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SCIENCE BULLETIN

National Science Council
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Report on Administrative Results of the NSC for Fiscal Year 1991

I. Actively Promote Nationwide Sci-tech Development

A. Carry out the "Ten-Year Plan for Sci-tech Development"

The Ten-Year Plan for Sci-tech Development includes twelve strategic mid-term plans in three areas: (1) promoting economic development: information technology, energy science and technology, material science, production automation, electro-optic technology, and biotechnology; (2) improving public welfare: hepatitis control, food science, environmental protection, and disaster mitigation; and (3) raising the level of academic research: synchrotron radiation and oceanography. In accordance with this plan and the Plan to Encourage Private Industry Participation in Sci-tech Research and Development, all government ministries and agencies have drawn up respective annual plans to help make the Ten-Year Plan a reality.

B. Approve, oversee, and evaluate important government sci-tech projects

The approval, control, and evaluation of government sci-tech R&D projects is currently carried out on two levels: the Executive Yuan and the division in charge of the project. The NSC has been appointed to carry out these tasks on behalf of the Executive Yuan. Two hundred fifteen project proposals (204 under the central government and 11 under the provincial government) have been evaluated by the NSC for fiscal year 1992. Proposed funding for these projects exceeds NT$19.9 billion. A total of 52 applications for the purchase of sci-tech instruments.

In addition, the NSC is responsible for 27 projects which receive funding directly from the central budget.

C. Hold the Fourth National Conference on Science and Technology

The Fourth National Conference on Science and Technology was held from January 21 to 25. The main purposes of the conference were to draw up a six-year national sci-tech development plan, revise the mid- and long-term sci-tech development plans, and breakthrough the current development bottleneck to move into the 21st century. The five central topics of discussion were: (1) actively improve the R&D environment, (2) raise the level of basic research, (3) use R&D to raise the level of industrial technology, (4) promote essential sci-tech development in all fields, and (5) balance the humanities and social sciences with sci-tech development based on their mutual effects.

This conference has created a greater understanding of the direction, policy, and essentials of current and future sci-tech development in the R.O.C. Important conclusions gathered from discussions at the conference will be an important reference in promoting sci-tech development down the road.

D. Draw up the six- and twelve-year sci-tech development plans of the R.O.C.

At the close of the Fourth National Conference on Science and Technology, the Executive Yuan instructed all relevant government bodies to coordinate with the NSC in revising the Ten-Year Sci-tech Development Plan (covering 1986 to 1995) based on important conclusions from the conference and on long-term development prospects and in extending the ten-year plan to a more strategic twelve-year plan (from 1991 to 2002). In order to allow sci-tech development and economic development to progress in step with each other, a six-year, mid-term plan for sci-tech development has been drawn up to coincide with the Six-Year Plan for Economic Development.

Once the six- and twelve-year plans have been approved by the Executive Yuan, the NSC will be in charge of promoting and coordinating the plans. All relevant government bodies will make appropriate plans according to fiscal budget constraints. During implementation of the plans, the NSC will conduct follow up evaluations on a seasonal basis and in-depth reviews on a semi-annual basis in order to effectively promote the plans.

E. Strengthen development of sci-tech research in new frontiers

Oceanography and aerospace science and technology are sci-tech disciplines which develop new frontiers. These fields have gained importance worldwide. In addition to continuing to promote basic research in oceanography, new research equipment – a small observation research vessel and an underwater work chamber – are planned to help strengthen domestic strength in developing new ocean sci-tech resources. The R.O.C. is also prepared to participate in "Experiments on Worldwide Ocean Currents" and "Observations of the Kuroshio", both large-scale international projects.

In addition, the Executive Yuan has approved the formation of a "Task Force for the Promotion and Guidance of Aerospace Science and Technology" to supervise the promotion and execution of aerospace sci-tech R&D projects. In 1991, sev-

eral project proposals were approved: "The Construction of an Earth Resources Satellite Ground Station", "Basic Research on 14 Special Topics in Aerospace Science and Technology", and "Cultivating Domestic and Foreign Personnel". It is hoped that these projects will encourage academic and industrial research organizations to participate in aerospace sci-tech R&D so that a foundation of information can be gradually laid down and personnel can be cultivated to participate in future satellite design and control so as to build a strong base in aerospace sci-tech development.

F. Promote electro-optic sci-tech development

Fiscal year 1991 saw the continuation of stage II of the "Plan for the Development of Electro-optic Science and Technology and Industry in the R.O.C.". The plan is to help domestic electro-optic manufacturers to establish key electro-optic product R&D and production capabilities. Academia, research organizations and private industry are drawn together to work on establishing an up-, mid-, and downstream research system to develop optical telecommunications and surface emitted laser diode. Two other projects to help traditional industry to be able to utilize electro-optic technology to increase product value are "Electro-optic Market and Technology Information Service" and "Analysis of Electro-optic Science and Technology and Industrial Trends". These projects will help accelerate industrial quality and therefore production competitiveness.

G. Promote regional optimization of sci-tech resources and plan the establishment of a Science City in Hsinchu

To be of use, research results must find their way from academic and other research organizations to industry. "Industrial Sci-tech Resource Optimization Communities" are being actively promoted to coordinate special regional characteristics and local resources to unite nearby industry, research organizations, and educational institutes. A trial community is already working in the Taoyuan area and results show promise. A trial community is scheduled to begin operation in Yunlin during fiscal year 1991. The program will be further extended into Changhua in the central region. These communities will also coordinate with other government programs such as the "Regional Technology Service Centers" promoted by the Ministry of Economic Affairs in order to accelerate regional industry development and to make industry more technology intensive.

The Hsinchu area is rich in research resources and industrial potential. In order to optimize this potential, the central and local governments have combined forces with private groups to help develop hi-tech industry through the establishment of a Science City. This city will unite sci-tech development and cultural resources in a modern, international arena for sci-tech exchange. After the "Feasibility Study of and Plan for a Science City in Hsinchu" was completed and approved by the Executive Yuan, a Planning Advisory Task Force was convened in February of this year and planning work has been proceeding rapidly.

II. Support Academic Research

In fiscal year 1991, government expenditure for the promotion of sci-tech research and development amounted to NT$6.16 billion, which is an increase of NT$1.66 billion (20.9%) over the previous year. The promotion of overall sci-tech development was allocated NT$45 million, or 7.4% of the total, while support for academic research was allocated NT$5.74 billion, or the remaining 92.6%. Support for academic research is broken down into four categories: research on special topics; cultivating, recruiting, and awarding sci-tech personnel; improving the sci-tech research environment; and strengthening international sci-tech cooperation. Detailed funding allocation is given in Figure 1.

A. Funding research on special topics

Funding for research on special topics was allocated by discipline. The natural sciences, which conducted 816 projects, received funding of NT$627 million. Engineering and applied sciences received NT$961 million for 1,688 projects. Biology, medicine, and agriculture carried out 1,584 projects and was allocated NT$972 million. The humanities and social sciences were given NT$201 million for 419 projects. One hundred ten projects were conducted in the field of science education with NT$57 million of funds. A total of NT$2.81 billion was allocated to finance 4,617 projects. This is an increase of 20.1% (773) in the number of projects and an increase of 35.3% in funding over the previous year. In addition, through these projects, 1,764 doctoral candidates and 5,506 Masters candidates were cultivated. An additional NT$248 million was used in purchasing mid-sized sci-tech equipment (218 purchases). For more information, please refer to Figure 2 and Chart 1.

B. Promote mission-oriented research projects

The NSC promotes certain mission-oriented research projects to help create a close working relationship among industry, academic circles, and research organizations. This helps to best utilize and develop all levels of research personnel and technologies. Important mission-oriented research projects for fiscal year 1991 are listed below:

*Enhance the promotion of the development of basic science

1. High-temperature semiconductors
2. Seismic wave propagation
3. Subtropical meteorology
4. Kuroshio exchange processes in the northeastern seas off Taiwan
5. Experiments on Worldwide Ocean Currents
6. Neurology Research
7. Research on the development of concepts in the natural sciences and on diagnostic teaching methods
8. Research on the level of science process skill learning of students in the R.O.C.
9. Individual research on natural science education
10. Basic research in national defense science and technology
11. Research on national science education indicators

*Promote economic development

1. VLSI
2. High polymer materials
3. Medical engineering
4. Genetic engineering
5. Enzyme industrial technology
6. RELP
7. Environmental changes and the process of industrial development: the Taiwan-area business management experience

*Improve the public standard of living

1. A study of hereditary diseases on molecular level
2. Hepatitis control
3. Research on herbal medicines
4. Basic research on high blood pressure and apoplexy

5. Disaster mitigation

6. Basic environmental protection research

C. Application and dissemination of research results

1. Patent application

For research results of NSC-sponsored projects which show promise, the NSC will, on behalf of the research project manager, submit applications for domestic and foreign patents. This serves as a reward as well as an insurance of intellectual property rights before the dissemination of the research results for broader application. During fiscal year 1991, eight American patents and 24 R.O.C. patents were granted to research results. A further 53 projects were chosen to submit patent applications.

2. Technology transfer of research results This year, six new technologies developed in research projects on special topics were transferred to industry. They are rotary analytical ferrograph analyzer, glaucoma diagnostic equipment, a Mandarin dictation writer, synthesis of pyrimidine and azapyrimidine arabinosides, a laser measuring machine, and an electrochromic materials derived from heterocyclic polymers.

D. Cultivate, Recruit, and Award Sci-tech Personnel (see the following table):

Type \ Fiscal Year		1990	1991
Overseas	Guest researcher	171	179
	Return to the R.O.C. for long-term service	161	190
	Special lecturer	13	16
	Short-term teaching post	497	459
	Guest speaker	105	97
	Special expert	3	3
Domestic	New educator	234	301
	Research during vacations	215	209
Total		1,399	1,454

Chart 1: Funding for Sci-tech Research Projects on Special Topics over the Past Three Years

Field	Fiscal Year 1991		Fiscal Year 1990		Fiscal Year 1989	
	Numbers of Projects	Funding (NT$millions)	Number of Projects	Funding (NT$millions)	Number of Projects	Funding (NT$millions)
Natural Sciences	816	627	738	519	666	407
Engineering and Applied Sciences	1,688	961	1,351	682	1,030	480
Biology, Medicine, and Agriculture	1,584	972	1,341	710	1,152	620
The Humanities and Social Sciences	419	201	316	129	234	90
Science Education	110	57	98	43	93	36
Total	4,617	2,818	3,844	2,083	3,175	1,633

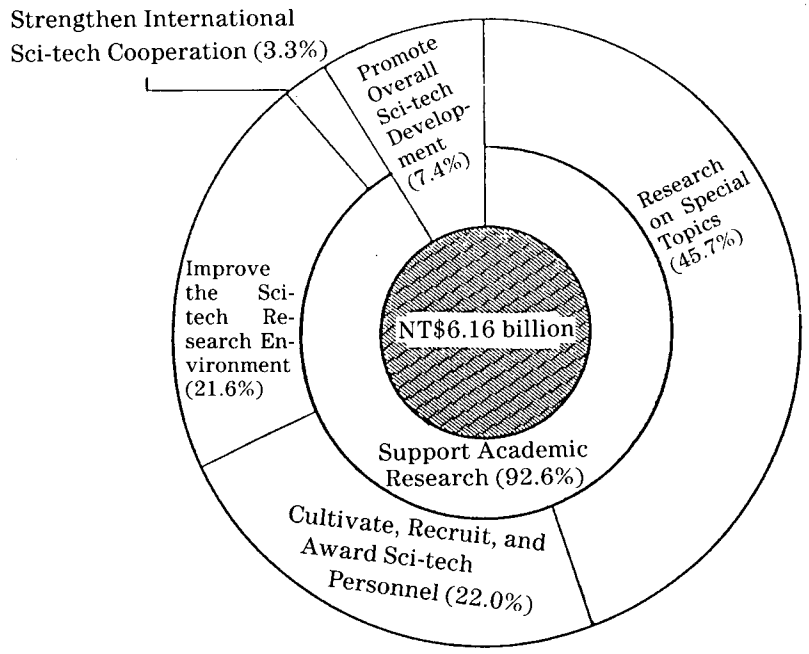

Figure 1: Allocation of Funds for 1991

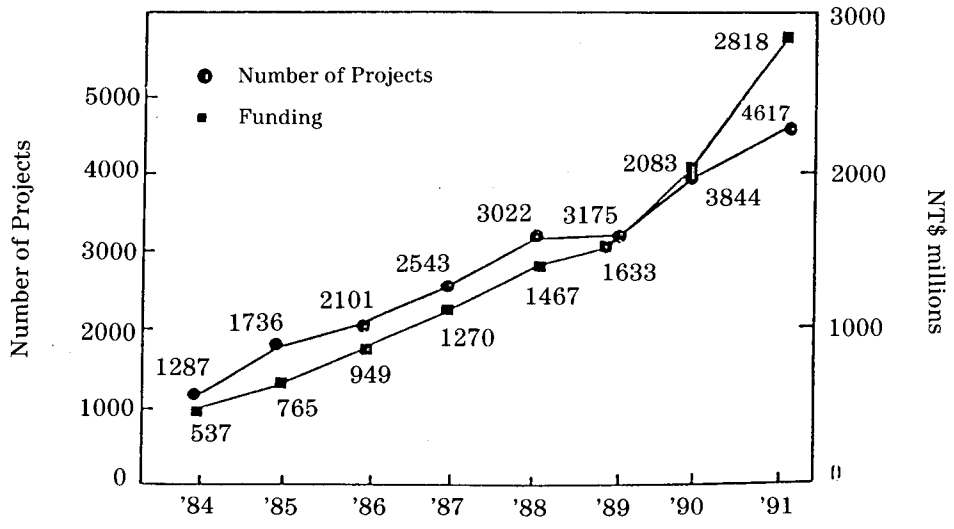

Figure 2: Support for Academic Research – Number of Projects and Fund Allocation

Recruiting Mainland Chinese Sci-tech Personnel to Participate in National Construction Projects

In order to invite overseas mainland Chinese to come to Taiwan to participate in sci-tech construction, NSC Chairman H.M. Hsia lead a group to the United States in mid-August for the purpose of contacting prospects. In order to better facilitate the recruitment of overseas mainland Chinese sci-tech personnel, the NSC drew up the "Regulations Governing the Recruitment of Overseas Mainland Chinese to Participate in Sci-tech R&D in Taiwan" based on the "Essentials of Recruiting Overseas Mainland Chinese to Participate in Sci-tech Research and Development in Taiwan". The "Regulations" have been approved by the Mainland Affairs Council.

Given the need for sci-tech personnel for the next six-year plan for sci-tech development, Premier Hau has instructed the NSC to begin actively searching for appropriate personnel in the United States since that is where a tremendous number of mainland Chinese sci-tech personnel are now located. Chairman Hsia's visit included meeting with several overseas Chinese scholars, including Chang Lin Tien (田長霖), Tsung Dao Lee (李政道), Chen Ning Yang (楊振寧), and Shiing-Shen Chern (陳省身), to obtain their advice in selecting mainland Chinese prospects. The trip also included a visit to the Austin campus of Texas University to tour the Innovation and Capital Research Center in order to understand how the center effectively transfers the results of academic research to industry. The American experience will be used as a reference in administering the Science-based Industrial Park (SIP) and in building the Science City both in Hsinchu.

The Imminent Publication of the "1990 Science and Technology Yearbook of the R.O.C."

The "1990 Science and Technology Yearbook of the R.O.C." has been compiled and is scheduled to be printed in late October. The first chapter in the Yearbook is a special report on the Fourth National Conference on Science and Technology in the R.O.C. which includes details on preparations for the conference, outlines of discussions regarding each of the central topics, proposals in each area, and a summary of conclusions. The second chapter, about sci-tech policy and guideposts, expounds the current policy-making decision process and policy targets; this chapter also lays out important sci-tech goals.

The third, fourth, and fifth chapters are about basic research industrial technology, and technology related to the people's livelihood. These chapters relate the current status of research and development, research results, and future prospects in these areas. The fields covered in these chapters include science and engineering, medicine, agriculture, the humanities and social sciences, and science education; electronics and information, microelectronics, mechanics, automation, materials and manufacturing, foods and medicines, energy and resources, farming, biology, telecommunications and electro-optics, and chemicals and textiles; transportation, medical treatment and health care, environmental protection, meteorology and seismology, construction, mitigation of disasters, and nuclear energy.

The last chapter deals with the status of sci-tech personnel (cultivating, recruiting, and awarding), the sci-tech research environment and international cooperation in science and technology and the establishment and standardization of intellectual property rights. This chapter also provides an introduction to four important research organizations: the Waterlife Inspection Office of the Council of Agriculture, the Electro-optic Industrial Research Institute of the Research Institute of Industrial Technology, the Food Industry Development Research Institute, and the Biomedical Research Institute of the Academia Sinica.

Brief Biographies of Three New Division Directors of the NSC

Director of the Division of Science Education:Dr. Rong-Fu Hsu (許榮富)

Dr. J.F. Hsu arrived at his new post as Director of the Science Education on September 2. Dr. Hsu came from his teaching post as professor of physics at National Taiwan Normal University where he was also chairman of the department and dean of the institute. His research has been concentrated in the following areas: "the Study on the Mechanism of Components and Measuring Model in Science Process Skills", "the Mechanism and Representative Modes of Understanding in Scientific Knowledge", and "Research on the Basic Abilities of Science Teachers". In 1986, Dr. Hsu was cited as an "Outstanding Academic Researcher" as a result of his work on the philosophy of science dealing with the intrinsic nature of science as a base and utilizing qualitative research design to develop a theoretical model of science process skill (SPS) organizational factors. In 1988, he was again awarded the "Outstanding Academic Researcher Award" this time for his innovative use of factorized evaluation principles and the external criteria validity which, when used with the same scientific materials, can, through the use of a variable factor interac-

tion design, provide concrete indicators of the growth and change of science process skills. Dr. Hsu developed SPS such that it can be effectively used in evaluating all levels of study and thought processes. In addition, Dr. Hsu established the TIPSII, GALT, and SLSI measurement charts. Dr. Hsu, in his new capacity, will be responsible for the planning and promotion of the research on and development of science education to raise the level of domestic research on science education and to improve the quality of science education on the whole.

Director of the Division of Engineering: Chung-Yu Wu (吳重雨)

C.Y. Wu was once an assistant professor conducting academic, educational research at the Electronics Research Institute. During this period as an assistant professor, he taught institute courses on "Digital IC Circuitry Design", "Analog IC Circuitry Design", and "Active Network Design" as well as university-level course on "Electronics" and "Digital System Design".

Starting September 1984, C.Y. Wu worked for two years as an assistant professor teaching and conducting research in the Department of Electrical Engineering at Portland University in Oregon in the United States. While there, Mr. Wu learned a great deal through the university and graduate educational system in the States and he also conducted research on VLSI circuit design. He has developed a great variety of contacts within academic and industrial circles. Mr. Wu returned to Taiwan in June of 1986 to become chairman of the Electrical Engineering Department at Chiao Tung University where he became dean of the Electronics Research Institute in August of 1989.

Director of the Division of Natural Sciences: Dr. Mo-Hsiung Yang (楊末雄)

As the seventh director of the Natural Sciences Division, Dr. M.H. Yang reported to his new post on September 1. Dr. Yang was a professor of nuclear science at Tsing Hwa University. Dr. Yang received his doctorate in radiochemistry from Tohoku University, Sendai, Japan. His expertise lies in analytical chemistry, radiochemistry, environmental chemistry, the design of analytical equipment and on-line research. Although he has worked in the Institute of Nuclear Science, his research has all been basic research in analytical chemistry; it is just that some of his analytical work calls for the use of isotopic radiation techniques.

Dr. Yang was a recipient of the "Outstanding Researcher Award" in 1985, 1987, and 1990. He has been guest researcher at the Isotope Department of the Nuclear Energy Research Institute of Japan, the High-purity Materials Analytical Research Laboratory of the Max Plank Research Institute in Germany, and the Radiochemistry Research Institute of the Munich Industrial University in Germany. Since 1986, Dr. Yang has published more than 110 articles in well-known publications worldwide. As director of the Natural Sciences Division, Dr. Yang will work at raising the standards of basic research domestically; he will also spend time planning and promoting important government research projects.