

### V.4.3 Long Term Strategy

During the period from the year 2011 to 2020, Vietnam should enhance the applied R&D aiming at becoming a center for R&D in ASEAN countries, based on the achievements of the short and medium term frame. For this purpose, it is recommended to continue the strategy R-1: "to reinforce national basis of R&D", and the strategy R-3: "to bring up the R&D capability of industry".

Further, it is recommended to begin the strategy R-5 "to accelerate the spread of foreign /domestic technologies over Vietnam".

## V.5 R&D Promotion Programs

### V.5.1 Concrete Program

#### (1) Rearrangement of State R&D Institutes

Figure V-5-1 illustrates the present organization of R&D for high-tech promotion in Vietnam. The organization is divided into mainly three categories: state R&D institutes belong to NCST, those under Ministries, and those belong to universities. Besides above categories, there are research units which belong to general corporations and enterprises.

NCST, to which state R&D institutes of the first category belong, is a R&D organization for natural science and priority technology like high-tech, under direct control of Government. There are 17 institutes in total under NCST. Among them, institutes for natural science are conducting basic research, applied R&D, and post graduate education for scientists, while those for priority technology are conducting mainly applied R&D and post graduate education for scientists or engineers.

State R&D institutes of the second category which belong to Ministries could be classified into those of national level, and those of specific subsector or specific enterprise level. Their main function is R&D for industrial technology, some of them has functions like applied R&D, introduction and spread of foreign technology into Vietnam, etc.

State R&D institutes which belong to universities are focusing their activities on education and training, besides it their function includes applied R&D, basic research, and R&D for industrial technology.

The present R&D organization has the following problems that should be solved.

- Some state R&D institutes have overlapped functions with each other. It is almost inevitable that state budget and human resource, which are limited in Vietnam, are scattered. This is not considered an efficient way.

- Vietnamese enterprises have a weak capability for R&D. Due to this weakness, Vietnamese enterprises cannot develop new products, nor improve product quality sufficiently.
- High-tech R&D institutes which belong to universities are focusing on education for researchers. They are rather small-scale and their R&D capability are inferior to that for institutes under NCST or Ministries.

The following measures are necessary to solve the above problems:

- (a) to establish a base of high-tech R&D to which state budget and resource should be concentrated,
- (b) to form institutional system to bring up R&D capability of enterprises, and
- (c) to make institutional system to raise universities' R&D capability, especially of basic research capacity

Five options, option-1 through 5, are proposed as a restructuring plan of Vietnamese R&D organizational system, as illustrated in Figures V-5-2. The five options are combinations of measures which aim at the above (a) through (c). An extent of restructuring increases in order of the option-1 to 5. The national base of high-tech R&D is NCST in case of options- 1 and 2, while it is the National High-tech R&D Center to be established newly in case of options -3, 4 and 5.

- Option-1: State R&D institutes which have strong connections with specific subsectors or enterprises should be moved to general corporations of the concerned subsector or the concerned enterprises respectively from Ministries' jurisdiction. This movement should be performed in the course of on-going restructuring scheme, for the purpose of strengthening R&D capability of industry. NCST should be kept as it is, making national level R&D for high-tech promotion. Natural science institutes of NCST should build up a closer connection with institutes of universities, providing human support. (Refer to Figure V-5-2)
- Option-2: High-tech R&D of national level should be concentrated in NCST by merging high-tech institutes under Ministries with NCST institutes in the same research field. Natural science institutes of NCST should build up a closer connection with institutes of universities, providing human support. A part of state R&D institutes which have strong connections with specific subsectors or enterprises should be moved to

general corporations of the concerned subsector or the concerned enterprises respectively from Ministries' jurisdiction. This movement should be performed in the course of on-going restructuring scheme, for the purpose of strengthening R&D capability of industry. (Refer to Figure V-5-3)

- Option-3: The National High-tech R&D Center should be found, being composed of institutes for individual high-tech fields to be established by integration of institutes currently belong to NCST and Ministries. The center should be located in HHTP and become the base of high-tech R&D, with a large amount of capital to be invested intensively to its facilities and equipment. Institutes of NCST in natural science and non-high-tech fields should be left in NCST to promote basic research with building up a closer connection with universities. In addition, State R&D institutes which have strong connections with specific subsectors or enterprises should be moved to general corporations of the concerned subsector or the concerned enterprises, respectively, from Ministries' jurisdiction. This movement should be performed in the course of on-going restructuring scheme, for the purpose of strengthening R&D capability of industry. (Refer to Figure V-5-4)
- Option-4: The National High-tech R&D Center should be found, being composed of high-tech institutes to be established by integration of institutes currently belonging to NCST and Ministries. The center should be located in HHTP. It is anticipated to be a base of high-tech R&D, by making an intensive investment in its facilities and equipment. Institutes under NCST in natural science and non-high-tech fields should be integrated into institutes of universities, forming a base of basic research. Consequently, NCST will be dissolved and absorbed into the new National High-tech R&D Center and institutes of universities. In addition, State R&D institutes which have strong connections with specific subsectors and enterprises should be moved to the concerned general corporations and enterprises, respectively, from Ministries' jurisdiction in the course of on-going restructuring scheme, for the purpose of strengthening R&D capability of industry. (Refer to Figure V-5-5)
- Option-5: The National High-tech R&D Center should be found, being composed of high-tech institutes to be established by integration of institutes currently belonging to NCST and Ministries. The center should be

located in HHTP. It is anticipated to be a base of high-tech R&D, by making an intensive investment in its facilities and equipment. Institutes of NCST in natural science and non-high-tech fields should be integrated into institutes of universities, forming a base of basic research. Consequently, NCST will be dissolved and absorbed into the new National High-tech R&D Center and institutes of universities. In addition, state R&D institutes which have strong connections with specific subsectors and enterprises should be moved to the concerned general corporations and enterprises, respectively, from Ministries' jurisdiction in the course of on-going restructuring scheme. All of state R&D institutes currently belong to Ministries should be moved to the National High-tech R&D Center, general corporation or enterprises, with the exception that policy research institutes will be kept under Ministries. (Refer to Figure V-5-6)

The table below gives comparison of five options.

Comparison of Five Options for Rearrangement of State R&D Institutes

Option	(a) to establish a base of high-tech R&D	(b) to form institutional system to bring up R&D capability of enterprises	(c) to make institutional system to raise universities' R&D capability
1	High-tech R&D will be conducted separately by NCST and R&D institutes under Ministries. (A base cannot be established by this option.)	State R&D institutes with strong connections with specific enterprises should be moved to general corporations or enterprises from Ministries' jurisdiction.	Natural science institutes of NCST should build up a closer connection with institutes of universities.
2	High-tech R&D of national level should be concentrated in NCST by merging high-tech institutes under Ministries with NCST institutes.	Ditto	Ditto
3	National High-tech R&D Center should be found by integration of institutes currently belong to NCST and Ministries.	Ditto	Ditto
4	Ditto	Ditto	Institutes under NCST in natural science and non-high-tech fields should be integrated into institutes of universities, forming a base of basic research.
5	Ditto	All R&D institutes under Ministries, except those to be integrated into the National High-tech R&D Center and those of policy research, should be moved to enterprises or general corporations.	Ditto

Further discussion on selection of the best option may be needed among the concerned Ministries of Vietnam, since there are many different opinions. The Study Team recommends the option-4 or 5, which are the same in terms of high-tech R&D promotion. Those two options are better than other three options from view points of "to establish a base of high-tech R&D to which state budget and resource should be concentrated" and "to make institutional system to raise universities' R&D capability", especially of basic research capacity. Difference between the option-4 and 5 is that non-high-tech field and policy related research institutes are left under Ministries in the case of the option-4, while only policy related research institutes are left under Ministries in the case of the option-5.

## (2) Promotion of International Cooperative Research Works

International cooperation in the R&D field has been done mainly in the form of sending Vietnamese researchers to foreign universities and research organizations, and inviting researchers from advanced countries. It is important to promote international cooperation in the form of the international cooperative research works, in addition to the above forms, to bring up human resource for R&D, enhance R&D capability and apply its achievement to Vietnam effectively.

A committee for the international cooperative research, which will investigate potential foreign partners' system and find out research subjects easy to be accepted by the partners, should be formed at first. The committee should apply suitable subjects to the foreign organizations after consideration of necessity of the subject as well as its acceptability.

Besides ODA, some R&D organizations open researcher's position to foreigners to proceed their R&D activities. For example, New Energy and Industrial Technology Development Organization (NEDO) in Japan employ researchers for their research projects as the NEDO Industrial Technology Fellowship Program. Under this program, well capable researchers are recruited from all over the world, in the past researchers were recruited from China, Russia, CIS countries, South Korea, India, Bangladesh, Germany, France, U.K., U.S.A., Canada, Eastern European countries, Australia, etc. If Vietnamese researchers can participate in this program, they can enrich their experience through international research works. In addition, the research subject could be applied to Vietnam, if the subjects are suitable. Announcement of second recruitment of researchers for the NEDO Industrial Technology Fellowship Program in FY 1997, and NEDO projects are attached as Attachment 1 and 2, respectively, for reference. However cares should be taken to avoid brain drain that might be caused by sending researchers to abroad.

### **(3) Increase in R&D Budget**

It is proposed that R&D budget be increased gradually to promote high-tech R&D in Vietnam. Targets of the budget should be high-ranking countries among ASEAN in the short-term, Newly Industrialization Economies (NIES) in the medium-term, and advanced countries in the long-term. To put it concretely, R&D expenses against GDP, which was estimated at about 0.4% in 1995, should be increased to the following targets:

- Short term (up to 2005): 1.5% (equivalent to Malaysia's target in 2000)
- Medium term (from 2006 to 2010): 2.0% (equivalent to 1994 level in South Korea)
- Long term (from 2011 to 2020): 3.0% (equivalent to current level in advanced countries)

### **(4) Increase in Number of Researchers**

It is proposed that number of researchers be increased, for promotion of R&D, from the current level of 5 to 10 in 10,000 total labors to the following targets:

- Short term (up to 2005): 20 in 10,000 total labors (equivalent to 1994 level in South Korea)
- Medium term (from 2006 to 2010): 30 in 10,000 total labors (equivalent to half of 1993 level in Germany)
- Long term (from 2011 to 2020): 50 in 10,000 total labors (equivalent to current level in advanced countries)

### **(5) Construction of High-Tech Parks**

Inviting foreign high-tech enterprises and R&D should be enhanced to promote high-tech industry in Vietnam. However, there is no candidate site where required incentives have been provided for locating high-tech enterprises and good atmosphere has been provided for establishment of research institutes.

Hoa Lac High-Tech Park should be constructed as well as Ho Chi Minh High-Tech Park to solve the problems and supply space of cooperation for high-tech promotion among the industrial sector, universities, and state R&D institutes.

### **(6) Reform of Legal Framework for Technology Transfer**

Current legal framework should be changed as follows to create an atmosphere that transferor can transfer their technology easily.

**(a) Minimization of governmental interference in technology transfer**

Technology transfer is basically a business conduct of enterprises to seek for profit, therefore interference by the Government should be kept in a minimum level. However, the current regulations are too much interfering technology transfer.

An example of Article 6 of the Ordinance on the Transfer of Foreign Technology (Ordinance), which specify items such as objective of technology transfer, royalty calculation and payment method, technology transfer schedule and training related to the transferred technology which should be included in a technology transfer contract.

Another example is Article 7 of the Ordinance, which prohibit to include the following restrictive clauses in a technology transfer contract.

- Obligations on technology transferee to purchase raw materials, equipment, intermediate goods and parts or to use permanently manpower from sources stipulated by the transferor.
- Restrictions concerning quality of production prices and terms for sale of products of the transferee, including the appointment of sales agents or commercial representatives.
- Restrictions on the markets to which transferees may export their products, other than those markets in which the transferor already manufactures or sells similar products, or has granted a franchise license to a third party.
- Restriction on R&D of transferred technology by transferees or on the acquisition of similar technology from other sources.

If all of these business arrangement are prohibited by regulations, enterprises having technologies would not be motivated to transfer their technologies to Vietnam. Therefore, relaxation of the above regulations should be investigated to follow the international practice.

**(b) Method for calculation of royalty**

For installment payment of royalty, the Vietnamese Government 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 royalty amount simply on sales value. Therefore, sales value method that is the world standard for royalty calculation should be allowed in Vietnam, if Vietnam really wishes to promote technical transfer from overseas.

**(c) Procedures for obtaining approval for technology transfer**

A government approval is needed to make a technology transfer agreement legally effective in Vietnam. However, detailed procedures for this process is not clearly specified in the regulations. Procedures for obtaining approval for a technology transfer should be clearly established to secure transparency of the procedures for technology transfer.

Appraisal period of 3 months, which is prescribed by the Circular No. 28 / TT-QLKH dated 22 January 1994 of MOSTE, should be shortened, in consideration of rapid progress of high-tech, to promote technology transfer to Vietnam.

**(d) Incentive measures**

Incentive measures for technology transfer are currently not provided specially for technology transfer, though 7 industrial sectors are specified, by Decree No. 29 (Article 15) dated May 12, 1995, as priority sectors and incentives by exemption and reduction of profit tax and turnover tax are given to those priority sectors. However, it should be noted that they may promote technology transfer through investment, but they are not direct incentives for transfer of technology. Furthermore, tax incentive are effective only for limited period as these taxes are going to be replaced by corporate income tax and VAT.

MOF is in the process of preparing a new Decree, in place of Decree No. 29, for provision of incentives to priority sectors, and various information and data are now being collected.

It should be recognized that reduction of income tax at source on royalty is a direct incentive measure for promotion of technology transfer from foreign countries. Tax incentive measures including reduction or exemption of income tax at source on royalty to be paid to overseas, should be provided for promotion of technology transfer from overseas.

**(7) Strengthening the Relation between R&D Institutes and Enterprises**

The current R&D department of enterprises is too weak for development of products and manufacturing processes, which is necessary for producing competitive products. Accordingly it is essential to strengthen R&D capability of Vietnamese enterprises.



State is currently changing the institutional framework of State R&D institutes. State R&D institutes under Ministries which have strong connections with specific enterprise will be merged by the concerned enterprise, and those which have strong connections with specific industrial subsector will be merged by general corporations of the concerned subsector.

The Study Team recommends to execute this on-going restructuring to reinforce R&D capability. It should be noted that State R&D institutes should still have a way to provide their service to non-state enterprises, even after this restructuring, to avoid disturbance of technological innovation by this restructuring.

#### (8) Tax Incentives for Enterprises' R&D Activity

The following three tax incentives are proposed for R&D expenses so that enterprises can enlarge their investment to R&D to modernize themselves by high-tech and to enhance product quality:

- to deduct a part of the incremental high-tech R&D expenses from the amount of corporate tax,
- to deduct a part of the acquisition cost of high-tech R&D property from the amount of corporate tax, and
- to exempt from the custom duty on imported property for high-tech R&D

The first incentive of the above is institution that a certain percentage, e.g. 20%, of an increment in R&D expenses from the past highest amount can be deducted from the amount of corporate tax, provided that an amount of deduction should not exceed a certain percentage, e.g. 10%, on the corporate tax.

The second incentive of the above will provide deduction of a certain percentage, e.g. 10%, of acquisition cost for the high-tech R&D property from the amount of corporate tax in addition to the deduction by the first incentive. The upper limit of the corporate tax deduction should be set at a certain percentage of the amount of corporate tax before deductions, e.g. 15% for a total of the first and second incentives.

The third incentive is an exemption of the custom duty to be imposed on imported properties for the high-tech R&D.

#### (9) Promotion of the Industrial Property Right Protection

The following programs are proposed for protection of the industrial property right:

(a) Amendment of the Civil Code

The Civil Code stipulating protection of copy right is very much complicated and not covering all aspects of the protection of copy right. The stipulation of this part of the Civil Code should be reviewed and amended so that the content of the protection of copy right in Vietnam may be clearly understood and unnecessary confusion and misunderstanding may be avoided.

(b) Information service

A brochure briefing the outline of the protection of intellectual property in Vietnam should be prepared by the Government initiative. The brochure should cover all intellectual property including industrial property and copy right.

A public information system, to announce decision made by NOIP and the Copy Right Office, should be established. At this moment, decision made by NOIP is informed only at application and sometime such applications are not accepted by NOIP. An automatic disclosure system should be established in place of the current system. Same type of disclosure system should be established also for judicial decisions by courts concerning intellectual property.

(c) Reinforcement of execution power

Number of staff of NOIP was 104 according to the annual report of NOIP for 1996, and that of the Copy Right Office is currently less than 20. NOIP and the Copy Right Office are suffering chronic shortage of staff. The facility of these offices should be reinforced by increase of number of staff and provision of education and training to the staff. Training and education center should be established in the organization.

Unification of administration of intellectual property including industrial property and copy right, namely a merger of NOIP and the Copy Right Office, should be considered to strengthen the execution of the regulations for protection of the intellectual property. It should also be considered that execution of copy right for computer software be transferred from the current Copy Right Office to NOIP as another option for strengthening the execution power.

(d) Strict execution of regulation

It is observed that illegal copies and goods are flooding in Vietnam's market. The investigation and prosecution of producers of illegal copies and goods is very limited at this moment. The regulations for protection of intellectual property should be strictly executed by the responsible Governmental offices with the reinforcement of the administrative bodies for the protection of intellectual property.

Cooperation between Government offices and agencies, such as NOIP, the Copy Right Office, MOSTE, Ministry of Justice, Police, General Department of Custom and Market Control Department of Ministry of Trade, should be also further reinforced.

(10) Establishment of Organization for Technology Mediation

It is proposed that technology exchange markets that is mediating organization for exchanging high-tech and related information should be established, for the purpose of smooth technology exchange and technology transfer. The organization would be effective, under the circumstances that transferred technologies are localized and practical "home-made" technologies are developed in Vietnam.

A membership system should be applied for technology exchange market organization, being composed of regular members and qualified members. Regular members will exchange technology, while qualified members will work as mediator or technical consultants. Exchanged information will include information on buying and selling of industrial properties, partners for joint research works, product distribution channel, buying and selling of computer software, human resources, subcontracting, and industrial location.

(11) Industrial Standardization

Industrial standardization is an important program for promoting high-tech industry, although it does not have direct relation to promotion of high-tech R&D.

Quality management is backward and it is limited to only the stage of quality testing in Vietnam. Therefore, Vietnamese producers have a high percent defective, which leads to low competitiveness of their products. Modern concept of quality management should be diffused through the education of management followed by the spread of quality management to leading enterprises. Vietnam should prepare equipment for quality testing, metrology, and calibration in public institutes and laboratories, and also should support leading enterprises to prepare such equipment.

Test system for certification and accreditation is backward in Vietnam, therefore, it should be prepared.

Accuracy of national standard cannot be kept at the moment due to lack of equipment precision and unsatisfactory facilities. Requirement of calibration for oil industry, electric / electronic industries cannot be satisfied in terms of accuracy and capacity. It is necessary to prepare balances for mass calibration, general electric standard, and high capacity flow standard for petroleum for the time being. It is difficult to bring up engineers for metrology and calibration at the moment. Therefore, it should be considered to establish an organization for training these engineers.

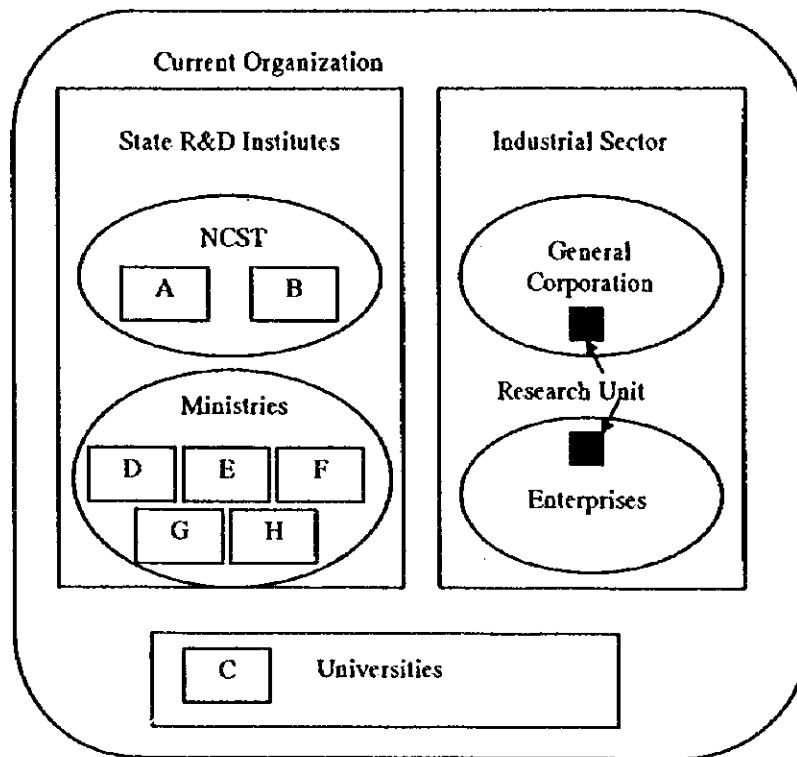
#### V.5.2 Priority Project

Establishment of the National High-tech R&D Center is proposed as a priority project for promotion of high-tech R&D as described on the next table.

It is necessary to found a committee on investigating the establishment of the National High-tech R&D Center in the first place to promote the project with a completion target of the year 2005. The committee should start investigation on significance of the establishment, organization, functions, scale, original R&D institutes to be integrated, and legal framework.

The committee should be made up of members who represent Ministries and Governmental organizations which currently control the state R&D institutes of high-tech fields such as electronics and information technology, machine and mechatronics, biotechnology, new materials and environmental technology and new energy, i.e., Ministry of Science, Technology and Environment (MOSTE), Ministry of Industry, Ministry of Agriculture, Ministry of Energy, Ministry of Education and Training, Ministry of Health, Department General of Posts and Telecommunications and NCST. Besides those members, a representative of Ministry of Planning and Investment should participate in the committee. It is suggested as an idea that Vice Prime Minister in charge of science, technology and education be assigned to a chairman of the committee and MOSTE be assigned for secretariat.

<p>The committee should be reorganized to a committee on preparation of the National High-tech R&amp;D Center to proceed the project, subject to decision that Vietnam would establish the center.</p>
<p><b>Project Name:</b> Establishment of the National High-tech R&amp;D Center (tentative name)</p>
<p><b>Objectives:</b> To promote high-tech R&amp;D by the effective use of Vietnamese resources of human and fund</p>
<p><b>Implementation Period :</b> The center should be established by the year 2005.</p>
<p><b>Outcomes :</b> Vietnamese high-tech R&amp;D institutes, which are mainly under NCST and Ministries, have sometime overlapped functions mutually. It is necessary to unify state R&amp;D institutes for high-tech which will solve the problems and promote R&amp;D by enabling to concentrate human and fund resources, make effective modernization of R&amp;D, diffuse the R&amp;D achievements, have information in common, make close interface and interaction mutually. This project is to establish the National High-tech R&amp;D Center (tentative name) as unified R&amp;D organization for high-tech, which will be the base of high-tech R&amp;D of Vietnam.</p>
<p><b>Major Activities :</b> Major activities of the National High-tech R&amp;D Center are as follows:</p> <ol style="list-style-type: none"> <li>1. <b>Function:</b> R&amp;D of high-tech field, including applied research, R&amp;D for industrial technology, localization of transferred technologies; technology transfer; diffusion of technology; education of researchers; international cooperative research; cooperative research with domestic and foreign enterprises; entrusted research; cooperative research with universities; sending Vietnamese researchers to overseas for research and training; inviting foreign researchers to Vietnam; sending and receiving information related to high-tech.</li> <li>2. <b>Fields of R&amp;D:</b> Information technology/electronics, machine/mechatronics, new material, biotechnology, environmental technology/new energy</li> <li>3. <b>Organization:</b> This center should be the same level as Ministries under direct control of the Government. The organizational structure consists of research institutes of various high-tech fields, and some departments such as administration, personnel, international cooperation and planning.</li> <li>4. <b>Employee:</b> Number of employee who will engage in R&amp;D works directly and indirectly is assumed to be approximately from 3,000 to 4,000.</li> <li>5. <b>Location:</b> The center should be located in the R&amp;D Zone of HHTP.</li> </ol>
<p><b>Implementation Body:</b> MOSTE and NCST</p>
<p><b>Rough Estimate of Investment:</b> Investment is estimated at the order of 500 million USD to 700 million USD , from investment for buildings with 210,000 to 280,000 m<sup>2</sup> of total floor area assuming 70 m<sup>2</sup> of floor area per researcher and investment of equipment assumed double to that of building.</p>
<p><b>Important Notice:</b> This project is proposed, assuming the HHTP project is realized.</p>

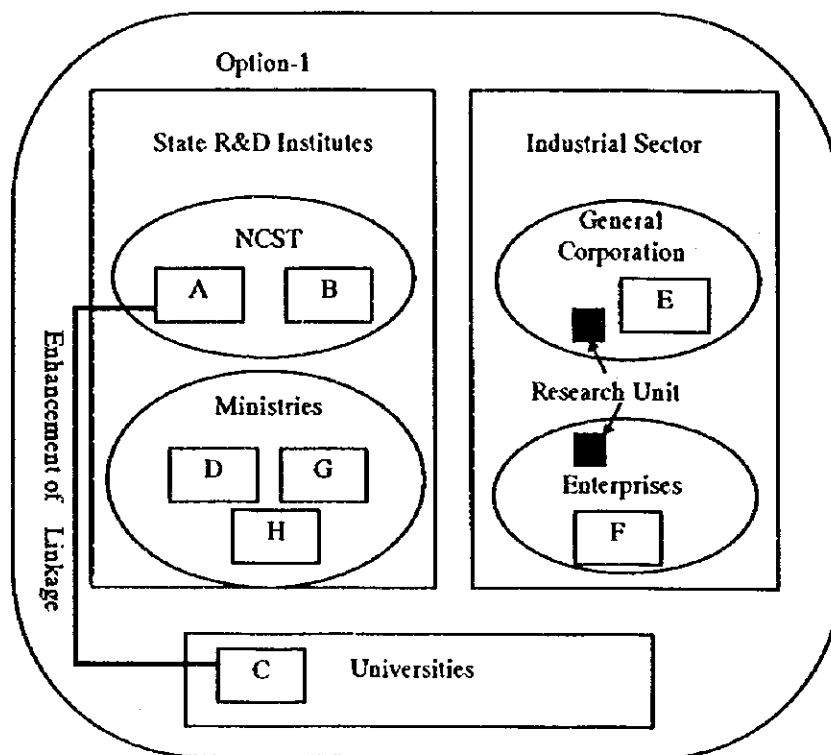


Characteristics and Function of R&D institutes

	Managing Body	Level	Field	Basic Research	Applied Research & Development	R&D for Industrial Technology	Tech. Transfer	Training Education
A	NCST	National	Natural Science	○	○			○
B	NCST	National	High-Tech		⊙			○
C	University	National	High-Tech	○	⊙	○		⊙
D	Ministries	National	High-Tech		○	⊙	(⊙)	(○)
E	Ministries	Subsector	Non High-Tech		○	⊙		(○)
F	Ministries	Enterprises	Non High-Tech		○	⊙		(○)
G	Ministries	National	Non High-Tech		○	⊙		
H	Ministries	National	Policy Research					

Note: ⊙ Main activities for R&D institutes      National: R&D for the whole Vietnam  
 ○ Activities of R&D institutes                      Subsector: R&D for the specific subsectors  
 (○) Activities of some R&D institutes              Enterprises: R&D for the specific enterprises

Figure V-5-1 R&D Organization for High-tech Promotion (Current Organization)

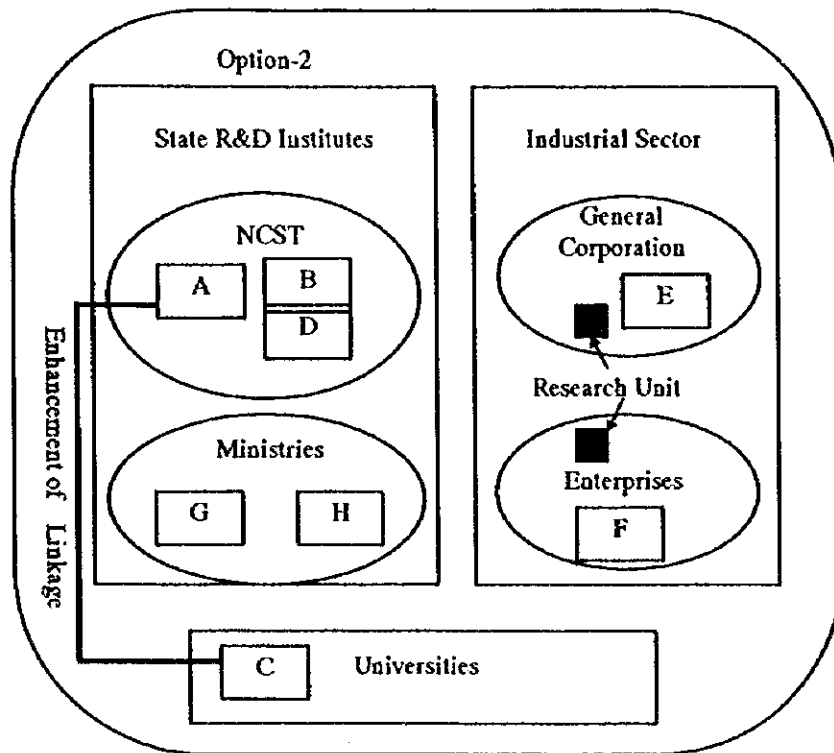


Characteristics and Function of R&D institutes

	Original Managing Body	New Managing Body	Level	Field	Basic Research	Applied Research & Development	R&D for Industrial Technology	Tech. Transfer	Training / Education
A	NCST	NCST	National	Natural Science	○	○			○
B	NCST	NCST	National	High-Tech		⊙			○
C	University	University	National	High-Tech	○	⊙	○		⊙
D	Ministries	Ministries	National	High-Tech		○	⊙	(⊙)	(○)
G	Ministries	Ministries	National	Non High-Tech		○	⊙		
H	Ministries	Ministries	National	Policy Research					
E	Ministries	General Corporation	Subsector	High-Tech					(○)
F	Ministries	Enterprises	Enterprises	High-Tech		○	⊙		(○)

Note: ⊙ Main activities for R&D institutes      National: R&D for the whole Vietnam  
 ○ Activities of R&D institutes      Subsector: R&D for the specific subsectors  
 (○) Activities of some R&D institutes      Enterprises: R&D for the specific enterprises

Figure V-5-2 R&D Organization for High-tech Promotion (Option-1)



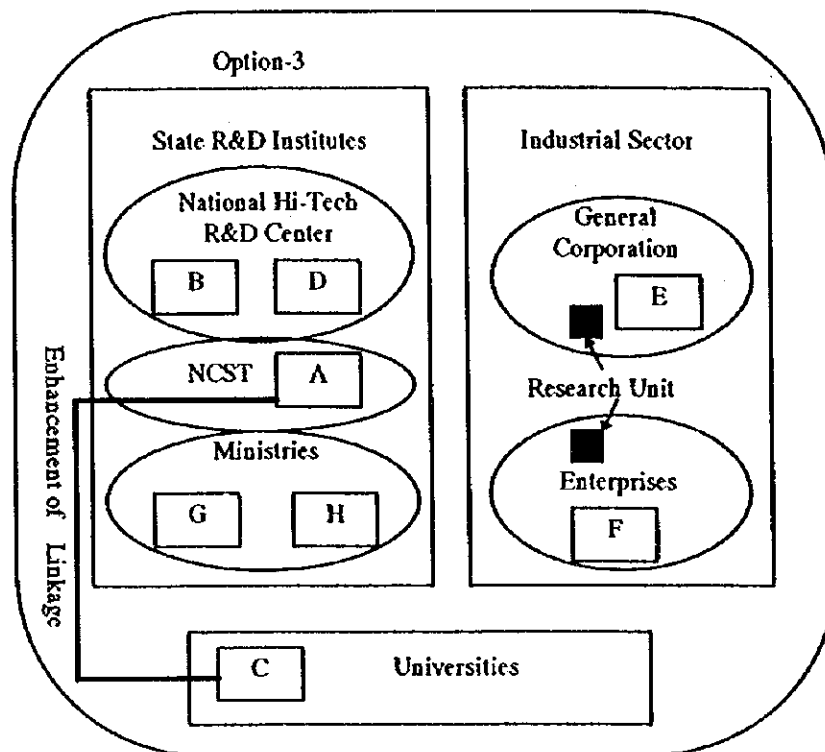
Characteristics and Function of R&D institutes

	Original Managing Body	New Managing Body	Level	Field	Basic Research	Applied Research & Development	R&D for Industrial Technology	Tech. Transfer	Training / Education
A	NCST	NCST	National	Natural Science	○	○			○
B	NCST	NCST	National	High-Tech		⊙			○
D	Ministries	NCST	National	High-Tech		○	⊙	(⊙)	(○)
C	University	University	National	High-Tech	○	⊙	○		⊙
G	Ministries	Ministries	National	Non High-Tech		○	⊙		
H	Ministries	Ministries	National	Policy-Research					
E	Ministries	General Corporation	Subsector	High-Tech		○	⊙		(○)
F	Ministries	Enterprises	Enterprises	High-Tech		○	⊙		(○)

Note: ⊙ Main activities for R&D institutes      National: R&D for the whole Vietnam  
 ○ Activities of R&D institutes      Subsector: R&D for the specific subsectors  
 (○) Activities of some R&D institutes      Enterprises: R&D for the specific enterprises

Figure V-5-3 R&D Organization for High-tech Promotion (Option-2)



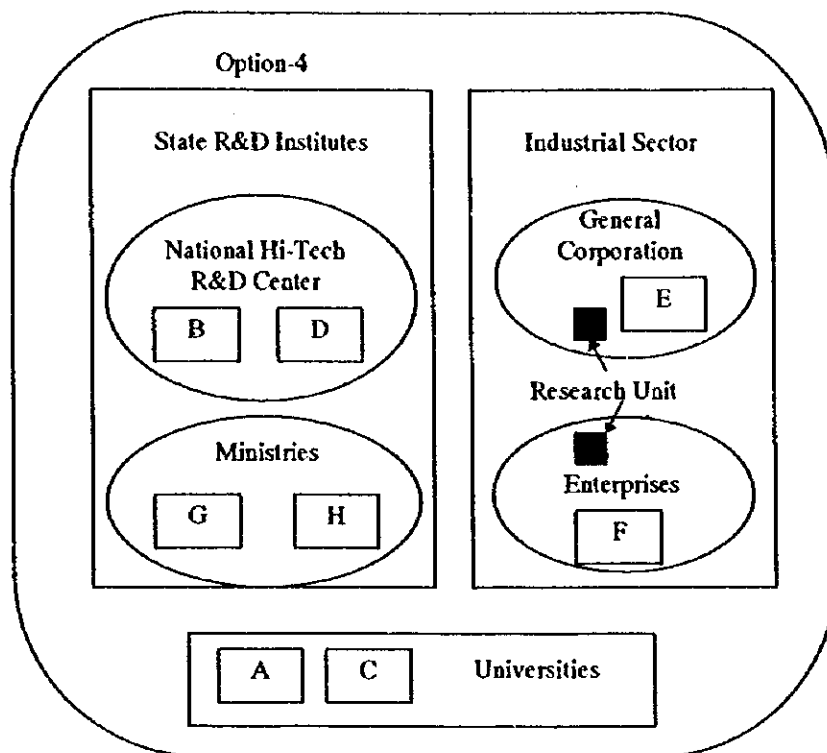


Characteristics and Function of R&D institutes

	Original Managing Body	New Managing Body	Level	Field	Basic Research	Applied Research & Development	R&D for Industrial Technology	Tech. Transfer	Training / Education
B	NCST	National High-Tech R&D Center	National	High-Tech		⊙			○
D	Ministries	National High-Tech R&D Center	National	High-Tech		○	⊙	(⊙)	(○)
A	NCST	NCST	National	Natural Science	○	○			○
C	University	University	National	High-Tech	○	⊙	○		⊙
G	Ministries	Ministries	National	Non High-Tech		○	⊙		
H	Ministries	Ministries	National	Policy-Research					
E	Ministries	General Corporation	Subsector	High-Tech		○	⊙		(○)
F	Ministries	Enterprises	Enterprises	High-Tech		○	⊙		(○)

Note: ⊙ Main activities for R&D institutes      National: R&D for the whole Vietnam  
 ○ Activities of R&D institutes                      Subsector: R&D for the specific subsectors  
 (○) Activities of some R&D institutes              Enterprises: R&D for the specific enterprises

Figure V-5-4 R&D Organization for High-tech Promotion (Option-3)

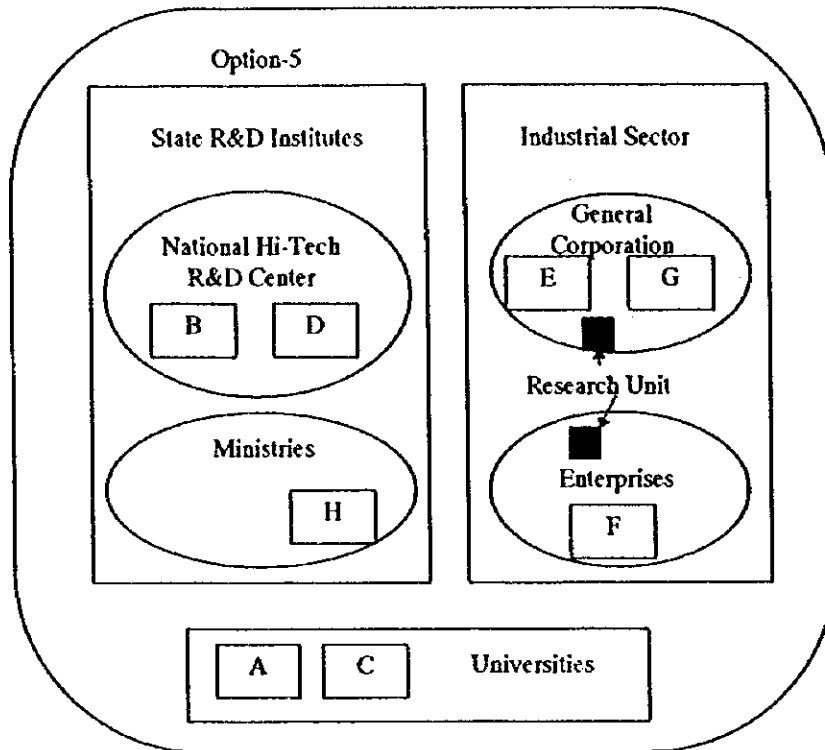


Characteristics and Function of R&D institutes

	Original Managing Body	New Managing Body	Level	Field	Basic Research	Applied Research & Development	R&D for Industrial Technology	Tech. Transfer	Training / Education
B	NCST	National High-Tech R&D Center	National	High-Tech		⊙			○
D	Ministries	National High-Tech R&D Center	National	High-Tech		○	⊙	(⊙)	(○)
A	NCST	University	National	Natural Science	○	○			○
C	University	University	National	High-Tech	○	⊙	○		⊙
G	Ministries	Ministries	National	Non High-Tech		○	⊙		
H	Ministries	Ministries	National	Policy-Research					
E	Ministries	General Corporation	Subsector	Non High-Tech					(○)
F	Ministries	Enterprises	Enterprises	Non High-Tech		○	⊙		(○)

Note: ⊙ Main activities for R&D institutes      National: R&D for the whole Vietnam  
 ○ Activities of R&D institutes                      Subsector: R&D for the specific subsectors  
 (○) Activities of some R&D institutes              Enterprises: R&D for the specific enterprises

Figure V-5-5 R&D Organization for High-tech Promotion (Option-4)



Characteristics and Function of R&D institutes

	Original Managing Body	New Managing Body	Level	Field	Basic Research	Applied Research & Development	R&D for Industrial Technology	Tech. Transfer	Training / Education
B	NCST	National High-Tech R&D Center	National	High-Tech		⊙			○
D	Ministries	National High-Tech R&D Center	National	High-Tech		○	⊙	(⊙)	(○)
A	NCST	University	National	Natural Science	○	○			○
C	University	University	National	High-Tech	○	⊙	○		⊙
H	Ministries	Ministries	National	Policy Research					
G	Ministries	General Corporation	National	Non High-Tech		○	⊙		
E	Ministries	General Corporation	Subsector	Non High-Tech		○	⊙		(○)
F	Ministries	Enterprises	Enterprises	Non High-Tech		○	⊙		(○)

Note: ⊙ Main activities for R&D institutes      National: R&D for the whole Vietnam  
 ○ Activities of R&D institutes      Subsector: R&D for the specific subsectors  
 (○) Activities of some R&D institutes      Enterprises: R&D for the specific enterprises

Figure V-5-6 R&D Organization for High-tech Promotion (Option-5)

## APPENDIX VI SELECTION OF HIGH-TECH INDUSTRY

### TABLE OF CONTENTS

	<u>Page</u>
VI.1 Method for Selection of High-Tech Sub-sectors.....	A-VI-1
VI.2 Prioritization of High-Tech Sub-sectors .....	A-VI-3
VI.3 Market Scale of Major High-Tech Products .....	A-VI-8

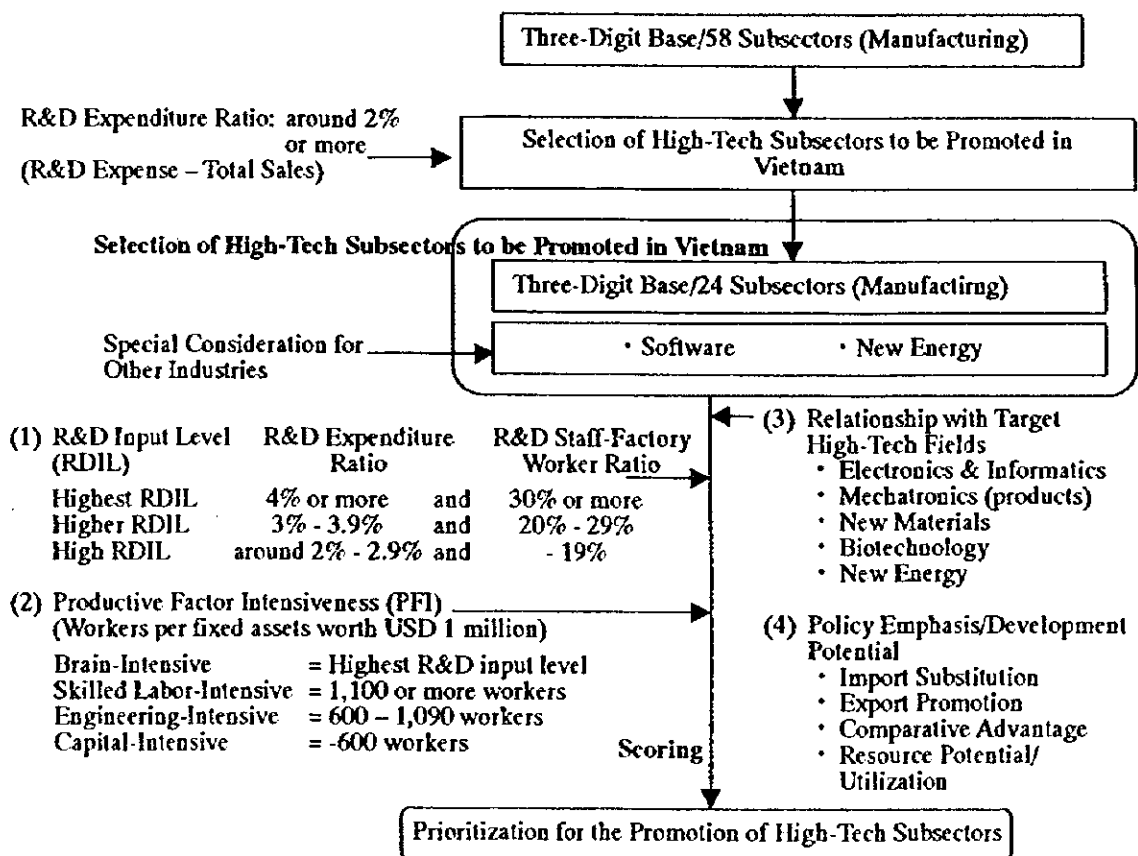


## APPENDIX VI SELECTION OF HIGH-TECH INDUSTRIES

### VI.1 Method for Selection of High-Tech Sub-sectors

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.

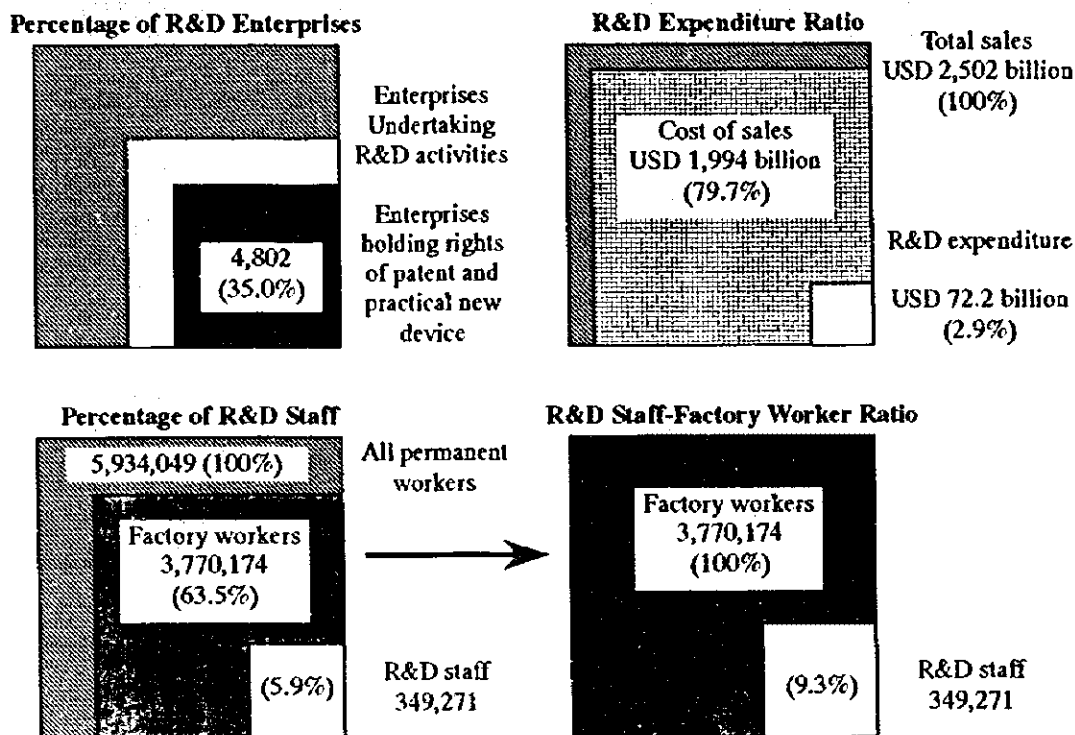
#### Selection of High-tech Sub-sectors to be Promoted and their Prioritization



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 factory workers.

Outline of R&D Activities by the Enterprises in Japan (from April 1994 to March 1995)



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)

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%. 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.

## VI.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 3-4-1. 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 of 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 herb for pharmaceuticals and natural gas for chemical fertilizers.

#### Scoring of indicators by sub-sector and prioritization

The table on next page shows the method of scoring the indicators mentioned previously to prioritize the high-tech sub-sectors and clarifies considerations on the point allocation for the scoring.

The weighted points are set up to total 100 points; 40 points weighted with four times for the policy emphasis and development potential, and 20 points weighted with two times for three other items/indicators, respectively. The points are allocated according to the differences among the indicators but they are half in a "strong" case as much as that in a "stronger" case. Scoring the sub-sectors such as industries of software and new energy is also done by referring to the data of manufacturing sub-sector with its attributes similar to them.

## Prioritization of High-Tech Sub-sectors and an Example of its Calculation

Level/Category	Original Allocation			Ex. Pharmaceuticals			(Comment for Considerations)
	(1) Po- int	(2) Wei- ght	(3) Score (1*2)	(1) Po- int	(2) Wei- ght	(3) Score (1*2)	
<b>R&amp;D Input Level (RDIL)</b>							
• Highest RDIL/Level-1 (L-1)	10	2	20	10	2	20	• Only one item is applicable to one industry • Points are allocated corresponding to the level but difference between points is limited based on the smallest or 5.
• Higher RDIL/Level-2 (L-2)	8	2	16				
• High RDIL/Level-3 (L-3)	5	2	10			20	
<b>Productive Factor Intensiveness (PFI)</b>							
• Brain-Intensive	4	2	8	4	2	8	• Only one item is applicable to one industry • Points are allocated to balance RDIL above and take into account the industry's possible development stage in Vietnam.
• Skilled Labor-Intensive	10	2	20				
• Engineering-Intensive	8	2	16				
• Capital-Intensive	2	2	4			8	
<b>Relationship with Target Hi-Tech Fields</b>							
• Electronics & Informatics: stronger	3	2	6				• It could be that all items are applicable to one industry, and therefore the total score should be equal to the sum that point of each five items times the weight. • Points are allocated corresponding to the potential market or growth potential.
• Mechatronics (products): stronger	2	2	4				
• New Materials: stronger	1	2	2				
• Biotechnology: stronger	3	2	6	1.5	2	3	
• New Energy: stronger (Every point is in "strong" case is half as much as that in "stronger" case.)	1	2	2			20	
<b>Policy Emphasis/Development Potential</b>							
• Import Substitution: stronger	2	4	8	2	4	8	• It could be that all items are applicable to one industry like the above case. • Points are allocated corresponding to the degree of emphasis/potential
• Export Promotion: stronger	3	4	12	1.5	4	6	
• Comparative Advantage: stronger	3	4	12	1.5	4	6	
• Resource Potential/Utilization: stronger (Every point is in "strong" case is half as much as that in "stronger" case.)	2	4	8	1.5	4	6	
Total Score			100			57	57

This scoring method is adopted so as to be easily traced, while ensuring its objectivity. Software industry gets the highest aggregated score of 60 points, followed by electronic parts/devices and optical equipment with 58 points as shown in Table 3-4-2. The high-tech sub-sectors are prioritized according to the points; sub-sectors with more than 50 points for priority 1, 36 to 49 points for priority 2, and less than 35 points for priority 3.

### Summary Conclusion

The sub-sectors ranked "priority 1" is of the first importance in the high-tech promotion of 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 fibers and steels produced by an integrated blast furnace might be less competitive within the globalizing economy.

Selection of the high-tech sub-sectors done so far could not cover all the high-tech industries due mainly to the limitation which stems from the data and quantitative analysis used for the selection. Food industry using biotechnology and new ceramics industry have not been selected to be in the high-tech sub-sector since their R&D expenditure ratios are less than 2% which is the criterion for selecting the high-tech sub-sectors. Despite these limitations, this selection work may appropriately direct the high-tech promotion in Vietnam.

### VI.3 Market Scale of Major High-Tech Products

The prediction of market scale of 'high-tech product' is difficult since the new products are supplied day by day and drive the ordinary goods out of the market. It is doubtful today's high-tech products will be the tomorrow's ones. The prediction of high-tech products referred here were done by the Japanese Government through the Delphi Method in 1991. The prediction procedure is summarized as follows;

- 1) Taxonomy of future technology and products which will be realized up to 2010,
- 2) Selection of technology and products from each categories based on the effect to the industries and economy,
- 3) Analysis of the possibility and year of realization and the potentials, and
- 4) Prediction of market scale.

The selected high-tech and high-tech products (realized up to 2010) in this study are summarized as follows.

- Information & Microelectronics terabit memory, super conductive device, super intelligent chip, terabit optical device, bio sensor, artificial translation system, virtual reality system, automaton data base system, etc.
- New Material ceramic gas turbine, new glass, amorphous alloy, engineering plastics, compound materials (metal, ceramics), etc.
- Life Science pharmaceutical (cancer, anti-virus dementia), artificial viscera, etc.
- Energy fuel battery, super efficient heat pump, super conductive electric storage system, etc.

- Automation intelligent robot, micro-machine, AI CNC, super precise machine tools, concurrent engineering, etc.
- Telecommunication mobile telecommunication equipment, satellite data network, TV conference system, TV telephone, Optical LAN, etc.
- Transportation super conductive liner motor car, ATC system, new generation automobile, etc.
- Space-use related Technology <omission>
- Environment CO2 fixing technology, etc.

The prediction was conducted by questionnaire survey to experts of each categories. The market volume is considered as the output from Japan, therefore the total market scale of the World shall be several times of these figures.

#### Market Size of Major High-Tech Categories

High-Tech Categories	Output (billion yen/ year)
• Information & Microelectronics (IT)	8,000
• Telecommunication (IT)	2,080
• Automation (Mechatronics)	216
• Transportation (Mechatronics)	5,130
• Life Science (Bio Technology)	-
• New Material	1,767
• Energy	620
• Environment	930

Note: Terminology in parenthesis is used the Study Team. Output is summing up the high-tech products which are expected to be realized till 2010.

Source: "Technology forecast in 2010, the evaluation of social & economic impact by the future technologies", 1991, Economic Planning Agency, Japan.











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