JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT
SOCIALIST REPUBLIC OF VIETNAM

THE MASTER PLAN AND FEASIBILITY STUDY ON THE HOA LAC HIGH-TECH PARK PROJECT IN THE SOCIALIST REPUBLIC OF VIETNAM

FINAL REPORT

MAIN (VOLUME I)

MASTER PLAN FOR HIGH-TECH INDUSTRY PROMOTION POLICY

MARCH 1998

NIPPON KOEI CO., LTD.
JAPAN INDUSTRIAL LOCATION CENTER
PACIFIC CONSULTANTS INTERNATIONAL

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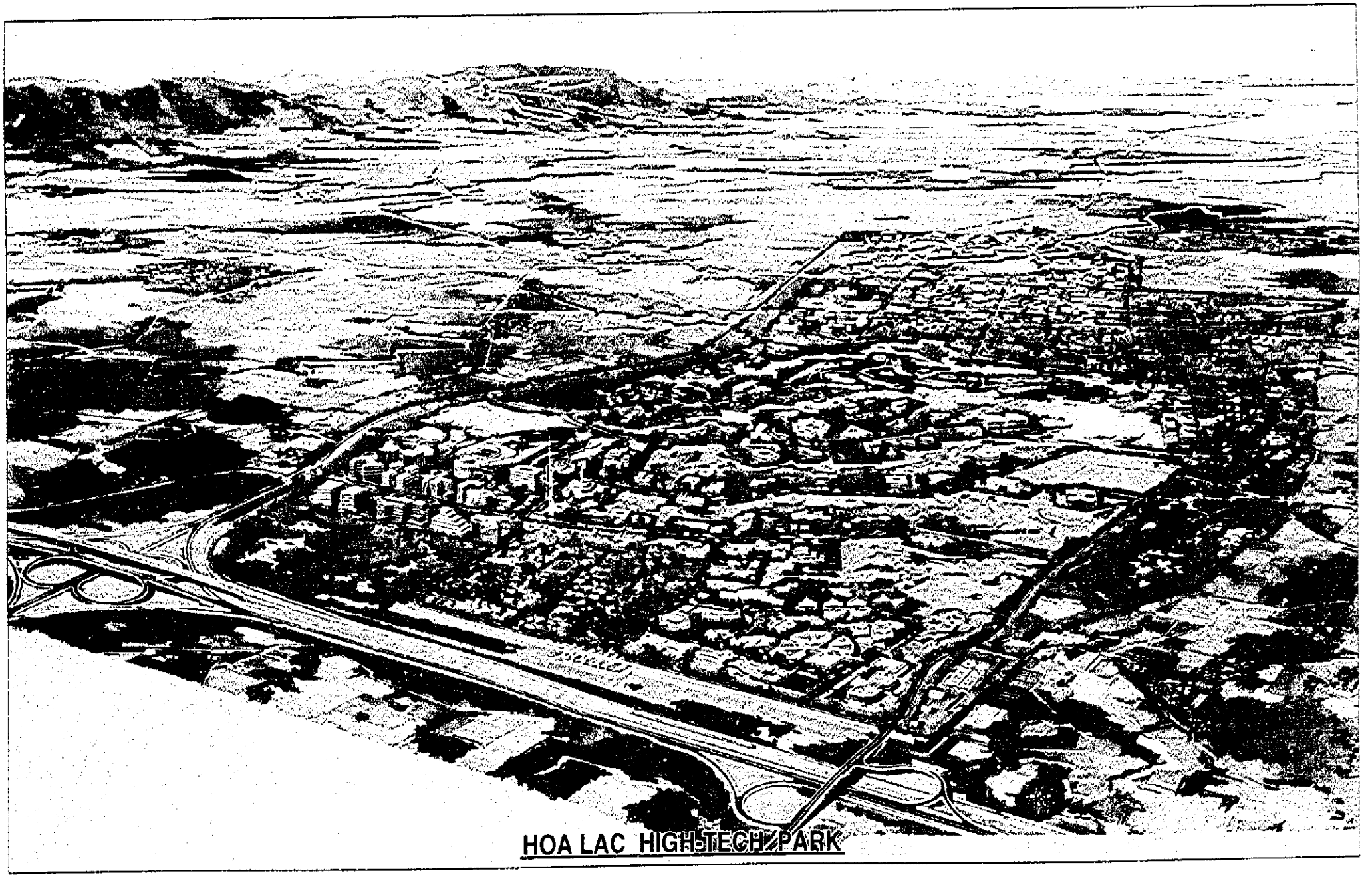
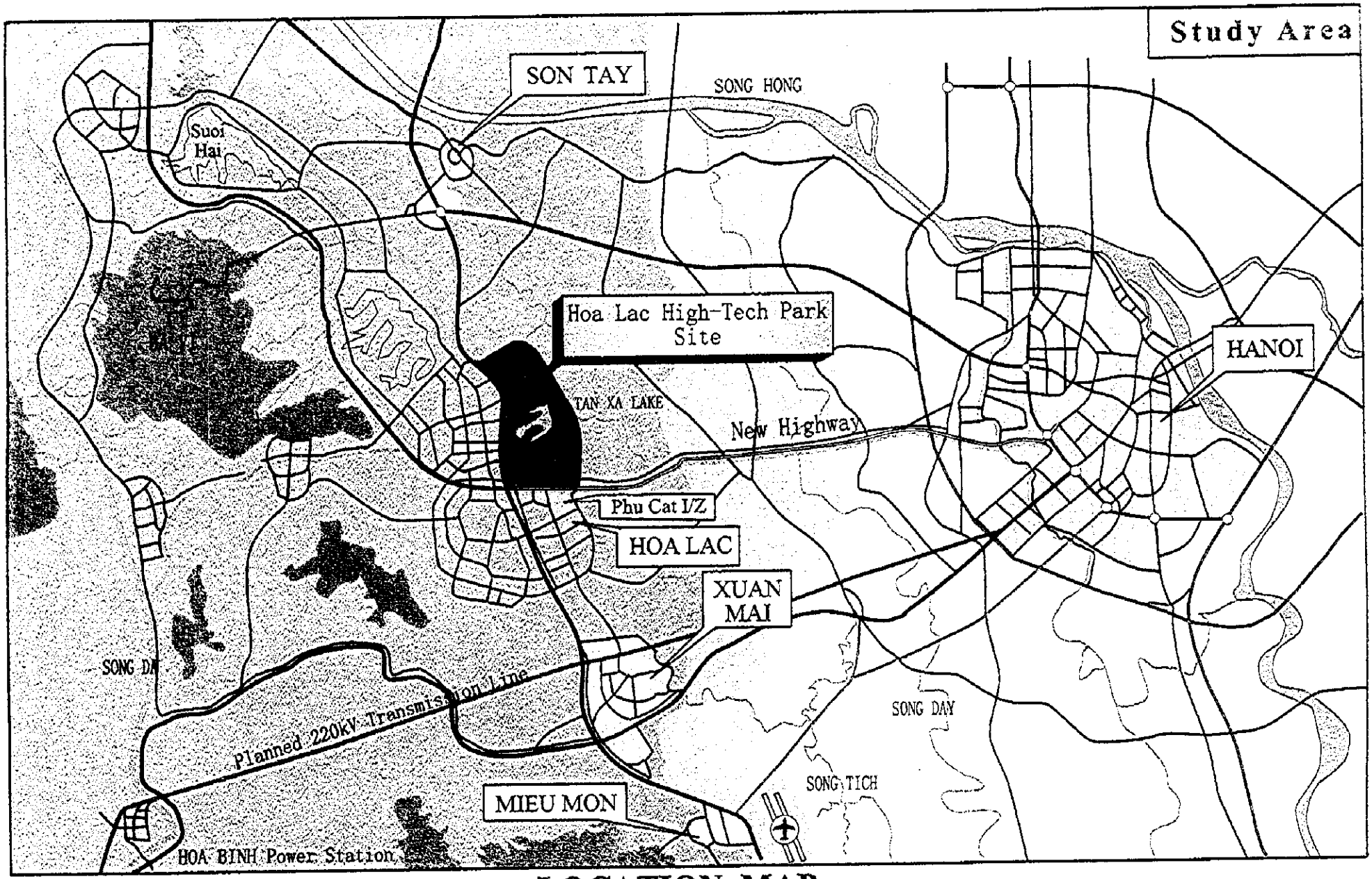
ESTIMATE OF PROJECT COST

Estimate of Base Cost : As of October 1997 Price Level

Currency Exchange Rate : USD1 = VND11,700 = Yen 120



HOA LAC HIGH-TECH PARK



LOCATION MAP

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct a development study on the Master Plan and Feasibility Study on the Hoa Lac High-Tech Park Project in the Socialist Republic of Vietnam and entrusted the study to the Japan International Cooperation Agency (JICA).

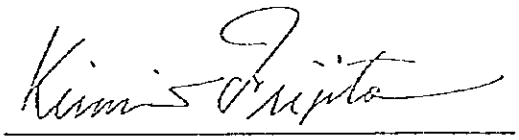
JICA sent to Vietnam a study team twice headed by Mr. Akagawa, Nippon Koei Co., Ltd. and constituted by members of Nippon Koei Co., Ltd., Japan Industrial Location Center and Pacific Consultants International from December 1996 to September 1997.

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

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

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

Mar, 1998



Kimio Fujita
President
Japan International Cooperation Agency

March 1998

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir,

We have the pleasure of submitting to you the Final Report of "The Master Plan and Feasibility Study on the Hoa Lac High-Tech Park Project in the Socialist Republic of Vietnam".

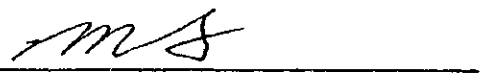
This report presents the results of the study that was carried out for a total period of 16 months from December 1996 to March 1998, by the Study Team composed of Nippon Koei Co., Ltd., Japan Industrial Location Center and Pacific Consultants International in accordance with the contract concluded with your Agency.

The report consists of (1) a master plan for high-tech industry promotion policy, and (2)a master plan on the Hoa Lac High-Tech Park and a feasibility study focused on its initial development.

On this occasion, we would like to express our deep appreciation and sincere gratitude to all those who extended their kind assistance and cooperation to the Study Team, in particular the officials concerned from the Ministry of Science, Technology and Environment of the Government of Vietnam and Steering Committee. We also would like to extend our acknowledgements to the officials of your Agency, the Ministry of Foreign Affaires, the Ministry of International Trade and Industry, and the Embassy of Japan in Vietnam. We cordially appreciate the cooperation of Professor. T. Yoshimi (Kobe-Gakuin Univ.) and Professor. Y. Okamoto (Hosei Univ.).

We hope the report will realistically contribute to the future high-tech industrial development in Vietnam.

Sincerely yours,



Masatoshi AKAGAWA
Team Leader for
The Master Plan and Feasibility Study on
the Hoa Lac High-Tech Park Project in
the Socialist Republic of Vietnam

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ABBREVIATIONS

Government of Vietnam/Public Institutions

CD	:	Customs Department
CEPD	:	Committee for Economic Planning and Development
DGPT	:	Department General of Posts and Telecommunications
DOSTE	:	Department of Science, Technology and Environment
DUT	:	Da Nang University of Technology
EPC	:	Environmental Protection Center
EVN	:	Electricity of Vietnam
FCC	:	Field Clearance Committee
FPT	:	Financing and Promoting Technology Corporation
FZ-IDC	:	Functional Zone Infrastructure Development Company
GDLA	:	General Department of Land Administration
HCM-HTP	:	Ho Chi Minh High Tech Park
HCMPC	:	Ho Chi Minh People's Committee
HCMPT	:	Ho Chi Minh Posts and Telecommunications
HCMUT	:	Ho Chi Minh University of Technology
HHTP	:	Hoa Lac High-Tech Park
HHTP-BOM	:	Hoa Lac High-Tech Park Board of Management
HHTP-IDC	:	Hoa Lac High-Tech Park Infrastructure Development Company
HHTP-SC	:	Hoa Lac High-Tech Park Steering Committee
HIU	:	Hanoi International University
HN-PC	:	Ha Noi People's Committee
HPT	:	Hanoi Posts and Telecommunications
HT-P	:	Ha Tay Province
HT-PC	:	Ha Tay People's Committee
HTPC	:	High-Tech Park Center
HUT	:	Hanoi University of Technology
IMI	:	Institute for Machinery and Industrial Instruments
IOE	:	Institute of Energy
ITRI	:	Industrial Technology Research Institute
MOC	:	Ministry of Construction
MOET	:	Ministry of Education and Training
MOF	:	Ministry of Finance
MOFA	:	Ministry of Foreign Affairs

MOI	:	Ministry of Industry
MOLISA	:	Ministry of Labor, Invalids and Social Affairs
MOSTE	:	Ministry of Science, Technology and Environment
MOT	:	Ministry of Trade
MOTC	:	Ministry of Transport and Communications
MPI	:	Ministry of Planning and Investment
NACENTEC	:	National Center for Technical Progress
NCIA	:	National Committee of Industrial Areas
NCSS	:	National Center of Social Science
NCST	:	National Center for Science and Technology
NEA	:	National Environmental Agency
NISTPASS	:	National Institute for Science and Technology Policy and Strategy Studies
NOIP	:	National Office of Industrial Property
NUH	:	National University Hanoi
NUHCM	:	National University Ho Chi Minh
OOG	:	Office of Government
PB	:	Project Bureau
PC	:	People's Committee
PM	:	Prime Minister
PMU	:	Project Management Unit
QUATEST	:	Technical Centers for Quality Assurance-Testing-Measurement
RDC	:	Regional Development Committee
SC	:	Steering Committee
SCCI	:	State Committee for Cooperation and Investment
SPC	:	State Planning Committee
STAMEG	:	Directorate for Standards and Quality
VDC	:	Vietnam Data Company
VNPT	:	Vietnam Posts and Telecommunications
VNUH	:	Vietnam National University - Hanoi
VTI	:	Vietnam Telecoms International
VTN	:	Vietnam Telecoms National

<u>International Organizations/Foreign Organizations</u>

AFTA	:	ASEAN Free Trade Area
AIT-CV	:	Asian Institute of Technology - Vietnam Campus

APEC	:	Asia-Pacific Economic Caucus
ASEAN	:	Association of Southeast Asian Nations
CEPD	:	Committee for Economic Planing and Development (Taiwan)
IEAT	:	Industrial Estate Authority of Thailand
IUCN	:	International Union for the Conservation of Nature
JETRO	:	Japan External Trade Organization
JICA	:	Japan International Cooperation Agency
MBC	:	Malaysia Business Council
MIDA	:	Malaysian Industrial Development Authority
ODA	:	Official Development Assistance
OECD	:	Organization for Economic Cooperation and Development
OECF	:	Overseas Economic Cooperation Fund (Japan)
SIDA	:	Swedish International Development Program
UNDP		United Nations Development Program
UNIDO	:	United Nations Industrial Development Organization
WTO	:	World Trade Organization

Others

APITD	:	Action Plan for Industrial Technology Development
ASIC	:	Applied Specific Integrated Circuit
BAW	:	Business/Administration Wing
BCC	:	Business Cooperation Contract
BI	:	Brain-Intensive Industry
BLT	:	Build Lease Transfer
BOD	:	Biological Oxygen Demand
BOT	:	Build Operate Transfer
CAD	:	Computer Aided Design
CAE	:	Computer Aided Education
CAM	:	Computer Aided Manufacturing
CBR	:	California Bearing Ratio
CKD	:	Complete Knock Down
CNC	:	Computer Numerical Control
COD	:	Chemical Oxygen Demand
COE	:	Center of Excellence
CP	:	Cleaner Production
CRTs	:	Cathode-Ray Tubes

DAWD	:	Daily Average Water Demand
DAWW	:	Daily Average Wastewater
DMWW	:	Daily Maximum Wastewater
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
EOP	:	End-of-Pipe
EPE	:	Export Processing Enterprise
EPZ	:	Export Processing Zone
FC	:	Foreign Companies
FDI	:	Foreign Direct Investment
FIRR	:	Fiscal Internal Rate of Return
F/S	:	Feasibility Study
GDP	:	Gross Domestic Product
GIS	:	Geographic Information System
GRP	:	Gross Regional Product
GVA	:	Gross Value Added
HMWC	:	Hourly Maximum Water Consumption
HMWW	:	Hourly Maximum Wastewater
HTIZ	:	High-Tech Industrial Zone
IAA	:	Industrial Adjustment Allowance
ICA	:	Industry Coordination Act
IKD	:	Incomplete Knock Dawn
INTECH	:	Initiative in New Technologies
IT	:	Information Technology
ITA	:	Investment Tax Allowance
ITRI	:	Industrial Technology Research Institute
IZ	:	Industrial Zone
JEIB	:	Japan Export-Import Bank
JV	:	Joint Venture
KLSE	:	Kuala Lumpur Stock Exchange
LASER	:	Light Amplification by Stimulated Emission of Radiation
LSI	:	Large Scale Integration
MDAS	:	Manpower Development Assistance Scheme
MPU	:	Microprocessor Unit
MSL	:	Mean Sea Level
NC	:	Numeric Control
NH	:	National Highway

NIC	:	North Industrial Corridor
NIES	:	Newly Industrialized Economies
NPESD	:	National Plan for Environment and Sustainable Development
NRI	:	National Research Institute
NSC	:	National Software Center
NTP	:	National Technology Plan
OCR	:	Optical Character Recognition
OJT	:	On the Job Training
PCB	:	Printed Circuit Board
PCU	:	Passenger Car Unit
PFI	:	Productive Factor Intensiveness
R&D	:	Research and Development
RDAS	:	Research and Development Assistance Scheme
RDIL	:	Research and Development Input Level
RISC	:	Research Incentive Scheme for Companies
RIZ	:	Red River Delta Industrial Development Zone
S&T	:	Science and Technology
SDAS	:	Software Development Assistance Scheme
SDF	:	Skills Development Fund
SEP	:	Strategic Economic Plan
SMEs	:	Small and Medium-sized Enterprises
SOEs	:	State-Owned Enterprises
SPM	:	Suspended Particulate Matter
SS	:	Suspended Solids
STC	:	Science Technology Corridor
STP	:	Scientific Technology Project
TPW	:	Techno-Partnership Wing
TQM	:	Total Quality Management
TW	:	Township Wing
VA	:	Value Added
VC	:	Vietnamese Company
VCIE	:	Venture Capital Investment Enterprises
VLSI	:	Very Large Scale Integration
VOCs	:	Volatile Organic Compounds

I. NECESSITY OF FOSTERING HIGH-TECH INDUSTRIES

In order to identify the role of high-tech industries in Vietnamese economy, it is important to assess the needs for high-tech industry development in the early development stage of industrialization of Vietnam.

1.1 Lessons from Other Countries

Import substitution of consumer goods was the target of industrialization in the ASEAN countries at the initial stage of their development. Since the economic and/or industrial structures of these countries were characterized as mono-cultural, i.e. to export primary goods and import manufacturing products such as consumer goods and a part of capital goods. Under this situation, instability of international primary goods market affected the national economy directly. To overcome this structural weakness was one of the top priority policy targets. This industrialization strategy based on import substitution was, however, impeded by the narrow domestic market and had to be changed. These governments, then, adopted the policy to attract export-oriented foreign industries. This policy alteration was possible mainly due to i) the tremendous expansion of world trade, and ii) the boom of investment by advanced countries' manufacturers in developing countries. The governments offered strong incentives and prepared the infrastructure to attract foreign direct investment (FDI). The policy adopted by the ASEAN countries was evaluated as effective since the economies in those countries showed remarkably high growth rates. Rapid industrialization through the introduction of FDI, however, caused difficulties such as shortage of skilled labor and engineers, soaring wage, etc. The types of industries introduced in the period were mainly characterized as technologically matured, foot-loose, and labor intensive. They tended to relocate their production lines to ask for better production conditions such as cheaper labor cost. It was true that foreign companies provided the opportunities to establish and foster domestic industries. But the majority lost the opportunities. The policy makers in these countries benefited little by the effect of technology transfer to the domestic industries and complained to the FDI about their behavior. The major problems about the technology transfer, however, were the lack of conditions to receive the transfer, e.g. a weak base of domestic manufacturers, limited supply capacity of engineers, etc.

From the point of view of industrialization process, the fostering of high-tech industries, in general, follows the development stage attaining a certain level of

industrial accumulation and social and industrial infrastructure. It is substantiated by experience that the ASEAN countries began to rear the high-tech industries after a ten-year industrialization process. On the other hand, the industrial promotion policy adopted by the Chinese Government, for example, indicated another possibility of fostering high-tech industries: It began to build high-tech parks in parallel with the adoption of FDI promotion policy which targeted the labor-intensive industries and attracted them to the special economic zones designated under the open door policy, making use of the advantages of rich labor force and low wage. The high-tech parks were planned with the recognition that the results of R&D activities by universities and national institutes had not been utilized by industries. Although the situation of industrial development and science and technology (S&T) level of China in the mid 1980s should be further evaluated, we should notice that the Chinese Government searched the way of high-tech industrialization through the promotion of labor-intensive industries. In the mid 1980s, since high-tech industrialization boomed in the world, the Chinese Government tended to go with this tide. However, the challenge to high-tech industrialization under the economic situation in which per capita GDP was less than USD 300 was considered to be premature. The programs of high-tech park development in China are summarized in Appendix II of Volume II and the high-tech industrial promotion policy in major ASEAN countries are described in Appendix II of Volume I.

The experience of other countries suggests that there are two options for high-tech industrialization: One is a step-by-step strategy to move high-tech after reaching a certain level of industrialization, and the other is to begin high-tech industrialization at the very initial stage of industrialization process. The latter strategy requires the conditions which make it possible to enter the high-tech fields. In the case of China, the minimum requirement for the entry into the high-tech competition was satisfied: There existed by that time already certain fruits of R&D activities and government budget was sufficiently available for the investment in the establishment of high-tech parks because of adequate size of GDP (although China's per capita GDP was only USD 300, the total amount of GDP was 15 times that of Vietnam in 1995). The Chinese Government also recognized that the R&D activities had generated certain results, but the linkage between R&D and the industries was rather weak.

The ASEAN countries where industrialization was carried with promoted FDI had little manufacturing bases and less tendency to nurture high-tech by themselves. The accumulation of S&T results in them was smaller than that of China, as demonstrated by the small number of graduates and post-graduates in the engineering

fields. Their governments understood the importance of R&D activities and high-technology for industries, however, the realization of high-tech industrialization had to wait until the manufactures reached a certain level both in quality and quantity.

The major lessons to be derived from these experiences are:

1) Clear targets were set and appropriate and consistent policies were adopted for the development of high-tech industries.

2) Though in most of the cases, high-tech industry development started after the full realization of the labor-intensive/export oriented industries, high-tech industry development started earlier in some cases including the cases of India for IT and software in Bangalore and China in the special economic zones of "High-Tech Industrial Development Zones".

3) FDI was the key tool for the high-tech industry development for all the cases at least at the initial stage.

4) Strong preferential measures were worked out and provided to the parties and enterprises involved in the high technology and high-tech industry development, both in financial and non-financial terms.

5) Deregulation and protection of intellectual property right were practiced.

6) In many cases including Taiwan and China, R&D promotion was made by the Government initiative.

7) Strategic fields rather than detailed categories were determined from the beginning and various incentives were given for their development.

8) Various policy measures were taken for reinforcing the interaction and cooperation between the academic, public research institutes and the private sector, including the promotion measures for the academic to materialize their research achievements into high-tech products.

9) High quality infrastructures and special zones for the high-tech related enterprises and entities were developed and offered. In all the studied cases, they are complexes having the functional zones of production, R&D, residential, supporting centers, etc.

Though currently, some of the ASEAN and NIES countries are suffering financial and economic hardship, the ASEAN model which emphasize the active introduction of FDI is not inappropriate from the economic viewpoint, provided that some improvement should be made including the strengthening of the financial system and

early reinforcement of the domestic resources including human resource, domestic enterprises, R&D capacity building, etc.

Though the current financial crisis and economic hardship in some of the ASEAN and NIES countries is affecting the Vietnamese economy at present and will continue to give impacts on the economy, the degree and the nature of the impacts is uncertain, depending on the various factors of these countries and Vietnam including their macroeconomic policies, political decisions and others. Possible impacts, however, may include the followings.

1) Negative impacts

   (i) More severe competition of exports among these countries is expected, resulting in the reduction of the price competitive power of the Vietnamese products overseas as well as in the domestic market, and

   (ii) Sharp decrease of the foreign direct investment from the ASEAN and some NIES countries is expected.

2) Positive impact

   (i) In the short range, foreign direct investment of the advanced countries might be diverted to Vietnam.

In any case, it is wise and recommended that Vietnam should accelerate its industrialization process including the development of the high-tech industries in order to minimize the possible adverse impacts.

1.2 Necessity and Role of High-Tech Industries

It is important to create a consensus on the development of high-tech industries at the present level of industrial development in Vietnam. One of the main motives for accelerated industrial development is the participation in ASEAN Free Trade Area (AFTA). AFTA has already agreed in principle to reduce the tariff rates for intra-regional trades to 0 - 5%. Vietnam has to reduce the tariff rates until 2006. On the other hand, the current international competitiveness of Vietnam lags far behind that of other members of AFTA. Joining AFTA will force Vietnam to remove tariff and non-tariff barriers to protect domestic industries under the scrutiny of AFTA. The only way for the local industries to survive is to modernize production technologies in order to increase efficiency and become competitive against other member countries. High-tech industry development should serve as part of technology improvement programs in this regard.

High-tech industry development is a policy to sustain a long-term industrial development. At the moment many foreign firms invest in Vietnam because they are attracted by inexpensive labor cost. A typical form of manufacturing is, therefore, assembly work as was generally seen at an early stage of industrial development in ASEAN countries. The ASEAN countries experienced that a rise in wage level brought by successful industrialization led to the loss of many foot-loose factories to other countries. The fear of de-industrialization by foot-loose factories has made policy makers in these countries realize that upstream knowledge-intensive activities are essential to allow firms to stay for a long time. The realization led to a sudden fever in high-tech park development in these countries such as CyberJaya in Malaysia, Bandong High-Tech Park in Indonesia, and Science City Plan at Western Seaboard in Thailand. Many high-tech firms are interested in fast growing Asian countries and Vietnam cannot afford to miss a big tide in investment in Asia. Vietnam has to join the competition with these countries which have better infrastructure than that of Vietnam. To overcome such difficulties Vietnam should establish its own system and strategy like the Chinese Government as mentioned above.

As discussed later, the strength of Vietnam lies in human resources. Those include not only hard working labor at a low wage but also a pool of scientists and engineers who received education in the ex-communist block. Well qualified human resources will expedite the process of industrialization in high technologies at a rapid pace.

The majority of manufacturing activities are now undertaken by state companies in Vietnam. Despite the national growth, the state companies are known to be inefficient with outdated equipment and technologies. The infusion of high-tech industries is considered to be one of the means to stimulate and urge the restructuring of these old manufacturing sectors.

Lastly, high-tech industries are the sectors that are expected to grow in the future. In order to sustain a long-term high economic growth in Vietnam, it is necessary to create a base for new businesses, exports and jobs in a long term. High-tech development serves to sustain the growth of the manufacturing sector in the long run.

The necessities/roles and potentials of high-tech industries in Vietnam discussed above can be summarized as follows.

Necessity/Role

(1) Direct Effects

1) GDP growth,

2) Increase of exports, import substitution and resulting improvement of the trade balance, and

3) Employment generation

(2) Indirect Effects

1) Improvement of the legal framework including the protection of intellectual property right and technology transfer,

2) Development of the institutional framework including the administrative setup for the registration and utilization of the industrial property right and licenses and financial assistance for the small and venture enterprises,

3) Strengthening of organizational structure for the research and development including the cooperation among the universities, state research institutes and enterprises,

4) Various spillover effects over the whole economy of the country, applying the developed high technologies and making use of high-tech products, and

5) Promotion of the FDI and participation into the international division-of-labor system.

Potential

Generally, high-tech industrialization starts after reaching the full growth as an industrial nation. Vietnam should run the high hurdles to achieve the objective, lacking developed high technologies, capital accumulation, management know-how and others. On the other hand, high-tech industries can be said as fit for the development in Vietnam, considering the followings and the objective could be met, if appropriate policies be formulated and measures be taken with utmost efforts.

1) Weight of R&D and high quality labor

R&D (research and development) is given the largest weight in the development of the high-tech industries. With relatively big number of research institutes, higher education institutes and researchers as well as relatively high

quality labor with high literacy rate, industriousness and intellectual capacity as a non-industrialized country, Vietnam is deemed to be fit for high-tech industry development.

2) "Compact industries"

High-tech industries are these of compactness and flexibility rather than those emphasizing sheer scale, transport cost of which is relatively small. Inland location of the major cities without large-scale international trading ports at present and north-to-south long extension of land, therefore, may not be a big hindrance to the high-tech industry development.

3) Resource and energy saving industries

High-tech industries are relatively resource and energy saving industries and the resource endowment is not an essential condition for the high-tech industry development.

4) Globalization of production

Currently, globalization is rapidly in progress in almost every aspect, including production, design and research activities. Vietnam has a chance to be integrated into the global structure of division-of-labor in the production and research for high-tech industries.

5) Smaller fund requirement

Certain high-tech industries including computer software and certain categories of bio-technology industry, do not necessitate large fund requirement which is most lacking in Vietnam now.

6) New technology horizons

In some cases, high-tech industry could be developed in new technology horizons rather than on the extension of the established technology or industry. For these cases, newcomers also can afford the chance for entering the new business.

II. POLICY ISSUES FOR HIGH-TECH INDUSTRY DEVELOPMENT

It is rather ambitious to foster or rear high-tech industries in Vietnam since the country is still in the very beginning of the industrial development stage. Manufacturers have less incentive to enter the high-tech fields because of their risks. Although the dynamism generated by the free competition system is the key factor for fostering high-tech industries, the Government and its policy should also be main players for high-tech industrialization at the initial stage. This section presents an overview of various sectors related to the development of high-tech industries and discusses policy measures with high priorities.

2.1 General Issues

(1) Finance

In November 1996, Vietnamese parliament approved the adoption of the Public Investment Program (PIP) which is mandated to serve as an action plan for the Sixth Five-Year National Plan (1996-2000). In PIP, the growth rate of the manufacturing sector is set at 14 - 15% per annum, and the required investment totals 194.5 trillion Dong during this period, of which FDI comprises 58%, the private sector 8%, and the public sector 34%. Two things are clear: the savings by the private and household sectors do not provide a sufficient source of investment and the alternative source is FDI. Not only the level of income as a source of finance falls short but also the household sector does not place sufficient confidence on the banking sector to entrust it with its invaluable savings. Therefore the surpluses from incomes are hoarded in cash in general. These savings are used only when people need to buy durable goods, invest in own businesses, lend money to relatives and friends, and to buy land use titles. One of the reasons for zealous speculation taking place on real estates in Vietnam is the lack of development of the financial sector. In the meantime it is only FDI that can provide resources for high-tech industry development.

(2) Human Resources

At present it is human resources that have a definite advantage over other neighboring countries in attracting foreign investment. For export processing firms, cheap and industrious labor is the most effective means to gain a competitive edge in the market. For high-tech industries, intellectual workers such as researchers and

engineers are just as important inputs as manual workers and skilled workers. So far, many people educated in the ex-communist block do not have jobs that require such educational background. Therefore there is an over-supply in human resources. However, since college enrollment ratio in Vietnam is less than 3%, rapid development in industrial sectors will deplete the supply of educated human resources before long. Courses in computer science are offered only by two universities in Hanoi and Ho Chi Minh City. The graduates in computer science are coveted by all foreign firms to only maintain their computer networks. As a result the local software companies are already experiencing shortage of engineers. Since human resource development takes time, it is necessary to increase the educational opportunities for engineers and scientists well in advance of industrial development in the future.

The Sixth National Five-Year Plan aims to raise the college enrollment ratio to 5% by the year 2000. It is necessary to expand the capacity of universities to meet the target. To meet the demands of industrial sectors, it is necessary to expand science and engineering departments as the first priority. According to the plan for new Hoa Lac city, Hanoi University is expected to establish a college of natural science first and a college of engineering between 2000 and 2010. In view of the complementary nature of education and HHTP, it is desirable to move up the schedule for the engineering college to increase the pool of educated workforce for high-tech industries.

No other system has replaced the loss of educational opportunities after the dissolution of the communist block. Japan is a good candidate country to offer educational opportunities for Vietnam since a forecast decrease in child population in the future is expected to create an excess capacity of the educational system in Japan.

(3) Technology

There is a concentration of heavy machinery industries around the Hanoi area. These factories produce machine tools, agricultural machinery, electricity generation equipment, and other production machinery. Therefore there is a pool of technologies for mechanical engineering. However, it is quite questionable whether these traditional technologies serve as a technological springboard for future high-tech industries in Vietnam. The equipment and facilities are outmoded, often being acquired in the 1950s. Lack of proper quality control and production management offsets the advantage of inexpensive labor in Vietnam, often conceding to the competition from inexpensive imports. The products are often produced in small lots or tailor-made. Therefore, engineers lack knowledge in the management of mass production which is the main stream of modern production. Though the culture and

tradition still help promote mechatronics and machinery industry development, impending participation in AFTA imperils the survival of these antiquated industries.

In spite of its current status of industrial development, Vietnam has an institution for metrology. As is the case with factories, the equipment and level of accuracy are not on a par with those of even neighboring countries. It is necessary to upgrade these facilities and the level of accuracy at a later stage to meet the needs arising from R&D activities in high-tech industries.

(4) Investment Environment

The first step of high-tech development is to induce foreign investment by firms that have advanced engineering and product development technologies. As a late comer in industrial development, Vietnam needs to speed up the catch-up process by inducing foreign investment since local availability of finance is severely limited.

As foreign investment in Vietnam has grown steadily, it appears that there are no imminent obstacles to foreign investment. According to the survey on Japanese firms conducted by the Export Import Bank of Japan, Vietnam is ranked in the third place after China and India as the most promising country for long-term investment. The major reason cited for the selection was an inexpensive labor. Despite this favorable reception by the private sector, actual implementation of investment after obtaining an investment license is faltering. Compared to the implementation ratio of 90% in Myanmer which is similar to Vietnam in many aspects, there are obvious obstacles to foreign investment in Vietnam. The main reasons for this unfavorable situation are delay in land acquisition, troubles in technology transfer agreement, and unexpected high cost in start-up. Among these three reasons, troubles in technology transfer agreement are fatal to the development of high-tech industries. At present the Government has approved all the technology transfer agreements. A delay in approval and disapproval of the terms of agreements has distracted many investors. Since high-tech industries are nothing but technologies, foreign firms with advanced technologies are likely to choose other countries unless they perceive that they can gain from the transfer of technologies.

After the adoption of the Foreign Investment Law, a large volume of foreign investment flowed into Vietnam thereby creating a basis for current industrial development. High-tech industrial development which leads to the next stage of industrial development in Vietnam is to develop a technological basis for the manufacturing sector in Vietnam. The core input for the technological development phase is knowledge and know-how. As was necessary for the first stage of industrial

development for capital, it is necessary to de-regulate the inflow of technologies for the second stage of industrial development. By removing the current regulations in technology licensing and providing due protection to intellectual property rights, rapid transfer of technology should be prompted.

The problem of land acquisition is a difficult issue in Vietnam in consideration of high population density and the prevailing speculation in land use rights. There should be a proper legal framework for land acquisition and resettlement. The provision of industrial estates such as HHTP can solve this problem since land is fully developed for immediate operation.

(5) Intellectual Property

One of the most important legal frameworks to be established for the promotion of high-tech industries is to provide due legal protection to intellectual property rights. Since high technologies are based on innovations, lack of proper protection of profits accrued to innovations will discourage R&D in Vietnam. Computer software is an important future key industry in the world. Vietnam already has an infant software industry especially emerging around Ho Chi Minh City. One impediment commonly noted by the managers of software companies is the lack of protection of copy rights against rampant pirating. New software companies possess the ability to develop original applications such as Optical Character Recognition and Geographic Information System. However, pirating reduces the market size substantially, making such an investment unprofitable. Foreign firms which are expected to bring in advanced production know-how and finally to develop local R&D activities will do so only when they are given proper legal protection. A legal framework for patent and copyrights should be established and enforced.

2.2 Some Critical Issues

(1) Finance

The establishment of a stable and reliable financing system is the most urgent issue for industrialization. Since the finance from stock market and/or abroad is limited, the long term fund is most crucial. The software industry, which is expected as one of the key industries, is considered as the industry of smaller initial investment, however the development cost of software is, by experience, too huge to be paid by individuals in advanced countries, except on a contract basis such as customizing or solution. In the long run, it will be possible to finance from the stock market, but in the short and medium terms appropriate measures are required to be prepared.

Presuming the current situation of Vietnamese banking system and technologies, it is difficult for the banks to provide sufficient loans to industries. It is recommended to expand the two-step loan scheme such as that initiated under the EU cooperation.

(2) Human Resources

The advantages of industrial development in Vietnam lie in the rich and capable human resources which are also essential for high-tech industrialization. However there remain some urgent issues to be solved. Technical education and vocational training, for example, are old-fashioned and do not meet the requirement of modern industries, therefore their modernization is an urgent issue along with the expansion of their supply capacity. It should be noted that technicians and skilled workers are the main players in the high-tech industries as same as researchers and engineers. It is required to raise the quality and expand the quantity of teachers and instructors. As for higher education, since the ratio of university entrance is lower than that in neighboring countries, there is a fear of shortage of engineers required for industrialization. Modern industries, especially high-tech industries, require post-graduates. The current situation of post-graduate education in Vietnam is inadequate because of Vietnam's dependence on former eastern countries for such education in the past. Its reform is a key element in high-tech industrialization.

(3) Technology

In the short and medium terms, technologies required for high-tech industrial development should depend on foreign companies. The obstacle to technology transfer is mainly the regulation on technological inducement which was adopted to cope with the shortage of foreign exchange reserves. Since high-technologies are changing perpetually, the delay of inducement caused by the regulation should be a deathblow to high-tech industrialization. If technological information is well distributed in Vietnam (technological information in the world is distributed in the real time), confusion and waste of resources can be avoided by deregulation. The acquisition of technological information will be possible through liberalization of access to it and the budgetary burden be small.

Even though industries will develop their own technologies in the long run, there are various issues to be solved in the short and medium terms. The preparation of a R&D system is the most crucial issue as well as human resource development. The linkage between the institutes and the industries is weak in Vietnam. Since the development of own technologies requires close cooperation between them, the preparation of a R&D system should be promoted as soon as possible.

(4) Investment Environment

The institutional and legal formations of the foreign investment environment are progressing year by year. However there are several complaints from foreign companies on such matters as difference between the promulgated rules and their practical application, taxation system for foreign employees, etc. The major complaint concerns the transparency of the application of rules. The public relation of new regulation and system for investment should be strengthened.

It is indispensable to prepare the infrastructure such as transportation system, utilities, etc. for operation of industries. The current situation of Vietnam's infrastructure is far behind that in neighboring countries. Although it is necessary to raise the level of infrastructure in the whole country, this can only be materialized in the long term due to budgetary constraint. In order to promote the development of high-tech industries under the current situation, it is a realistic approach to concentrate infrastructure investment in a certain area where infrastructure at international standards is required.

(5) Intellectual Property

The protection of intellectual property is a decisive factor for the development of high-tech industries. Although legal and institutional preparations are proceeding in Vietnam, in practice both budget and staff are insufficient. Applications of industrial property are expected to increase with industrialization. The technology inspection field will expand when high-tech industrialization progresses. Under the present situation of budget and staff, the inspectors shall have a great backlog of applications. It is recommended that a document-investigation system based on database be introduced together with the increase in number of inspectors. Since the database is huge, it is almost impossible for Vietnam to build it by itself. It is realistic to cooperate with the three biggest Patent Offices of Europe, USA, and Japan and to use the existing databases established by them. The protection of copyright of software which can easily be pirated is also an urgent issue.

III. TARGET HIGH-TECH INDUSTRIES

3.1 Definition of High-Tech Industry

High technology is a technology that expands the frontier of existing technologies by incorporating the fruits of advanced scientific researches. A high-tech product is an embodiment of high technologies in its production process or product design. A high-tech industry is an industry that produces high-tech products. A high-tech industry is characterized by continuous innovations to introduce new products with new and increased functions to the market. Therefore a high-tech company spends much resources in the development of new technologies and products.

When a new high-tech product succeeds in the market, the product can enjoy monopolistic profits at first. However, soon the competitors imitate the technology or invent an alternate technology, driving down the profits. To regain profits, a company invents another new product which drives the competitors from the market. In this way, a high-tech industry continues its creative destruction. In one way, the high-tech degree can be measured by the length of product life cycle. In the computer-related industries, the prevailing product life cycle is now less than one year while it was 2 – 3 years only a decade ago.

Another indicator to distinguish a high-tech industry is the proportion of technology in its contribution to production. However, there is no accounting system to distinguish technology as a separate asset and in reality technologies are integrated both in equipment and workers. Therefore it is not possible to measure a high-tech industry in terms of technological intensity. A conventional indicator is the proportion of R&D expenditure to the revenue or the ratio of R&D personnel to the entire workforce (detailed discussion will be made in Section 3.3).

3.2 Attributes of High-Tech Industry

High-tech industry's attribute in terms of its technological aspect is that the technology works in the field, wherein science and technology are in crossing-over in the field of molecule/atom, and that its mechanical precision demands 1/1,000 mm to 1/10,000 mm. With regard to this, high-tech industries are closely linked with each other or interdisciplinary as shown in Figure 3-2-1. New materials are the most interdisciplinary and linked with each high-tech field such as informatics/electronics, mechatronics, biotechnology, and new energy. In addition, the original attribute of

high-tech industry is technology innovation, which demands a continuous R&D activity. The attributes of high-tech industry necessitating continuous R&D to develop new technologies, new fields, and new products have resulted in a sizable R&D expenditure. In this respect, the Study Team has selected the 24 categories of high-tech industry to be promoted in Vietnam, of which R&D expenditure-total sales ratio is more than around 2% based on the data in Japan. (Refer to the section 3.3 in this chapter)

In terms of productive factor intensiveness, high-tech industry has intensiveness of knowledge, engineering, skills, and information higher than that of other or ordinary industries. In addition, it is relatively capital/equipment-intensive. As such, its labor productivity is higher; in case of the 24 categories of high-tech industry mentioned above, their averaged labor productivity was 30-40 percent higher than that of other industries, according to the Census of Manufacturers in Japan from 1986 to 1995. It is also an attribute of high-tech industry that its sub-sectors are mostly less resource-intensive such as land and water.

High-tech industry is complex in terms of production structure, and has many related and supporting industries, since diversified technologies and products (parts, components, and materials) are used for the production. The related/supporting industries comprise not only manufacturing of goods, but also various kinds of services such as design, engineering, consulting, prototype fabrication, testing, inspection, and measurement.

High-tech industry has a big market potential. The market for high-tech products expands corresponding to economic growth and heightening of consumer's needs, since high-tech products are highly elastic to income. In terms of supplier aspect, a limitless number of products can be produced by diversified combinations of technologies and materials in the field of molecule/atom. In the meantime, high-tech products, of which functions and prices are high, have been mostly marketed to advanced countries, since their market is limited in low-income countries. In this context, a global competitiveness is necessary for exporting such high-tech products.

High-tech production and products are highly less resource/energy-intensive, since some of them have been developed to address constraints on limited resources and energy, and also to protect environment. This attribute may offset high prices of high-tech products. In addition, less resource-intensive high-tech products are mostly not bulky, and are "light, thin, short and small." As such, some of them like integrated circuits are called "gram industry" with high value/prices per weight.

"Global division of labor between production processes" is one of the attributes of high-tech production. Not a few multinational companies have adopted an integrated production system between and among their factories dispersed across the world. This is a global networking of production made possible by innovation of transport and telecommunications. However, there is not always a contradiction between this networking and the high-tech industrial clustering in specific industries and areas through the localized division of labor, since both of them have been logically based on economies of the scale and the optimum distribution of resources.

When looking at the aspect of business management, high-tech industry is a "high-risk and high return" business. Continuous R&D/innovation and open-up of new market are costly and highly risky. A severe competition is sometimes conducive to no profit. The high return is a compensation for such risky business. As such, high-tech industry is called "venture business."

The governments have strongly intervened and supported the development of high-tech industry even in advanced countries. As studied in a "Master Plan for High-Tech Industrial Policy" (Volume I), the government, while recognizing the high-tech to be a part of national security, has developed many policy measures such as; "creation of market" as the model project by subsiding and/or assisting the development of high technologies and products, of which market are still premature; and a hedge/compensation for risky R&D and business such as tax reduction on capital gain, and public support for R&D of private enterprise, promotion of start-up of business, and incubation.

Compared to the ordinary industry, high-tech industry is more selective and demanding in locational conditions for its factory/laboratory, due partly to its attributes mentioned so far. A big agglomeration of high-tech industry across the world has been in general developed in and around the metropolis, since it is considered crucial in terms of cost reduction to utilize benefits from agglomerations of industry and R&D function in the metropolis/mother city. In addition, access to airport and sea port is a critical condition for the global division of labor between production processes. Development of expressway is also very important in terms of access to airport, seaport and metropolis. Accessibility to the most advanced information is an essential condition not only for business, but also for effective R&D activities, including access to global telecommunications/Inter Net with low cost. Finally, it is also essential to provide hi-level researchers and engineers with an attractive environment including amenity, living conditions, and recreational functions.

With regard to the site conditions for high-tech industrial location, precision processing industry tends to select a solid ground site with less vibration. Some industries demand water in high quality and electricity without voltage fluctuation. Other than such on-site conditions, supply of good manpower is an important condition common to all the high-tech industries. A reasonable land price is the minimum condition competitive for severe races between countries/regions to attract high-tech industry, while high-tech industry is relatively less sensitive to land prices.

3.3 Target High-Tech Fields

The selection of high-tech industries has several objectives in spite of its risk of eliminating potential industries. Since at the initial stage Vietnam needs to rely on foreign investments as the sources of high-tech industries, the initial targets will focus not on the real frontiers of technological development with risky potential technology but rather on the well-established high-tech industries. The resources for investment promotion are limited and also the infrastructure, human resource development and other production environment to support the development of high-tech industries will depend on the types of industries to be promoted to some extent, it is necessary for planning purposes to set target industries. In actual implementation, the planned HHTP will have flexibility to accommodate unintended high-tech industries since the requirements for different industries have common denominators in many if not all cases. In other words the target industries will have to be re-evaluated from time to time and need to be modified.

Judging from the current growth and expected future potentials, the following industries are chosen as target industries:

- Informatics and electronics,
- Machinery and mechatronics,
- Biotechnology,
- New materials, and
- Pro-environment technologies including new energy.

The above technologies are characterized by vigorous technological development. The first three categories of informatics, electronics, and machinery and mechatronics have been already established as a sizable market in the world while the last three categories have not fully manifested their potential due to their infancy in technological development.

(1) Informatics and Electronics

Microelectronics revolution initiated by the invention of semiconductors and followed by LSI and MPU has set the computer (informatics) on an explosive growth path to become a major industry of today. Computer technologies are now merging with communication technologies to form global data networks with immense potentials to change the geography of production, consumption and education from centralization to decentralization. Technological innovations in informatics can be characterized by the intensification of semiconductors and hard disks. At an interval of 2 - 3 years the size of memory chips doubles; the processing speed of MPU doubles; and the density of hard disks doubles. The semiconductor intensified not only in size but also in functionality as a simple transistor, circuit, and to a chip set, reducing production cost dramatically.

An important event in informatics is the emergence of a product called software, which consists of nothing but data and logic. The software industry is highly labor intensive of intellectual kind. The development of global data communication networks has enabled the division of work and integration of production for software without any regard to distance. Bangalore in India and Beijing in China have become the production centers for software. For manufacturers it is becoming a common practice to adapt a global optimal procurement to achieve the lowest possible production cost. The importance of computer software is increasing all the more under such a trend and it is highly recommended to develop software industry now for its continued growth potential and decentralized nature of production.

(2) Biotechnology

Biotechnology either copies, restrains, or enhances the functions possessed by a living creature. The industries that utilize biotechnology comprise a wide range of industries such as agriculture, food processing, medicine, chemicals, mining, energy, and environmental engineering. Due to its range of applications, the potential market is expected to be very large in the future. At present, actual implementation is seen only in a few products related to agriculture, medicine, and food processing partly due to the time requirement in manifesting a desired feature in most plants and animals. Traditionally, fermentation and cross-breeding were the core of biotechnology. After the invention of genetic engineering which is based on gene splicing by the use of enzymes, there was a new rush into this new-born technology. Ever-increasing computing power available for R&D pushed the genetic engineering to a new height of genetic mapping which is an attempt to find out the roles of each part of genes of plants,

and animals. This new technique is expected to provide knowledge in controlling diseases and characteristics of animals and plants.

Different species are the sources for new genetically engineered products. Tropical regions are known to be the largest genetic reservoirs in the world. Vietnam's proximity to varied climatical regions is suited for the collection and manipulation of genes. There is a motive from developed countries to undertake joint researches to establish gene banks and database for mutual benefits.

(3) Machinery and Mechatronics

Hanoi has been a center for heavy machinery production. However, if these industries were exposed to direct international competition without government protection, the chance of their survival is slim, therefore it is not possible to anticipate future growth of these industries in the extension of current practices. Nevertheless, it is quite possible and useful to utilize social tradition and culture related to machinery production since basic thinking behind machinery production could serve as an asset for the introduction of modern production system of machinery industries. The share of the machinery sector is not as large as electronics but its significance should be well understood. As any type of manufacturing requires machinery for production, the production machinery is often the embodiment of production technologies for any manufacturing. Combined with a certain feed back control system such as a computer and programmable logic chip, the machinery can integrate the skills that are used to control the parameters for production at an optimal level. Today machines are becoming integrated with electronics and computers to form a hybrid industry so-called mechatronics. Vietnam will see rapid expansions in basic industries such as cement, steel, and electricity. A bulk of modern equipment may be imported but at the same time, such investment will induce local supply of material handling equipment which suits local production for its site specificity. There are large opportunities for local production in material handling equipment business. Since access to the market is so crucial, there is a good chance of developing mechatronics industry for material handling equipment.

(4) New Materials

Often the discovery of a new material instigates a whole new industry. Microelectronics revolution was triggered by the discovery of a new material called semiconductor. As every engineering field always seeks more resilient, flexible, heat-endurable, lighter materials to break the limits of product capability and to achieve higher cost-performance, there is always a demand for new materials. New materials

cover both organic and inorganic materials. Typical organic new materials are carbon fiber, composite materials, engineering plastics, etc. Inorganic materials are semiconductor, special alloys, engineering ceramics, etc.

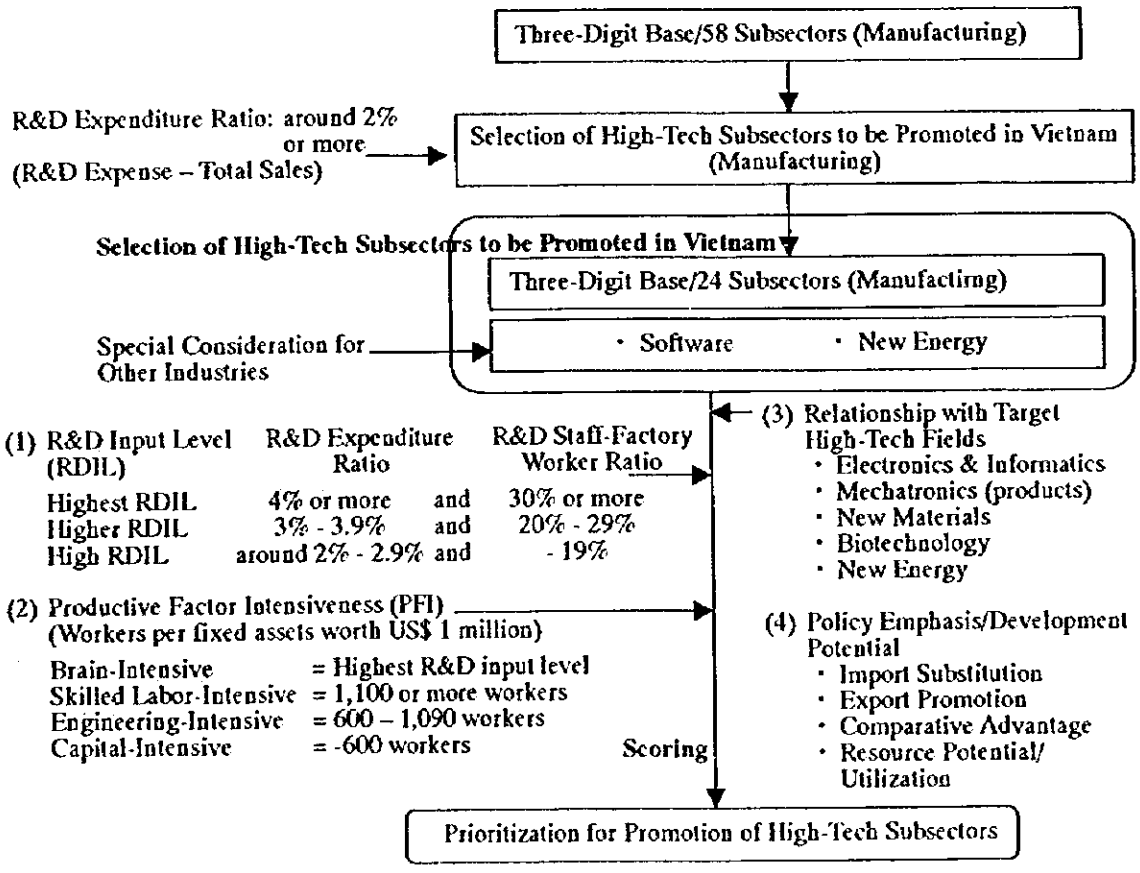
(5) New Energy

From a global point of view, it is deemed necessary to develop new clean energy sources in the medium term. With the worldwide economic growth together with population explosion, the conventional technologies are bound to become unacceptable when global warming and acid rain intensify. With the certainty of market in the future, new energy is a promising sector for R&D as well.

3.4 Prioritization of High-Tech Industries

The figure below shows the process of selecting the high-tech sub-sectors to be promoted in Vietnam, which will be differentiated in terms of their promotional priority by their attributes as an industry, their relationship with the target high-tech fields, the policy emphasis on them, and their development potential.

Selection of High-Tech Sub-sectors to be Promoted and their Prioritization



(1) Selection of High-Tech Sub-sectors to be Promoted

This selection will be done based on a quantitative analysis. For this purpose, the Basic Survey of Business Structure and Activity in Japan (the 1994 fiscal year report by the Ministry of International Trade and Industry) is used. The Survey collected data from 13,731 enterprises with 50 or more employees encompassing 58 sub-sectors (3-digit classification base), of which 48.6% or 6,669 enterprises conducted R&D activities and 35% or 4,802 enterprises held the rights of patent and practical new devices as shown in the figure below. Their expenditure for R&D totaled USD 72.2 billion per year, and corresponded to 2.9% of their total sales. The R&D staff numbered 349,271, which accounted for 5.9% of the total number of employees and 9.3% of the total number of factory workers.

Based on the above data, 24 manufacturing sub-sectors are selected to be the high-tech sub-sectors to be promoted in Vietnam, on the condition that their R&D expenditure ratio to the total sales is more than 2.0% (refer to Table 3-4-1). This ratio among the 58 sub-sectors averages 2.9%, which is considered relatively too high to be the criterion for selecting the high-tech sub-sectors. Therefore it is modified, taking into account the different conditions and development stages between Vietnam and Japan. Software and new energy industries without these data are also the high-tech sub-sectors in line with their relationship with the target high-tech fields.

(2) Prioritization of High-Tech Sub-sectors

This prioritization will be done by scoring the following items/indicators:

R&D input level and productive factor intensiveness

It could be useful for an efficient promotion of the high-tech sub-sectors to establish appropriate policy measures in accordance with their attributes as an industry. In this context, the following indicators are used to categorize the sub-sectors, for which criteria are set up based on the distribution pattern of their values among 24 sub-sectors.

- R&D input level comprising R&D expenditure ratio and R&D staff-factory worker ratio
- Productive factor intensiveness, which is broken down into brain, skilled labor, engineering, and capital intensiveness. The brain-intensive sub-sector corresponds to one with the highest R&D input level. Others are judged by the indicator of labor-equipment ratio (workers per fixed assets depreciated).

The results of this categorization are shown in Table 3-4-2. The sub-sector categorized into the highest or higher R&D input level necessitates new technology and new product development to ensure its competitiveness, and could be a "knowledge-oriented sub-sector" for which linkage with universities/public institutes and close location to them are essential. The productive factor intensiveness implies that provision of engineers is an important policy measure for the engineering-intensive sub-sector, and that capital-intensive sub-sector is expected to be promoted as a national project due mainly to its huge and risky investments.

Relationship with the target high-tech fields

This is the relationship between the 5 target high-tech fields and the high-tech sub-sectors. A sub-sector with stronger relationship with some fields is prioritized for its promotion. This relationship is judged based on the following considerations:

- Relationship with electronics/informatics, mechatronics, new materials, and new energy
  The relationship depends on whether a sub-sector has the product belonging to the high-tech fields or not, and is judged according to the product's share of the sub-sector's production as a whole.

- Relationship with biotechnology
  The relationship depends on whether a sub-sector uses biotechnology for the production, and is judged according to the share of products produced by biotechnology in the sub-sector's production as a whole. The relationship is considered to be not strong for the products such as biochip and biocomputer needing a long term for their commercialization.

Policy emphasis and development potential

The policy emphasis is broken down into import substitution and export promotion, while the development potential comprises the sub-sector's international competitiveness and the resource potential/utilization in Vietnam.

Import substitution in Vietnam will proceed centering on consumer goods in the short term. In the long term, intermediate and capital goods may be locally produced in place of imported ones. However, it should be noted that advanced countries have a strong advantage on production of capital goods. As for export promotion, skilled labor-intensive sub-sectors are prospective in the short term.

Vietnam has an international comparative advantage of its capable manpower. Also considering Vietnam's current development stage, skilled labor-intensive sub-

sectors are likely to have the strongest advantage, and the second may be engineering-intensive sub-sectors. On the other hand, capital-intensive sub-sectors in earlier starter countries are very competitive in cost, and therefore Vietnam's participation in them seems to be not prospective. The resource potential/utilization represents availability of industrial materials in Vietnam such as herbs for pharmaceuticals and natural gas for chemical fertilizers.

Summary Conclusion

The sub-sectors ranked "priority 1" are of the first importance in the high-tech promotion in Vietnam. The importance is not only based on the high-tech level, but also is attributable to the development viability, particularly in the short and medium terms. In this context, the sub-sectors with low priority would need a long term to develop, and sub-sectors such as synthetic fiber and steel produced by integrated blast furnace might be less competitive within the globalized economy.

Table 3-4-1 Selected 24 Manufacturing Sub-Sectors

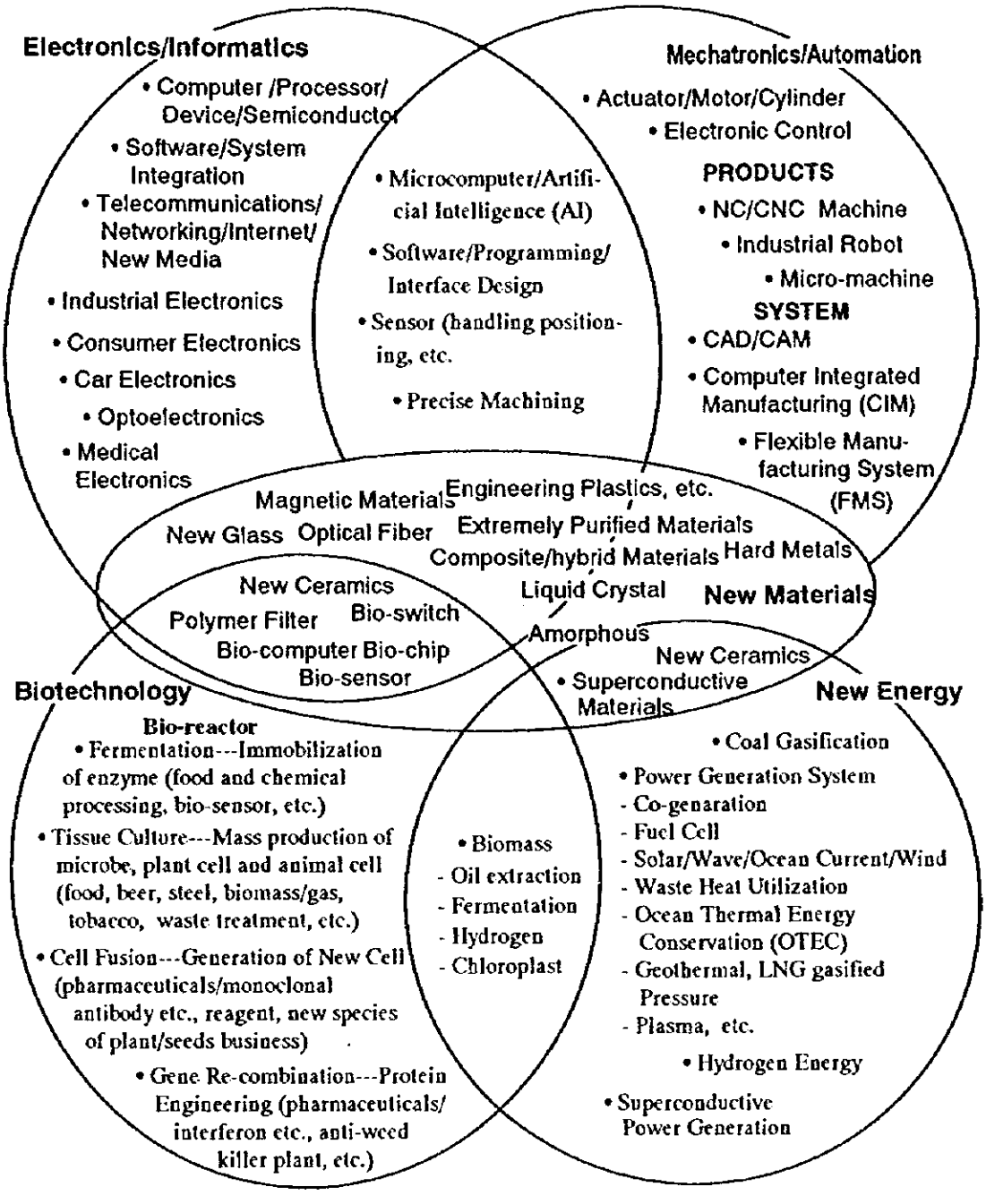
Categorization by R&D Input Level (RDIL) /Productive Factor Intensiveness (PFI)	(High-Tech Manufacturing Industries)	R&D Expenditure Ratio	R&D Staff-Factory Worker Ratio	Workers per Fixed Assets (Prs. per US$ mil.)
	Manufacturing Total (Average)	2.9%	9.3%	755
Highest RDIL/ Brain-Intensive	· Pharmaceuticals	9.8%	58.2%	855
	· Medical Equipment, etc.	6.8%	30.0%	1,250
	· Detergents, Surfactans, etc.	4.0%	32.1%	595
Higher RDIL/ Engineering-Intensive	· Office/Service Industry Use Equip.	4.0%	22.3%	976
	- Copier, Word Processor, etc.			
	- Air conditioner, etc.			
Higher RDIL/ Capital-Intensive	· Organic Chemicals	4.5%	22.2%	318
	- Petrochemicals			
High RDIL/ Skilled Labor-Intensive	· Communication Equipment	5.6%	12.8%	1,516
	- Telecommunications Equipment			
	- TV, Tape player, Audio equip.			
	· Industrial Electrical Machinery/Equip.	4.4%	7.5%	1,473
	- Motor, Connector, Switch, etc.			
	· Other Electrical/Electronic Products	3.8%	11.3%	1,489
	- Tester, Disc Drive, Battery, etc.			
	· Other Precision Instruments	3.7%	10.6%	1,570
	-Measuring Instrument			
	· Electronic Parts/Devices, etc.	3.6%	7.9%	1,133
	- Integrated Circuit (IC)			
	- Electronic Ceramics, etc.			
	· Optical Equipment & Lenses	3.1%	11.3%	1,802
	· Watches/Clocks & Parts	2.1%	4.3%	1,186
High RDIL/ Engineering-Intensive	· Electronic Equipment	6.8%	10.9%	965
	- Computers, X Ray Equip. VTR,			
	- Multimedia euip., Laser Equip. etc.			
	- Infomation Terminal			
	· Electrical Home Appliances	6.1%	13.0%	710
	· Rubber Tires & Tubes	3.5%	15.2%	728
	· Motor Vehicles & Parts, etc.	3.3%	11.2%	815
	· Special Industrial Machinery	3.1%	8.9%	986
	(for food/wood processing, weaving,			
	sewing, plastics, agriculture, etc.)			
	· Other Chemical Products	2.5%	28.7%	808
	- Cosmetics, Pesticide, Gule, etc.			
	· Other General Machinery/Equip.	2.1%	6.9%	1,023
	- Pump, Compressor, Bearing, etc.			
	-Industrial robot, Mold/Die, etc.			
	· Metal Processing Machinery/Equip.	2.0%	8.9%	998
	- Machining Center, NCN, Tool, etc.			
	· Glass and Glass Products	1.9%	4.5%	609
	- New Glass, etc.			
High RDIL/ Capital-Intensive	· Synthetic Fibers	3.9%	9.1%	494
	· Fertilizers & Inorganic Chemicals	2.6%	18.1%	458
	· Iron & Steel Products	2.1%	4.8%	242

Note: Enterprises with 50 or more employees/1 dollar = 100 Japanese Yen
Source: The 1995 Basic Survey of Business Structure and Activity (The Ministry of International Trade and Industry, Japan)

Table 3-4-2 Prioritization of High-Tech Sub-Sectors to be Promoted

NOTE: E/I=Electronics & Informatics M=Mechatronics NM=New Materials
Bio=Biotechnology NE=New Energy
IS=Import Substitution EP=Export Promotion
CA=Comparative Advantage of Vietnam RP=Resource Potential/Utilization
PRTY=Priority
Potential/Score: 1 (50 or more), 2 (36-49), 3 (-35); Score: average 47/higest 60/lowest 26
Potential * = less possible to promote it as a high-tech industry in Vietnam

Categorization by R&D Input Level (RDIL)/ Productive Factor Intensiveness (PFI)	(High-Tech Manufacturing Industries)	Scores by Factor and Their Total											PRTY
		RDIL	PFI	Relation to Target High-Tech Fields					Policy Emphasis/Development Potential				TL	
				E/I	M	NM	Bio	NE	IS	EP	CA	RP		
Highest RDIL/ Brain-Intensive	· Pharmaceuticals	20	8				3		8	6	6	6	57	1
	· Medical Equipment, etc.	20	8	3					8	6	6		51	1
	· Detergents, Surfactans, Paints, etc.	20	8			1			8			4	41	2
Higher RDIL/ Engineering-Intensive	· Office/Service Industry Use Equip.													
	- Copier, Word processor, etc.	16	16	6					8	6	6		58	1
	- Airconditioner, etc.	16	16	3					8				43	2
Higher RDIL/ Capital-Intensive	· Organic Chemicals													
	- Petrochemicals	16	4			1	3		8				32	3
High RDIL/ Skilled Labor-Intensive	· Communication Equipment													
	- Telecommunications equipment	10	20	6					8	6	6		56	1
	- TV, Tape player, Audio equip.	10	20	6					4	6	12		58	1
	· Industrial Electrical Machinery/Equip.													
	- Motor, Connector, Switch, etc.	10	20	3					4	6	12		55	1
	· Other Electrical/Electronic Products	10	20	3	2				4	6	12		57	1
	- Tester, Disc Drive, Battery, etc.	10	20	3					4	6	12		55	1
	· Other Precision Instruments													
	-Measuring instrument	10	20	3					4				37	2
	· Electronic Parts/Devices, etc.	10	20	6					4	6	12		58	1
	- Integrated circuit, etc.	10	20	6			3		4	6	6		55	2
	- Electronic ceramics, etc.	10	20	6					4	6	12		58	1
	· Optical Equipment & Lenses	10	20	6					4	6	12		58	1
	· Watches,Clocks & Parts	10	20	6					4	6	12		58	1
High RDIL/ Engineering-Intensive	· Electronic equipment													
	- Computers, X Ray Equip. VTR,	10	16	6			3		4	6	6		51	1
	- Multimedia euip., Laser equip . etc.	10	16	6					4	6	6		48	2
	- Infomation terminal	10	16	6					4				36	2
	· Electrical Home Appliance	10	16	3					4				33	3
	· Rubber Tires & Tubes	10	16			1			4				31	3
	· Motor Vehicles & Parts (P), etc.	10	16	3					4	6	6		45	2
	· Special Industrial Machinery	10	16	3					4				33	3
	(for food/wood processing, weaving, sewing, plastics, agriculture, etc.	10	16	3	2				8		6		45	2
	· Other Chemical Products	10	16								6		32	3
	- Cosmetics, Pesticide, Gule, etc.	10	16				3				6	4	39	2
	· Other General Machinery/Equip.	10	16	3	2						6		37	2
	- Pump, Compressor, Bearing, etc.	10	16								6		32	3
	- Industrial robot, Mold/Die, etc.	10	16	3	4				8		6		47	2
	· Metal Processing Machinery/Equip.	10	16	6	4						6		42	2
	- Machining center, NCN, Tool, etc.	10	16	6	4				8		6		50	1
	· Glass and Glass Products	10	16	3		1			8			4	42	2
	- New glass, etc.	10	16	6		2							34	3
High RDIL/ Capital-Intensive	· Synthetic Fibers	10	4			1	3		8				26	3
	· Fertilizers & Inorganic Chemicals	10	4				3		8		6	4	35	3
	· Iron & Steel Products	10	4			1			8			4	27	3
(Informatics)	(Software)	20	8	6	4				4	6	12		60	1
(New Energy)	(Coal Gasfication, etc.)	10	16					2			4	8	40	2



Source: JICA Study Team

Figure 3-2-1 Main Products/Technological Fields of High-Tech Industry and Their Linkages

IV. BASIC STRATEGIES AND SCENARIO FOR HIGH-TECH INDUSTRIALIZATION

4.1 Basic Strategies

Among all the strategies to be adopted for the development of high-tech industries in Vietnam, deregulation is the most fundamental one and key to the materialization of high-tech industrialization in the country. Deregulation of investment and trade would be the minimum requirement for investors to make decisions. Deregulation of access to international information, which is of special importance for the high-tech industries more than others, is another prerequisite for investors. Since Vietnam is already a member of the ASEAN and has the obligation of meeting the requirement of free trade and investment by 2006, achieving deregulation is of urgent necessity.

From the viewpoint of fostering the high-tech enterprises in the country, deregulation is also of vital importance. Alleviation of the regulation currently imposed on the enterprises would bring about the effect of vitalizing and modernizing the existing enterprises to expand their activities into the field of high-tech industries as well as stimulating the incubation of new ones.

With quite limited resources of management and finance and narrow market channels as well as inadequate technology level at this stage, capacities and knowhow of the enterprises in the industrialized countries should fully be utilized in every aspect. In this sense, developing the physical and institutional infrastructure for inviting foreign investors should, therefore, be another basic strategy for high-tech promotion.

The Vietnamese Government now faces a formidable task of modernizing the nation's economic structure within a short period of time to catch up with other countries. There are many obstacles that lie ahead. The shortage of resources severely restrains the scope of public works. In practice the Government has to rely on foreign investment to provide finance, technologies, and management to the development of industries for some time to come. This limitation is true in the field of high-tech industry as well. There can be a long list of policy measures and projects for the promotion of high-tech industries, but the Government cannot afford to concentrate its limited resources in high-tech industries alone. Naturally the Government has to adopt a pragmatic approach in the development of high-tech industries. One pragmatic strategy is to create an environment to induce foreign investment and transfer of

technologies in high-tech fields and prepare the human resources to enhance the absorption capacity of high technologies in the medium-term.

Prioritization of High-Tech Development Measures

In view of financial limitation of the Vietnamese Government and other urgent areas for public investment, institutional framework, and human resource development should proceed infrastructure and superstructure development. For instance liberalization of technology transfer from abroad requires no financial investment.

Based on the assessment of current issues and scenario development, the recommended strategies are summarized below.

- Promotion of FDI and J/V

  Strategy 1 : Improvement of Investment Environment for High-Tech Industry
  - T1 : Simplification of procedures for investment licensing and implementation
  - T2 : Preparation of special incentives for high-tech industry

  Strategy 2 : Focused Public Investment
  - T3 : Development of internationally competitive high-tech parks
  - T4 : Provision of high quality utilities to high-tech parks

  Strategy 3 : Strengthening of Investment Promotion
  - T5 : PR on the advantages of Vietnam
  - T6 : Establishment of the international investment promotion network
  - T7 : Modernization of management in Vietnamese companies
  - T8 : Deregulation of J/V contract conditions

- Human Resource Development

  Strategy 4 : Strengthening of Science and Technology Education
  - T9 : Modernization of university and graduate school education
  - T10 : Establishment of programmes for studying abroad

  Strategy 5 : Training of Technicians and Skilled Labor for High-Tech Industry
  - T11 : Improvement of technical education system
  - T12 : Training of instructors on technical skills

- R&D Promotion

  Strategy 6 : Improvement of Industrial Technology to Catch Up With Advanced Countries
  - T13 : Improvement of R&D institutions
  - T14 : Protection of intellectual property rights

  Strategy 7 : Strengthening R&D Capabilities
  - T15 : Promotion of international joint R&D
  - T16 : Provision of incentives for R&D activities

- Industry Modernization

  Strategy 8 : Strengthening of Technology Transfer
  - T17 : Deregulation of the technology transfer system

- New High-Tech Business Creation

  Strategy 9 : Fostering of Software Industry
  - T18 : Development of international communication networks
  - T19 : Protection of copyrights
  - T20 : Deregulation of access to world information
  - T21 : Setting-up of business incubation for software companies

  Strategy 10: Development of Investment Environment
  - T22 : Establishment of a public financing system for SME
  - T23 : Enforcement of venture capital and venture business

The details of the above 10 strategies and 23 programmes are expected to cover whole Vietnam. It takes a long time to expand these in the whole country and, as a result, Vietnam may lose a big opportunity to invite FDI. It is more pragmatic to establish special zones for high-tech industries to implement the above-mentioned measures to attract high-tech industries quickly.

Development Method

The major policy for the development of high-tech industries is to promote FDI, develop human resources, promote R&D activities and rear small and medium enterprises. In the short term most resources should be allocated to attract high-tech FDI. In the medium and long terms, human resources development shall occupy the central position of the policy. Since foreign investment plays the central role in high-tech development in Vietnam, at first the Government has to focus on creating a favorable environment for high-tech investment.

4.2 Scenario of High-Tech Industrial Development

High-tech industrial development should be implemented efficiently. The scenario consists of three phases: Phase 1 is the period up to the year 2005, Phase 2 between 2006 and 2010, and Phase 3 between 2011 and 2020. Some of the actions in this scenario might be carried out before the said periods or prefer to begin the previous period.

(1) High-Tech Industry Development Phasing

Phase 1: High-Tech Transfer

The informatics and electronics industries shall precede the other selected industries as leading sectors. The main players in the industries are FDI including joint ventures. Assembly industries will occupy the central position in the production structure followed by the development of supporting industries. In the late stage of Phase 1, some part of the products development such as the improvement of products may begin.

One of the important local sectors to be promoted in this period is software industry where local enterprises have a chance to develop. Since initial investment is relatively small, the entry into the market is easy. By the development of a communication network, the market has a potential to expand globally. The main players in software industries will be Vietnamese enterprises. To achieve the scenario, it is crucial to improve the legal and institutional frameworks including the protection of copyright for computer software.

Phase 2: Assimilation and Improvement of Transferred Technology

After creating a base for the high-tech manufacturing sector during Phase 1, there will be natural spin-offs and development of markets for subcontracting.

The major objectives are to promote the conversion of imported technologies to "home-made" technologies and to develop the technologies made in Vietnam in Phase 2. Through the localization of advanced technologies, the existing companies will be modernized to gain international competitiveness. The main players in the high-tech industries such as informatics and electronics and mechatronics will be not only FDI but also Vietnamese companies. In the production structure, assemblers will continue to play the central part. The function of the design and engineering will expand and product qualities will improve.

Phase 3: Independent Development

At this phase, industrial development in the ASEAN countries will have reached maturity. After a period of consolidated regional market through AFTA, there will be regional specialization within industrial sectors. It is envisaged that competition with other neighboring countries and convergence of income levels will necessitate product differentiation and local agglomeration of firms related to certain products such as hard disks and semiconductors. Within its confine of sub-sector, each industry will become the regional high-tech center in ASEAN or Asia-Pacific region.

Based on the above scenario, the priority order of the selected high-tech fields are as follows.

First Priority: Computer Software

i) Fitness of the quality of labor of the Vietnamese, endorsed high appreciation by the of the foreign enterprises invested in Vietnam and the consistent achievement in the World Mathematics Contest,

ii) Small initial investment,

iii) Close industrial linkage with IT field,

iv) Possibility of inland location with the adequate telecommunication infrastructure,

v) World investment trend, in particular FDI, and

vi) Example of the achievement in India, development stage of which is not so much different from that of Vietnam

Second Priority: IT (Information Technology/ Telecommunications/Computer)

IT should follow, considering;

i) Trend of FDI of the high-tech advanced countries,

ii) Close linkage with the basic industry of machinery as well as computer software, and

iii) Possibility of inland location due to its compactness

Third Priority: Bio-technology

Bio-technology should follow, considering;

i) Contribution to the modernization and raising the productivity of the primary industry of agriculture, and

ii) Raising the value-added of the food and pharmaceutical industries which are currently the key manufacturing industries in Vietnam

Third Priority: Mechatronics

Mechatronics then should follow because of;

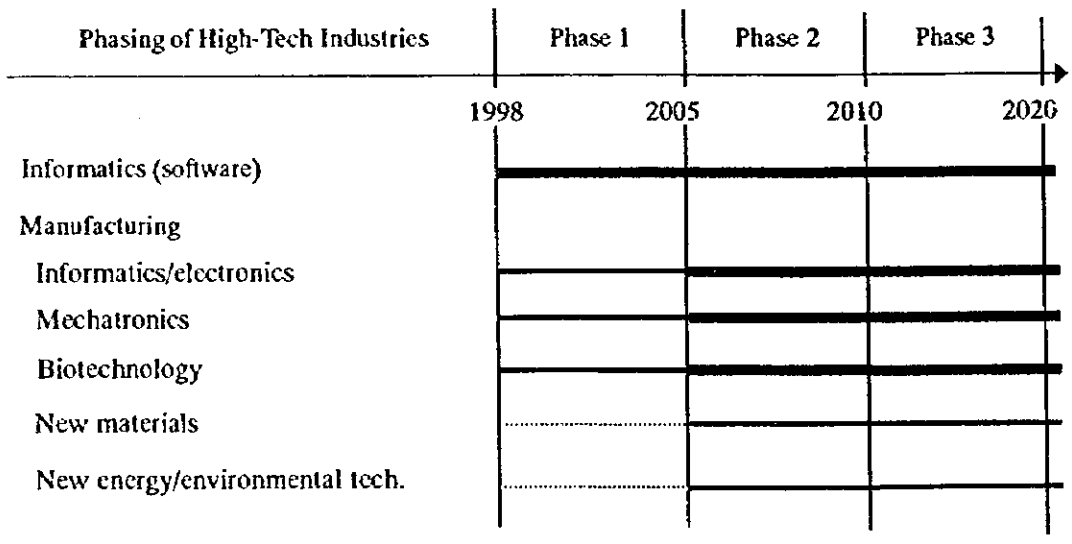
i) Important role and function of mechatronics industry for raising the precision and performance as well as productivity of machinery industry, and

ii) Close linkage with IT field

Fifth Priority: New Material and New Energy

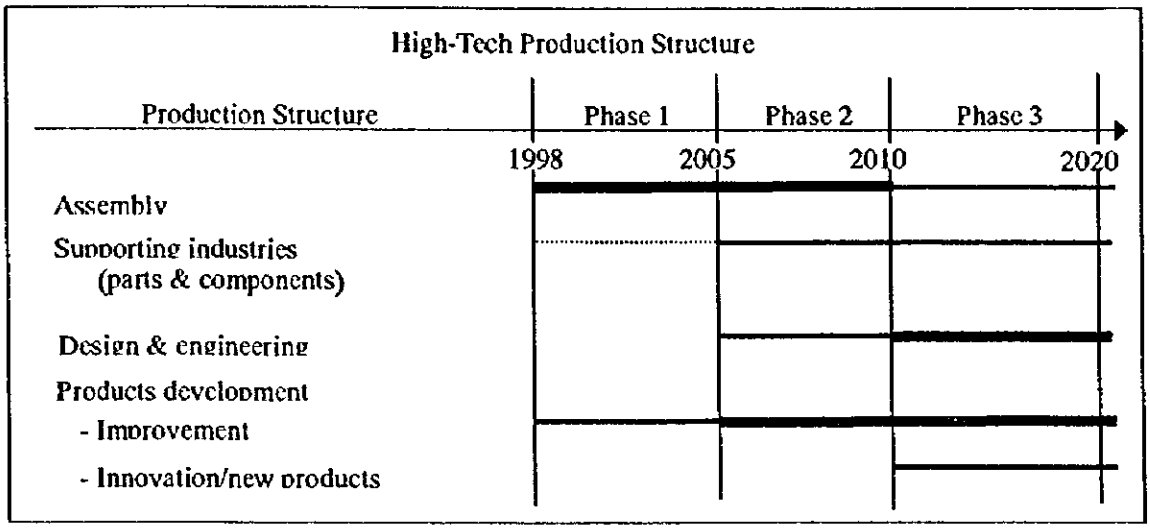
These two fields have close relevance with the wide range of the high-tech industries and would give big positive impacts. However, Vietnam has no clear comparative advantage in these fields. Besides, they require sizable investment and lengthy time for development. These two fields should, therefore, be reared in longer perspective among the priority fields.

Phasing of High-Tech Industrial Development

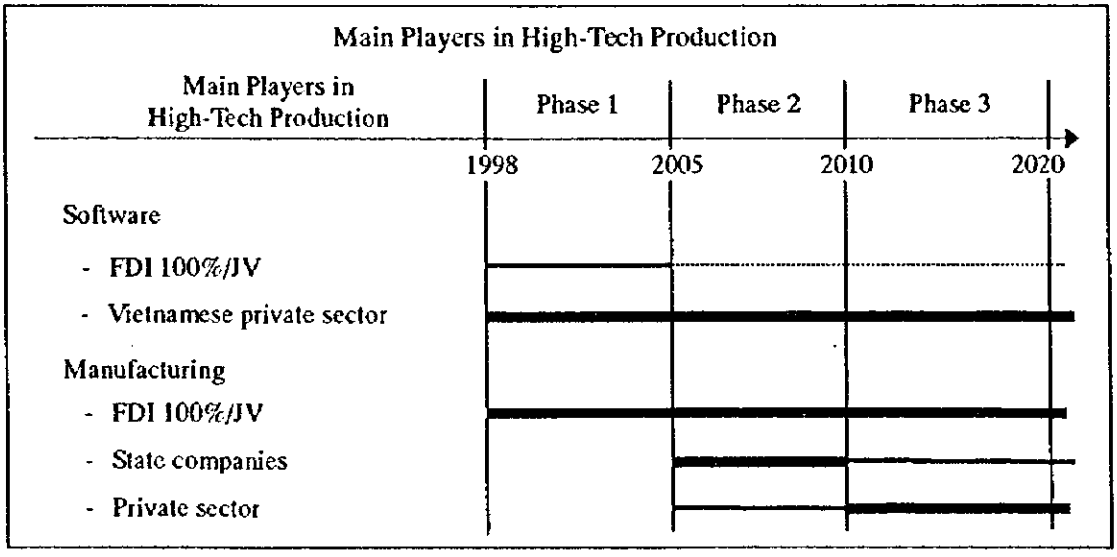


As for the high-tech industrial structure, assembly type of high-tech industries will be prevailing with FDI at initial stage. The supporting industries such as parts and compornent manufactures will follow in the mid term. The product-development should be started in the mid term in the form of product-improvement. The long term

objectives of the high-tech industrial structure shall be to produce the original high-tech products with the own technology.



The main players in the high-tech industry should be changing along with the development stage and structure. In the high-tech manufacturing, FDI and its JV (joint venture) with the Vietnamese will be the principal player in the short-term and continue to be one of the main players in the foreseeable future. In the medium-term, state-owned enterprises (SOEs) will come onstage, utilizing their experience as JV partners. In the long-term, Vietnamese private enterprises will enter the stage. In the software production, Vietnamese organizations, either SOEs, state research or academic institutes or the private, should be the main players from the short-term. Main players in the high-tech production in the time-frame is shown below.



(2) Human Resource Development Scenario

Human resource development (HRD) is basically the medium and long-term target aforementioned. In order to promote high-tech industries, which is the short term target, training of highly skilled technicians is crucial since the demand of technicians and engineers in high-tech industries is larger than that of ordinary labor-intensive industries. The vocational training and/or skill development system in Vietnam is far behind and cannot satisfy the requirement of high-tech industries. In the short term, therefore, the target of HRD is to nurture technicians and skilled labor, to train instructors for training schools, and to prepare for supply them to high-tech industries.

The modernization of universities and postgraduate education is also an urgent issue, however its implementation might be a medium- and long-term target. Since human resource is essential for promotion of high technologies, expansion of the overseas study system is required to solve the delay of reform.

In the medium and long terms, it is important to nurture human capital in order to strengthen Vietnam's own high-tech industries. Since the young generation must be familiar with the results of science and technology, it is required to introduce high-tech equipment in primary schools and to provide students with opportunities to touch and feel science and technology (for example to establish a science and technology museum).

(3) R&D Activities Development Scenario

Phase 1: Basic Research Capacity Building

In Phase 1, technology transfer from FDI and technology introduction from abroad will be promoted vigorously. The objective is to catch up with the preceding countries in industrial technology in preparation for joining AFTA. The priorities in the R&D fields will be given to informatics and electronics, mechatronics, and biotechnology. International joint researches will be promoted to help Vietnamese researchers gain experiences in scientific researches and product development. The main players in Phase 1 should be national research institutes since FDI will not bring in R&D functions at this stage.

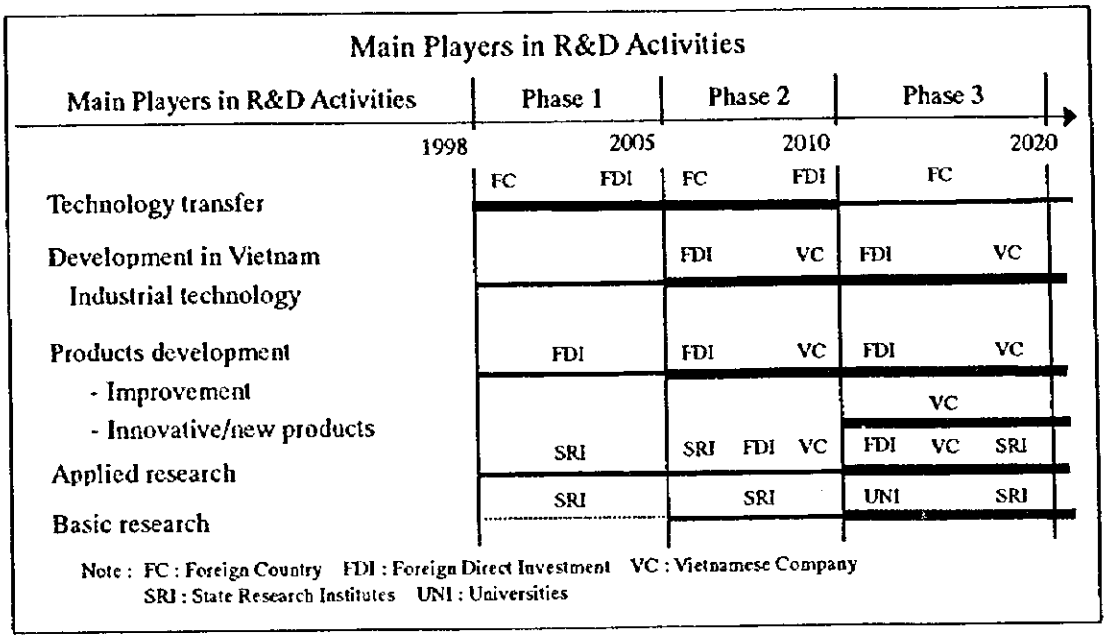
Phase 2: Localization

The introduction of high technologies will continue in Phase 2. Major objectives are to strengthen the institutions to develop 'home-made' technologies.

Technological development in frontier topics such as new materials and new energy may be chosen. Basic research activities will begin at the early stage of this period at national institutes. FDI will transfer a substantial portion of R&D activities to Vietnam and local firms will start some product development activities.

Phase 3: Self-reliant and Independent Research

Technological development in process and products will be mainly carried out by Vietnamese companies. New products and innovative technologies will be introduced to the international market. In various organizations such as national institutes, Vietnamese companies, and FDI, applied research will be carried out. Basic researches will be carried out by universities and national institutes.



V. TARGET OF HIGH-TECH INDUSTRIAL PROMOTION

As indicators to measure the level of high-tech industry development in Vietnam, the ratios of R&D expenditure to GNP and the number of scientists and researchers to labor force are proposed. The ratio of R&D expenditure to GNP is estimated at around 0.4% in 1995 in Vietnam. The number of scientists and researchers per 10,000 workers is estimated at 5 to 10 (The current situation of R&D Expenditure and R&D personnel are reviewed in Appendix V.1). In Vietnam, the number of researchers is almost equivalent to that of the ASEAN countries and the R&D expenditure is smaller than that of ASEAN. At the beginning, the target ratio of researchers should be set at a slightly higher level; in the short term it should be at the same level as the current level of NIES (Korea), in the medium term at half of the current level of advanced countries, and in the long term at the same level as that of advanced countries. The target ratio of R&D expenditure, on the other hand, should be slightly moderate at the beginning; in the short term it should be at the level of ASEAN (Malaysia) in 2000, in the medium term at the current level of NIES (Korea), and in the long term at the current level of advanced countries. The targets are set for the three phases of development of high-tech industries in Vietnam as follows:

Phase 1 : Up to 2005

Objective : Infrastructure development for high-tech industries through technology transfer

Target : The R&D expenditure ratio to GNP will be 1.5%, and the number of scientists and researchers per 10,000 workers will be 20.

The target R&D expenditure ratio to GNP is equivalent to the target level of Malaysia for 2000 and the target ratio of scientists and researchers is almost the same as that of Korea in 1994.

Phase 2 : 2006 - 2010

Objective : Modernization and advancement of existing industries by introduction of high technologies/creation of domestic high-tech industries

Target : The R&D expenditure ratio to GNP will be 2.0%, and the number of scientists and researchers per 10,000 workers will be 30.

The target R&D expenditure ratio to GNP is equivalent to the level of Korea in 1994 and the target ratio of scientists and researchers is almost the half of that of Germany in 1993.

Phase 3 : 2011 - 2020

Objective : Self-sustained high-tech industrial development and high-tech center in ASEAN region or Asia-Pacific region

Target : The R&D expenditure ratio to GNP will be 3.0%, and the number of scientists and researchers per 10,000 workers will be 50.

The both targets are at the same levels as those of advanced countries in recent years.

Targets of High-Tech Industrial Promotion

High-Tech Indicators	Short Term 2005	Medium Term 2010	Long Term 2020
R&D expenditure ratio to GDP	1.5%	2.0%	3.0%
Number of researchers & scientists per 10,000 workers (person)	20	30	50

Assuming that the working population ratio is 50 % and that ratio of the number of the researchers in each sector is proportional to its share of the value-added in GDP, total number of researchers and high-tech related researchers could be estimated as shown below.

Number of Researchers

Number of Researchers	Phase 1 2005	Phase 2 2010	Phase 3 2020
Total Number	84,780	133,660	246,080
High-Tech Related			
Share of VA of high-tech industry	3.0 %	6.3 %	12.0 %
Number of researchers	2,540	8,420	29,530

VI. STRATEGY OF INVESTMENT PROMOTION IN HIGH-TECH INDUSTRIES

6.1 Frame of Investment Promotion Policy

The lessons from the other ASEAN and East Asian countries indicate that the promotion of FDI was the prior policy leading to high-tech industrialization. To achieve the target, each government provided various tax and non-tax incentives to attract the high-tech FDI. In addition to such incentives, the governments prepare a favorable business environment for investors, such as establishment of high-tech parks (the high-tech industry promotion policy in other countries are assessed in Appendix II). In Vietnam, the condition of FDI has been improved. FDI, however, slowed down in recent years. One of the reasons for such trend is that foreign investors still evaluate the Vietnamese investment environment as inadequate compared with other Asian countries.

In order to promote investment, especially foreign investment, it is required to implement various measures in the following four aspects.

- To create a good business environment,
- To offer good incentives,
- To provide good infrastructure and facilities for high-tech industries, and
- To form a sales promotion system.

(1) Strategy I-1: To create a good business environment

Investors require an environment in which they can do business without being subject to unreasonable regulations. Vietnam is renovating the system, but it has not secured the satisfaction of investors. It is true that regulations are effective in some cases such as nurturing domestic infant industries, but the transparency of economic conditions is essential to create competitiveness of companies, to attract foreign companies, and to vitalize the market.

The policy to achieve the above is as follows:

- Forming an investment system
  - Establishment of a financial system,
  - Establishment of a stock market, and
  - Protection of intellectual property.

- Easy access to all business-related information
    - Announcement of procedures of investment licensing,
    - Announcement of economic indicators, and
    - Announcement of rules.
- Deregulation
    - Issuance of export and import licenses,
    - Technology transfer agreement,
    - Royalty agreement, and
    - Work permission for foreign engineers
- Making procedures transparent
- Making the utilities cost reasonable
- Revising the land use right system

(2) Strategy I-2: To offer good incentives

To promote investment, good incentives should be offered, including not only monetary incentives such as tax exemption, but also non-monetary incentives such as services. Non-monetary incentives are stressed here, considering that present Vietnam is not inferior to neighboring countries concerning monetary incentives.

Incentives proposed here are applicable to the whole country. More progressive incentives for high-tech industry promotion could be applied to special zones for high-tech development.

- Monetary incentives
    - Exemption/reduction of corporate income tax
    - Exemption/reduction of custom duty
    - Exemption/reduction of personal income tax
    - Exemption/reduction of tax on royalty
- Non-monetary incentives
    - One-stop service
    - Mass transportation service
    - Business support service

- Regional incentives

Stronger incentives for investment are advisable to be applied to the less developed regions.

(3) Strategy I-3: To provide good infrastructure and facilities for high-tech industries

In Vietnam there are no industrial zones targeting high-tech industries at present. Special industrial zones offering high quality infrastructure and facilities, that is high-tech parks, are required.

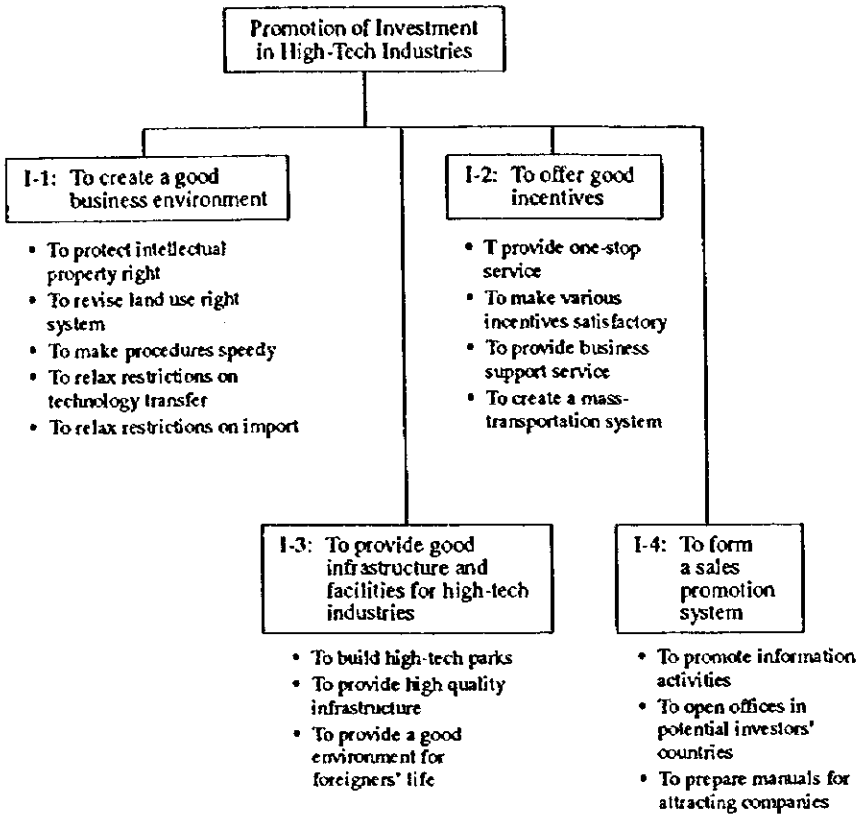
- To build a high-tech park,
- To provide high quality infrastructure, and
- To provide a good environment for foreigners' life.

(4) Strategy I-4: To form a sales promotion system

However good an investment environment is offered, it is of no use if investors are not informed about it. Vietnam should therefore disseminate information about the country and take care of the companies located in Vietnam.

- To open offices in potential investors' countries,
- To hold seminars on investment,
- To prepare:
  - A brochure in foreign languages
  - A homepage on the Internet
  - Manuals for attracting companies
  - Listing of potential investors
  - Listing of local experts available for foreign companies
- To formulate an organization for exchanging information with foreign companies.

Frame of Investment Promotion



6.2 Concrete Programs

(1) Creation of Excellent Business Environment

1) Financial system

The difficulty in local financing is one of the bottlenecks that hinder the development of local enterprises and joint ventures. The common way of saving money in Vietnam is holding money in cash or in the form of precious metals at home. Financial institutions have not been sufficiently developed yet to circulate the surplus money for investment. In addition banks are suffering from bad debts to state companies. Consequently, banks do not have much capacity to lend the private sector.

The financial system should be secured and the stock market should be established quickly in order to raise fund easily.

2) Intellectual property right

Vietnam has ratified the Paris Agreement and has issued a patent law. But laws and systems related to technology transfer are not compatible with the international rules and practices. Despite the copyright law, software is copied

freely in reality. In short, the idea of intellectual property right including copyright has not been established in Vietnam yet. The idea of protecting intellectual property right should be spread.

3) Flexible immigration policy

The longest commercial multiple visa issued by the Government of Vietnam is valid for 6 months, causing unnecessary inconvenience to expatriates. When foreigners work in Vietnam, they have to experience complex procedures such as applying for visa extension every 6 months. In order to foster high-tech industry, it is required to make the system simple and allow many foreign engineers to work in Vietnam.

Taiwan's case should be referred to for a flexible immigration policy. Abundant human resources for R&D, including good researchers who were use to be working in the Silicon Valley in the U.S., who were originally from Taiwan, contributed to the development of information in Taiwan.

4) Legal system and procedure

As a result of the continuous improvements in the legal structure, the procedures such as investment licensing have become more transparent and take shorter time. But still some companies have difficulty in getting the licenses. A legal system and fair jurisprudence system should be established quickly to give more stability to business.

5) Infrastructure cost

Since the user charges for utilities and telephone service in Vietnam are higher than in other competing countries, it is necessary to lower these charges to make production input costs competitive with other countries.

6) Permission of free transfer of land use right

Enterprises should be permitted to transfer the land use right freely, and the current limitation of value of land use right for mortgage should be abolished so that land use rights held by enterprises may be used as collateral for borrowing money from banks. This land use right reform will significantly contribute to solving the financial problem that the enterprises face in Vietnam. This should be applicable both for the private and the public sectors.

7) Calculation of royalty

For installment payment of royalty, the Government of Vietnam is specifying that the royalty should be calculated either on after-tax profit or on net value. However, it is common practice in the world to calculate the royalty amount simply on sales value.

In Vietnam, a government approval is needed to make technology transfer agreement legally effective. High-tech industry takes much of revenue from royalty. The technology transfer agreement including the calculated rate of royalty should be concluded freely between parties concerned without government approval.

(2) Excellent Incentives

1) Monetary incentives

(a) Exemption/reduction of corporate tax

Companies can enjoy tax exemption for a period of 8 years at the longest. This incentive is competitive against neighboring countries. To foster high-tech industry, there is a policy option to designate the following incentives:

- Accelerated depreciation
- Double deduction of certain eligible R&D expenditures

(b) Exemption of import duty on machinery, equipment and instruments

High-tech industry uses expensive machinery, equipment and instruments which need to be replaced after a few years in many cases. All of them are imported.

At present, import duty is exempted when a factory is built and expanded. But import duty is imposed on the machinery, equipment and instruments for renewal and on parts for repairing machinery. All the machinery should be duty free.

(c) Personal income tax

The maximum tax rate is 50%, considerably higher than that in the ASEAN countries. The tax rate for high income earners including foreign engineers is too high to let them stay in Vietnam. Personal income tax on expatriates should be reduced so as not to increase production costs and to encourage technology transfer.

(d) Income tax on royalty

A tax of 15%/10% is currently imposed on royalty income in Vietnam. The tax rate is as high as that in other Southeast Asian countries. To encourage technology transfer, this tax on royalty income should be exempted or reduced.

2) Non monetary incentives

(a) One-stop service

The procedures of application for investment license and construction permission and reporting on import and export should be handled by a one-stop system.

(b) Business support service

Foreign companies have difficulty in preparing for operation of a factory outside their home country. For example, they have difficulty in finding partners for joint ventures or subcontractors and in recruiting workers.

A new organization should be founded to provide the introduction service for recruitment of human resource, a directory of potential partners for JV, and a list of companies for subcontracting.

(c) Regional incentives

By now only a few high-tech companies can be seen in Vietnam. In order to catch up with competitors effectively, high-tech-related companies should be accumulated in a special area such as a high-tech park. Therefore, more progressive incentives should be offered to the special areas and to the areas which are lagging behind the country's economic development.

(3) Infrastructure Development

1) Building of high-tech parks

In Vietnam there are no suitable sites for high-tech companies in terms of both facilities and services. The Government should play a main role in building high-tech parks.

2) High quality infrastructure

High-tech industry's utility requirements are not just in volume. The quality required of electricity, water and telecommunications is much higher than that of ordinary industry.

The area where high-tech companies are located should be provided with international standard infrastructure adequate in quality as well as in quantity.

3) Good conditions for foreign engineers

Most investment will come from foreign countries. It means that good condition for foreigners should be offered. The road signs and hospital markers should be written also in English and some international schools should be established.

(4) Sales Promotion

It is important to conduct sales promotion as well as to make the investment environment in Vietnam known to the outside world. As every ASEAN country tries to lure investments in high-tech fields, sales promotion activities are becoming more and more important.

1) Overseas investment promotion office

Most countries have investment promotion offices in the potential investors' countries. Such offices make propaganda activities for the country and provides information to investors. For example, the Economic Development Board (EDB) of Singapore, Malaysian Industrial Development Authority (MIDA) of Malaysia, and Office of Board of Investment (BOI) and Industrial Estate Authority of Thailand (IEAT) have their own offices in Japan. They provide documents in Japanese, and do activities for inviting companies.

The Government of Vietnam should consider a more active investment promotion approach such as opening offices of MPI in the potential investors' countries.

2) Seminars

Holding seminars overseas is a good opportunity to give publicity on the advantages of Vietnam to investors directly. Missions to Vietnam are also effective to show the Vietnamese attractiveness in a visible form.

3) Documents for attracting companies

Documents such as brochure or guidebook should be prepared in the languages of the potential investors' countries. A design homepage in several languages in the Internet is an option for advertisement.

4) Manual for investment promotion

An investment promotion manual should be prepared. This manual will show the way of picking up potential investors and contacting them and the flow up to the decision making on an investment. It helps the person in charge of sales promotion to understand his task and to do his work effectively. And it secures the minimum service to investors.

(5) Others

A series of campaigns over a year should be held as "Vietnam Year" in Japan and the U.S, which are considered to be the most potential investors. During that year, through some campaigns, the name of Vietnam will be known as a country of investment and sightseeing.

The campaign office, for example, has a space with a standing exhibition on Vietnam and provides videotapes, pamphlets and maps introducing Vietnam. In that year, seminars and missions are held intensively, and classes introducing Vietnamese culture such as language or customs are given.

In addition to the above-mentioned measures and projects for the promotion of investment in high-tech industries, it is recommendable that a Science and Technology Exhibition be held in Vietnam in the early 21st century. Holding the exhibition will be a common target for the promotion of science and technology including all the sectors concerned with high technology in the country. The exhibition will provide an excellent opportunity for the publicity of the high-tech products and industry as well as the investment environment for foreign investors, and thereby promote the export of high-tech products and foreign direct investment. It is recommended that the exhibition be held in HHTP (Hoa Lac High-Tech Park) which will be the pioneer of the high-tech development in the country. The details of the exhibition are given in the following page.

Project Name: Exposition of Science and Technology
Target: 1) Advertisement of HHTP 2) Showing the government attitude towards S & T 3) Enlightening the national knowledge on S &T
Duration: about 6 months in 2010
Project Outcome: 1) Promoting investment in HHTP 2) Advertisement and sales promotion for other high-tech parks 3) Showing the level of S & T in Vietnam 4) Promoting HHTP to success
Activities: The number of visitors is estimated to be about 20 million. The pavilions will exhibit the latest S & T achievements in the world, in order to enlighten Vietnamese people's knowledge concerning S & T. Infrastructure except pavilions should be constructed so that it can be used by located companies after the exposition. A facility should be kept as a memorial and be used as a S & T museum, where Vietnamese people can always have a touch of S & T.
Implementing Agency: 1) A committee for exposition should be formed in the Government; this committee will work for raising money and inviting to the exposition. 2) An organization composed of MOSTE, Infrastructure Development Companies for HHTP, will be established, and work for operating the exposition, promoting exhibition and advertisement.
Estimated Cost: USD 400 million
Remarks on the Project Implemention: The exposition in 2005 has already been decided to be held in Japan. A world exposition is held every 5 years, therefore Vietnam should target the exposition in 2010. In order to hold the exposition, Vietnam must finalize a plan by 2002, and obtain the decision of the Bureau of International Exposition (BIE) at its general meeting to be held in 2003. The budget for infrastructure construction is not included in this project. The public sector should construct the utilities such as road, electric system. Access from airport to the site should be considered for foreign visitors.

VII. HUMAN RESOURCES DEVELOPMENT PROGRAMS FOR HIGH-TECH INDUSTRIES

7.1 Frame of Human Resources Development

(1) Issues of Human Resources Development in Vietnam

Based on the assessment of the current situation and the Government policy (Refer to the Appendix IV.1), the issues of human resources development in Vietnam are summarized as follows:

1) Issues in basic education

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

2) Issues in technical education and vocational training

- There are far from enough number of vocational training centers especially in industry related fields. Also equipment need to be updated.
- The curricula are mostly for repair and maintenance, and do not fit for modern industries, except for the courses in software development.
- The number of technicians and skilled workers are small to the number of engineers.
- The teaching staff of technical and vocational training need to have re-training to adapt to the new industrial technologies.
- There are few incentives for factories to train their employees.

3) Issues in higher education

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

- After scholarship to study in Russia and Eastern European countries practically stopped in 1989, teaching staff and Ph.D. holders are aging.
- Further cooperation between higher education and industries need to be developed.

4) Issues of the industries

- Master plan and strategies to promote small- and medium-scale enterprises (SMEs) need to be established.
- More engineers and higher-level technicians need to be developed.
- SMEs cannot access to technical information.
- SMEs cannot upgrade the skill level of their labor force by their own resources.
- There is little government support for training in labor skill and enterprise management.

(2) Keys to the Success from Experiences in Singapore and Malaysia

On the other hand, several keys to the success of technical education and vocational training institutions become clear from the experiences in Singapore and Malaysia (Refer to the Appendix IV.2).

1) 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, and 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.

(3) Frame of Human Resources Development

After carefully analyzing the current situation, 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.

1) 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.

2) 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.

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

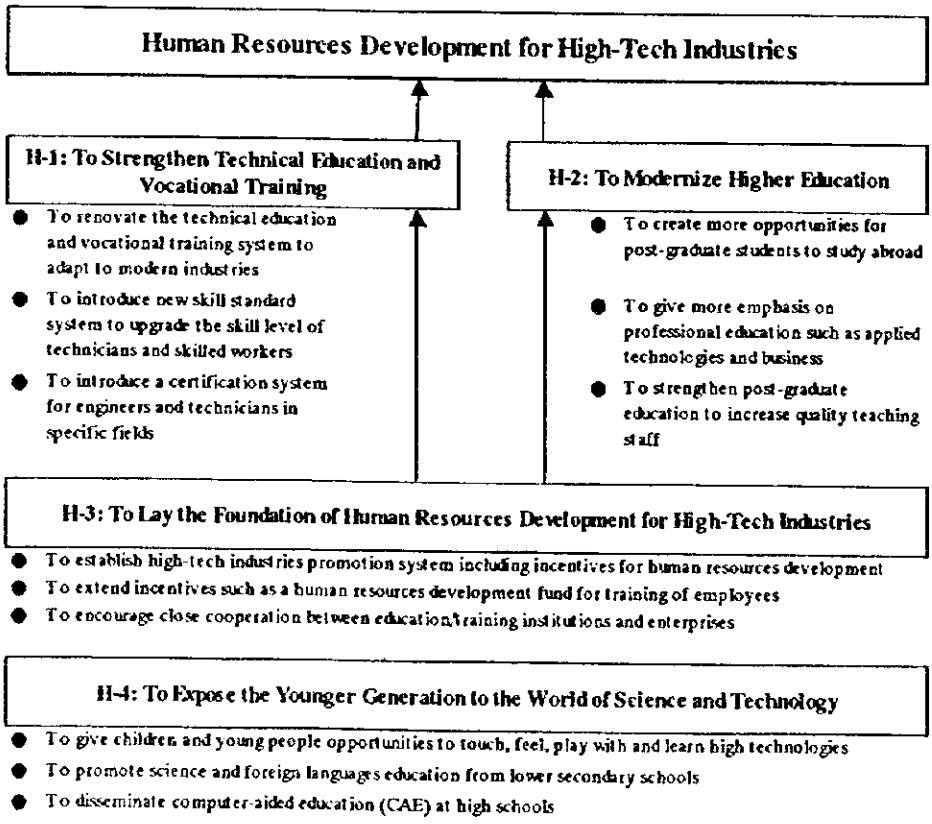
One of the crucial issues in Vietnam is modernization of state factories and promotion of small- and medium-scale enterprises, and human resources

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.

4) 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



(4) Required Number of High-Tech Labor

With the assumed figures for the value-added of the high-tech industries and the labor productivity of the high-tech labor which are derived from the assumed figures for the future GDP and the share of the high-tech industries in GDP, the required number of the high-tech labor could be estimated. Proportion of labor among the engineers, technicians, skilled and semi-skilled as well as un-skilled could be estimated assuming that the proportion is similar to that of electronic industry of Thailand in 1995, i.e., 5 % for engineers, 10 % for technicians, 25 % for skilled and semi-skilled and the rest of 60 % for unskilled as shown below.

Required Number of High-Tech Labor

Classification	Phase 1 2005	Phase 2 2010	Phase 3 2020
Engineers	2,830	6,460	18,455
Technicians	5,660	12,920	36,910
Skilled & Semi-skilled	14,150	32,300	92,275
Un-skilled	33,960	77,520	221,460
Total	56,600	129,200	369,100

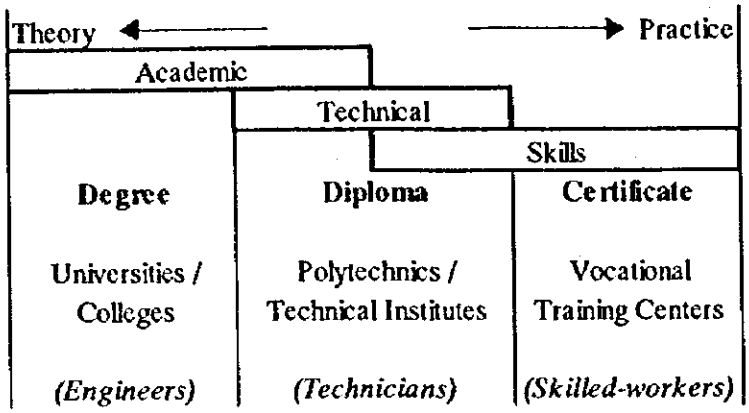
7.2 Concrete Programs

(1) Technician Training

The number of technical education and vocational training institutions in Vietnam is not enough especially in industry related fields, and also curricula and equipment need to be updated. The ratio of the numbers of technicians and skilled workers to one engineer is very small and the need for high level technicians is expected to increase rapidly as high-tech industrialization proceeds. Thus it has become an urgent task to renovate technical education and vocational training system to adapt to modern industries.

Technical education and vocational training were classified as theory oriented high technical education at universities and colleges and skill oriented vocational training at vocational centers and in plants. As industrialization progresses, however, technicians who understand both theory and skill have been considered more and more important. For this reason, the needs for technical cooperation in training of high level technicians have been extremely high in the countries like Singapore, Malaysia and Thailand.

Spectrum of Education and Training



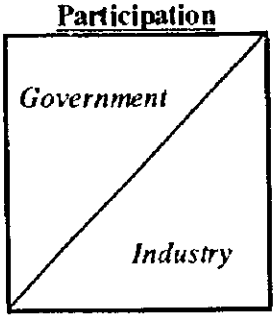
Technical institutes for high level technicians usually offer two-year courses for high school graduates and are often called *polytechnic* in other ASEAN countries. In Vietnam, however, polytechnic means 5-year technical university, a higher educational institution longer than regular universities and colleges, thus the Study Team uses the name *technical institute* instead. German Malaysian Institute says they are teaching *know-why*, while French Malaysian Institute says *know-how* and *know-what*.

(2) Re-training, Contracted Training and Extension Services

Besides long-term institutional training of technicians, short- and medium-term re-training of workers, supervisors and managers, and technical guidance services are also important programs with immediate effects. These programs are especially attractive to small- and medium-scale enterprises.

Functions of Technical Educational Institutes / Vocational Centers

Functions	Duration
* Technical Education	Long-term
* Technical Training	Medium-/short-term
* Vocational Training	Medium-/short-term
* Re-training	Short-/Medium-term
* Contracted Training	Short-term
* Extension Services	Ad hoc
* (Hi-tech) Consulting	Ad hoc



Long-term institutional training or education is usually provided by government spending large amount of subsidies. In vocational training especially re-training, contracted training, extension services and consulting, however, enterprises play a major role. Ministries in charge also change from a ministry in charge of education to labor and to industry.

Also from the experiences in other ASEAN countries, it is essential for sustainability of training institutes to operate basically independently. Testing services, consulting, prototyping, joint-projects are the activities necessary to earn income for the institutes. Participation of the industry is necessary in management of the institutes, dispatch of engineers as instructors and consultants, drafting and updating curricula, in-plant training etc.

Therefore, even if projects are formulated independently according to each specific function or activity such as long-term institutional training, short-term training and consulting, it is desirable that the management body is one and only for all the functions and activities and the institutes are being operated sustainably as a whole.

(3) Scholarship for Studying Abroad and International Joint Research Program

The graduates of graduate school count 12,752 in Vietnam at the end of 1996, and more than 60% 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 scholarship to study in those countries practically stopped since 1989, aging of faculties of universities and colleges, and senior researchers of institutes and laboratories is one of the critical issues in Vietnam. Out of 629 professors in Vietnam, none of them are under 40 years old and only 3.9% are under 50 years old. More than 80% of all the professors and associate professors are over 51 years old. To create more opportunities to study abroad and to establish international joint research system are urgent to strengthen the faculties and senior researchers.

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. To recall these overseas Vietnamese, i) to assure the freedom of leaving Vietnam anytime, ii) to pay salaries by the international standard, iii) to provide good environment for R&D, iv) to provide good living facilities, v) to provide good education to their children, etc. are necessary in general. It is not realistic to assume that all the conditions above can be materialized in short-term, thus promotion of interchanging engineers and scientists, and of contribution by investing to Vietnam or by promoting Vietnamese exports is necessary.

Besides scholarship for studying abroad and international joint research program, emphasis at universities and colleges needs to be given more on professional education such as applied technologies and business management. For these programs, engineers and scientists who have studied abroad, overseas Vietnamese engineers and scientists, foreign engineers, scientists executives and managers can contribute. Needless to say, it is indispensable that executives and engineers of Vietnamese enterprises participate. A post-graduate business school which is in preparation at Hanoi National University is a good example of professional education necessary in Vietnam now.

(4) Foundation of Human Resources Development

As a foundation of human resources development for industries, master plan and strategies for promotion of small- and medium-scale enterprises or high-tech industries are necessary to be established. In the master plan, an overall scheme for renovating technical education and vocational training to adapt to modern industries is to be shown. Then incentives for enterprises to train their employees, a fund similar to human resources development fund, a system to encourage close cooperation between education/training institutions and enterprises, introduction of new skill standard system to upgrade the skill level of technicians and skilled workers, and introduction of a certification system for engineers and technicians in specific fields need to be placed in the master plan.

(5) For the Younger Generation

The Study Team proposes a national science and technology museum as a place for children and young people to touch, feel, play with and learn high technologies. To be concrete, the museum is a combination of a planetarium, a tilted-dome 70mm motion picture theater, several exhibition rooms such as a zero-gravity experience room, a spacesuit fitting room, an exhibition room of artificial satellites and rockets, an exhibition room of a stone of the moon and meteorites etc., and a virtual reality theater room for CG motion picture. The museum need to be a self-supporting institution.

In basic education level, the Study Team proposes to select several model lower secondary and high schools, to introduce a personal computer per student, to teach fundamental knowledge of English and computers, to introduce computer-aided education (CAE) and to develop a system, curricula and teaching materials for disseminating CAE to lower secondary and high schools nationwide.

7.3 Priority Projects for the Human Resources Development

Aiming at rearing the human resources for the development of high-tech industries in Vietnam, it is recommended that the following projects be put priority for early implementation.

1) To implement the program for sending Vietnamese students abroad at graduate school level, in particular in the high-tech field,

2) To establish Technical Institutes for bringing up the technicians for the high-tech industries which are seriously in short supply and badly needed in the country,

3) To establish training centers which are based on the on-the-job style training to bring up skilled labor for the high-tech industries and their supporting ones.

The first project is described in the following page. The second and the third projects are explained in detail in Volume II. The first institute and the center are recommended to be implemented in the HHTP.

Project Name: Scholarship for studying abroad

Target:

Development of human resources who play leading roles in the fields of high-tech at universities, colleges, institutes and laboratories.

Duration: until 2010

Project Outcome:

Increase of the number of Ph.D. and master degree holders in high-tech related science and technology fields

Activities:

- Scholarship for the graduates of universities and colleges or master degree holders in high-tech related fields such as information technology, mechatronics and biotechnology.
- A system of 5-month language (English, Japanese etc.) training in Vietnam + 2- to 5-year studying abroad in master or Ph.D. courses + 6-month to 2-year on-the-job training abroad is established.
- The scholarship provides tuition and living expenses for about 100 new students a year, thus total number of students abroad is 400 a year in full operation.
- Duration of the program is assumed as 10 years.

Implementing Agency:

Ministry of Education and Training and Ministry of Science, Technology and Environment

Estimated Cost: USD200 million (100 new students/year x 10 years)

Remarks on Implementing the Project:

It is essential that the Scholarship starts before the construction of HHTP and provides enough leading human resources when HHTP begins operating.