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NSC Strategies and Measures

Chairman Liu Chao-shiuan's Statement at GIO Press Conference

The National Science Council (NSC) has three major tasks: (1) coordinating other government ministries and commissions to promote the nation's total science and technology development, (2) supporting and assisting academic and basic scientific studies, and (3) planning and promoting science-based industrial parks. To carry out these three tasks, NSC has adopted the following strategies and measures during the current stage:

I. Integrating the resources for science and technology research and development

In the Republic of China, the task of promoting science and technology is distributed among related ministries and agencies. The allocation of major resources, formulation of policies, and the examination and approval of projects are made through NSC coordination and the communication among the related ministers and heads of agencies, making the integrated use of resources more effective. Take National Sci-tech Projects, for example. The NSC mechanism is used in the selection of telecommunications, disaster prevention, genetic medicine and agrobiology. To fulfill these projects, NSC has effectively brought together the upstream, midstream and downstream R&D resources whether they are in universities, in research institutes or in the private industry. Besides, NSC has established an inter-agency Science and Technology academic cooperation task force to promote national defense science and technology with the Ministry of National Defense, industrial science and technology with the Ministry of Economic Affairs, nuclear science and technology with the Atomic Energy Council, and environmental science and technology with the Environmental Protection Administration. At the same time, it has integrated the science and technology research resources of the public and private sectors to enlarge the research capacities of universities, the Academic Sinica and the various foundations to meet the requirements of the government and the industrial sectors. Related ministries have a number of channels for research cooperation with the private sector, but in an effort to make the best use of the limited resources, NSC and the Ministry of Economic Affairs have established a "Government-Industry Meeting for Cooperative and Coordinating Research and Development," which is jointly presided over by the deputy heads of the two agencies. If a private enterprise wants to promote an R&D projects in conjunction with the government, it may submit its plan to this meeting and the meeting will use its power to decide on an optimum method to support the said enterprise.

II. Laying the legal foundation for science and technology development

In accordance with a consensus reached

Chairman Liu Chao-Shiuan reported at Government Information Office (GIO) Press Conference regarding NSC strategies and measures during the current stage.

at the Fifth National Science and Technology Conference, NSC drafted the Science and Technology Basic Law. This draft law covers humanity and social sciences and regulates the basic researches, use of budgets, organization, projects, intellectual property right, international cooperation, incentive measures, and personnel. Like other basic laws, this one is a policy statement and has the features of comprehensiveness and universality to become the legal basis for all related detailed statutes. But it also contains some concrete and breakthrough articles. For instance, it provides clearly that the government may invest large amount of manpower, material power and financial power to support the private sector's research and development efforts. Moreover, the government may disperse it intellectual property right generated by joining the research and development to private research and development agencies and even to an individual inventor for commercial production to stimulate the motives for more research and development. The draft law has also established the concept of interflow between government and private researchers, which amounts to a deregulation of personnel exchange. However, more coordination and communication need to be made before detailed and concrete provisions can be hammered out, because this involves the power of the Examination Yuan. The draft law was approved by the Executive Yuan on July 31, 1997, and is pending deliberation by the Legislative Yuan.

III. Improving the environment and the standard of academic research

The ROC ranks 18th in the world in terms of the total number of papers on basic scientific research that have been included in Science Citation Index (SCI) and 11 in the number of papers included in Engineering Index (EI). In technological development, the ROC's points of patents approved by the U.S. have won it the 7th place in the world. These figures show that in terms of quantity the ROC has scored remarkable successes. In the future, we should work hard to make quality breakthroughs. In this end, NSC has adopted the following measures:

1. Improve the strategy for research subsidies

All targets and priorities of subsidies are guided by policy. In addition to the pursuit of continuing growth in "quantity," we hope we can make brilliant world-class contributions in some fields.

2. Promote frontier science programs

NSC has selected priority fields in the disciplines of natural sciences and life science and is prepared to invest in them large amounts of money steadily and in the long run. NSC has set up two world-class research centers: the Theoretic Science Research Center and the Oceanographic Science Research Center. The former will focus on the study of mathematics and theoretic physics. Invited to lead the researches are such gurus like Nobel-prize winners C.N. Yang and T.D. Lee (for research in physics) and Shing Tung Yau (for research in mathematics). The Oceanographic Science Research Center was established because Taiwan is an island, calling for systematic studies in both the theoretic and the applied fields.

3. Increase the functional of national laboratories and make them the center for promoting international cooperative research

The NSC Synchrontron Radiation Research Center and Japan's famous Spring 8 Sychrontron Radiation Research Center are planning to engage in international cooperative research. Its National Center for High-performance Computing is now contacting the U.S. for joining in the White House's plan for the next generation internet. Its National Space Program Office has entered into close cooperation with NSF-supported academic institutes which have impressive research records in the U.S. All these are measures for enhancing the research standards of ROC national laboratories through international cooperation.

4. Stress the importance of studies of humanity and social sciences

NSC will continue the policy of greatly increasing the budget for the studies of humanity and social sciences. Statistics show that the ROC's studies of social sciences rank 25th in Social Science Citation Index (SSCI). It is believed that we can make greater progress if we can work harder. To reconcile the studies of science and technology on the one hand and humanity and social sciences on the other, the NSC has held several Interactive Forums on Humanities and Sciences, receiving warm responses in society. This activity will continue.

IV. Planning and promoting science-based industrial parks

The Hsinchu Science-based Industrial Park has become well known in the world, which in some areas is one of the best. The 1996 statistics showed that the turnover of all the firms in the Park was NT$310 billion, employed more than 62,000 people, and hosted more than 220 firms. For the third phase expansion, the Park has condemned and bought 200 hectares of land for development. The fourth-phase expansion is being planned to include the Chunan Park in Miaoli county, whose 99 hectares of land will be used for firms engaged in biological science and technology, optical electric production, and telecommunication manufacturing. Also included will be the Tungluo Park in Miaoli county which is scheduled to be set up in 2000.

The infrastructure construction of the Tainan Science-based Industrial Park is going on rapidly and smoothly. Up to now, 42 firms have been approved to invest in the Park, of which two have started to build their plants. It is expected that the total investment in the park will top NT$1,400 billion. By estimate, this new park will reach the scale of the Hsinchu Park only in half of its time. Nevertheless, the location is in a relatively low-lying area, so NSC has listed the drainage and flood control there as a demonstration item of the national disaster prevention projects. In the perimeter of the park, 2,000 hectares of land are reserved for coordinated development in order to link the Park with the community cultural development of the area. It is hoped that the area will become a modern culture-cum-science city.

V. The prospects set forth in the White Paper on Science and Technology

NSC compiled, in accordance with the consensus of the Fifth National Science and Technology Conference, the first White Paper on Science and Technology of the Republic of China, which has been approved by the Executive Yuan as the goal of NSC activities. The White Paper envisions the following three prospects:

1. On academic studies

In five years, the Republic of China will have world famous researchers and research institutes and is expected to make world-class contributions in several fields of basic research, making Taiwan an Asia-Pacific research redoubt.

2. On industrial technology

It is expected that by 2000 the production value of the ROC's technology-intensive sector will account for 40% of the total industrial production and by 2010 this will exceed 50%. At that time, the import and export of technology will gradually reach a balance, many high-tech corporations will become multinationals, and big enterprises of other countries will come to Taiwan to sign strategic alliances with local firms. This will make Taiwan into an Asia-Pacific manufacturing center of science and technology.

3. Building Taiwan into an island of science and technology

NSC will continue to set up science-based industrial parks which will be supported with satellite parks. It will also strengthen the information and communication connections between these parks to make them into a close-knit web to carry out the ideal of making Taiwan into an advanced information society and an island of science and technology. In the process, NSC will put stock in the linkup of science and technology with humanities, community culture and the development of new cities. This is to make every science-based park into a city of culture, science and technology.

A Report on Chinese Speech Processing and Chip Design R&D

After three years of work, the NSC-sponsored research project entitled "Chinese Speech Processing and Chip Design" has completed the development of many new-generation computer speech recognition and processing technologies. The participants in this university-industry cooperative project include professors Jhing-Fa Wang and Chung-Hsien Wu of national Cheng Kung University's department of computer science and information engineering and the firms of Taicom, Eletech, and Macronix. The project has resulted in several patents and a number of products that are already on the market, including the following systems:

1. Mandarin Venus Dictate System (for Mandarin and the Minnan dialect)

This system is an extension of the first-generation Mandarin Venus Dictate System. Because it was able to recognize a large spoken vocabulary, the first generation system has done well on the market. Although speech recognition systems are already in widespread use, most users demand that a system be able to recognize input consisting of arbitrary sentences and phrases. This demand has led to the introduction of the second-generation Mandarin Venus Dictate—a Chinese voice recognition system able to accept arbitrary sentences and phrases.

2. Japanese mandarin Venus Dictate System

This Japanese speech recognition system uses the same framework as the mandarin Venus Chinese speech recognition system. Because Japanese and Chinese words share a common C/V phonetic structure, this system was developed relatively quickly by providing clear definitions of the C/V phonetic units of Japanese and using collected speech data to perform speech recognition training. The Japanese phonetic units defined in this system may serve as a starting point for future efforts to develop Japanese speech systems.

3. Chinese Text-to Speech Conversion System

Previously, anyone who wanted to receive e-mail needed a computer and either a modem or a network connection. But under many circumstances, such as while outdoors or in a vehicle, this equipment is not readily accessible. To eliminate this inconvenience, a telephone e-mail reader with voice verification and special e-mail software was developed.

4. Internet Telephone Voice Transmission System

This system incorporates a 1.6K high sound quality voice encoder and 4.8K CELP real-time realization, and provides users with multiple bit rate speech compression. The speech compression and expansion software, together with network and telephone interfaces, provide two applications systems that respectively enable network and telephone transmission. Now users will be able to select the bit rate delivering the sound quality best suiting their needs and the requirements of their environment.

5. Natural Language Processing System (Natural Language Telephone Exchange Query System)

This system is currently able to accept users' written input and correctly respond to users' queries concerning the telephone extension numbers of units or individual personnel. The next stage in this project is to integrate telephone network

speech recognition technologies and speech synthesis technologies in order to allow natural speech input from users and provide answers to queries using speech synthesis. It is anticipated that use of this system in offices and schools will save considerable manpower.

In the future this university-industry research project will pursue the development of the following technologies:

1. A more stable and reliable mandarin/Minnan speech recognition system able to accept at least 50 characters per minute (the current Mandarin Venus Dictate System is able to operate at a speed of 25 characters per minute). Higher speeds will enable a more natural human-computer interface.

2. An improved Japanese speech recognition system. The successful development of this system will help Taiwan's software industry penetrate the Japanese market.

3. More natural Mandarin and English speech output, allowing computers to speak more fluently.

4. Improved low bit rate compression (below 1.2K) and video/network technology for use in the next generation of videoconferencing and videophone systems.

5. A computer speech telephone system for hospital registration and telephone exchanges, etc. This type of system will incorporate computer speech recognition and natural language interpretation technologies.

Cancer Therapy Using Genetically Engineered Abrin Toxin

Cancer has become the leading cause of death in Taiwan, and its mere mention is enough to strike fear into most people. However, thanks to progress in medical technology, prospects are good if a person discovers cancer early and immediately seeks treatment. Apart from surgery, radiation and chemotherapy are the most commonly used methods of treatment. But although these methods are able to eliminate cancer cells, they have the drawback of also damaging normal cells. Therefore, the development of drugs that are able to recognize and destroy cancer cells without harming normal cells is an urgent task.

The cell membranes of cancer cells are different from those of normal cells, and one of the differences is the presence of many growth factor receptors. These growth factor receptors bind with growth factors as tightly as a magnet grips steel nails. Researchers are now trying to take advantage of this characteristic by using genetic engineering techniques to attach toxin molecules to growth factors. When these modified growth factors bind with receptors on the cell membranes of cancer cells, the toxin portion will enter the cell and kill it.

An NSC-sponsored research project headed by Prof. Lin Jung-yaw has inserted the genes for Abrin toxin and epidermal growth factor (EGF) in coliform bacillus using a plasmid carrier. The resulting bacteria express a fusion protein consisting of the two original proteins. This protein was then tested to determine its ability to kill different kinds of cancer cells. The results clearly show that the fusion protein is more effective at killing cancer cells with a large number of growth factor receptors than at killing those with a low number. In the case of A431 cells vulvaepidermal cells and HeLa cells (human cervix), the fusion protein is 125 more effective against the former than the latter. The conclusion of this work is that the genetically engineered immunotoxin fusion protein containing the Abrin toxin A chain and growth factor is a strong inhibitor of the growth of cancer cells with a large number of growth factor receptors (such as cancer cells from the brain, lung, stomach, colon, and ovary). Because there are relatively few growth factor receptors on ordinary normal cells, it is expected that in clinical practice the fusion protein will be able to recognize and kill cancer cells with many growth factor receptors, while doing little harm to normal cells. Plans are now being made for the future development of different types of immunotoxins that will provide maximum efficacy and minimal damage when used against different types of cancers.

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