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Conclusions and Recommendations by Group 1 — General Policy, Manpower & Basic Sciences

The 5th Board Meeting of Advisors for Science
And Technology, the Executive Yuan

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Introduction

These notes are introduced to complement and supplement Dr. Wang's report on Group 1 meetings, and to present some recommendations of the Advisors.

I) Funding

The present rate of growth of the Government R & D Budget is probably adequate considering the state of the economy. The problems to be addressed are thus those of using the available funds more effectively.

I.1) These are natural and unavoidable fluctuations in research expenditures. Since the government budget of the ROC is on a strict yearly basis some kind of reservoir fund is thus most useful, to take care of contingencies as well as to permit the initiation of small but original research projects at universities. This function was partially fulfilled by the NSC research fund, presently almost exhausted.

It is recommended that the NSC research fund be partially replenished, but also that small (5 to 10% of university R & D Budget) reserved funds be established at universities, especially to initiate small research projects without undue red-tape.

However, the use of these reserved funds should be monitored a posteriori carefully to avoid possible mismanagement.

I.2) For big research projects and investments, planning coordination by NSC should be improved to avoid duplications or interference.

I.3) The desirable growth of industrially financed R & D is dealt with by Group 4. One additional recommendation might be that industries, which have a more flexible salary scale, be helped and encouraged to hire returning overseas Chinese engineers and scientists.

I.4) One of the most important and difficult problems with consequences on the development of basic science and technologies, as well as on the possibility to train more Ph. D. domestically is that some means of recognizing, rewarding talent and performance in a much reasonable way than the present flat salary scale permits must be found.

— It is the only way in the long run to promote quality, without which quantity is useless. Solutions to these problems seem to meet with difficulty of psychological and possibly cultural nature. Advisors can only recommend that all possible solutions be studied in earnest, alone or in combination.

— Modulating the NSC annual research stipends according to performance rather than rank can provide a little help.

— Allowing public university president to modulate upwards the salary of good performance would be useful to break the "Vicious Circle" of too much egalitarianism. However this, if adopted would also require careful a posteriori monitoring. Whether such a measure should or could be funded by a tuition increase to compensate in part by scholarship or student loans, raises political judgement beyond advisor competence.

— Equal treatment of domestically trained and returning overseas scientists is desirable so as not to create an incentive to first go abroad. But it should not be confused with equal treatment of good and mediocre performers. The establishment of a settlement subsidy would, however help in bringing back overseas scholars without creating an unwanted distortion of treatment.

— The most drastic, but also the most efficient solution might be to create an institution with a foundation rather than a public service status, similar the German "Max Planck Foundation" which could hire the most brilliant scientists, while allowing them to participate in university teaching, and to supervise Ph. D. candidates. This solution has helped saving German's science from near collapse when excessively egalitarianism habits developed in universities.

II) Basic Sciences

As the R & D System of ROC matures, basic sciences will be needed more and more, so their development in the future should be slightly faster than for the general R & D budget, but special attention should be given to the quality and relevance of the work.

II.1) Manpower

Ph. D. are in short supply, and training abroad leads to a large brain drain.

The establishment of a "graduate school program" of scholarships for Ph. D. candidates is desirable. It could be accompanied by the promise of 1 or 2 year. Post-Doc Fellowships abroad or domestically for the best Ph. D.s.

II.2) The selection of priority areas in basic sciences should be based on the estimated probability to achieve excellence as well as on long term relevance for the problems of the ROC.

One obvious class of priority areas are those for which Taiwan Geographical location or other special characteristics make research work easier here than elsewhere. These include, seismology, atmospheric studies, oceanography and the like. These fields are also of practical importance for Taiwan's life. Programs are already under way in these fields in a very satisfactory way, and should be encouraged further.

The other areas of priority should be active fields of science relevant for ROC development, and where scientific talent is or can be made available quickly. Such fields are for example, Molecular Biology, including recombinant DNA, or Atomic and Molecular Physics.

II.3) Synchrotron Radiation Facility

Such a facility would be the biggest simple pure Science Investment ever for ROC. There is no doubt it would be useful, be it only because it would be conducive to interdisciplinary work in many disciplines (Physics, Chemistry, Biology, even Medicine). But several problems are to be solved before such a facility is built, or it will lead to a failure ROC could ill afford.

- Availability of funds not only for construction but for future operation. Assuming the figures of the feasibility study are valid this means US\$3 million per year for 20 or 30 years. Since operation, retrofit improvement, beam line modernisation will cost as much per year as building.

- Availability of two groups of key persons: One in charge of building the machine and one of convincing, animating and coordinating user groups.

Development of a sufficient degree of consensus in the scientific community which two groups of people mentioned above could help bring about this consensus is presently obviously not sufficient. Establishment of a training program abroad near similar facilities in the US, FRG, France and possibly Japan. (This should not be difficult).

As a result it is suggested that the ideas for the Synchrotron radiation facility should be retained in principle, but that actual construction should not be undertaken till the above problems are solved.

Two conservatory measures are necessary:

- Reserve space near the Atomic and Molecular Physics Institutes to make eventual cooperation between the two operation possible. But care should be taken that user

groups not connected to Physics should have equal access to the facilities.

- Provide some funds for further study, recruitment of the two groups of key persons, and preliminary training abroad of relevant scientists.

III) Public Relations

Advisors concur with the point raised during the discussions that a public relation effort is necessary to maintain adhesion of ROC's population to Science without creating undue expectations that it will solve all problems in the short term.

At least 20,000 of the expatriates in the U.S. are Ph. D. holders, the same survey indicates.

A government recruitment mission is currently touring U.S. campuses in hopes of luring more Chinese talents back for assignments in Taiwan. The mission is armed with a list of over a thousand job slots in government and private agencies which are to be filled by persons with postgraduate degrees.

Gov't Soliciting Support Of Business Community For Manpower Program

Donations to the government's science manpower development fund have reached NT\$200 million, still NT\$100 million below the target, according to the Executive Yuan.

The Ministry of Education has set up a special account to accept further donations which may be made in a lump sum or in installments.

The special fund will be used to pay for scholarships for doctoral and master candidates and research grants for professors.

The Cabinet will allocate NT\$200 million for the program while calling on the business community to contribute NT\$300 million.

Speaking to over 300 business leaders attending the tea party last month, Premier Sun Yun-suan said the government is soliciting donations from the private sector not because the public treasury cannot afford the money but because private financing of the manpower program is not subject to restrictions of existing laws and regulations.

K.T. Li, minister without portfolio and host of the tea party, said the nation is in short of highly trained scientists and technologists. Only by pooling public and private resources to shore up a manpower pool can the shortage be eliminated, he added.

Under the personnel cultivation

program, the government will provide 500 scholarships to graduate students and 100 research grants to professors in the next two years.

The scholarship is NT\$15,000 a month for doctoral candidates and NT\$10,000 a month for candidates studying for master degrees, while the

professorial research grant amounts to NT\$240,000 annually.

The NT\$280 million needed to finance the program will be raised from various sources, including donations by the private sector.

Private donors may specify the area of research of study by the recipients of the scholarship and research grants. They may even ask the recipients to serve in their companies for a certain period of time upon completion of their advanced studies or research.

Premier Sun Calls for Better Hi-tech Training

To better train high-tech personnel, Premier Sun Yun-suan last month instructed the Ministry of Education and the National Science Council to work out a long-range scientific program starting at the high school level. He also urged the Ministry of Education to improve the quality of high-tech training in graduate schools.

Minister without Portfolio Walter H. Fei also pointed out that the training of high-tech personnel has to begin at senior high schools. During the past three years, the Ministry of Education has sent several groups of high school principals and teachers to the United States to study successful science programs. They have made valuable recommendations based on their findings. The Cabinet urged the Education Ministry to study the feasibility of

those recommendations in order to upgrade the teaching of science in secondary education.

As for expanding the graduate schools, the Cabinet said, the emphasis should be put on quality instead of quantity. The shortage of qualified teachers and up-to-date facilities are two main problems to be solved to prevent an even greater brain drain.

As a parallel move the Cabinet has approved an NT\$100 million special appropriation to finance a development of technology.

The immediate measures under the program include the training and recruiting of high-tech personnel abroad. Seven medium and long-range measures will also be put under the charge of related government agencies.

Symposium on Separation Technology Held

A symposium on separation technology was held in Taipei on May 16-18 under the joint auspices of the National Science Council, the Coordination Council for North American Affairs and the American Institute in Taiwan.

Some 200 leading Chinese and American scientists, industrial leaders and students attended the symposium.

Nearly 30 papers were presented during the two and half days of academic discussions.

Prof. M.C. Chang, chairman of the NSC, made the following observations at the opening session:

"As we all know, almost all industrial processes can not be completed without a good grasp of separation steps. Therefore, the separation technology which cover all combinations of the three phases of matters (solid-liquid-gas), has become a core-subject in the chemical engineering curricula. I have noticed that in this symposium, among all authors, you have covered all relevant aspects of separation technology, not only technologically, but also economically. Particularly, some papers have put emphasis in energy considerations. In our country, we have come a long way to establish our chemical industries since we identified "petrochemical complex" as one of our ten major national development projects in the past. It has advanced to the solid foundation of today. We are confident that our chemical industry will continue to grow through more

interaction and joint symposium of this nature. Also, you may be interested to know that we at NSC have also singled out the Separation Technology as one of the six areas for research encouragement in Chemical Engineering. I wish to see more of such symposium on separation technology to continue in the days to come."

In this symposium, about 30 speeches and articles were presented for deep and wide discussions from chemical-engineering process to diagnostic science, biological technology to the control of environment pollution, basic theories to industrial application, and from improving traditional production process to its broadened new areas.

Through the symposium, we found

the communication was of great help to our academic research group. We have emphasized theoretical research on separation technology for the past, since the need of lift-up on chemical-engineering in the country, the separation technology thus shall be a key point process and will be emphasized increasingly. Therefore the new concepts and new techniques timely introduced from foreign countries are necessary for the research and development activities in the country. Although this was a very short-time symposium, it did end with many successful outcomes, and will be helpful for the future effective communication of academic groups of each other, and furthermore, will be helpful for the level lift-up on chemical-engineering in the country.

More Chinese Scholars Abroad Returning Here To Take Up Assignments

The Republic of China attracted the largest number of Chinese scholars trained on foreign campuses since the nation's brain drain began three decades ago.

A total of 1106 Chinese scholars and students returned from abroad last year to take up various assignments. They include 150 persons with Ph. D. degrees and 881 holders of master degrees, according to official statistics.

Authorities concerned attributed the reversed trend of brain drain partly to the worldwide economic recession and partly to the government's recruitment efforts and increasing job opportunities in Taiwan.

The statistics also indicate that a total of 7442 Chinese scholars returned to Taiwan for permanent settlement between 1971 and 1982.

Over 67,000 college graduates went abroad for advanced training during the past 30 years. Among those who have stayed overseas, approximately 60,000 are in the United States, according to an official survey.

NSC-Supported Research Projects

Yuh-meei Lin
NSC72-0201-B001a-34
Studies on the synthesis and stability of the sex pheromone of rice stem borer (*Chilo suppressalis*)

C. J. W. Maa
NSC72-0201-B001a-35
Study on the differentiation and enzymatic properties of antennal esterases of diamondback moth

Sin-che Lee
NSC72-0201-B001a-36
Study on the Family Pemadasyidae of Taiwan

Wen-yung Lee
NSC72-0201-B001a-37
Electron microscopic study on the

ovariole development in the oriental fruit fly

Guang-hsiung Kou
NSC72-0201-B001a-38
The immunosuppressive effects of oxytetracycline in eel

S. N. Chen
NSC72-0201-B001a-39
Studies on the enzyme linked immunoassay of *Angiostrongylus cantonensis* and its antigenic analysis

Dorothy W. King
NSC72-0201-B001a-40
The effect of cadmium on placentae of pregnant mice

Che-tsung Chen
NSC72-0409-B019-01
Biology of sharks in northern Taiwan

waters

Yung-ho Chiu
NSC72-0409-B052-01
A study of the meteorological conditions associated with the forest fires

Ta-wei Hu
NSC72-0409-B054-02
The introduction and silvicultural studies of nitrogen fixing trees in the tropics

Hsin-kan Wu
NSC72-0409-B001-03
Genetics and cytogenetics of the blast fungus (*Pyricularia oryzae*)

Hsien-yi Sung
NSC72-0409-B002-06
Studies on the edible yeast protein isolates and the by-products

J. C. Su
NSC72-0409-B002-07
A study on sucrose synthase

Kun-huang Hwang
NSC72-0409-B002-08
Preliminary survey on the soil enzymatic activities

Chiang Pai
NSC72-0409-B005-11
Genetic analysis of a modifier gene for peroxidase isozymes coded by the *Px-1* locus in rice

Wei-chin Chang
NSC72-0409-B001-05
Genetic manipulation: Favorable mutants in ginseng tissue and cell cultures

Jen-leih Wu
NSC72-0409-B001-06
Effect of UV on the transcriptase of fish RNA virus

S. N. Chen
NSC72-0409-B002-11
Detection, prevention and control of viral diseases of cultured fishes, 2. The application of ELISA on the detection of EVE in diseased fish and cell culture

Engineering and Applied Sciences

Sheng-taur Mau
NSC72-0410-E002-01
A study on the accidental torsion in seismic design of buildings

Ming-chung Lin
NSC72-0410-E019-01
Shoreline evolution of beaches around coastal structures

Y. P. Chin
NSC72-0410-E006-01
Stress-strain and strength characteristics of cohesionless soil for foundation design

Hung-kai Wang
NSC72-0410-E002-01
A study on spatial choice behavior of the consumers

Tsong Yen
NSC72-0410-E005-01
Investigating and improving the thermal insulation efficiency of current buildings subject to energy savings

Chin-tong Kou
NSC72-0410-E006-02
The basic study on the sand drift under the irregular wave action

Chin-tong Kou
NSC72-0410-E006-03
Wave forecasting and statistics study

off the Taiwan coast

Shue-chia Wang
NSC72-0410-E006-04
A practical method for reliability analysis and error detection in large control net

Deh-shiu Hsu
NSC72-0410-E006-05
Active control of multi-story buildings

Deh-shiu Hsu
NSC72-0410-E006-06
Computer program development of steel structural design

Tysen Huang
NSC72-0410-E009-01
A study on the influence of curb parking to road capacity

Hsiao-fan Wang
NSC72-0401-E007-06
An alternative mathematical approach to movement as complex human behavior

Yuan-fang Chou
NSC72-0402-E006-03
Effect of stacking sequence on fatigue life of composite materials

S. T. Lee
NSC72-0401-E002-02
A numerical investigation of laminar gas diffusion flame

Lien-wen Chen
NSC72-0401-E006-01
Analysis of vibration and stability of thick plates

Cheng-i Weng
NSC72-0401-E006-02
Study on axially symmetric forging

Y. W. Liang
NSC72-0401-E006-04
The engine performance and exhaust emissions of the "Methanol-Diesel" fuel in the diesel engine with spark-assistance

Shui-shong Lu
NSC72-0401-E002-03
Development of integrated computer-aided design and manufacturing system

Nan-sen Liao
NSC72-0401-E009-01
Effects of flow oscillation on boiling crisis in tube

Hong-sen Yan
NSC72-0401-E006-03
Type synthesis of planar mechanical devices

B. J. Huang
NSC72-0401-E002-04
Studies on heat transfer characteristics of natural circulation loop

Chen-feng Kao
NSC72-0402-E006-02
Electrochemical study for the synthesis of O-aminobenzyl alcohol from O-aminobenzoic acid

Liang-san Lee
NSC72-0402-E008-01
Salt effect in liquid-vapour equilibrium

Min-dar Lee
NSC72-0402-E002-01
Study on the hydrogenation of butadiene

Jen-feng Kuo
NSC72-0402-E006-03
A new method for determining monomer reactivity ratios and composition at large extent conversion

Chuh-yung Chen
NSC72-0402-E006-04
A method for controlling the rate of radical polymerization

I-kai Wang
NSC72-0402-E007-01
The kinetic study and development of dehydrogenation catalyst of ethylbenzene

Chun-i Lin
NSC72-0402-E011-01
On the chlorination of titanium dioxide in the presence of carbon

Chi Hwang
NSC72-0402-E006-01
Applications of continued fraction expansion methods in control systems

Yu-der Lee
NSC72-0402-E007-02
Reology, processing, and mechanical properties of wholly aromatic polyesters

Hsiao-i Hsieh
NSC72-0402-E002-04
Ion-selective electrode research

Wei-ming Lu
NSC72-0402-E002-06
A study on continuous production of glutamic acid by immobilized whole cell

T.P. Yen & J.H. Fang
NSC72-0202-M008-01
The geologic and geophysical study of the Hengchung Peninsula, Southern Taiwan

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