# APPENDIX IV HUMAN RESOURCES DEVELOPMENT POLICIES

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# APPENDIX IV HUMAN RESOURCES DEVELOPMENT POLICIES

## IV.1 Current Situation of Human Resources Development

### IV.1.1 Current Situation of Human Resources Development

(1) Education and Training System in Vietnam

In education and training system in Vietnam, there are pre-school education, basic education (five years of elementary school + four years of lower secondary school + three years of high school), higher education (four to six years of university and college), vocational and technical education and vocational training, and it is a 5-4-3-4 system since 1989 (refer to Figure IV-1-1). Elementary school became compulsory since 1991.

1) Pre-school education

At the pre-school education level, there are nursery schools and kindergartens which enroll about 0.4 million children and 1.9 million children respectively. About 30% of the age group receive pre-school education.

(a) Nursery school (from age 3 months, duration: up to 3 years)

(b) Kindergarten (from age 3, duration: up to 3 years)

2) Basic education

At the compulsory education level, elementary schools enroll about 10 million in 1995-1996 school year and it is approximately 2 million a grade. At the lower secondary education level, lower secondary schools enroll about 3.7 million in 1995-1996 school year and it is approximately 0.9 million a grade. That means about 45% of the graduates of elementary schools go to lower secondary schools. At the upper secondary education level, high schools enroll about 0.9 million students in 1995-1996 school year and is about 0.3 million a year. 30 - 35% of the graduates of lower secondary schools or about 15% of the graduates of elementary schools go to high school.

(a) Elementary school (compulsory since 1991, from age 6, duration: 5 years)

(b) Lower secondary school (from age 11, duration: 4 years)

(c) High school (from age 15, duration: 3 years)

3) Higher education

At the higher education level, universities including open universities enroll about 320 thousands and colleges enroll about 40 thousands. About 20% of the graduates of high schools are admitted by universities and colleges and the ratio among school-age youths is less than 3%, which is relatively lower than around 10% of Malaysia and Indonesia, more than 15% of Thailand, more than 30% of Japan and more than 40% of Korea. There are 65 universities and 45 colleges in Vietnam, of which 40 universities and colleges including two open universities are under the Ministry of Education and Training (MOET) and the others are under the Ministry of Construction, the Ministry of Industry etc. Two of the universities in Hanoi and Ho Chi Minh (HMC) are placed especially as the National Universities and there are nine private universities and colleges.

College (from age 18, duration: 3 years)

University (from age 18, duration: 4 - 6 years)

As shown in the table below, 43 or about 40% of the universities and colleges are teachers' colleges and there are only 23 technical universities and colleges.

Number of Universities / Colleges / Institutes

| | |
|---|---|
| Technical | 23 |
| Economics | 13 |
| Medical and Physical | 9 |
| Cutural and social sciences | 16 |
| Educational | 43 |
| Others | 6 |
| Total | 110 |

(Source: MOET, 1996)

Out of the 320 thousands university and college students, more than 90% or about 280 thousands students attend national universities and colleges and private universities and colleges enroll only 25 thousands students. National universities and colleges also offer technical training and the number of trainees sums up to 200 thousands a year.

Number of Students and Trainees at Universities and Colleges

| | Full-time Students | Part-time Students | Inservice Training | Total Students |
|---|---|---|---|---|
| National Universities and Colleges | 277,731 | 90,625 | 194,533 | 568,321 |
| Private Universities and Colleges | 25,012 | 0 | 828 | 25,840 |

(Source: MOET, December 1996)

According to MOET statistics, the dropout rate is 6 - 8% a year, but the ratio of graduates to freshmen in 1996 is one to four because the capacities of universities and colleges are increasing. The ratio becomes even higher to one to five for in-service training students.

Number of Accepted Students and Graduates at National Univ./ Coll.

| | Full-time Students | Part-time Students | Inservice Training | Total Students |
|---|---|---|---|---|
| Number of Accepted Students | 99,524 | 17,520 | 52,374 | 169,418 |
| Number of Graduates | 27,422 | 12,118 | 10,160 | 49,700 |

(Source: MOET, December 1996)

4) Vocational and technical education

Vocational and technical education is offered by technical secondary schools [TSS] and vocational training schools [VTS]. TSS is for those who have completed lower secondary as well as upper secondary education, and VTS is for those who have completed primary as well as lower secondary education. There are 244 TSSs with about 118 thousands students and 174 VTSs with about 89 thousands students as of the end of 1996. 34 of the 244 TSSs and 111 of the 174 VTSs are for industries and transportation. About 20% of TSS and 50% of VTS students are taking industries and transportation courses. About two thirds of the TSSs are located locally, but more than half of the VTSs are located centrally.

(a) Vocational training school [VTS] (duration: 2 - 3 years)

(b) Technical secondary school [TSS] (duration: 3 - 3.5 years)

Number of Technical Secondary/Vocational Schools

| | Central | Local | Total |
|---|---|---|---|
| Technical Secondary School [TSS] | | | |
| Industries and Transportation | 21 | 13 | 34 |
| Agriculture and Forestry | 22 | 18 | 40 |
| Culture and Education | 19 | 101 | 120 |
| Others | 21 | 29 | 50 |
| Total | 83 | 161 | 244 |
| Vocational Training School [VTS] | | | |
| Industries and Transportation | 49 | 62 | 111 |
| Agriculture and Forestry | 23 | 7 | 30 |
| Culture and Education | 2 | 2 | 4 |
| Others | 22 | 7 | 29 |
| Total | 96 | 78 | 174 |

(Source: MOET, December 1996)

The average number of students per one teacher is a little more than ten both at TSSs and VTSs as shown below.

Number of Students and Teachers at TSS and VTS

| | Full-time Students | Graduated in 1996 | Other Students | Teachers |
|---|---|---|---|---|
| Technical Secondary School [TSS] | | | | |
| Central | 41,099 | 11,619 | 9,091 | 3,800 |
| Local | 76,673 | 24,786 | 21,144 | 5,890 |
| Total | 117,772 | 36,405 | 30,235 | 9,690 |
| Vocational Training School [VTS] | | | | |
| Central | 59,450 | 21,453 | 9,511 | 4,124 |
| Local | 29,907 | 9,719 | 3,521 | 1,853 |
| Total | 89,357 | 31,172 | 13,032 | 5,977 |

(Source: MOET, December 1996)

5) Vocational training

Short-term vocational training for about 800 thousands workers is offered by vocational training centers, and it is estimated that there are roughly 2,000 centers. There is practically no prerequisite to be admitted by vocational training centers. 126 vocational centers, at least one sometimes four in every province, also provide employment promotion services.

- Vocational training center [VTC] (duration: 0.5 - 2 years)

(2) Technical Level of Employees

1) Current situation of labor force in Vietnam

According to two studies conducted by the Ministry of Labor, Invalids and Social Affairs [MOLISA] in 1996:

(a) Total labor force in Vietnam is 36,789 thousands, of which 837 thousands [2.3%] are graduates of universities and colleges (11,218 finished graduate schools) and 1,408 thousands [3.6%] are graduates of secondary technical and vocational schools. Skilled workers with certificates count 826 thousands, skilled workers without certificate count 768 thousands, which sum up to 1,594 thousands [4.3%], and unskilled workers count 32,950 thousands [89.6%] (refer to Table IV-1-1).

(b) Total labor force in Vietnam is 35,866 thousands, of which 828 thousands [2.3%] are graduates of universities and colleges (11,561 finished

graduate schools) and 1,378 thousands [3.8%] are graduates of secondary technical and vocational schools. Skilled workers with certificate count 810 thousands, skilled workers without certificate count 761 thousands, elementary skilled workers count 636 thousands which sum up to 2,208 thousands [6.2%], and unskilled workers count 31,452 thousands [87.7%] (refer to Table IV-1-2).

The results of these two studies coincide and the only difference lies in the category of elementary skilled workers.

About the numbers of engineers, technicians and skilled workers, the figures of 1994 is widely used; 4.7 millions for the skilled-workers, 759 thousands for the graduate of universities, colleges and graduate schools, 1.24 millions for the graduates of secondary vocational and technical schools, and 2.77 millions for the skilled workers. Based on these figures, the ratio is 1.6 graduates of secondary vocational and technical school and 3.6 skilled workers per one engineer. Although the figures basically coincide with the two studies above, it is difficult to compare the ratio with those of neighboring countries. The reasons are:

(a) The ratio is based on the total labor force, thus the fact that unskilled workers count 97% of the agricultural labor force, which share almost 70% of the total labor force, bias the ratio.

(b) It is unreasonable to include elementary skilled workers into skilled workers. Also it is not always true to assume the graduates of secondary vocational and technical school as technicians, especially when the curricula do not fit to modern industries.

Considering there facts, industry sector and sub-sectors are extracted from the statistics into Table IV-1-3. The ratio for industry sector is 2.2 graduates of secondary vocational and technical school and 15.4 skilled workers per one engineer and that for machine, electric and electronic sub-sector is 2.1 and 13.0 per one engineer. In these figures, the ratios of technicians and skilled workers are much higher than the figures widely used.

These ratios are compared with the figures in Malaysia and Thailand in Table IV-1-4 and Figure IV-1-2. It is clear that the number of technicians is very small to the number of engineers in Vietnam and development of technicians is an urgent task..

2) Skill standard system

The skill standards for 55 types of job including a train driver, a navigator and a forester, which are currently used in the state factories, were introduced by the Ministry of Labor in 1973. These standards directly link to the wage standards. During 1980's, MOET, the Ministry of Heavy Industries, the Ministry of Power, the Ministry of Light Industries, Director General of Post and Telecommunication and Committee for Broadcasting and Television conducted studies for new skill standards, but no national new standards have been introduced yet. In the skill standards currently used, skill is classified by the maximum of nine classes. The standards in industries sector cover only manual workers and do not correspond to modern industries. Also there are no standards for highly skilled workers and technicians.

(3) Development of Faculties and Researchers

1) Study in Russia and Eastern European countries

According to the statistics of MOET as of December 1996, the number of faculties of universities and colleges is 23,359, about 30% are the holders of Master's degrees or above and about 8% are Ph.D. or above.

Number of Professors, Associate Professors and Lecturers

| | | |
|---|---|---|
| Professor | 325 | (1.4%) |
| Associate Professor | 1,286 | (5.5%) |
| Ph.D. | 279 | (1.2%) |
| Master Degree | 5,418 | (23.2%) |
| Lecturers | 16,051 | (68.7%) |
| Total | 23,359 | (100.0%) |

(Source: MOET, December 1996)

The graduates of graduate school count 12,752 in Vietnam and more than 40% are Ph.D. or above. More than 80% or about 10 thousands of them are the graduates of the graduate schools in Russia and Eastern European countries. The figures of MOSTE show that there are more than 800 thousands engineers and scientists in Vietnam and more than 45 thousands researchers are working at more than 300 national institutes.

Number of Scientists and Postgraduates

| | | |
|---|---|---|
| Professor | 629 | (4.9%) |
| Associate Professor | 3,048 | (23.9%) |
| Ph.D. | 1,360 | (10.7%) |
| Master Degree | 7,715 | (60.5%) |
| Total | 12,752 | (100.0%) |

(Source: MOET, December 1996)

Professors and associate professors are titles and do not necessary mean they are the faculties of universities and colleges. There are 629 professors in Vietnam, but only 345 or a little more than half of them are the faculties. The age distribution of professors and associate professors show that more than 80% are over 51 years old and there are no professors and only 15 associate professors under 40 years old. The faculties are aging.

Branch and Age Distribution of Professors and Associate Professors

| | Branch | | | Age Distribution | | | |
|---|---|---|---|---|---|---|---|
| | Industries | Economy | Others | Under 40 | 41-50 | 51-60 | Over 60 |
| Professor | 325 | 31 | 273 | 0.00% | 3.87% | 52.96% | 43.14% |
| Associate Professor | 1,738 | 320 | 982 | 0.47% | 21.15% | 67.63% | 10.25% |
| Total / Average | 2,063 | 351 | 1,255 | 0.39% | 18.19% | 65.12% | 15.88% |

(Source: MOET, December 1996)

The main reason is that the scholarship to study in Russia and Eastern European countries practically stopped since 1989. Higher education, especially postgraduate education in Vietnam relied significantly on those countries. The graduates of ex-USSR universities count 20,511 and is more than half of the graduates studying abroad. As for vocational training, ex-Czechoslovakia contributed 38,590 trainees or more than 40%.

Number of Students Studied Abroad

| | Universities / Colleges | Vocational Training | Total |
|---|---|---|---|
| 1. USSR (Russia) | 20,511 | 12,403 | 32,914 |
| 2. China | 3,829 | 17,060 | 20,889 |
| 3. (East) Germany | 3,105 | 13,932 | 17,037 |
| 4. Czechoslovakia | 2,624 | 38,590 | 41,214 |
| 5. Hungary | 1,910 | 1,000 | 2,910 |
| 6. Bulgaria | 1,878 | 5,977 | 7,855 |
| 7. Poland | 1,815 | 3,570 | 5,385 |
| 8. Romania | 1,614 | 1,000 | 2,614 |
| 9. Cuba | 969 | 0 | 969 |
| 10. (North) Korea | 684 | 900 | 1,584 |
| 11. Mongolia | 118 | 0 | 118 |
| 12. Australia | 79 | 0 | 79 |
| 13. Albania | 65 | 0 | 65 |
| 14. Belgium | 45 | 0 | 45 |
| 15. Japan | 27 | 0 | 27 |
| 16. Lao | 24 | 0 | 24 |
| 17. Others (5 countries) | 41 | 0 | 41 |
| Total | 39,338 | 94,432 | 133,770 |

(Source: MOET, up to December 1994)

2) Overseas Vietnamese

It is said that there are more than 2.6 million Vietnamese residing abroad, of which 0.3 million or 11.5% are estimated as engineers and scientists. More than half of them, or 1.4 million live in North and South America, 0.4 million in Europe, 0.5 million in Asia and 0.15 million in Pacific Region. They are from all over Vietnam, but many Chinese Vietnamese left Southern part of Vietnam after 1995.

Number of Overseas Vietnamese

| Country | Number |
|---|---|
| 1. U.S.A. | 950,000 |
| 2. France | 400,000 |
| 3. China | 300,000 |
| 4. Australia | 160,000 |
| 5. Thailand | 120,000 |
| 6. Germany | 100,000 |
| 7. Russia | 100,000 |
| 8. Cambodia | 100,000 |
| 9. Hong Kong | 50,000 |
| 10. Poland | 30,000 |
| 11. U.K. | 25,000 |
| 12. Czech, Slovakia | 20,000 |
| 13. Taiwan | 15,000 |
| 14. Netherlands | 10,000 |
| 15. Lao | 10,000 |
| 16. Ukraine | 10,000 |
| 17. Belgium | 7,000 |
| 18. Japan | 6,000 |
| Others | 200,000 |
| Total | 2,600,000 |

(Source: The Saigon Times, March 30-April 5, 1996)

As shown below, the number of overseas Vietnamese visiting Vietnam are increasing since 1991 when they started complying statistics, however there is no statistics if they settled down or not. On the other hand, IMF estimates that overseas Vietnamese are sending USD1 billion a year to Vietnam.

lumber of Overseas Vietnamese Coming Hom

| Year | Number | |
|---|---|---|
| 1991 | 70,000 | |
| 1992 | 100,000 | |
| 1993 | 165,000 | |
| 1994 | 220,000 | |
| 1995 | 265,000 | |
| 1996 | 195,000 | (Tentative) |

(Source: Committee for Overseas Vietnamese)

IV.1.2 Human Resources Development Policy in Vietnam

(1) Basic Policy

The human resources development policy in 8th National Congress set twelve targets for the year 2000 to become an industrialized nation and to make eight to tenfold the GDP of 1990 by the year 2000.

1) the overwhelming majority of five-year-old children will have access to pre-school education
2) all those aged between 15 and 35 will be literate
3) to ensure schooling to children of poor households
4) to encourage and support talented and promising students
5) to emphasize teaching of foreign languages and informatics
6) to open more boarding schools in difficulty-stricken areas and areas of ethnic minorities
7) to combine training with research
8) to encourage on-the-job training
9) to increase training overseas and at locally-based international training centers
10) to increase the ration of trained labor from 10% at present to around 22% - 25%
11) to raise the educational and professional standards of women

12) to formulate a strategy on education and training development in the period of national industrialization and modernization, and etc.

(2) Policy Paper in Information Technology

General concepts and objectives on human resources development for the development of information technology (IT) toward 2000 is as follows;

1) to train qualified professionals in the field of IT
2) to promote IT education in secondary schools
3) to disseminate general information on IT throughout society
4) to strengthen the use of IT in the education and training sector itself
5) to formulate a national project on "IT and Education, Training"

And the targets are;

1) not less than 20,000 experts, of which more than half are programmers, about one fourth are analyzers of systems, and one fourth are other experts
2) to set forth a plan for education and training so that managers and experts in economic and technical branches will have the knowledge and skills
3) to increase the dissemination of IT knowledge in secondary school

To achieve these targets, the measures below to be taken.

1) to set up or upgrade the IT departments facilities in existing universities or technological colleges
2) in the 1995 - 1996 plan, IT departments of National University Hanoi (NUH), National University Ho Chi Minh (NUHCM), Hanoi University of Technology (HUT), Ho Chi Minh University of Technology (HCMUT) and Da Nang University of Technology (DUT) can accept annually from 100 to 200 new students who will follow the 4-year education
3) to open a specialized training system with two-year duration to train programmers and technicians in informatics; from now up to the year 2000, this specialized training system must be able to accept annually about 2,000 students
4) to open re-training courses to transfer a significant number of staff, engineers or students graduated from other branches (math, physics, economics, engineering...)

5) to set up a number of Advanced Training Centers for Informatics offering short-term or medium-term training courses for specialists, trainers and researchers; in pilot form at MOET, nearby the universities, research institutes or independent centers set up by non-governmental organizations; partly from the State-budget, necessary to attract funds from cooperative programs with foreign countries, from multinational and from domestic informatics companies

6) to set up an annual plan to send specialists abroad to attend re-training or advanced training courses; also a plan to select outstanding students to study at full-time in the developed countries

7) to continue the implementation of informatics education programs in the secondary schools

8) short-term and practical training programs to teach the use of computers as a working tool for an increasingly growing labor force

9) to develop the IT application in education and training, firstly to research and develop software of training with high performance; in the next years, dissemination of informatics training and knowledge about IT; gradually extend the scope of developing software for teaching foreign language and others

To encourage education and training, three points are specified.

1) to encourage training, training at vocational training centers and training units in non-public sector

2) regulations permitting teaching of IT in both Vietnamese and English

3) multinational companies shall have the responsibility for recruiting and training skills for Vietnamese partners

(3) Policy Paper in Biotechnology

In the Resolution of Vietnam's Government on the development of biotechnology to 2010, the action necessary for human resources development is described as below.

To build up a line-up of scientific and technological staff and the bases as well the training program in high school and re-training of the staff

To achieve this:

1) MOSTE, together with other related Ministries, will establish a plan for reorganization of the system of science and technology organs on biotechnology and will establish the policy and the training plan in high school

2) the State will stimulate the contact between the Vietnamese biotechnology persons in Vietnam and in the world through international seminars and will improve the investment to R & D of biotechnology

3) to utilize high level specialists from other countries in Vietnam and also the Vietnamese community in abroad become advisor participating directly at the process of building the program of development, of staff training, of research on the development of technology

IV.1.3 Issues in Human Resources Development

(1) Basic Education

1) Elementary schools is compulsory since 1991, but still about 10% of the children cannot access to school and only 50% can finish lower secondary school. Many lower secondary schools jointly use elementary school buildings and two shifts sometimes three shifts are practiced.

2) Foreign languages and computers need to be taught from lower secondary schools.

(2) Technical Education and Vocational Training

1) There are far from enough number of vocational training centers especially in industry related fields. Also equipment needs to be updated.

2) The curricula are mostly for repair and maintenance, and do not fit for modern industries, except for the courses in software development.

3) The number of technicians and skilled workers are small to the number of engineers.

4) The teaching staff of technical and vocational training need to have re-training to adapt to the new industrial technologies.

5) There are few incentives for factories to train their employees.

(3) Higher Education

1) The ratio of university and college students among school-age youths is 2.3 - 2.5% and is lower than many neighboring countries. The number of university and college students need to be increased.

2) Since ex-USSR and Eastern European countries substituted Vietnamese post-graduate education, graduate schools in Vietnam need to be improved.

3) After scholarship to study in Russia and Eastern European countries practically stopped in 1989, teaching staff and Ph.D. holders are aging.

4) Further cooperation between higher education and industries need to be developed.

(4) Industries

1) Master plan and strategies to promote small- and medium-scale enterprises (SMEs) need to be established.

2) More engineers and higher-level technicians need to be developed.

3) SMEs cannot access to technical information.

4) SMEs cannot upgrade the skill level of their labor force by their own resources.

5) There is very little government support for training in labor skill and enterprise management.

## IV.2. Lessons from Neighboring Countries

### IV.2.1 Singapore

Since 1979, Singapore has been implementing the two programs below to take off from labor-intensive industries to knowledge- and technology-intensive industries.

(1) Technical Institute Project

Human resources development division of Economic Development Board had started five technical institute projects to develop technicians in cooperation with multinational corporations and bilateral technical cooperation.

1) Precision Engineering Institute (PEI) and

2) Philips Government Training Centre (PGTC)

were established by cooperation from the private sector, and

3) Japan-Singapore Technical Institute (JSTI),

4) German-Singapore Institute (GSI) and

5) French-Singapore Institute (FSI)

were established by bilateral technical cooperation.

1) Precision Engineering Institute (PEI)

Precision Engineering Institute (PEI) , which was established by cooperation of several German or German-Singaporean enterprises in Singapore, offers two-year certificate program (Technical Level 2) in machining, precision engineering and die & mold for the graduates of lower secondary schools.

2) Philips Government Training Centre (PGTC)

Philips Government Training Centre (PGTC), which was established in cooperation with Philips of Netherlands, also offers two-year certificate program (Technical Level 2) in machining, precision engineering and die & mold for the graduates of lower secondary schools.

3) Japan-Singapore Technical Institute (JSTI)

Japan-Singapore Technical Institute (JSTI), a project in cooperation with JICA, also started from certificate program (Technical Level 2), however currently offers industrial technician certificate program, three years for the graduate of lower secondary schools and two years for the graduate of high schools. The fields are mechatronics and industrial electronics.

4) German-Singapore Institute (GSI)

German-Singapore Institute (GSI) was established in cooperation with GTZ and offers polytechnic level diploma program in up-to-date production technology, factory automation and plastic technology. The program is three years for the graduates of lower secondary schools and two years for those of high schools.

5) French-Singapore Institute (FSI)

French-Singapore Institute (FSI) was established in cooperation with the Chambers of Commerce and Industries of Paris and a electronics technical institute under the Commerce. FSI offers a polytechnic level diploma program in electronics. The program is also three years for the graduates of lower secondary schools and two years for those of high schools.

Several keys to the success of these technical institutes can be drawn as follows.

1) These technical institutes offer not only long-term institutional training, but short-term re-training, contracted-training and others.

2) The institutes are being operated independently, thus earning revenues from testing services, consulting services, trial production, joint-production projects with enterprise and so on.

3) The institutes get cooperation from industry in management of the institutes, updating of the curricula etc.

4) Foreign companies and joint-ventures contribute funds, free leasing of production machinery and the chair under the name of the company.

5) The salaries of the instructors are comparable with engineers in the private sector.

6) The projects were initiated not by bilateral technical cooperation but by private sector. There was an idea to establish a joint training center among private enterprises beforehand, Singaporean government followed the idea. Since private sector took the lead from the beginning, participation of private sector to the institutes were quite natural.

7) German dual system was applied and modified in Singapore, and in-plant training is practiced in the factories after finishing institutional training or at the workshop of the institutes.

In February 1993, JSTI, GSI and FMI merged and became parts of Nanyang Polytechnic, the fourth polytechnic in Singapore.

(2) Skills Development Fund

Skills Development Fund was established by Skills Development Levy Act in 1979. Companies are required to contribute 1% (originally 4%) of the salaries of their employees whose salaries exceed S$1,000 a month to the Fund. Companies can get the Fund back when their employees get in-plant training, attending seminars, training or overseas training. The purpose of the Fund is to promote skill development or re-education of the workers through the incentives for training of employees. All the companies are the target of the Fund, however training of the employees of small- and medium-scale enterprises is given priority.

Training Grant Scheme (TGS) for conventional skills and Emerging Critical Skills Development Grant Scheme (FGS-DGS) are the two main programs of SDF. The incentives are in three types: i) make up of the salaries of the worker who are having full-time training (not only for in-plant training, but for full-time training at authorized training institutes), ii) make up for training abroad within 12 weeks, iii) subsidies for training at authorized training institutes and seminars (30%, 50% or 70% of the fee).

To make the procedure simple, "Approved-in-Principle" applies to the programs and enterprises can complete the procedure to utilize one of these incentives at the training institutions not at government offices.

IV.2.2 Malaysia

In Malaysia, German Malaysia Institute (GMI) project started in 1991 about ten years behind Singapore. And now Malaysia French Institute (MFI) and Japan Malaysian Technical Institute (JMTI) projects are undergoing.

Human Resource Development Fund (HRDF), which is similar to Singapore Skills Development Fund (SKD), was also introduced to Malaysia. HRDF applies only for enterprises with more than 50 employees or more than RM (Malaysian ringgit) 2.5 million and 1% of the salaries are compulsory.

Since the concept is same in Malaysia, the points which are characteristic of Malaysia are described as below.

(1) Development of Technicians/Industrial Technologists

Many vocational training centers at National Occupational Skills Level 1-2 (operators and skilled-workers) which are determined by National Vocational Training Council (NVTC) exist in Malaysia, but no institutes for Level 3. On the other hand, engineers in Malaysia tend not to go into factories but remain in air-conditioned offices, shortage of technicians in factories is critical. Also as industrialization in Malaysia proceeds and the targets have become modernization of factories, technological innovation and incubation of supporting industries etc., the crucial point is strengthening of research and development abilities (production design and development in the early stages) and managing abilities. Thus technical training institutes of technicians and industrial technologists, such as an instructors' training center CIAST in cooperation with JICA, GMI, FMI and JMTI have originated with bilateral technical cooperation.

(2) Management of Technical Institutes

1) Penang Skills Development Centre (PSDC)

Penang Skills Development Centre (PSDC) is a training center established by the federal government, Penang state government, Penang Development Corporation (PDC) and 58 foreign and foreign joint-venture companies. The management of PSDC is characterized by close cooperation between the public and private sectors. In the industrial estates developed by PDC, around 700 enterprises with 180 thousands employees, mainly semiconductor related factories, are located. Of which, around 250 enterprises with 130 thousands employees are foreign or foreign joint-venture companies and more than half of them belong to electric and electronic industries. Industrial estates, where many same type of industries occupy, a training center established in each estate is expected to have

advantages such as i) closeness of working sites and training sites, ii) sharing of training costs among occupants, iii) easiness of grasping needs of the industry, iv) cooperation of the private sector in training activities, v) technical transfer from large corporations to the supporting industries. Revenues of PSDC from 1990 to 1995 is as follows and the public sector contributes 36%, while the private sector 64%.

Input to Penang Skills Development Centre (in RM)

| | | |
|---|---|---|
| **Government** | | |
| Federal Government | 2,431,475 | (18.46%) |
| Penang State Government | 540,000 | (4.10%) |
| PDC by Land and Building | 894,000 | (6.79%) |
| PDC by Manpower | 27,600 | (0.21%) |
| Building Rehabilitation | 885,000 | (6.72%) |
| Public Sector Total | 4,778,075 | (36.28%) |
| **Industry** | | |
| Donation of Equipment & Machinery | 2,540,391 | (19.29%) |
| Free Rent of Equipment & Machinery | 5,849,920 | (44.42%) |
| Private Sector Total | 8,390,311 | (63.72%) |
| **Total** | 13,168,386 | (100.00%) |

(Source: Hearing at PSDC)

PDC, whose chairman is Governor of Penang state, has been playing a major role of organizing occupying enterprises and governments, and Penang state has established Human Resource Development Council composed of the government, private enterprises and educational and training institutes, the first example in state level in Malaysia. The Council has been working on grasping the needs of human resources in the state and promoting training. The state itself plays a major role in attracting foreign direct investment and promoting human resources development.

2) German Malaysian Institute (GMI)

German Malaysian Institute (GMI) , which is a high-level training institute of production technology and industrial electronics, was established as a company limited by guarantee - no share capital of MARA, a Malaysian governmental agency for promoting domestic industries, and Malaysian German Chamber of Commerce (MGCC). The salaries of the instructors of the institute is well above the average of government officers and are comparable with engineers in the private sector, and that makes GMI possible to maintain good human resources.

The planned budget of GMI and actual cost at the end of 1993 are as follows. Originally, GMI was intended to be a governmental institution with 100% subsidies,

but has changed to become an independent institution with enough fund. GMI could get only RM (Malaysian ringgit) 29 million of fund, in reality, instead of requested RM80 million, also the interest rate is around 5% lower than expected 7 - 8 % a year. Thus it is difficult to keep the budget. Consequently, annual tuition fee of GMI was increased from RM5,000 to RM7,000 in 1995.

Budget and Cost of German-Malaysian Institute

**Original Plan in 1990** (in RM million)

| Malaysian Side | | German Side | |
|---|---|---|---|
| Equipment & Machinery | 21.83 | Equipment & Machinery | 8.46 |
| Building Rehabilitation | 8.17 | Dispatch of Experts for 10 years | - |
| 5 years of Subsidies for Operational Cost | 31.50 | | |
| Malaysian Side Total | 61.50 | German Side Total | 8.46 |

**Actual at the end of 1993** (in RM million)

| Malaysian Side | | German Side | |
|---|---|---|---|
| Equipment & Machinery | 5.00 | Equipment & Machinery (Federal) | 8.50 |
| Building Rehabilitation | 9.00 | ditto (Private) | 1.60 |
| Operational Fund | 29.00 | ditto (Baden-Wurttemberg State) | 3.00 |
| | | ditto (Bayern State) | 1.00 |
| Malaysian Side Total | 43.00 | German Side Total | 14.10 |

(Source: The German-Malaysian Institute Progress Report - 1992/1993)

Annual operational cost of GMI is RM6 to 8 million, and even after the raise of tuition fee from 5,000 to 7,000, it requires annual subsidies of RM2.6 million. To become an independent institution, minimum fund of RM75 million is necessary. Because an annual cost per a trainee is round RM20,000, annual training fee needs to be as expensive as RM20,000 to become a 100% independent institution, which was made clear in the feasibility study for GMI.

Revenue of GMI (in RM million)

| | 29M Fund | | 75M Fund | |
|---|---|---|---|---|
| Fund | 29M x 5% Interest Rat | 1.45 | 75M x 5% Interest Rat | 3.75 |
| Tuition | RM7,000 x 450 | 3.15 | RM7,000 x 450 | 3.15 |
| Subsidies | | 2.60 | | 0.00 |
| Total | | 7.20 | | 6.90 |

(Estimated by JICA Team)

Since the number of enterprises who can accept trainees for in-plant training is still quite limited, the dual system has been converted to practice in-plant training in the workshop of the training institute. The concept is that an enterprises and a

training center coexist under one roof. Production services combined with in-plant training help the budget of the center too.

The board members of GMI consist of four representatives from the private sector, three from training institutes, two from Governments (one from Economic Planning Unit of Malaysia and one from German Embassy in Malaysia) and the president of GMI, and again it is clear that participation from the private sector is taken very seriously. The services GMI provides to the private sector are:

i) Three-year full-time diploma level training courses,

ii) Part-time training courses,

iii) On-the-job training of instructors,

iv) Curricula and programs,

v) Up-dated technical information and seminars,

vi) Consulting,

vii) Production services.

On the other hand, the private sector is expected to provide to GMI such as:

i) Dispatch of sponsored trainees,

ii) Acceptance of in-plant trainers' training,

iii) Adjustment and update of curricula,

iv) Promotion of in-house training,

v) Acceptance of in-plant training

vi) Contract out of projects and training services, and others.

These show that it is essential for training institutes not only giving long-term institutional training, but providing services such as production services, contracted training, joint projects and consulting together with the private sector.

## IV.3. Human Resources Development Strategies for High-Tech Industries

### IV.3.1 Frame of Human Resources Development in Vietnam

After carefully analyzing the current situation and human resources development policies in Vietnam and lessons in neighboring countries, the Study Team proposes four strategies and programs as the frame for human resources development in Vietnam.

H-1: To strengthen technical education and vocational training for high-tech industries

The number of technical education and vocational training institutes are limited and they are mainly for maintenance and repairs rather than modern industries. Another critical issue is shortage of technicians and skilled workers relative to the number of engineers. To overcome these issues, strengthening of technical education and vocational training for high-tech industries has the highest priority. For concrete programs to realize this strategy, the Study Team proposes i) to renovate the technical education and vocational training system to adapt to modern industries, ii) to introduce new skill standard system to upgrade the skill level of technicians and skilled workers, and iii) to introduce a certification system for engineers and technicians in specific fields.

H-2: To modernize higher education

Higher education in Vietnam is suffering from low ratio of university and college students among school age youths, low capacity of graduate schools, aging of university / college faculties and Ph.D. holders, and misfit to the needs of the industry. Thus for the early stage of the renovation of higher education, the Study Team proposes i) to create more opportunities for post-graduate students to study abroad, ii) to give more emphasis on professional education such as applied technologies and business management, and iii) to strengthen post-graduate education to increase quality teaching staff.

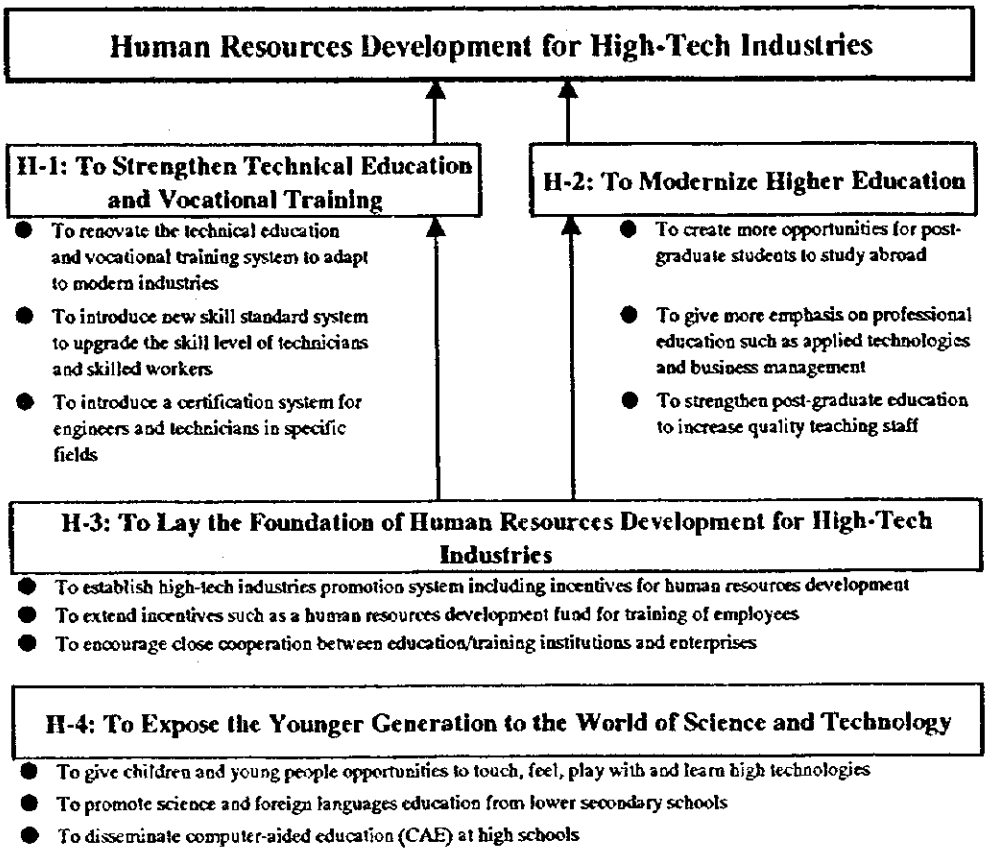
H-3: To lay the foundation of human resources development for high-tech industries

One of the crucial issues in Vietnam is modernization of state factories and promotion of small- and medium-scale enterprises, and human resources development is extremely important as a foundation. Master plan and strategies for industrial human resources development, however, have not been drafted and no systematic approaches have been done for enterprises to develop their employees. The Study Team therefore proposes i) to establish high-tech industries promotion system including incentives for human resources development, ii) to extend incentives such as human resources development fund for training of employees, and iii) to encourage close cooperation between education/training institutions and enterprises.

H-4: To expose the younger generation to the world of science and technology

In long-term, it is quite important to prepare the environment such that the rising generation are interested in and then become familiar with science and technology. Thus the Study Team therefore proposes i) to give children and young people opportunities to

touch, feel, play with and learn high technologies, ii) to promote science and foreign languages education from lower secondary schools, and iii) to disseminate computer-aided education (CAE) at high schools.




Frame of Human Resources Development in Vietnam

### IV.3.2 Short- and Medium-Term Strategies

In short- and medium-term, the priority is given to the programs which have immediate effects, and preparation for implementing long-term programs. The Study Team therefore proposes the short- and medium-term strategies of human resources development for high-tech industries as follows.

- Short-term (until 2005): to strengthen post-graduate education by expanding scholarship program for mainly post-graduate students to study abroad; to establish a model technical education/vocational training institution; to prepare setting foundation of human resources development for high-tech industries; to promote computer-aided education (CAE) at model schools.

- Medium-term (until 2010): to establish several technical education/vocational training institutions; to establish a system of human resources development for high-tech industries; to disseminate computer-aided education nation-wide.

In short- and medium-term therefore,

H-1: To strengthen technical education and vocational training for high-tech industries
H-2: To modernize higher education
shall be materialized fully, and preparation for
H-3: To lay the foundation of human resources development for high-tech industries
H-4: To expose the younger generation to the world of science and technology
shall be completed.

### IV.3.3 Long-Term Strategies

In long-term, not only promoting technical education and vocational training with immediate effects to develop technicians and skilled workers, but a strategy that will enable the younger generation to have fundamental knowledge and to get familiar with science and technology. The short- and medium-term strategies H-1 and H2 are continuously important:

H-1: To strengthen technical education and vocational training for high-tech industries
H-2: To modernize higher education
Also H-3 and H-4 are expected to become fully effective:
H-3: To lay the foundation of human resources development for high-tech industries
H-4: To expose the younger generation to the world of science and technology

Table IV-1-1 Number of Economically Active People Aged 15 and Over in Past 7 Days by Occupation Group and Technical Level in 1996

*(Number of Skilled Workers and Technicians to One University Graduate)*

| | Total | Universisty | Post Graduate | Middle Vocational | Skilled workers with Certificate | Skilled workers w/o Certificate | Unskilled |
|---|---|---|---|---|---|---|---|
| Total | 36,789,221 | 824,810 | 11,218 | 1,407,721 | 826,391 | 768,483 | 32,950,369 |
| | *100%* | *2.2%* | | *3.8%* | *4.3%* | | *89.6%* |
| | *100%* | *1* | | *1.68* | *1.91* | | *39.41* |
| Party/State Leader | 186,436 | 23,155 | 700 | 34,559 | 4,602 | 4,746 | 118,558 |
| | *100%* | *12.8%* | | *18.5%* | *5.0%* | | *63.6%* |
| | *0.5%* | *1* | | *1.45* | *0.39* | | *4.97* |
| Enterprise Director | 37,437 | 19,190 | 598 | 4162 | 1,030 | 1,241 | 11,170 |
| | *100%* | *52.9%* | | *11.1%* | *6.1%* | | *29.8%* |
| | *0.1%* | *1* | | *0.21* | *0.11* | | *0.56* |
| Management Officer | 405,752 | 115,752 | 1,041 | 142,063 | 7,321 | 3,749 | 135,695 |
| | *100%* | *28.5%* | | *35.0%* | *2.7%* | | *33.4%* |
| | *1.1%* | *1* | | *1.22* | *0.09* | | *1.16* |
| Technical Staff | 99,097 | 45,423 | 835 | 17,277 | 8,279 | 5,621 | 21,577 |
| | *100%* | *46.7%* | | *17.4%* | *14.9%* | | *21.8%* |
| | *0.3%* | *1* | | *0.37* | *0.30* | | *0.47* |
| Agriculture / Forestry Technical | 37,698 | 12,405 | 0 | 12,517 | 1,048 | 499 | 11,175 |
| | *100%* | *32.9%* | | *33.2%* | *4.1%* | | *29.6%* |
| | *0.1%* | *1* | | *1.01* | *0.12* | | *0.90* |
| Science / Education Training | 728,276 | 282,072 | 4,971 | 334,286 | 1,584 | 2,436 | 102,787 |
| | *100%* | *39.4%* | | *45.5%* | *0.6%* | | *14.1%* |
| | *2.0%* | *1* | | *1.16* | *0.01* | | *0.36* |
| Culture / Art Officer | 75,153 | 20,335 | 0 | 9,952 | 4,404 | 6,140 | 34,234 |
| | *100%* | *27.1%* | | *13.2%* | *14.0%* | | *45.6%* |
| | *0.2%* | *1* | | *0.49* | *0.52* | | *1.68* |
| Health Care Officer | 233,899 | 43,969 | 1,231 | 105,860 | 3,584 | 3,944 | 75,186 |
| | *100%* | *19.3%* | | *45.3%* | *3.2%* | | *32.1%* |
| | *0.6%* | *1* | | *2.34* | *0.17* | | *1.66* |
| Law / Investigation-related Officer | 14,617 | 7,121 | 92 | 2,642 | 0 | 37 | 4,695 |
| | *100%* | *49.3%* | | *18.3%* | *0.3%* | | *32.1%* |
| | *0.0%* | *1* | | *0.37* | *0.01* | | *0.65* |
| Secretary and Mental-side Other | 188,116 | 39,261 | 339 | 28,049 | 7,828 | 1,447 | 111,098 |
| | *100%* | *21.1%* | | *14.9%* | *4.9%* | | *59.1%* |
| | *0.5%* | *1* | | *0.71* | *0.23* | | *2.81* |
| Mining/Coal/Oil Technology Related and Industries | 3,704,595 | 48,864 | 96 | 108,017 | 220,867 | 531,663 | 2,796,224 |
| | *100%* | *1.3%* | | *2.9%* | *20.3%* | | *75.5%* |
| | *10.1%* | *1* | | *2.21* | *15.37* | | *57.11* |
| Agricultural | 24,732,180 | 61,333 | 1,012 | 365,658 | 218,768 | 98,562 | 23,986,639 |
| | *100%* | *6.3%* | | *1.5%* | *1.3%* | | *97.0%* |
| | *67.2%* | *1* | | *5.87* | *5.09* | | *384.74* |
| Forestry Related | 36,268 | 1,053 | 0 | 2,095 | 458 | 717 | 31,921 |
| | *100%* | *2.9%* | | *5.8%* | *3.2%* | | *88.0%* |
| | *0.1%* | *1* | | *1.99* | *1.12* | | *30.31* |
| Aquatic Breeding and Harvesting | 635,442 | 1,343 | 0 | 6,217 | 5,911 | 2,577 | 619,347 |
| | *100%* | *0.2%* | | *1.0%* | *1.3%* | | *97.5%* |
| | *1.7%* | *1* | | *4.63* | *6.32* | | *461.17* |
| Transport | 737,485 | 8,260 | 0 | 16,742 | 212,228 | 20,516 | 479,614 |
| | *100%* | *1.1%* | | *2.3%* | *31.6%* | | *65.0%* |
| | *2.0%* | *1* | | *2.03* | *28.18* | | *58.06* |
| Communication / Post Related | 29,927 | 2,488 | 0 | 6,598 | 4,722 | 733 | 15,337 |
| | *100%* | *8.3%* | | *22.0%* | *18.2%* | | *51.2%* |
| | *0.1%* | *1* | | *2.65* | *2.19* | | *6.16* |
| Lifting-machine Controlling | 21,869 | 0 | 0 | 168 | 3,485 | 148 | 18,062 |
| | *100%* | *0.0%* | | *0.8%* | *16.6%* | | *82.6%* |
| | *0.1%* | *NA* | | *NA* | *NA* | | *NA* |
| Trading | 3,530,562 | 56,391 | 229 | 151,981 | 68,583 | 40,187 | 3,213,029 |
| | *100%* | *1.6%* | | *4.3%* | *3.1%* | | *91.0%* |
| | *9.6%* | *1* | | *2.68* | *1.92* | | *56.75* |
| Public Services | 474,869 | 8,667 | 52 | 15,051 | 16,788 | 19,467 | 414,728 |
| | *100%* | *1.8%* | | *3.2%* | *7.6%* | | *87.3%* |
| | *1.3%* | *1* | | *1.73* | *4.16* | | *47.57* |
| Other Production Based | 878,227 | 27,147 | 0 | 43,076 | 34,670 | 23,504 | 749,694 |
| | *100%* | *3.1%* | | *4.9%* | *6.6%* | | *85.4%* |
| | *2.4%* | *1* | | *1.59* | *2.14* | | *27.62* |

(Source: Status of Labour - Employment in Vietnam 1996)

Table IV-1-1 Number of Economically Active People Aged 15 and Over in Past 7 Days by Occupation Group and Technical Level in 1996

*(Number of Skilled Workers and Technicians to One University Graduate)*

| | Total | Universisty | Post Graduate | Middle Vocational | Skilled workers with Certificate | Skilled workers w/o Certificate | Unskilled |
|---|---|---|---|---|---|---|---|
| Total | 36,789,221 | 824,810 | 11,218 | 1,407,721 | 826,391 | 768,483 | 32,950,369 |
| | *100%* | *2.3%* | | *3.8%* | *4.3%* | | *89.6%* |
| | *100%* | *1* | | *1.68* | *1.91* | | *39.41* |
| Party/State Leader | 186,436 | 23,155 | 700 | 34,559 | 4,602 | 4,746 | 118,358 |
| | *100%* | *12.8%* | | *18.5%* | *5.0%* | | *63.6%* |
| | *0.5%* | *1* | | *1.45* | *0.39* | | *4.97* |
| Enterprise Director | 37,437 | 19,190 | 598 | 4162 | 1,030 | 1,241 | 11,170 |
| | *100%* | *52.9%* | | *11.1%* | *6.1%* | | *29.8%* |
| | *0.1%* | *1* | | *0.21* | *0.11* | | *0.56* |
| Management Officer | 405,752 | 115,752 | 1,041 | 142,063 | 7,321 | 3,749 | 135,695 |
| | *100%* | *28.8%* | | *35.0%* | *2.7%* | | *33.4%* |
| | *1.1%* | *1* | | *1.22* | *0.09* | | *1.16* |
| Technical Staff | 99,097 | 45,423 | 835 | 17,277 | 8,279 | 5,621 | 21,577 |
| | *100%* | *46.7%* | | *17.4%* | *14.0%* | | *21.8%* |
| | *0.3%* | *1* | | *0.37* | *0.30* | | *0.47* |
| Agriculture / Forestry Technical | 37,698 | 12,405 | 0 | 12,517 | 1,048 | 499 | 11,175 |
| | *100%* | *32.9%* | | *33.2%* | *4.1%* | | *29.6%* |
| | *0.1%* | *1* | | *1.01* | *0.12* | | *0.90* |
| Science / Education Training | 728,276 | 282,072 | 4,971 | 334,286 | 1,584 | 2,436 | 102,787 |
| | *100%* | *39.4%* | | *45.9%* | *0.6%* | | *14.1%* |
| | *2.0%* | *1* | | *1.16* | *0.01* | | *0.36* |
| Culture / Art Officer | 75,153 | 20,335 | 0 | 9,952 | 4,404 | 6,140 | 34,234 |
| | *100%* | *27.1%* | | *13.2%* | *14.0%* | | *45.6%* |
| | *0.2%* | *1* | | *0.49* | *0.52* | | *1.68* |
| Health Care Officer | 233,899 | 43,969 | 1,231 | 105,860 | 3,584 | 3,944 | 75,186 |
| | *100%* | *19.3%* | | *45.3%* | *3.2%* | | *32.1%* |
| | *0.6%* | *1* | | *2.34* | *0.17* | | *1.66* |
| Law / Investigation-related Officer | 14,617 | 7,121 | 92 | 2,642 | 0 | 37 | 4,695 |
| | *100%* | *49.3%* | | *18.1%* | *0.3%* | | *32.1%* |
| | *0.0%* | *1* | | *0.37* | *0.01* | | *0.65* |
| Secretary and Mental-side Other | 188,116 | 39,261 | 339 | 28,049 | 7,828 | 1,447 | 111,098 |
| | *100%* | *21.1%* | | *14.9%* | *4.9%* | | *59.1%* |
| | *0.5%* | *1* | | *0.71* | *0.23* | | *2.81* |
| Mining/Coal/Oil Technology Related and Industries | 3,704,595 | 48,864 | 96 | 108,017 | 220,867 | 531,663 | 2,796,224 |
| | *100%* | *1.3%* | | *2.9%* | *20.3%* | | *75.5%* |
| | *10.1%* | *1* | | *2.21* | *15.37* | | *57.11* |
| Agricultural | 24,732,180 | 61,333 | 1,012 | 365,658 | 218,768 | 98,562 | 23,986,639 |
| | *100%* | *0.3%* | | *1.5%* | *1.3%* | | *97.0%* |
| | *67.2%* | *1* | | *5.87* | *5.09* | | *384.74* |
| Forestry Related | 36,268 | 1,053 | 0 | 2,095 | 458 | 717 | 31,921 |
| | *100%* | *2.9%* | | *5.8%* | *3.2%* | | *88.0%* |
| | *0.1%* | *1* | | *1.99* | *1.12* | | *30.31* |
| Aquatic Breeding and Harvesting | 635,442 | 1,343 | 0 | 6,217 | 5,911 | 2,577 | 619,347 |
| | *100%* | *0.2%* | | *1.0%* | *1.3%* | | *97.5%* |
| | *1.7%* | *1* | | *4.63* | *6.32* | | *461.17* |
| Transport | 737,485 | 8,260 | 0 | 16,742 | 212,228 | 20,516 | 479,614 |
| | *100%* | *1.1%* | | *2.3%* | *31.6%* | | *65.0%* |
| | *2.0%* | *1* | | *2.03* | *28.18* | | *58.06* |
| Communication / Post Related | 29,927 | 2,488 | 0 | 6,598 | 4,722 | 733 | 15,337 |
| | *100%* | *8.3%* | | *22.0%* | *18.2%* | | *51.2%* |
| | *0.1%* | *1* | | *2.65* | *2.19* | | *6.16* |
| Lifting-machine Controlling | 21,869 | 0 | 0 | 168 | 3,485 | 148 | 18,062 |
| | *100%* | *0.0%* | | *0.8%* | *16.6%* | | *82.6%* |
| | *0.1%* | *NA* | | *NA* | *NA* | | *NA* |
| Trading | 3,530,562 | 56,391 | 229 | 151,981 | 68,583 | 40,187 | 3,213,029 |
| | *100%* | *1.6%* | | *4.3%* | *3.1%* | | *91.0%* |
| | *9.6%* | *1* | | *2.68* | *1.92* | | *56.75* |
| Public Services | 474,869 | 8,667 | 52 | 15,051 | 16,788 | 19,467 | 414,728 |
| | *100%* | *1.8%* | | *3.2%* | *7.5%* | | *87.3%* |
| | *1.3%* | *1* | | *1.73* | *4.16* | | *47.57* |
| Other Production Based | 878,227 | 27,147 | 0 | 43,076 | 34,670 | 23,504 | 749,691 |
| | *100%* | *3.1%* | | *4.9%* | *6.6%* | | *85.4%* |
| | *2.4%* | *1* | | *1.59* | *2.14* | | *27.62* |

(Source: Status of Labour - Employment in Vietnam 1996)

Table IV-1-2 Employment by Level of Technical Skills in 1996

*(Number of Skilled Workers and Technicians to One University Graduate)*

| | Total | University | Post Graduate | Middle Vocational | Skilled workers with Certificate | Skilled workers without Certificate | Elementary | Unskilled |
|---|---|---|---|---|---|---|---|---|
| Whole Country | 35,866,175 | 816,098 | 11,561 | 1,378,282 | 809,831 | 761,425 | 636,246 | 31,452,198 |
| | *100%* | *2.3%* | | *3.8%* | *6.2%* | | | *87.7%* |
| | | *1* | | *1.67* | *2.67* | | | *38.00* |
| | | | | | *1.90 (Except Elementary)* | | | |
| Red River Delta | 7,383,210 | 245,331 | 5,458 | 390,998 | 233,942 | 142,269 | 155,917 | 6,209,217 |
| | *100%* | *3.4%* | | *5.3%* | *7.2%* | | | *84.1%* |
| | | *1* | | *1.56* | *2.12* | | | *24.76* |
| | | | | | *1.50 (Except Elementary)* | | | |
| Hanoi | 1,135,568 | 128,725 | 4,666 | 100,283 | 63,532 | 54,629 | 29,295 | 754,426 |
| | *100%* | *11.7%* | | *8.8%* | *13.0%* | | | *66.4%* |
| | | *1* | | *0.75* | *1.11* | | | *5.66* |
| | | | | | *0.89 (Except Elementary)* | | | |
| Hai Phong | 834,314 | 32,600 | 73 | 48,234 | 47,997 | 23,117 | 18,509 | 663,774 |
| | *100%* | *3.9%* | | *5.8%* | *10.7%* | | | *79.6%* |
| | | *1* | | *1.48* | *2.74* | | | *20.32* |
| | | | | | *2.18 (Except Elementary)* | | | |
| Hatai | 1,164,199 | 23,202 | 130 | 52,133 | 20,863 | 9,240 | 24,672 | 1,033,945 |
| | *100%* | *2.0%* | | *4.5%* | *4.7%* | | | *88.8%* |
| | | *1* | | *2.23* | *2.35* | | | *44.31* |
| | | | | | *1.29 (Except Elementary)* | | | |
| Ho Chi Minh | 2,223,198 | 152,909 | 1,973 | 95,949 | 102,039 | 187,792 | 31,567 | 1,650,955 |
| | *100%* | *7.0%* | | *4.3%* | *14.5%* | | | *74.3%* |
| | | *1* | | *0.62* | *2.08* | | | *10.66* |
| | | | | | *1.87 (Except Elementary)* | | | |

(Source: Status of Labour - Employment in Vietnam 1996)

Table IV-1-2 Employment by Level of Technical Skills in 1996

*(Number of Skilled Workers and Technicians to One University Graduate)*

| | Total | University | Post Graduate | Middle Vocational | Skilled workers with Certificate | Skilled workers without Certificate | Elementary | Unskilled |
|---|---|---|---|---|---|---|---|---|
| Whole Country | 35,866,175 | 816,098 | 11,561 | 1,378,282 | 809,831 | 761,425 | 636,246 | 31,452,198 |
| | *100%* | *2.3%* | | *3.8%* | *6.2%* | | | *87.7%* |
| | | *1* | | *1.67* | *2.67* | | | *38.00* |
| | | | | | *1.90 (Except Elementary)* | | | |
| Red River Delta | 7,383,210 | 245,331 | 5,458 | 390,998 | 233,942 | 142,269 | 155,917 | 6,209,217 |
| | *100%* | *3.4%* | | *5.3%* | *7.2%* | | | *84.1%* |
| | | *1* | | *1.56* | *2.12* | | | *24.76* |
| | | | | | *1.50 (Except Elementary)* | | | |
| Hanoi | 1,135,568 | 128,725 | 4,666 | 100,283 | 63,532 | 54,629 | 29,295 | 754,426 |
| | *100%* | *11.7%* | | *8.8%* | *13.0%* | | | *66.4%* |
| | | *1* | | *0.75* | *1.11* | | | *5.66* |
| | | | | | *0.89 (Except Elementary)* | | | |
| Hai Phong | 834,314 | 32,600 | 73 | 48,234 | 47,997 | 23,117 | 18,509 | 663,774 |
| | *100%* | *3.9%* | | *5.8%* | *10.7%* | | | *79.6%* |
| | | *1* | | *1.48* | *2.74* | | | *20.32* |
| | | | | | *2.18 (Except Elementary)* | | | |
| Batai | 1,164,199 | 23,202 | 130 | 52,133 | 20,863 | 9,240 | 24,672 | 1,033,945 |
| | *100%* | *2.0%* | | *4.5%* | *4.7%* | | | *88.8%* |
| | | *1* | | *2.23* | *2.35* | | | *44.31* |
| | | | | | *1.29 (Except Elementary)* | | | |
| Ho Chi Minh | 2,223,198 | 152,909 | 1,973 | 95,949 | 102,039 | 187,792 | 31,567 | 1,650,955 |
| | *100%* | *7.0%* | | *4.3%* | *14.5%* | | | *74.3%* |
| | | *1* | | *0.62* | *2.08* | | | *10.66* |
| | | | | | *1.87 (Except Elementary)* | | | |

(Source: Status of Labour - Employment in Vietnam 1996)

Table IV-1-3 Number of Economically Active People Aged 15 and Over in Past 7 Days by Occupation Group and Technical Level in 1996

*Detail of Mining/Coal/Oil Technology Related and Industries*

*(Number of Skilled Workers and Technicians to One University Graduate)*

| | Total | University | Post Graduate | Middle Vocational | Skilled Workers with Certificate | Skilled workers w/o Certificate | Unskilled |
|---|---|---|---|---|---|---|---|
| Mining/Coal/Oil Technology Related and Industries | 3,704,595 | 48,864 | 96 | 108,018 | 220,870 | 531,663 | 2,796,233 |
| | *100%* | *1.3%* | | *2.9%* | *20.3%* | | *75.5%* |
| | *100%* | *1* | | *2.21* | *15.37* | | *57.11* |
| Motive Equipment-related | 30,393 | 656 | 0 | 4,059 | 8,773 | 5,255 | 11,612 |
| | *100%* | *2.2%* | | *13.4%* | *46.2%* | | *38.2%* |
| | *0.82%* | *1* | | *6.19* | *21.38* | | *17.70* |
| Mining/Coal/Oil Technology Related | 61,247 | 763 | 0 | 2,204 | 8,672 | 1,294 | 48,291 |
| | *100%* | *1.2%* | | *3.6%* | *16.3%* | | *78.8%* |
| | *1.65%* | *1* | | *2.89* | *13.06* | | *63.29* |
| Metallurgy/Mould/Coke Refining | 22,817 | 100 | 0 | 762 | 3,629 | 5,600 | 12,710 |
| | *100%* | *0.4%* | | *3.3%* | *40.4%* | | *55.7%* |
| | *0.62%* | *1* | | *7.62* | *92.29* | | *127.10* |
| Machine-manufacturing / Electric and Electronic | 562,908 | 16,829 | 0 | 35,682 | 99,939 | 119,497 | 290,792 |
| | *100%* | *3.0%* | | *6.3%* | *39.0%* | | *51.7%* |
| | *15.19%* | *1* | | *2.12* | *13.04* | | *17.28* |
| Chemical Industry Related | 74,857 | 3,232 | 52 | 4,580 | 3,693 | 5,172 | 58,095 |
| | *100%* | *4.4%* | | *6.1%* | *11.8%* | | *77.6%* |
| | *2.02%* | *1* | | *1.39* | *2.70* | | *17.69* |
| Paper Industry Related | 21,049 | 291 | 0 | 621 | 707 | 653 | 18,771 |
| | *100%* | *1.4%* | | *3.0%* | *6.5%* | | *89.2%* |
| | *0.57%* | *1* | | *2.13* | *4.67* | | *64.51* |
| Building Material Production | 102,279 | 351 | 0 | 3,264 | 2,571 | 9,590 | 86,473 |
| | *100%* | *0.3%* | | *3.2%* | *11.9%* | | *84.5%* |
| | *2.76%* | *1* | | *9.30* | *34.65* | | *246.36* |
| Aquatic Product Processing Related | 569,168 | 2,789 | 0 | 6,649 | 9,655 | 76,877 | 473,090 |
| | *100%* | *0.5%* | | *1.2%* | *15.2%* | | *83.1%* |
| | *15.36%* | *1* | | *2.38* | *31.03* | | *169.63* |
| Printing | 31,121 | 1,062 | 0 | 1,792 | 1,838 | 3,744 | 22,659 |
| | *100%* | *3.4%* | | *5.8%* | *17.9%* | | *72.8%* |
| | *0.84%* | *1* | | *1.69* | *5.26* | | *21.34* |
| Textile | 183,854 | 1,758 | 0 | 3,930 | 9,315 | 39,166 | 129,646 |
| | *100%* | *1.0%* | | *2.1%* | *26.4%* | | *70.5%* |
| | *4.96%* | *1* | | *2.24* | *27.58* | | *73.75* |
| Garment | 776,285 | 5,239 | 0 | 11,886 | 26,434 | 161,710 | 570,892 |
| | *100%* | *0.7%* | | *1.5%* | *24.2%* | | *73.5%* |
| | *20.95%* | *1* | | *2.27* | *35.91* | | *108.97* |
| Leather / Artificial Leather Based | 107,212 | 167 | 0 | 603 | 2,458 | 7,659 | 96,300 |
| | *100%* | *0.2%* | | *0.6%* | *9.4%* | | *89.8%* |
| | *2.89%* | *1* | | *3.61* | *60.58* | | *576.65* |
| Food Processing | 518,415 | 5,636 | 0 | 12,694 | 13,817 | 15,683 | 470,491 |
| | *100%* | *1.1%* | | *2.4%* | *5.7%* | | *90.8%* |
| | *13.99%* | *1* | | *2.25* | *5.23* | | *83.48* |
| Civil Engineering Related | 642,990 | 9,978 | 44 | 19,245 | 29,019 | 79,763 | 504,814 |
| | *100%* | *1.6%* | | *3.0%* | *16.9%* | | *78.5%* |
| | *17.36%* | *1* | | *1.92* | *10.85* | | *50.37* |

(Source: Status of Labour - Employment in Vietnam 1996)

Table IV-1-3 Number of Economically Active People Aged 15 and Over in Past 7 Days by Occupation Group and Technical Level in 1996

*Detail of Mining/Coal/Oil Technology Related and Industries*

*(Number of Skilled Workers and Technicians to One University Graduate)*

| | Total | University | Post Graduate | Middle Vocational | Skilled Workers with Certificate | Skilled workers w/o Certificate | Unskilled |
|---|---|---|---|---|---|---|---|
| Mining/Coal/Oil Technology Related and Industries | 3,704,595 | 48,864 | 96 | 108,018 | 220,870 | 531,663 | 2,796,233 |
| | *100%* | *1.3%* | | *2.9%* | *20.3%* | | *75.5%* |
| | *100%* | *1* | | *2.21* | *15.37* | | *57.11* |
| Motive Equipment-related | 30,393 | 656 | 0 | 4,059 | 8,773 | 5,255 | 11,612 |
| | *100%* | *2.2%* | | *13.4%* | *46.2%* | | *38.2%* |
| | *0.82%* | *1* | | *6.19* | *21.38* | | *17.70* |
| Mining/Coal/Oil Technology Related | 61,247 | 763 | 0 | 2,204 | 8,672 | 1,294 | 48,291 |
| | *100%* | *1.2%* | | *3.6%* | *16.3%* | | *78.8%* |
| | *1.65%* | *1* | | *2.89* | *13.06* | | *63.29* |
| Metallurgy/Mould/Coke Refining | 22,817 | 100 | 0 | 762 | 3,629 | 5,600 | 12,710 |
| | *100%* | *0.4%* | | *3.3%* | *40.4%* | | *55.7%* |
| | *0.62%* | *1* | | *7.62* | *92.29* | | *127.10* |
| Machine-manufacturing / Electric and Electronic | 562,908 | 16,829 | 0 | 35,682 | 99,939 | 119,497 | 290,792 |
| | *100%* | *3.0%* | | *6.3%* | *39.0%* | | *51.7%* |
| | *15.19%* | *1* | | *2.12* | *13.04* | | *17.28* |
| Chemical Industry Related | 74,857 | 3,232 | 52 | 4,580 | 3,693 | 5,172 | 58,095 |
| | *100%* | *4.4%* | | *6.1%* | *11.8%* | | *77.6%* |
| | *2.02%* | *1* | | *1.39* | *2.70* | | *17.69* |
| Paper Industry Related | 21,049 | 291 | 0 | 621 | 707 | 653 | 18,771 |
| | *100%* | *1.4%* | | *3.0%* | *6.5%* | | *89.2%* |
| | *0.57%* | *1* | | *2.13* | *4.67* | | *64.51* |
| Building Material Production | 102,279 | 351 | 0 | 3,264 | 2,571 | 9,590 | 86,473 |
| | *100%* | *0.3%* | | *3.2%* | *11.9%* | | *84.5%* |
| | *2.76%* | *1* | | *9.30* | *34.65* | | *246.36* |
| Aquatic Product Processing Related | 569,168 | 2,789 | 0 | 6,649 | 9,655 | 76,877 | 473,090 |
| | *100%* | *0.5%* | | *1.2%* | *15.2%* | | *83.1%* |
| | *15.36%* | *1* | | *2.38* | *31.03* | | *169.63* |
| Printing | 31,121 | 1,062 | 0 | 1,792 | 1,838 | 3,744 | 22,659 |
| | *100%* | *3.4%* | | *5.8%* | *17.9%* | | *72.8%* |
| | *0.84%* | *1* | | *1.69* | *5.26* | | *21.34* |
| Textile | 183,854 | 1,758 | 0 | 3,930 | 9,315 | 39,166 | 129,646 |
| | *100%* | *1.0%* | | *2.1%* | *26.4%* | | *70.5%* |
| | *4.96%* | *1* | | *2.24* | *27.58* | | *73.75* |
| Garment | 776,285 | 5,239 | 0 | 11,886 | 26,434 | 161,710 | 570,892 |
| | *100%* | *0.7%* | | *1.5%* | *24.2%* | | *73.5%* |
| | *20.95%* | *1* | | *2.27* | *35.91* | | *108.97* |
| Leather / Artificial Leather Based | 107,212 | 167 | 0 | 603 | 2,458 | 7,659 | 96,300 |
| | *100%* | *0.2%* | | *0.6%* | *9.4%* | | *89.8%* |
| | *2.89%* | *1* | | *3.61* | *60.58* | | *576.65* |
| Food Processing | 518,415 | 5,636 | 0 | 12,694 | 13,817 | 15,683 | 470,491 |
| | *100%* | *1.1%* | | *2.4%* | *5.7%* | | *90.8%* |
| | *13.99%* | *1* | | *2.25* | *5.23* | | *83.48* |
| Civil Engineering Related | 642,990 | 9,978 | 44 | 19,245 | 29,019 | 79,763 | 504,814 |
| | *100%* | *1.6%* | | *3.0%* | *16.9%* | | *78.5%* |
| | *17.36%* | *1* | | *1.92* | *10.85* | | *50.37* |

(Source: Status of Labour - Employment in Vietnam 1996)

Table IV-1-4 Number of Workforce by Technical Level

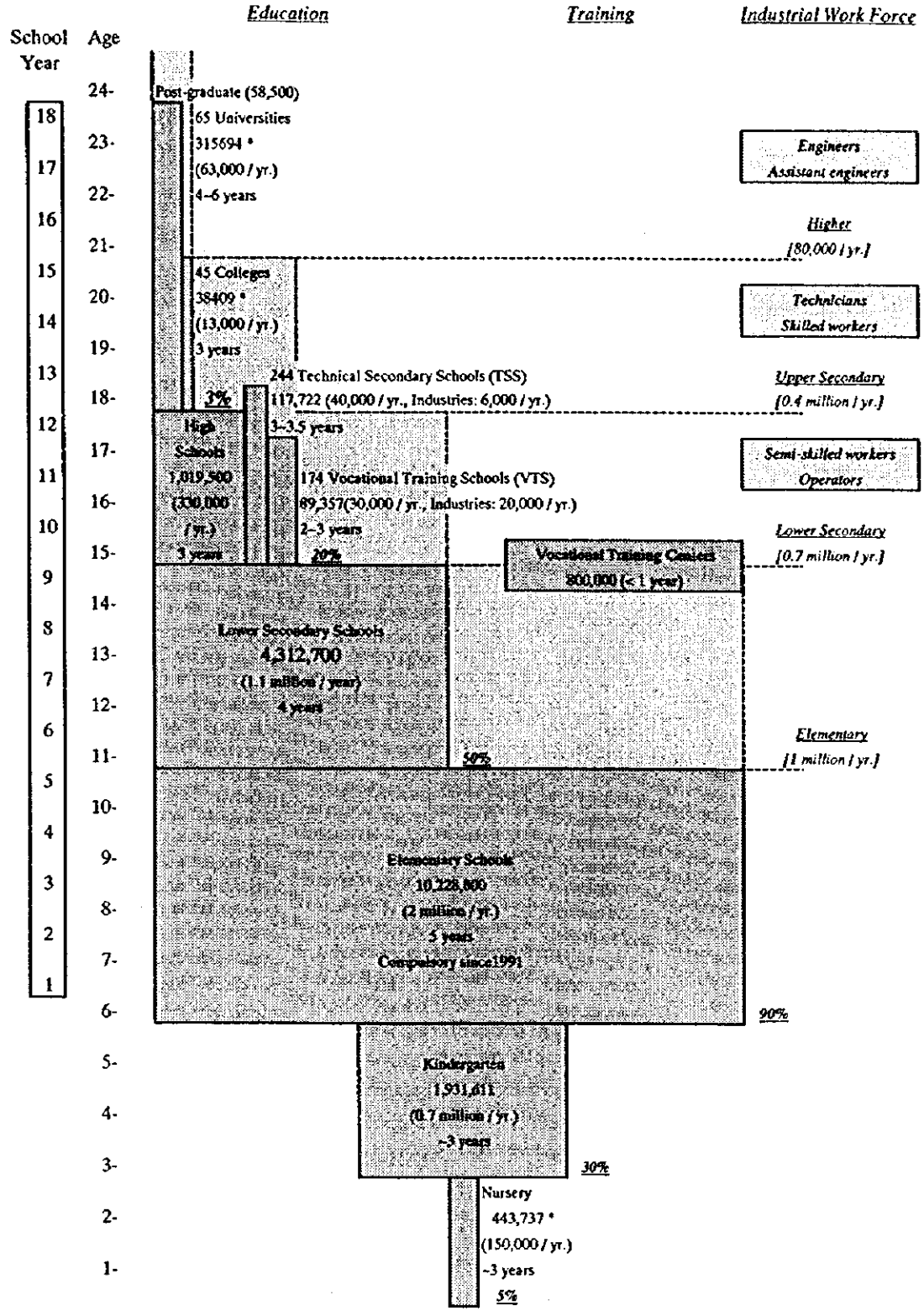
| Vietnam | Total | University Graduates | Middle Vocational | Skilled-/Semi-skilled Workers | Unskilled Workers |
|---|---|---|---|---|---|
| Total in Vietnam | 36,789,221 | 836,028 | 1,407,721 | 1,594,874 | 32,950,369 |
| | *100%* | *2.3%* | *3.8%* | *4.3%* | *89.6%* |
| | | *1* | *1.68* | *1.91* | *39.41* |
| Science, E&T | 728,876 | 287,043 | 334,286 | 4,020 | 102,787 |
| | *100%* | *39.4%* | *45.9%* | *0.6%* | *14.1%* |
| | | *1* | *1.16* | *0.01* | *0.36* |
| Mining and Industries | 3,704,595 | 48,960 | 108,017 | 752,530 | 2,796,224 |
| | *100%* | *1.3%* | *2.9%* | *20.3%* | *75.5%* |
| | | *1* | *2.21* | *15.37* | *57.11* |
| Machine, Elec. and Electronic | 562,908 | 16,829 | 35,682 | 219,436 | 290,792 |
| | *100%* | *3.0%* | *6.3%* | *39.0%* | *51.7%* |
| | | *1* | *2.12* | *13.04* | *17.28* |
| Chemical Industry Related | 74,857 | 3,284 | 4,580 | 8,865 | 58,095 |
| | *100%* | *4.4%* | *6.1%* | *11.8%* | *77.6%* |
| | | *1* | *1.39* | *2.70* | *17.69* |
| **Thailand** | Total | Engineers | Technicians | Foremen / Group Leaders | Workers |
| Automotive Industry in IEA of Thailand (1996) | 5,253 | 209 | 788 | 1,839 | 2,417 |
| | *100%* | *4.0%* | *15.0%* | *35.0%* | *46.0%* |
| | | *1* | *3.77* | *8.80* | *11.56* |
| Petrochemical Industry in IEA of Thailand (1996) | 1,727 | 103 | 432 | 518 | 674 |
| | *100%* | *6.0%* | *25.0%* | *30.0%* | *39.0%* |
| | | *1* | *4.19* | *5.03* | *6.54* |
| Electronic Industry in IEA of Thailand (1996) | 8,897 | 352 | 881 | 2,378 | 5,286 |
| | *100%* | *4.0%* | *9.9%* | *26.7%* | *59.4%* |
| | | *1* | *2.50* | *6.76* | *15.02* |
| **Malaysia** | Total | Engineers | Engineering Assistants | | |
| Total in 1990 | 98,900 | 26,500 | 72,400 | | |
| | | *1* | *2.73* | | |
| Civil Engineering | 38,200 | 11,100 | 27,100 | | |
| | | *1* | *2.44* | | |
| Electrical & Electronic | 38,500 | 6,200 | 32,300 | | |
| | | *1* | *5.21* | | |
| Mechanical Engineering | 11,600 | 5,200 | 6,400 | | |
| | | *1* | *1.23* | | |
| Chemical Engineering | 1,400 | 800 | 600 | | |
| | | *1* | *0.75* | | |
| Others | 9,200 | 3,200 | 6,000 | | |
| | | *1* | *1.88* | | |
| Target in 2000 | 251,900 | 56,600 | 195,300 | | |
| | | *1* | *3.45* | | |
| Civil Engineering | 78,000 | 19,500 | 58,500 | | |
| | | *1* | *3.00* | | |
| Electrical & Electronic | 90,500 | 14,600 | 75,900 | | |
| | | *1* | *5.20* | | |
| Mechanical Engineering | 43,200 | 10,800 | 32,400 | | |
| | | *1* | *3.00* | | |
| Chemical Engineering | 8,000 | 2,000 | 6,000 | | |
| | | *1* | *3.00* | | |
| Others | 32,200 | 9,700 | 22,500 | | |
| | | *1* | *2.32* | | |

Table IV-1-4 Number of Workforce by Technical Level

| Vietnam | Total | University Graduates | Middle Vocational | Skilled-/Semi-skilled Workers | Unskilled Workers |
|---|---|---|---|---|---|
| Total in Vietnam | 36,789,221 | 836,028 | 1,407,721 | 1,594,874 | 32,950,369 |
| | *100%* | *2.3%* | *3.8%* | *4.3%* | *89.6%* |
| | | *1* | *1.68* | *1.91* | *39.41* |
| Science, E&T | 728,876 | 287,043 | 334,286 | 4,020 | 102,787 |
| | *100%* | *39.4%* | *45.9%* | *0.6%* | *14.1%* |
| | | *1* | *1.16* | *0.01* | *0.36* |
| Mining and Industries | 3,704,595 | 48,960 | 108,017 | 752,530 | 2,796,224 |
| | *100%* | *1.3%* | *2.9%* | *20.3%* | *75.5%* |
| | | *1* | *2.21* | *15.37* | *57.11* |
| Machine, Elec. and Electronic | 562,908 | 16,829 | 35,682 | 219,436 | 290,792 |
| | *100%* | *3.0%* | *6.3%* | *39.0%* | *51.7%* |
| | | *1* | *2.12* | *13.04* | *17.28* |
| Chemical Industry Related | 74,857 | 3,284 | 4,580 | 8,865 | 58,095 |
| | *100%* | *4.4%* | *6.1%* | *11.8%* | *77.6%* |
| | | *1* | *1.39* | *2.70* | *17.69* |

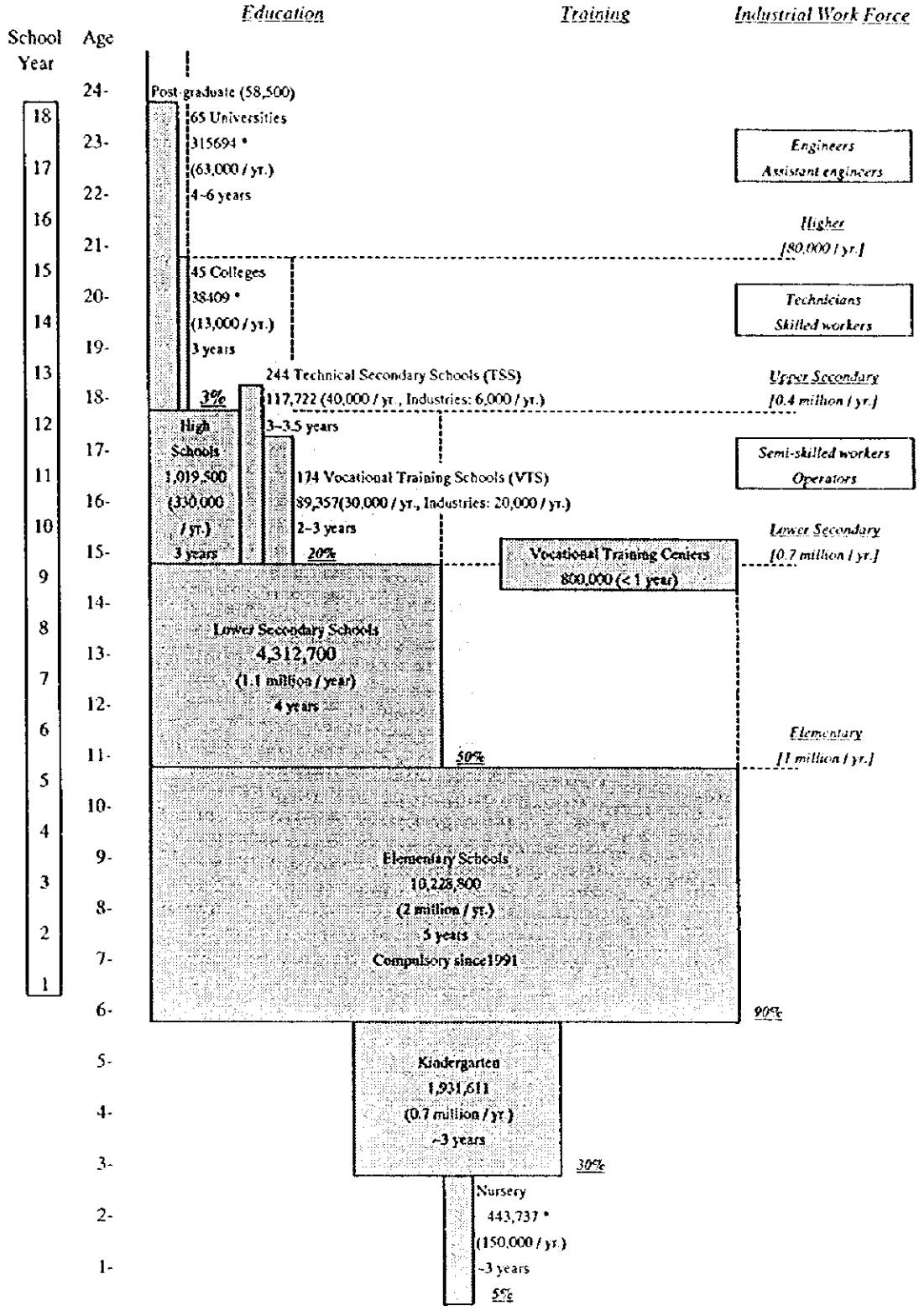
| Thailand | Total | Engineers | Technicians | Foremen / Group Leaders | Workers |
|---|---|---|---|---|---|
| Automotive Industry in IEA of Thailand (1996) | 5,253 | 209 | 788 | 1,839 | 2,417 |
| | *100%* | *4.0%* | *15.0%* | *35.0%* | *46.0%* |
| | | *1* | *3.77* | *8.80* | *11.56* |
| Petrochemical Industry in IEA of Thailand (1996) | 1,727 | 103 | 432 | 518 | 674 |
| | *100%* | *6.0%* | *25.0%* | *30.0%* | *39.0%* |
| | | *1* | *4.19* | *5.03* | *6.54* |
| Electronic Industry in IEA of Thailand (1996) | 8,897 | 352 | 881 | 2,378 | 5,286 |
| | *100%* | *4.0%* | *9.9%* | *26.7%* | *59.4%* |
| | | *1* | *2.50* | *6.76* | *15.02* |

| Malaysia | Total | Engineers | Engineering Assistants |
|---|---|---|---|
| Total in 1990 | 98,900 | 26,500 | 72,400 |
| | | *1* | *2.73* |
| Civil Engineering | 38,200 | 11,100 | 27,100 |
| | | *1* | *2.44* |
| Electrical & Electronic | 38,500 | 6,200 | 32,300 |
| | | *1* | *5.21* |
| Mechanical Engineering | 11,600 | 5,200 | 6,400 |
| | | *1* | *1.23* |
| Chemical Engineering | 1,400 | 800 | 600 |
| | | *1* | *0.75* |
| Others | 9,200 | 3,200 | 6,000 |
| | | *1* | *1.88* |
| Target in 2000 | 251,900 | 56,600 | 195,300 |
| | | *1* | *3.45* |
| Civil Engineering | 78,000 | 19,500 | 58,500 |
| | | *1* | *3.00* |
| Electrical & Electronic | 90,500 | 14,600 | 75,900 |
| | | *1* | *5.20* |
| Mechanical Engineering | 43,200 | 10,800 | 32,400 |
| | | *1* | *3.00* |
| Chemical Engineering | 8,000 | 2,000 | 6,000 |
| | | *1* | *3.00* |
| Others | 32,200 | 9,700 | 22,500 |
| | | *1* | *2.32* |




[1995 - 1996] (Figures with * [1994 - 1995])

Figure IV-1-1 Education and Training System in Vietnam




[1995 - 1996] (Figures with * [1994 - 1995])

Figure IV-1-1 Education and Training System in Vietnam

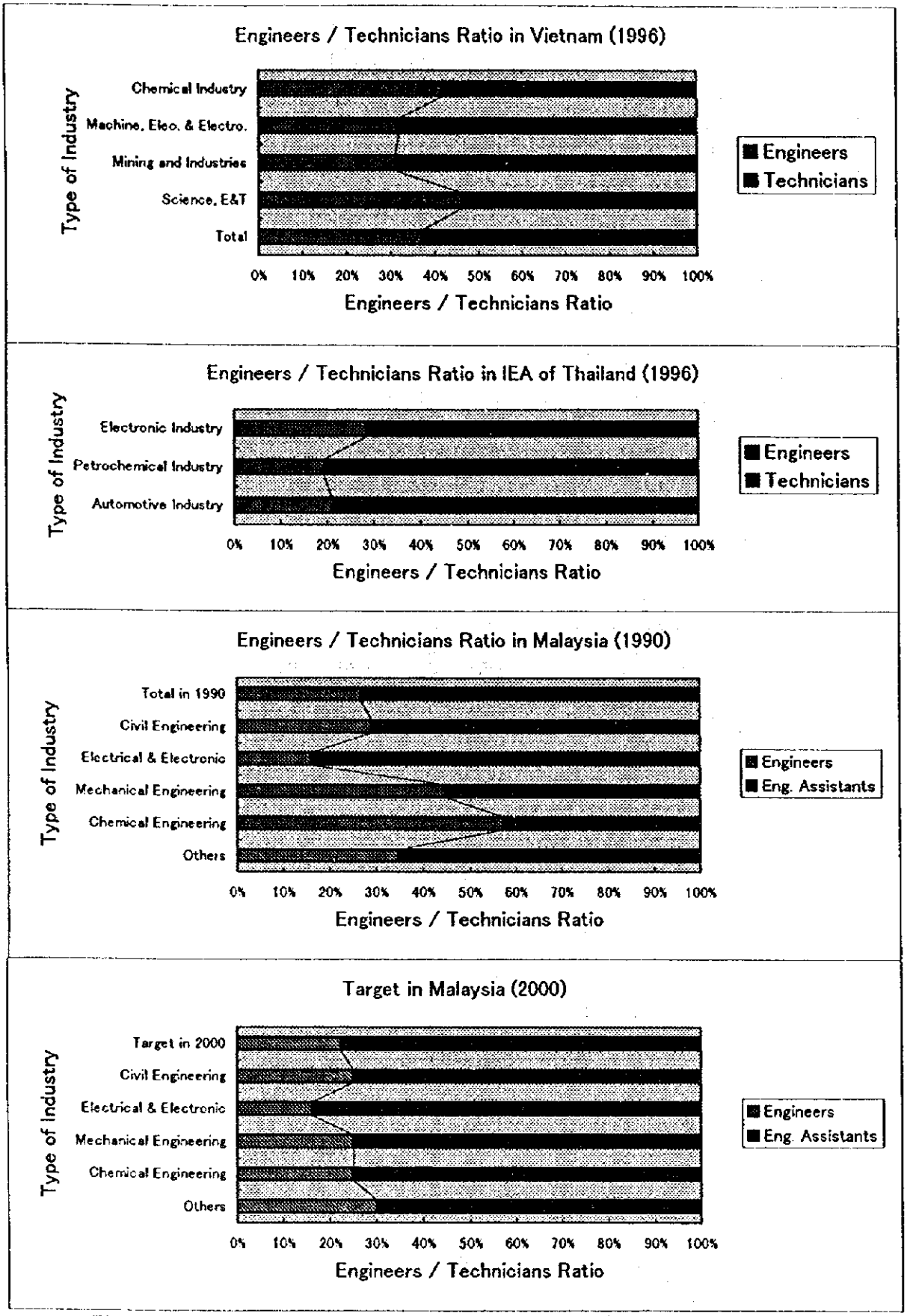



Figure IV-1-2 Engineers / Technicians Ratio in Vietnam, Thailand and Malaysia

# APPENDIX V RESEARCH AND DEVELOPMENT PROMOTION POLICIES

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# APPENDIX V RESEARCH AND DEVELOPMENT PROMOTION POLICIES

## V.1 Current Situation of R&D Activities

### V.1.1 Expenditure for R&D

Expenditure of State budget for science had increased sharply by 3.8 times from VND 143.1 billion in 1990 to VND 539.6 billion in 1993 as shown in the table below. The expenditure corresponded to 0.19% of GDP in 1991, 0.30% in 1992, and 0.40% in 1993. Increase in State budget for science indicates that the Vietnamese Government has been giving high priority to science.

Expenditure of State Budget for Science in Vietnam

(VND Billion)

| | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|
| Expenditure of State Budget for Science | 143.1 | 148.6 | 327.5 | 539.6 |
| GDP at current price | | 76,707 | 110,535 | 136,571 |
| Expenditure for Science per GDP | | 0.19% | 0.30% | 0.40% |

(Source: Statistical Yearbook-1995)

Expenditure for R&D as percentage of GDP are listed below for OECD and ASEAN countries for comparison with Vietnam. The expenditure in Vietnam includes only of state organization. R&D expenditure of private sector in Vietnam, which may be quite smaller than that of state organization, could be neglected for the comparison purpose.

Expenditure for R&D as % of GDP in Other Countries in 1993

| | | | |
|---|---|---|---|
| Malaysia * | 0.39 | Sweden | 3.26 |
| Thailand * | 0.16 | Australia | 1.58 |
| Singapore * | 0.86 | Belgium | 1.66 |
| Indonesia * | 0.18 | Austria | 1.52 |
| Philippines * | 0.09 | Mexico | 0.32 |
| U.S.A. | 2.66 | Finland | 2.23 |
| Japan | 2.72 | Denmark | 1.80 |
| Germany | 2.48 | Turkey | 0.46 |
| France | 2.45 | Norway | 1.94 |
| U.K. | 2.19 | Portugal | 0.63 |
| Italy | 1.30 | Ireland | 1.22 |
| Canada | 1.50 | New Zealand | 1.22 |
| Netherlands | 1.89 | Greece | 0.62 |
| Spain | 0.88 | Iceland | 1.33 |
| Switzerland | 2.68 | | |

Source: OECD, STIU database November 1995 and
1992 National Survey of Research & Development (Malaysia)

Note *) : R&D expenditure as percentage of GNP in 1992

Vietnam's R&D expenditure in 1993 that is 0.4 % on GDP is smaller than 0.86 % in Singapore, however it is equivalent to Malaysia and larger than Thailand, Indonesia and Philippines. Compared with OECD countries in 1993, it is considerably smaller than advanced countries such as US, Japan, Germany, France, United Kingdom, Switzerland, Sweden and Finland of which expenditure exceed 2% on GDP. Vietnam ranked as the same level as Mexico, Turkey, Greece and Portugal for R&D expenditure.

V.1.2 R&D Personnel

Labor in state sector for science and technology activities decreased from 49,500 in the year 1990 to 27,200 in the year 1994, while total labor force increased gradually from 30,286,000 to 33,663,900 during the same period. Consequently, labor force for science and technology in the state sector per 10,000 total labor force decreased from 16.3 in the year 1990 to 8.1 in the year 1994.

Labor Force for Science and Technology Activities in Vietnam

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| • Labor in State Sector for Science and Technology Activities (1,000 persons) | 49.5 | 44.6 | 37.5 | 37.6 | 27.2 |
| • Total Labor Force (1,000 persons) | 30,286.0 | 30,974.0 | 31,815.2 | 32,718.0 | 33,663.9 |
| • Labor Force for Science and Technology in State Sector per 10,000 Labor Force | 16.3 | 14.4 | 11.8 | 11.5 | 8.1 |

(Source: Statistical Yearbook-1996 for (1), Statistical Yearbook-1995 for (2) )

The following table shows the R&D personnel per 10,000 total labor force in Malaysia and OECD countries. All listed countries have more R&D personnel per 10,000 total labor force than Vietnam, except for 2 persons in Malaysia, 4 in Mexico and 8 for Turkey.

R&D Personnel per 10,000 Total Labor Force in Other Countries in 1993

| | | | |
|---|---|---|---|
| Malaysia * | 2 | Belgium | 95 |
| Japan | 126 | Austria | 67 |
| Germany | 125 | Mexico | 4 |
| France | 125 | Finland | 122 |
| U.K. | 99 | Denmark | 95 |
| Italy | 58 | Turkey | 8 |
| Canada | 83 | Norway | 104 |
| Netherlands | 97 | Portugal | 29 |
| Spain | 48 | Ireland | 65 |
| Switzerland | 135 | New Zealand | 54 |
| Sweden | 129 | Greece | 35 |
| Australia | 91 | | |

Source: OECD, STIU database November 1995 and 1992 National Survey of Research & Development (Malaysia)

V.1.3 Institution and Organization for R&D

(1) State R&D Institutes

Almost all R&D activities in Vietnam are carried out by State R&D institutes. It is said that there are more than 400 State R&D institutes in Vietnam. As this number includes many sub-institutes under the R&D institutes, real number of R&D institutes is less than that.

State R&D institutes are divided into two categories: those belong to the National Center for Science and Technology (NCST) or the National Center of Social Science which directly under the Prime Minister, and those under control of Ministries, agencies at Ministry's level, or Government's agencies. In the Natural Science and Technology field, there are 17 institutes belong to NCST and 170 institutes under control of Ministries, agencies at Ministry's level, or Government's agencies.

The function and activities of NCST are:

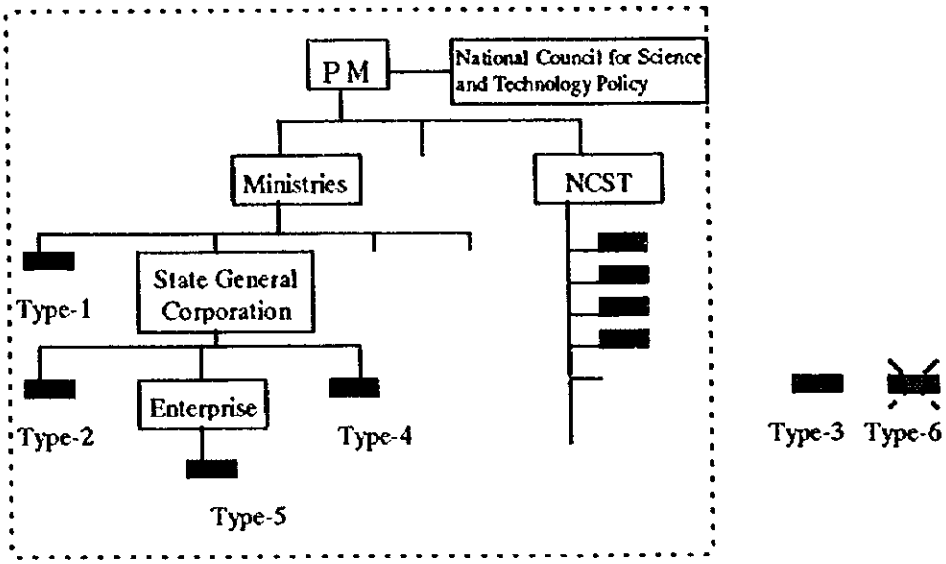
- to organize and carry out research and development activities in natural science and in the priority fields of technology,
- to improve scientific and technological resource, and potentials of NCST including technical / material infrastructure and scientific manpower training, and
- to cooperate with foreign partners in scientific and technological R&D.

The following 17 institutes belong to NCST: Institute of Mathematics, Institute of Information Technology, Institute of Physics, Institute of Chemistry, Institute of Natural Products, Institute of Biotechnology, Institute of Ecology and Biological Resources, Institute of Geology, Institute of Geophysics, Institute of Geography, Institute of Oceanography, Institute of Mechanics, Institute of Material Science, Institute of Tropical Technology, Institute of Tropical Biology, Institute of Applied Mechanics, and Institute of Chemical Technology.

R&D institutes under control of Ministries, agencies at Ministry's level, or Government's agencies have a function of applied R&D or strategic function.

(2) Rearrangement of State R&D Institutes

The above mentioned State R&D institutes which are under control of Ministries, agencies at Ministry's level, or Government's agencies are being rearranged to the structure shown below, in accordance with Government decision No. 782 that was issued on October 24, 1996 and effective from January 1, 1997.




R&D institutes of type-1 shown on the above figure will be left under direct control of Ministries, agency of Ministry level or Government's agency. Those institutes will still receive finance from the state budget for their operation and development investment according to their function, duty and development demand.

Type-2 institutes will belong to State General Corporations such as Vietnam General Corporation of Chemistry, Vietnam General Corporation of Electricity and Vietnam General Corporation of Oil and Gas. For these institute, their authorized Ministries and State General Corporations take responsibility of management and giving assignment to the institutes so as to keep their operation in conformity with that of State General Corporation. This type of institutes will receive finance from the state budget for no more than 5 years for the salary fund and administrative expenses.

Institutes those categorized as type-3, 4 and 5 will become institute that operate with their own budget, as an independent state enterprise, and as a part of a state enterprise, respectively. Institutes of type-6 will be merged with others or stop operation. Institutes of type-3 through 6 will be supported by the state budget for no more than 5 years.

Among State R&D institutes, 41 institutes have been selected for type-1 as well as 6 institutes for type-2. Other institutes are being categorized into 6 types.

## V.2 Current Status and Problems of R&D Promotion Policy

### V.2.1 Review of Policy

#### (1) Review of Basic Policy for Science and Technology Promotion

The 1996-2000 five-year plan for socio-economic development describes the basic policy for science and technology promotion as summarized below. In the five-year plan, development of science and technology is depicted to enhance the endogenous capacity as an important factor to drive the process of industrialization and modernization.

1) Objectives

The objectives of the five-year plan are:

- to work out scientific grounds to be capable of absorbing world achievements in science and technology,
- to carry out initial development of a number of high-tech field such as electronics, information, biotechnology, new materials and automation,
- to set up technology renewal by at least 10% per year in various branches of production, paying special attention to quality of technologies,
- to focus on application of advanced technologies, gradually bringing Vietnamese technology to the standard of the region, and
- to bring about visible progress in the protection of ecological environment.

2) Program

In order to achieve the above objectives, the following program have been worked out.

Renewal of technology

The level of technology should be moved directly to modern technology in key production sectors with impact on many branches, in export production sectors and in new field of investment. Technology should be improved continuously for a number of traditional trades. Technical means should be renewed for inspection, measurement, and control. Automation is necessary for enhancing product quality.

Development of high-tech

The program to develop information technology should include:

- to strive to build infrastructure for information technology by the year 2000,
- to apply information technology to all sectors of national economy so as to achieve tangible progress in terms of productivity, quality and efficiency, and
- to set up a nation-wide information web connected with a number of international webs.

For biotechnology, the following actions should be taken.

- to develop biotechnology with a view to securing fast generation and multiplication of new variety of plants and animals,
- to produce various types of vaccine and antiserum, and agents for rapid and accurate disease diagnosis, and
- to develop technologies to address environmental pollution.

It is necessary to develop new materials which are highly effective and durable under the severe tropical condition. Automation should be introduced to a number of key factories so that it could form the production chain which determine the quality of products.

Two high-tech zones which serve as a venue for scientific institutions and local and foreign business to secure high technology and high-tech industries should be developed in Hanoi and Ho Chi Minh City.

Development of natural science

It is essential to develop the various disciplines of natural science and research into a number of promising fundamental present and future issues of science to keep abreast with the world standards in the fields of mathematics, cybernetics and calculation, physics, mechanics, chemistry, biology and earth sciences.

Enhancement of the quality and competitiveness of products

The quality and competitiveness of Vietnamese products should be enhanced to reach the international standards by applying science and technology measures and renewal of institutions and management policies, focusing on a number of staples such as rice, coffee, rubber, aquatic products, garment, oil and gas and assembled products. Institutional network should be placed to control and certify product quality.

Protection of industrial property right

Protection of industrial property right should be set up in order to ensure wholesome competition within the market system and stimulate the creativity of scientists and working people.

Incentives

The State is to adopt policies that provide incentives for the application of technical advances through preferential treatment in tax, credit, import-export tariffs, etc. It is necessary to extend support to the economic sectors which need scientific research and technological innovation.

Rearrangement of institutes

Rearrangement of science and technology institutions should continue towards greater concentration on strategic areas of science and technology, closely linking scientific research with education and training, and placing a number of existing specialized research institutes under the direct jurisdiction of various corporation.

Founding sources

It is indispensable to look for diverse funding sources for rapid increase in investment for science and technology. Besides budget allocation, policy measures have to be devised to tap additional sources for investment in science and technology from business, the various economic sectors, and international assistance.

Protection of the ecological environment

It is essential to ensure rational utilization of natural resources and protection of the ecological environment. The following measures are listed for the protection of the ecological environment.

- Surveys of environmental pollution should be undertaken urgently to investigate and evaluate irrational exploitation of natural resources that is detrimental to the environment, and to devise effective remedial measures.
- The projects for environmental rehabilitation and protection should be carried out.
- National park and forest reserves should be created.
- Tree planting should be implemented in cities and industrial estates.

- Advanced techniques should be applied for toxic and waste treatment.
- All plans and projects of socio-economic development, foreign investment, and capital construction must be examined and weighed with regard to their environment impact and their suggested remedial measures.
- Environmental degradation caused by production facilities should be terminated. It is needed to stop at its original source of pollutant, at first and foremost, of water and air.
- It is necessary to extend the green coverage to requisite level of ecological safety.
- It is needed to ensure sound working and living environmental conditions in industrial estates and urban centers, as well as environmental hygiene in rural area.

(2) Review of Policy on the Development of Information Technology

Resolution of the Government No. 49/CP dated August 4 1993 provides general concepts and objectives for the development of the information technology (IT) up to the year 2000. In addition, it shows major measures to ensure implementation of this policy.

1) General concepts

- IT development is mainly based on the use of foreign technology.
- IT development should be based on the "open systems" concept.
- IT development will be mainly application-oriented.

2) Objectives

- To develop computer systems and communication facilities as an integrated network, with software, information systems and databases that can serve the needs of state management and key activities of the economy,
- To develop in a diffused way the use of IT to increase productivity and the quality and effectiveness of production and trading, as well as to promote gradual modernization of the production sectors, important services and national security,
- To popularize "information culture" in the society, and
- To lay the foundation for an IT industry, giving priority to the development of a "software" industry.

3) Contents of R&D in IT

Research work on IT should aim at acquiring modern knowledge and gaining a thorough insight into development trends of the technology world-wide with a view to:

- selecting appropriate tactics for technology transfer to build up an IT infrastructure,
- conducting research and design of systems, and developing applied software, and
- conducting research for producing IT products, especially software.

It is necessary to set up an institute for IT under NCST as a leading institute for conducting R&D in the IT field. Research work in universities should be enhanced. There should be policies to encourage opening IT R&D units in different branches and organizations from different economic sectors.

4) Policies and principal measures

Responsible Ministries and Government agencies are specified for the implementation of the following policies:

- information generation and standardization of information generated in society,
- standardization of imported equipment in the field of IT,
- information exchange and protection,
- technology transfer and international cooperation,
- utilization of foreign consultants and the expertise of Vietnamese living abroad,
- support and mobilization of funds for IT development,
- privileges in the utilization of telecommunication facilities by research and education activities,
- protection of intellectual property and author's right, and
- institutional arrangement for implementation.

5) Master plan up to the year 2000

The master plan presents the contents of works to be deployed up to the year 2000 to implement the Resolution No. 49/CP. In the master plan, structuring of IT R&D is presented as follows:

Structuring of IT R&D

In order to achieve the content of R&D of Resolution No. 49/CP, an assessment is required of efficiency, direction, contents of activities of the existing institutions of research; thereby to set forth measures to re-oriented and increase the research staff, material and technical basis for the activities of R&D as specified:

- to build the IT institute belonging to NCST with some other key institutions belonging to MOSTE, MOI, etc. to become the most active force in IT R&D,
- to strengthen the IT department of colleges and universities with a view to making them, in addition to the function of education and training, becoming important units of IT R&D, to develop the capacity of training staff and involve the young generation in R&D activities,
- by means of policies of assistance and preferential incentives encouraging the set up of an IT R&D section in various branches and localities, in the companies belonging to different economic sectors with investment from local or joint venture sources, and
- to build rapidly a database communication network for education, R&D in nationwide scale under procedures and norms of the Internet and through a common gateway linkable to Internet, creating favorable conditions for Vietnamese circles of education, R&D to exchange information with each other and with international colleagues.

(3) Review of Policy on the Development of Biotechnology

Resolution of the Government No. 18/CP dated March 11, 1994 provides concepts, targets, contents and measures and policies for the development of biotechnology up to the year 2010.

1) Concepts

- To develop the biotechnology in order to optimize the exploitation, protection and development of Vietnamese biological resources,

- To develop the biotechnology in order to make services for the agricultural, forestall, fishing works, for the protection of the human health and the living environment, and
- To develop the biotechnology based on the choice of the world achievements and their application under the concrete Vietnamese conditions, for a rapid access in the advanced technology together with the modernization of the traditional technology.

2) Target

- To research for a large application of scientific and technological achievements belonging to the world's biotechnology,
- To build up a biotechnology development branch, and
- To create a system of scientific and technological organizations in the biotechnology system.

3) Contents

<u>For the development of agriculture, sylviculture and fisheries</u>

- To create the technology of rehabitation and multiphication of cereals seeds, vegetables, flowers, fruits, industrial plants, aquatic vegetal, and forest trees having a good quality and a high resistance towards the unfavorable ambient conditions as well as towards the insects and diseases,
- To apply the modern biotechnology in cross breeds to exploit the precious races for developing domestic animals, poultry and sea-products,
- To utilize the biotechnology measures for developing, maintaining and stocking the precious and scarce sources genes,
- To create industrial production of biological fertilizers fixing of nitrogen, stimulated material for growing, micro-organisms finished products for vegetal protection,
- To apply biotechnology for creating foods rich in nutritional material (protein, vitamin), veterinary medicine, various common vaccines serving the industrial breeding of domestic animals, poultry, sea-products and wild animals,
- To make research and to develop biotechnology sector for protection and processing of agricultural, forestry and sea-products in order to reduce

damages after cropping, to maintain and to improve quality of these products serving the interior consumption and exportation, and

- To study the development of processing technology for the standard products in agriculture, sylviculture and fishing to become high economic value of products.

For human health

- To study and develop all technologies belonging to biotechnology sector producing medicine for disease treatment, taking especially care of antibiotic drugs production, production of classical vaccines and some categories of vaccines new generations,
- To study and develop the industrial production of finished products serving for diagnosis and treatment of bacterium infected disease or not bacterium infected, and
- To study and develop biotechnology of producing biological finished products for the prevention and struggle against malnutrition among children and for improving for community's physical strength.

For environmental protection and biological resources

- To study and develop biotechnology for treatment of city's discharges, infected sources of water and air,
- To study and develop technologies for ecological environment protection, especially for development of the forestry program and recovery with greenness the unoccupied land,
- To study the development, maintenance and protection of biological resources, and
- To limit losses of genes sources.

For other technological branches

- To study and develop biotechnology producing acids and organic solvents, and
- To study and apply biotechnology for exploitation of mineral resources, oil and gas.

For build-up of science and technology potentialities of biotechnology

- To concentrate to build-up a line-up of science and technology (S&T) staff on homogeneous biotechnology level and profession for a short time duration,
- To re-train staffs and build-up of training program in the high school,
- To reorganize the system of R&D to expand the biotechnology sector,
- On the bases of existing S&T organizations, to fully worked-out biotechnology institute depending on NCST,
- To enhance the laboratories of other research organizations helping them to receive and improve the foreign technology and to create the technology for national economical branches, step by step,
- To transfer some laboratories in specializing of concrete technology development and technology with medium level to enterprises so that they can create conditions of investment in their own S&T bases, and
- To build-up banks of genes rapidly as well the banks of data about genera and species and information of biotechnology.

To build-up the biotechnology industry

- On the bases of the foreign technology, to renew the existing biotechnology production bases and to establish new production bases with priority for production and processing bases for agriculture, forestry, sea products, and production of antibiotic drugs and vaccines,
- On the bases of foreign technology and the technology created in Vietnam, to proceed the mechanization and modernization of traditional technology of production; fish-sauce, sauce, Soya bean-sauce industry for interior consumption and exportation, and
- To develop process design and to create equipment chain of biotechnology for the pilot-base of production, including the priority for design capacity and equipment chain for fermentation.

4) Measures and policies

Increasing the latent S&T potential

Responsible Ministries are specified for implementation measures in the policy paper.

The measures and policies stimulating the build-up a biotechnology base

The State will stimulate measures in order

- to renew enterprises or import the advanced technology,
- to control closely the importation of products and technologies, and
- to establish the S&T base for improving increasingly the technology level.

International cooperation

The State will encourage the utilization of high level specialists from other countries and Vietnamese community in abroad for advisers participating directly at the processes of building the program of development, of staff training, and of R&D of the technology.

Funds of investment

The State gives investment to scientific research works about the development of the S&T potentialities. The investment to develop the production in the sector related to biotechnology is arranged by the enterprises themselves. Particularly towards the manufacturing of the products having a public service character and the living environment protection, the State will invest the whole or partly.

(4) Policy on the Development of Materials S&T

Resolution of the Government No. 88/CP dated December 31, 1996 provides objectives, orientation, contents and measures and policies for the development of materials S&T till the year 2010.

1) Objectives

- To take a number of sectors of the material industry to the level of the developed countries in the region by the year 2000,
- To take a number of sectors of the material industry to the medium advanced level of the world by the year 2010,
- To build Vietnam's materials industry on a firm basis and with a structure capable of meeting the requirement of producing materials for the key industries of the national economy, and
- To establish a system of R&D institutions.

2) Orientation

- To attach importance to the study, and raise the intrinsic S&T capability to receive, adapt and modify the imported technologies to suit to practical conditions and requirements of production,
- To pay attention to the development of technologies that use natural resources and minerals available in Vietnam, conducting R&D of advanced technologies in the manufacturing of traditional materials and new materials,
- To make in depth investment, improving the existing technologies focusing on the processes that determine the technical properties of materials and competitiveness of products,
- To attach importance to developing small and medium-scale establishments, and
- The State to support R&D of new and high technologies and encourage the material industries to apply them.

3) Contents

Concentrated on the realization of the following major contents.

Metal materials

- Production of steel and basic metal materials of various kinds (non-coke metallurgical technology),
- Production of high-quality steel, steel alloy and other alloys for machine building, chemicals, cement and petroleum technologies,
- Requirement of national defense, advanced molding technologies for processing, treatment, analysis and testing,
- Powder metallurgy, material for soldering, spray-coating and manufacturing composite metal materials,
- Processing of copper and aluminum and their alloy,
- Mineral prospection and exploration , and general treatment of minerals,
- Producing ferro-alloys and high-quality metal oxides from Vietnam's mineral resources,
- Producing pure and superpure metals, precious and rare metals, and advanced technical materials from rare earths, and

- Producing special alloys for use in electricity, electronics and other industries.

Construction materials

- Cement manufacture technology: the "dry" method with highly-automatic advanced technology to upgrade and renew "wet" method, and
- Types of cement: special types such as durable sulfate cement for use in the sea environment, cement for use in oil wells, high-intensity cement, and Portland-Puzzolan cement for use in special structures, besides the common type of Portland cement.

Ceramic, porcelain and glass materials

- Technology for producing materials with high-level technical properties as substitutes for some kinds of steel and alloys,
- Technology for art ceramics and porcelains for export,
- Technology for fire-resistant materials with quantity and quality that satisfy most of the need of metallurgical, glass and cement industries,
- Technology for manufacturing porous ceramics and catalytic layers, insulation porcelain for use in electric equipment and high-voltage transmission lines, ceramic materials used in the treatment of environmental pollution, and
- Technology for producing construction glass, medical glass, glass for scientific laboratories, glass for lighting industry, high-quality glass for decoration, electricity-insulating glass, heat-insulating fiber glass, fiber glass for composite materials and optical fiber glass.

Polymer materials

- Composite materials from flexible and inflexible heated polymers reinforced with glass fiber, basalt fiber and carbon fiber,
- Technology for denaturing wood with polymer substances,
- High-grade products and composite materials from natural rubber, vegetal resins and oils,
- Various types of paint and other anti-corrosion composite materials for protecting metals in strong corrosive environments such as sea water, hot and humid environment, equipment used in the chemical industry, etc,

- Polymer composite materials for electric and electronic purposes in harsh environmental conditions, and
- Special polymer membranes, biological polymers, polymers used for biological dissolution, polymer used for treatment of environmental pollution and other special polymers.

Protection of materials

Application of protecting material methods under the tropical climatic conditions of Vietnam, especially the coastal areas and the sea environment including:

- protecting sea construction by electrical methods,
- coating layer, and
- inhibitors.

Electronic materials

- Manufacturing technology of high-quality ferrite, rare earth magnet, amorphous and micro-crystal materials,
- Manufacturing technology of sensor materials and component (semi-conductor, super-conductor, new electricity conducting substances, piezoelectric ceramics) used in measuring equipment, automation equipment, for biological and medical purposes,
- Manufacturing technology of opto-electronic and photonic materials and components: light-emitting semiconductive materials and components, semiconductive laser, non-liner optic materials, optic conductor, amplified optic conductor, laser disc, opto-electric materials, etc, and
- Manufacturing technology of energy admitting and converting materials used as power sources of electronic equipment.

4) Major policies and measures

- The S&T plans for material should be drawn up on the national scale.
- The S&T of material should be built up by reorganizing R&D institutions, concentrating on the establishment of a number of key units in the key areas, setting up high-tech zones, and setting up a number of establishments for manufacturing and R&D of new material technologies.

- R&D should be set up with building an appropriate mechanism for combining scientific activities and production activities.
- Establishments for training should be upgraded and built at different institutions and universities as well as improving the professional level. International training institutions should be encouraged to set up branches, sub-institutes, and sub-department for training in Vietnam. People should be sent to abroad for training.
- Domestic establishments to international cooperation should be encouraged. Domestic and foreign enterprises should be encouraged to invest in fields of prioritized material in high-tech zone and export processing zone.
- The State shall invest in R&D. It shall also draw up policies and preferential measures to mobilize capital sources from enterprises, economic sectors, production organizations, to attract foreign investment capital and to support the training, scientific research and application of material technologies partly with fund from the State budget and international aid, especially from ODA program.

V.2.2 Problems

There are some problems in the current status of R&D in Vietnam. They should be solved for promotion of R&D in the high-tech fields.

- Although there are many state research institutes in Vietnam, their functions are sometime overlapped. Therefore, it is almost inevitable that state budget and human resource, which are limited in Vietnam, are scattered. This is not considered an efficient way.
- Vietnamese enterprises have a weak capability for R&D. Due to this weakness, Vietnamese enterprises cannot develop new products, nor improve product quality sufficiently.
- High-tech R&D institutes which belong to universities are focusing on education. They are rather small-scale and their R&D capability is inferior to capacity of institutes under NCST or Ministries.
- Expenditure for R&D is limited in Vietnam as mentioned in the section V.1.1 of this appendix. It is very difficult to mobilize other sources of investment than the state budget to promote S&T.
- Most of state research institutes in the high-tech field need to increase the number of their staff and further education and training of their staff.

- In many research institutes, equipment for R&D works is not sufficient in terms of modernity and the number of it.
- Many research institutes are not satisfied with their R&D environment including building facilities, floor space and telecommunication facilities. In some cases, staff of research institutes does not have a good access of both foreign and domestic information.
- Activities of R&D institutes are not only R&D, but also education for master and doctor degree and contract jobs such as consignment R&D, development of software, constancy, education of enterprise's employees, manufacturing and selling of instruments and equipment, and engineering services. Income from such contract jobs covers a large portion of total expenditure of each institute, although the ratio of income from contract jobs to that from the state budget largely depends on the character of the institutes. Accordingly, the staff do not devote all their energy and effort for their research and study.

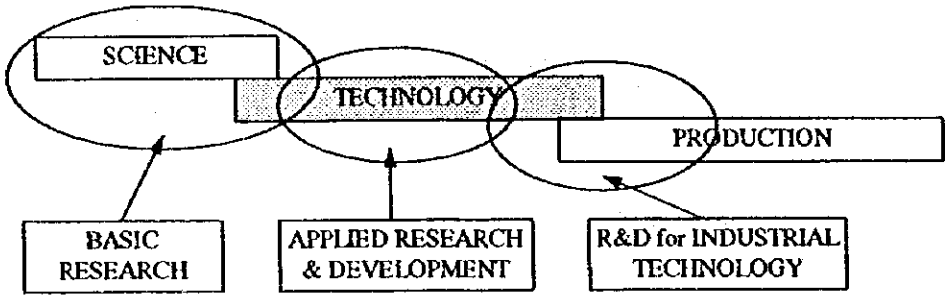
## V.3 Target Fields of R&D

### V.3.1 R&D Activities and High-Tech Industrialization

High-tech is defined as technology that expands the frontier of existing technologies by incorporating the fruits of advanced scientific researches. Therefore a high-tech industry that produces high-tech products needs continuous R&D activities to introduce new products with new and increased functions to the market. The contribution of R&D activities to production is quite large in the case of high-tech industry, compared with the conventional industry.

The figure below illustrates the R&D activities for S&T and production which are necessary for the high-tech industrialization. The basic research is made for science and fundamental parts of technology to set up hypotheses and theories, or to acquire new knowledge of facts. The applied R&D includes research activities for looking for possibilities that knowledge is fit for practical use, searching for new applications of existing methods, and development of new products. The third stage, that is R&D for industrial technology. The achievements of the applied R&D become applicable for production through this stage. This stage includes the design of production facilities and process, and manufacturing prototype of them.

R&D for High-Tech Industrialization




V.3.2 R&D Fields to be Promoted

The following industries are chosen as target high-tech industries. In these fields, R&D activities should be promoted for high-tech industrialization.

- Informatics,
- Machine and mechatronics,
- Biotechnology,
- New materials, and
- Pro-environment technologies including new energy

V.4 R&D Promotion Strategies

V.4.1 Framework of R&D Strategy

Desirable R&D strategies for high-tech promotion are proposed as follows.

(1) Strategy R-1: "To reinforce national basis of R&D"

The basis of R&D in Vietnam presents some problems such as overlapped functions among state R&D institutes, weak R&D capability of industry and universities, less researchers and R&D budget than advanced countries, and R&D environment that needs improvement. Reinforcement of the R&D basis is necessary, as a strategy, to solve these problems for promotion of R&D of the high-tech field. The following programs are proposed for this strategy: rearrangement of state R&D institutes with a review of the present national organization of R&D from view points of high-tech promotion, promotion of international cooperative research works, increase in R&D budget, increase in number of researchers, education of researchers, and construction of high-tech parks

suitable for high-tech R&D. As a priority project for this strategy, establishment of the National High-tech R&D Center is proposed.

(2) Strategy R-2: "To accelerate technology transfer from overseas countries"

Technology transfer from overseas countries, in the short-term period, is appropriate to catch up advanced countries in terms of high-tech industries, being capable of saving time and capital for R&D. However, it is not necessarily active. It is proposed as the second strategy for high-tech R&D promotion that technology transfer from overseas countries be accelerated. The definite program proposed are: relaxation of restriction on technology transfer, permission of the royalty calculation method on the basis of sales value, establishment of clear procedure for obtaining approvals of technology transfer, and provision of incentives for technology transfer.

(3) Strategy R-3: "To bring up the R&D capability of industry"

Vietnamese enterprises have weak R&D capability, from the State enterprises up to the private enterprises. Due to this weakness, Vietnamese enterprises cannot develop new products nor improve product quality sufficiently. It is essential for high-tech industry promotion that enterprises' capability for R&D be brought up. The following concrete programs are proposed for this strategy: strengthening the relation between R&D institutes and enterprises, and provision of tax incentives for enterprises' R&D activity.

(4) Strategy R-4: "To promote the protection of the industrial property right"

The protection of the industrial property right is effective measure for the R&D promotion, since it is good incentive for researchers to carry out R&D activities and for facilitation technology transfer from overseas countries. Legal system has already been prepared to some extent for the protection of the industrial property right, however, its application should be improved. The proposed definite programs includes: provision of information service, reinforcement of execution power of the National Office of Industrial Property (NOIP) and the Copy Right Office, strict execution of regulation against illegal copies and goods, and amendment of the Civil Code stipulating protection of copy right to avoid unnecessary confusion and misunderstanding.

(5) Strategy R-5: "To accelerate the spread of foreign /domestic technologies over Vietnam"

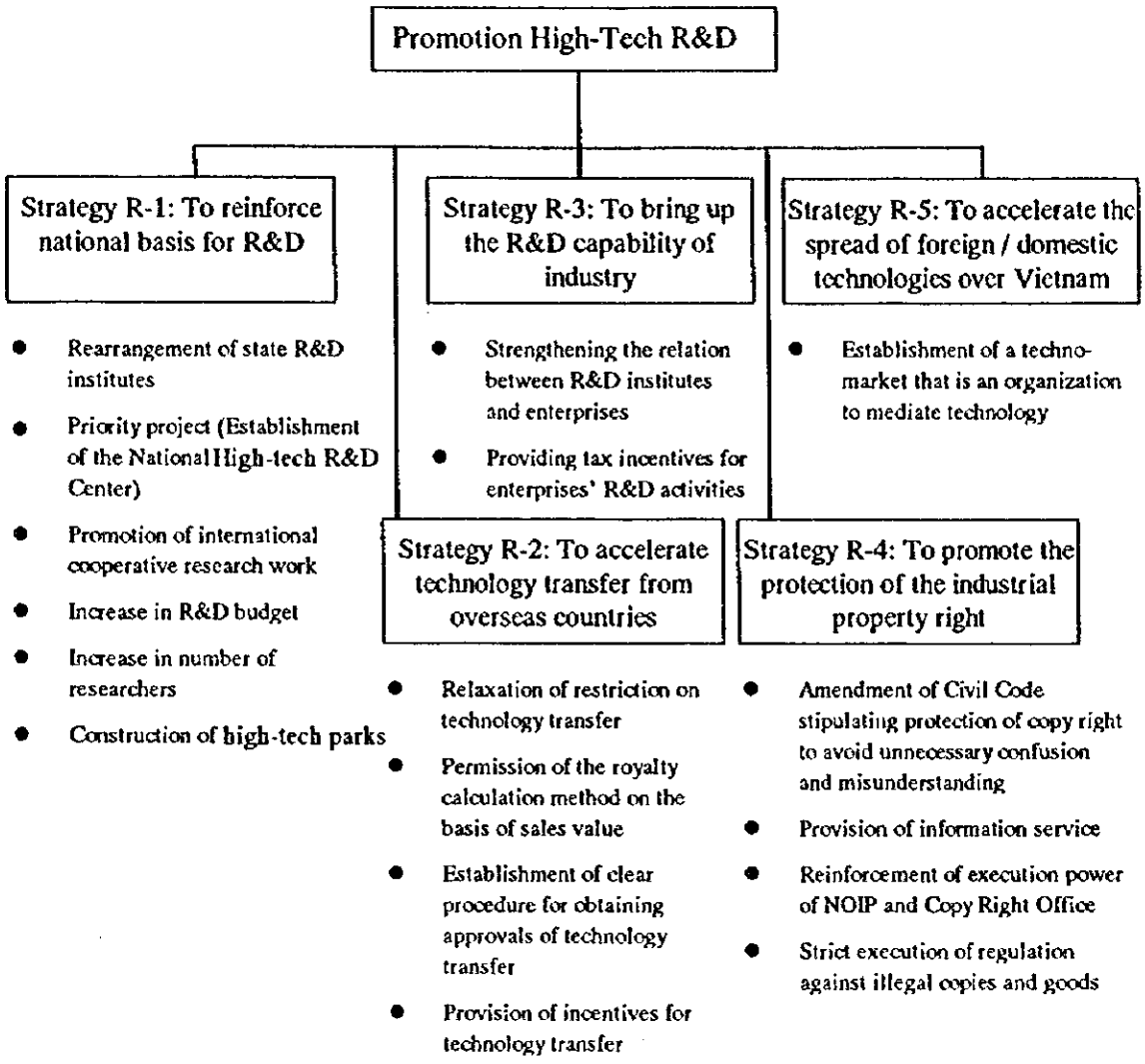
It is important for industrialization to spread technology that was transferred from foreign countries or obtained by R&D in Vietnam. It should be accelerated. As a practical program for this strategy, establishment of a techno-market that is an organization to mediate technology is proposed.

The figure on the next page illustrates the framework that consists of five strategies, programs and priority projects to promote R&D for high-tech. The strategies are divided into the short/medium-term strategies and long-term strategies in terms of implementation period.

V.4.2 Short and Medium Term Strategy

Vietnamese enterprises do not have much accumulation of technology and capital, therefore, they cannot afford to assign human resources and to invest for technology development. However, they are obliged to catch up ASEAN countries urgently. Under such circumstances, the path that Vietnam should pursue in the short and medium term periods is proposed below.

- In the short-term frame (up to the year 2005), Vietnam should acquire technology from foreign countries, followed by promoting R&D for industrial technology based on the acquired technology.
- In the medium-term frame (from the year 2006 to 2010), Vietnam should promote the applied R&D aiming at acquisition of own technology, continuing the technology transfer from foreign countries.




Framework of R&D Promotion Strategies

In the short and medium term frame, the following four strategies should be applied for promotion of R&D.

- Strategy R-1: " To reinforce national basis of R&D"
- Strategy R-2: "To accelerate technology transfer from overseas countries"
- Strategy R-3: "To bring up the R&D capability of industry"
- Strategy R-4: "To promote the protection of the industrial property right"