of the 1992 East Java Enterprise Survey 1993
- The Secretary General of the People's Consultative Assembly, Decrees of People's Consultative Assembly of Indonesia 1993
- The Investment Coordinating Board, Statistics on Investment
- The Investment Coordinating Board, A Brief Guide for Investors 1993
- United Nation, International Standard Industrial Classification of All Economic Activities
- World Bank, Consolidates Report on Policy and Research Activities Professional Human Resources Development Project

MALAYSIA

- Bureau of Research and Consultancy, Institute Technology MARA
- CIAST, Summary of CIAST Module Contents
- German Malaysian Instituto, Prospectus
- German Malaysian Instituto, Production Technology Short-term Course
- German Malaysian Instituto, Industrial Electronics Short-term Course
- International Islamic University, News Bulletin
- International Islamic University, A Different Sort of University
- International Islamic University, Undergraduate Prospectus 1994/95
- Laporan Institute, Institute Technology Mara
- Ministry of Education, Education in Malaysia
- Mechanical Engineering Center, Educational Statistics of Malaysia 1987, 1988, 1989, 1990
- University Malaysia, Faculty of Engineering
- University Pertanian Malaysia, Research Report 1989-93
- University Pertanian Malaysia, Excellence in Education
- University Pertanian Malaysia, Post Graduate Program Tropical Fish Health
- UTM Research and Consultancy Unit, UTM in Brief 92/93
- University Sains Malaysia, Study Abroad Scheme Prospectus

- University Sains Malaysia, Prospectus 1991-92

KOREA
- Dong Yang Technical College, College Bulletin
- Dong Yang Technical College, Dept. of Electronics Machine and Equipment List
- Hankuk Aviation University, University Bulletin 1994/1995
- Hankuk Aviation University, Information of Undergraduates and Graduates School 1993
- Hunsung Science High School Seoul, School Bulletin
- Induk Junior College, College Information 1994
- Korean Manpower Agency, Technical Manpower Training and Licensing System in Korea
- Korea University, Korea University Bulletin 1993-1995
- Korea University, International Education at Korea University 1994
- Ministry of Education, Education in Korea 1993-1994
- Ministry of Education, Directory of Korean University 1994
- Ministry of Labor, Vocational Training in Korea
- National Statistic Office, Major Statistics of Korean Economy 1994
- Pusan National University, University Bulletin
- Seoul National University, Curricula for Undergraduate – Graduate Courses 1991
- SIVAT (Seoul Institute for Vocational Training in Advanced Technology), SIVAT Handbook, SIVAT News
- Yonsei University, College of Yonsei University
- Yonsei University, Yonsei Engineering Center

JAPAN
- Aoki Takeshi, Export Oriented Industrialization JETRO 1993
- MITI, Trend and Issues of Industrial Science•Technology in Japan 1992
- Institute of Developing Economics, Industrialization of Full-set Type in Indonesia
- The University of Tokyo, Information on the Faculty of Engineering
- Science & Technology Agency, White Paper-Science•Technology 1994
- World Bank, World Development Report 1995

JICA