

**STI OUTLOOK 2002 – COUNTRY RESPONSE TO POLICY QUESTIONNAIRE****JAPAN****1. General framework and trends in science, technology, and industry policy****1.1. Overview and assessment of policies for science, technology, and industry***Reorganization of the central government*

To strengthen the administrative leadership of the Cabinet and Prime Minister, the Council for Science and Technology Policy (CSTP) was established within the Cabinet Office on 6 January 2001. This council discusses comprehensive national measures and other issues concerning science and technology and reports to Prime Minister.

Main missions of CSTP:

- Acting as a control tower of S&T under the Prime Minister's leadership.
- Steering S&T with foresight and mobility.
- Integrating natural S&T and social sciences/humanities while holding views to the world.
- Establishment of ethics on S&T.

This reorganization also brought the merger of ministries to strengthen and gain efficiency of the Japan's S&T administrative system. For example, the Ministry of Education, Science, Sports and Culture and the Science and Technology Agency was merged into the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and promotes the S&T integrated strategic research by national research institutions with basic research by universities.

In addition, flexible R&D system is required to keep up with the rapid change of technological innovation. At 1<sup>st</sup> April 2001, many national institutions changed their status to independent administrative institutions, which get more flexible financial, organizational and personal management to be able to make efficient and effective investment in promising research fields and to response ever-changing technological needs.

*Second Science and Technology Policy (<http://www8.cao.go.jp/cstp/english/s&tmain-e.html>).*

The Science and Technology Basic Law enforced on November 1995 gives nations a responsibility for formulating and implementing comprehensive policies with regard to the promotion of S&T.

Based on this law, considering the circumstances around S&T, examining the achievements and problems of the first S&T Basic Plan adopted in July 1996 covering for FY1996 to FY2000, the second Science and Technology Basic Plan was approved by the Cabinet on March 30, 2001.

(1) The assessment of the first Basic Plan is following.

- As for providing competitive and flexible R&D environments.
- Competitive research funds were nearly doubled and funds for young researchers were increased substantially. The 10 000 researchers-support-plan was achieved in number in the force year and enriched young generation to activate R&D fields but difficulty in job hunting after post-doctoral period still exists.
- Mobility of human resources, despite the system innovation such as in fixed-term appointment and relaxation of civil servant's side-employment for industry-academia-government co-operation, had not been improved entirely.
- As for R&D evaluation
- The earnest evaluations of research institutes and research themes have been introduced and universities were obligated to have self-evaluation.
- Reflection of evaluation to resource allocation/personnel changes and transparency of evaluation process have not been considered sufficiently.
- As for encouraging industry-academia-government co-operation.
- Some systems, such as adoption of national institutes' research consigned by private company and patent rights for consignment research results, were reformed and national institutions were restructured in aiming to apply and commercialize the R&D results. Consequently the numbers of patent application by national research institutes and public-private joint research have been increasing steadily, and technology licensing offices to connect these patents with industry have become active all around Japan. Also a law was revised to promote joint-research facilities in national university.

(2) Basic Policies

Taking into consideration the assessment above, to realize the vision for establishing Japan based on creativity of science and technology, following three policies are adopted.

- Strategic priority setting in science and technology.
- S&T system reform to create excellent achievement.
- Globalisation of S&T activities.

Strategic priority setting in science and technology

In order to achieve sustainable economic development by activating industry and to secure people's comfortable and safe life, Japan must promote R&D through positive and strategic investment in prioritised areas. Policies of priority setting is to be set on, among S&T fields to attain the vision of Japan, as follows:

- Creating knowledge that will be the source of new developments (intellectual assets enhancement)
- Promoting sustainable growth in world markets, improving industrial technologies, and creating new industries, and employment (economic effects)
- Improving people's health and quality of life, enhancing national security or disaster prevention (societal benefits)

And to grant priority on four areas:

- Life sciences — which contributes to prevent/treat disease in aging and low-birth-rate society and to resolve food shortage.
- Information and telecommunications — which are advancing rapidly, and lead directly building advanced IT network society and fostering an IT industry and a high-tech industry.
- Environmental sciences — which are indispensable for human health care and conservation of people's living as well as sustainment of human existence.
- Nanotechnology and materials — which can disseminate into a broad range of fields, and keep bring Japan at an advantage and to allocate R&D resources intensively.

#### S&T system reforms to create and utilise excellent results

S&T system is a mechanism in which resources are invested on the basis of social understanding/agreement, human resources are developed, necessary infrastructure is constructed, R&D is activated, and its achievement is enjoyed by the society. Therefore the system consists of R&D system, training of personnel relating to S&T, maintenance of facilities for promoting S&T, and also interface to industry and society.

In order to upgrade S&T activities and to accelerate restoration to society, Japan will reform the S&T system, while expanding the investment, as followings: enriching human resources and infrastructure, conducting high-quality R&D, generating the achievement at the world's highest level, offering it to industry and society, and explaining these activities to the public on its responsibility.

#### + R&D system reform

- Doubling competitive research funds and introducing 30% of indirect cost.
- Improving mobility of human resources by encouraging fixed-term appointment and apply-and-review basis recruit.
- Encouraging young researchers to be independent by enlarging special funds and changing conditions for associate professors and research assistants

- Reforming evaluation system by introducing new guidelines and reflecting on resources allocation
- Allowing flexible expenditures and performance in R&D activities
- Providing a wide variety of carrier-path and improving conditions for foreign researchers and female researchers

+ Strengthening of comprehensiveness in industrial technology and system reform of industry-academia-government co-operation

- Cultivating human resources to promote industry-academia-government co-operation and maintaining a database of research activities and researchers.
- Promoting industrialisation utilising achievement of governmental institutes through technology transfer with exclusive and transferable patent system
- Improving conditions for S&T promotion in local areas forming “intellectual clusters”

+ Human resources development and S&T education reform

- Innovating universities to be an international standard by fostering excellent scientists and engineers with creativity, originality, practice-ability and a broad outlook.
- Evaluating universities by themselves as well as by experts outside and opening the results to public.

+ Arrangement on infrastructure for S&T promotion

- Building and improving facilities of universities putting the highest priority with an arrangement plan.
- For support to research institutes, securing exclusive support in each laboratory by employing necessary staff members and investing intensive utilities in the institute for common or specialised purpose.
- Maintaining techno-infrastructure systematically and strategically, such as R&D materials, standards, equipment and database.
- Providing research information basis with highly advanced LAN and information network.
- Improving systems on intellectual property rights and to encourage international standardisation.
- Establishing manufacturing basis, such as to cultivate skill full experts and to make a database of success-and-failure samples.
- Promoting activity of academic societies.

### Globalization of S&T activities

The government globalises Japan's S&T activities, assembling world-class researchers and information into Japan, to create excellent R&D results and to solve global problems confronting human beings. To overcome alarming that excellent researchers and private research funds have drained away from Japan in recent years, it is necessary to establish brilliant research environments that is open and fascinating for first-class researchers in the world to gather in.

- Proposing and conducting international co-operative projects (for global-scale issues and international joint activities on fundamental research.
- Enhancing dissemination of information to the world.
- Globalising domestic R&D circumstances.

### ***1.2. Features and changes in the nature and process of policy evaluation***

An appropriate evaluation is essential to realize the competitive and open research circumstance and to distribute resource with priority and efficiency. Based on the first Science and Technology Plan, the National Guideline on the Method of Evaluation for Government R&D was decided in August 1997 and carries out the full-scale evaluation.

As for national universities, at 1999, it is obliged to do self-evaluation and to make public its results and required to examine the results by externals. In addition, National Institution for Academic Degrees reorganized as a new body in April 2000, to be allowed to implement works as a national organization for university evaluation, to carry out more reliable evaluations based on the professional and objective judgments by the third party. The institution evaluates national universities, National Education and Research Institutions, and the public universities, which are requested by their founders, and evaluation work has undertook following three areas:

1. University-wide thematic evaluation
2. Evaluation of educational activities in each academic field
3. Evaluation of research activities in each academic field

Since FY2000 to FY2002, it is preparatory phase and from FY2003, NIAD will evaluate all national universities in all fields regularly. (<http://www.niad.ac.jp/english/index.htm>).

However, second Science and Technology Basic Plan says that it is insufficient that reflection of evaluation to resource allocation/personnel changes and transparency of evaluation process and it is necessary to increase feasibility of evaluation.

To improve these problems, the National Guideline on the Method of Evaluation for Government R&D was revised in November 2001. The main direction of this reform of evaluation system:

- Ensuring fairness and transparency of evaluation.
- Reflecting evaluation results to resource allocation.
- Ensuring necessary resource for evaluation and establishing evaluation system.

This guideline has implemented integrated with the policy evaluation systems and coordination of government-wide policy which start since January 2001 to be conducted to ascertain the necessity, efficiency, effectiveness, fairness, and priority of policy that each of the Cabinet Office and Ministries takes upon and evaluation of Independent Administrative Institutions.

## **2. Public sector research and public research organisations**

### **2.1. Policy changes and background/rationale related to public sector R&D**

To realize the policy in second S&T Basic Policy, following changes is

- Increasing competitive funding for the R&D to attempt to double the amount of it.
- Putting the grant priority on four areas as life sciences, information and telecommunications environmental sciences, nanotechnology and materials.

To make government R&D more efficient and effective, the institution for university evaluation was established and the National Guideline on the Method of Evaluation for Government R&D was revised in November 2001.

### **2.2. Initiatives to reform the organisation and governance of universities and public research organisations**

To make efficient and effective investment in promising research fields and to response economic growth and other social needs, many national institutions changed their status to independent administrative institutions (IAIs) at April 2001, and university has been also examined as a direction of changing their status to IAIs.

National Institute of Advanced Industrial Science and Technology (AIST), which had been a group of 16 organisations in MITI, was reorganised as a single independent administrative institute in April 2001. The reform formed a part of the Japanese central government agencies reformation. The new AIST is the Japan's largest public research organisation with about 3 200 employees and whose budget for FY 2001 is about 85 billion Yen.

National Institute of Advanced Industrial Science and Technology Independent Administrative Organisation Law defines the mission of AIST: 1) research and development for industrial science and technology, 2) geological survey, 3) measurement standards, and 4) technological application to private sectors.

The system of an independent administrative institute is as follows: The competent minister of an institute determines a term of three to five years and set up a mid-term goal regarding, for example, efficiency of business management. Based on the goal, the president of the institute establishes mid-term plan and have it approved by the competent minister. The institute runs its business based on the mid-term goal and the mid-term plan. During the process of the business of the institute, the competent minister keeps his/her involvement to the least. The independent administrative institute gets national grant but whose spending is not controlled by the government. Also, the institute increases ratio of other funding source such as competitive funding and business investment. Hence, autonomy and independence of the institute are enhanced. At the same time, its business performance is strictly assessed according to the mid-term plan.

The Law of General Rule for Independent Administrative Organisation compels the ministries to establish an assessment committee for independent administrative institutes in its competence. The member of such committee are chosen from outside of the ministry.

To realise advantages of the independent administrative institute system and increase flexibility of the institute, the institute is taking the following measures:

- Enhance flexibility of personnel management
  - Concentrate researchers to strategically focused areas
  - Establish new system to give preferential treatment to superior researchers and to treat young researchers.
- Enhance flexibility of organisational management
  - Boost harmonised research across sections or trans-sectional research.
- Enhance flexibility of budget and property management
  - Promote interchange of research with outside agencies and slim down business related to overhead costs.

c.f. AIST English Home Page [http://www.aist.go.jp/index\\_en.html](http://www.aist.go.jp/index_en.html)

### **3. Government support for private-sector R&D and innovation**

#### ***3.1. Changes to enhance the effectiveness of policy instruments used to provide public support for private sector R&D and innovation***

##### *Tax Incentive*

Since FY 1999, modified tax incentive, "Tax Deduction Programs on Experimental and Research Expense Increments" has been enforced. The modification aimed to cope with the decline of the private R&D funding by increasing the number of applicable companies and to enhance incentives of private companies to fund their R&D. By the deduction program, when a corporation's expenses (calculated as losses on the income ledger sheet) for research and development in an applicable fiscal year exceed the average value of the three years with the highest R&D expenses within the most recent five-year period (but limited to when they exceed the value of R&D expenses incurred in the next-to-last operating fiscal year and the last operating fiscal year), a value equivalent to 15% of that marginal value is exempted from tax (but limited to 12% equivalent of corporate tax [but calculated at 15% equivalent of support expenses when special R&D expenses which are spent for joint R&D with national institutes exist, and limited to 14% equivalent of corporate tax.]). The same is applied for individual business.

According to the National Tax Agency, the total reduction amount was 41 billion Yen in FY 2001, increased from 38 billion Yen of FY 2000.

*More Competitive Selection*

Based on the Science and Technology Basic Plan, the government focuses its R&D spending to the targeted area. The government clarifies policy goals to be achieved through R&D when it enforces its R&D plan. Also, the government categorises similar R&D projects to make them more effective and efficient.

**4. Enhancing collaboration and networking among innovating organizations**

**4.1. Initiatives to promote collaboration and networking among innovating organisations**

- Initiatives to strengthen regional/local innovation systems

By the FY2002 budget, MEXT will start the new program to create innovative clusters at the selected about 10 regions with big potentiality. The cluster has universities and public research institutions, which is a center of it, and many research institutions and R&D companies and operate with attaching importance to the independence of regional government.

The concrete measurement is to carry out co-operative researches among industry, academic and government based on the needs of the industry to create new technology, arrange the co-ordinator and patent attorneys, promote to make patenting of research achievements at the Centers for Co-operative Research at universities as centers of the innovative clusters.

- Efforts to boost collaborative research through public/private partnerships in R&D.

MEXT began establishing Centers for Cooperative Research in national universities to promote collaborative research in 1987. As of 2001, there are 61 centers.

**4.2. Initiatives to promote stronger industry-science relations**

The Law for Promoting University-Industry Technology Transfer (enforced in August, 1998) helps the establishment of TLOs (Technology Licensing Organisations) that handle obtaining patents, marketing, and licensing on behalf of university researchers. 23 TLOs have been approved with government support as of November 2001.

National and local government facilitate the acceptance of funds from the private sector to national and public universities since F.Y.2000. (*e.g.* collaborative research can be implemented based on the 'long term contract' over one fiscal year.)

Dual assignment for researchers of national university or national research institute to the directorship of private enterprises that aims to commercialize their research results, is allowed owing to the adjustment of the regulation of the National Personnel Authority, under the Government Officials Act, since F.Y.2000.

In May 2001, the Minister of Economy, Trade and Industry, Minister Hiranuma, launched an initiative, "the Plan for the Creation of New Markets and New Jobs" or "Hiranuma Plan". The plan aspires to establish one thousand venture companies derived from universities within three years and to increase the number of intellectual property rights granted to universities by tenfold within a decade. To that aim, the plan advocates improvement of the foundation for innovation by promoting competition among university

researches, by reorganising management of universities and by encouraging strategic technology transfer from academics to industry.

The Ministry of Economy, Trade and Industry establishes various policies to achieve the aim of the plan. For example:

- Encourage commercialisation of university research results by supporting co-operation between industry and academics.
- Support incubators who sponsors venture business derived from universities.
- Promote establishment of venture capital for ventures derived from universities.
- Support business to let post-doctoral researchers work in venture companies or other practical business.

*c.f.* METI HP for the Hiranuma Plan <http://www.meti.go.jp/english/information/data/cPlan010525e.html>

## **5. S&T human resources**

### ***5.2. Changes in training and education programmes for scientists and engineers***

In order to foster human resources supporting science and technology activity in Japan and to promote public understanding of science and technology, it is essential to enhance the nation interests in science and technology and to enrich the learning opportunity further for raising scientific intellectual curiosities and creativities on science and technology. However, in Japan, " youth's disinterest in science and technology " has been pointed out, and it has been important to take counter measure. To figure out these serious concerns, three measures are mainly taken as follows.

First, National Museum of Emerging Science and Innovation, which opened on July 2001, is to be the national science center to develop and practice new methods for innovative exhibits and hand-on experiments about cutting-edge technologies to wipe out the negative image people have that such advanced technologies are too difficult to understand. This Museum also plays the distribution centers of information on various activities involved with science and technology for promoting public awareness of science and technology and fostering human resources, such as lectures by famous researchers.

Second, International Robot Games Festival (RoboFesta) where participants can understand the importance of coexistence of humankind and technology, can become more familiar with technology, and can experience the excitement of science and technology through robot competitions, exhibitions and forums, was held in 2001.

Third, Rika-e Initiative is a program for science and technology education and improvement of public science and technology literacy with digitalised learning materials, which is called Honmono Contents. These Contents, which will be distributed to schools nation-wide through the Internet, are being developed by using state-of-the-art and latest research outputs such as simulation programs and various observation data from research institutes, universities and so forth.

## **6. International co-operation and globalisation**

### ***6.1. Initiatives to promote international co-operation in science, technology and innovation***

In the S&T Basic Plan, it is said that globalisation of domestic research environments should be advanced by the way of promotion of international researchers exchange programs such as fellowship program for young researchers to research in foreign country. MEXT promotes such an international scientific exchange program for both universities and public research institutions through Japan Society for the Promotion of Science (JSPS). Activities of JSPS include not only personnel exchange but also exchange program such as Core University Program. Please see <http://www.jsps.go.jp/e-home.htm> for more information.

### ***6.2. Policies and programmes to foster international collaboration in research and development***

In the S&T Basic Plan, concerning basic researches those require international cooperation, it is said that international projects should be proposed to the world from our country, and achievement attained from these projects should be returned to the world to solve global problems.

Along with it, for instance, Japan Science and Technology Corporation (JST) has conducted International Cooperative Research Project (ICORP) since 1989 as a series of basic researches conducted jointly with foreign research organizations in order to develop the seeds of innovative science and technology by integrating the advanced research activities of Japan and of other countries concerned, contribute internationally by fostering broad public dissemination of the knowledge gained from such research, and promote research exchange between Japan and other countries, thereby promoting science and technology.

For more details including on-going and past project list, please see <http://www.jst.go.jp/inter/icorp-e.html>.