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Pacific Grove
California
November 6-10, 1966

National Academy of Sciences - National Research Council

This report is a record of the U. S. —Philippines Workshop on Cooperation in Science, Technology and Development held in Pacific Grove, California, November 6-10, and Washington, D.C., November 13-18, 1966. It will be reviewed by the Science Organization Development Board of the National Academy of Sciences—National Research Council following its presentation to the Office of Technical Cooperation and Research, Agency for International Development.

The Workshop is part of a science cooperation program conducted by the Office of the Foreign Secretary, NAS—NRC, under contract AID/csd 1122. Additional support was provided by the Ford and Rockefeller Foundations, the Government of the Philippines and private sources.

Recommendations included in the report are a concensus of the views of the Workshop participants and are not necessarily to be construed as declarations of the intentions or commitments of the U. S. Government, NAS—NRC, or the National Science Development Board of the Philippines.

Report of the

Second U. S. —Philippines Workshop on Cooperation in Science and Technology

Asilomar Conference Grounds
Pacific Grove, California
6-10 November 1966

Conducted by

Office of the Foreign Secretary
National Academy of Sciences
and
National Science Development Board
Republic of the Philippines

In Cooperation with

Office of Technical Cooperation and Research
Agency for International Development

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Summary Report

The second in a continuing series of science workshops of the Joint U. S. — Philippines Science Cooperation Program sponsored by the Philippine National Science Development Board (NSDB) and the U. S. National Academy of Sciences— National Research Council (NAS-NRC)was held at the Asilomar Conference Grounds in Pacific Grove, California, November 6-10, 1966.

The workshop delegations consisted of Philippine and American scientists and technologists representing the public and private sectors as well as government officials from the Philippines concerned specifically with science policy questions.

Meeting informally as scientists cooperatively investigating problems of mutual concern, they discussed how science and technology might make a more significant impact on economic and social development in the Philippines. Following sessions in California, Philippine participants conferred for a week with members of the U. S. Government and scientific community in Washington. D. C.

The workshop discussions were particularly timely in light of the recent joint communiqué of Presidents Johnson and Marcos issued on the occasion of President Marcos' state visit of September 1966, which stated in part:

> "...the two presidents noted the cooperative programs already started between the Philippine National Science Development Board and the U. S. National Academy of Sciences, and agreed that these programs should be expanded so that private and public research efforts can be applied to the advance of knowledge about growing food on the land and in the sea in the tropics..."

The first science workshop, held in Manila in 1965, surveyed the general situation of science and technology in the Philippines. The second concentrated mainly on problem areas whose effects on economic and social development in the Philippines could be reduced by increased application of organized scientific and technological effort.

The elaboration of mechanisms essential for the progress of organized scientific endeavor, including the strengthening of existing governmental and private organizations responsible for such efforts in the Philippines, was considered, as was the necessity for closer working relationships between private industry, universities, research institutes, professional societies and government science organizations—nationally and binationally. Attention was also given to U. S. — Philippines cooperation in improving scientific and technological libraries.

Areas of particular concern discussed at the workshop were: industrial research and development; food, nutrition and demography; the coconut; mineral resources; energy sources; water sources; oceanography and fisheries; meteorology; water and air pollution.

Specific recommendations call for the creation of joint study groups to examine: the expansion of Philippine industrial research and development; problems of food, nutrition and demography; the establishment of a center, possibly international, for coconut research and development and a comprehensive program for improvement of the coconut industry in the Philippines; the organization and operation of the National Science Development Board in relation to the estimated research and development needs of the Philippine Republic.

The participants urge increased U. S. - Philippine cooperation in the training of scientists and technologists, particularly to work on problems of oceanography and weather, and for sharing trained personnel and existing facilities in the Philippines. They propose a meeting of U. S. and Philippine oceanographers and marine biologists in the near future to discuss specific joint programs in these fields.

The problem of water and air pollution in relation to increasing industrialization and urbanization requires urgent attention. Existing Philippine programs were reviewed and the possibility of sending U. S. scientists and engineers to the Philippines to assist the NSDB in assessing problems and recommending programs leading to their solution is suggested.

Recognizing the urgency of increasing investment in scientific and technological research and development in the Philippines, the group recommends that the means to finance such activities be given priority consideration by the private industrial and public sectors.

The participants agree that these conference workshops provide valuable opportunities for frank and full exchanges of ideas important to science and public policy and that this means of communication should be continued and expanded. The third workshop, which is to be held in the Philippines in 1967, was discussed and it was agreed special attention be given to science education and problems of urbanization and industrialization.

The following pages contain the session reports, the summary of recommendations for collaborative programs and contributed papers as submitted by the Philippine participants.

RECOMMENDATION I: Creation of a Subcommittee on Industrial Research and Development

Purpose:

a) To examine the current needs in the Philippines for industrial research and development with special reference to the magnitude of those needs rather than to detailed research programs.

b) To estimate the growth of those needs during the next 20 years.

c) To explore steps which can be taken by government through the NSDB, by industry and by the universities in order to meet those needs.

d) To make recommendations to the Philippine Government through the NSDB, to industries and to universities as to the most desirable immediate steps to be taken.

e) To identify possible sources of support.

Duration of study: Twelve months, with report to be given at next workshop.

Composition of subcommittee: Six persons designated by the NSDB and an equal number designated by the NAS. One-third of the members should be drawn from government, one-third from industry and one-third from universities.

Chairman: Co-chairmen, one each designated by NSDB and NAS.

Staff: The NSDB and the NAS will each designate a staff member to work with the subcommittee.

Frequency of meetings: It is estimated that the staff members will meet three times during the course of the study. The subcommittee will meet two times for a total of six weeks.

Travel: NSDB will pay for Philippine travel to the U. S. and expenses of meetings in the Philippines. NAS will pay for U. S. travel to the Philippines and for expenses of meetings in the U. S.

Implementation: Subject to adequate financing being obtained by the NSDB and the NAS.

RECOMMENDATION II: Creation of a Continuing Subcommittee to Strengthen Philippine Programs of Science and Technology in the Areas of Food, Nutrition and Demography

Purpose: a) Joint examination by the NSDB and the NAS on a continuing basis of the need in the Philippines for research in problems of food, nutrition and demography.

b) Joint examination of the research programs in these areas.

c) Recommendations for research priorities.

d) Identification of possible sources of expanded program support and suggestions for possible relationships with other national and international programs, both public and private, in these areas.

Duration of study: Continuous.

Composition of subcommittee: Six persons designated by the NSDB and an equal number designated by the NAS. An effort should be made to include persons knowledgeable in appropriate areas such as food technology, nutrition, pest control, agriculture, marine biology and demography. They should be persons from government, industries and the universities.

Chairman: Co-chairmen, one each designated by the NSDB and the NAS.

Frequency of meetings: Once each year in the Philippines to be scheduled between workshops.

Finance: NSDB will offer hospitality in the Philippines. NAS will provide travel funds.

Implementation: Subject to adequate financing being obtained by the NSDB and the NAS.

RECOMMENDATION III: Creation of a Study Committee on Coconut Research and Development

Background: Foreign exchange earnings from coconut products exceed those from any other export commodity of the Philippines. A substantial proportion of the Philippine population in the low income bracket depend for their livelihood on this major export industry. This situation also prevails in other Asian countries such as Indonesia and Ceylon. The excise tax concession on coconut oil processed from copra imported into the U. S. from the Philippines is scheduled to terminate and the competitive position of Philippine coconuts in the world market is also threatened by detergents made from mineral oil, synthetics, and other substitutes. It is believed, however, that the proper application of science and technology can maintain and improve the competitiveness of this major export commodity.

Purpose:

a) To examine the possible need for establishing an international coconut research and development institute of the Philippines along the lines of the IRRI.

b) To review the programs sponsored by the NSDB and other government and private agencies in these areas.

c) To identify the areas of research and development and recommend priorities.

d) To assess and if possible quantify the economic benefits that can be derived from the program.

e) To study the budget and financial requirements necessary to implement the recommendations of the committee.

f) To recommend possible sources of funding.

Duration of study: Twelve months with report to be given at next workshop.

Composition of study committee: Three persons designated by the NSDB and an equal number designated by the NAS. The Philippine group should include one representative each from the private sector, the university community, and the interested agencies of the government.

Chairman: Co-chairmen, one each designated by the NSDB and the NAS.

Staff: The Philippine group and the United States group will each supply a staff member.

Frequency of meetings: The committee will meet twice for approximately three weeks total. The staff will meet three times during the course of the year.

Travel: The U. S. group will provide for travel of Americans to the Philippines and hospitality will be provided by the NSDB.

Implementation: Implementation is subject to procurement of funds by the NAS and NSDB.

RECOMMENDATION IV: Cooperation in Oceanography and Fisheries Research

The Workshop participants agreed their representatives in the field of oceanography and fisheries should stimulate action on the points detailed below in their respective countries:

in the Philippines -

a) Increase efforts in fisheries exploration.

b) Encourage the private sector to exploit new fisheries.

c) Improve fisheries technology.

d) Develop techniques in fish culture.

e) Gather environmental data related to fisheries from adjacent seas and inshore water, using Navy vessels.

f) Participate actively in the Intergovernmental Oceanographic Commission's marine planning and operations.

g) Request participation of Peace Corps representatives and consultants in fish farming and marine activities.

in the United States -

a) Increase the availability of fellowships, traineeships and courses open to Philippine applicants.

b) Make space available and encourage participation of Philippine scientists on U. S. oceanic vessels in waters near the Philippines.

c) Encourage training of Peace Corps personnel for work in fish farming and marine activities in the Philippines.

d) Publicize the need for participation of U. S. scientists and engineers in fisheries and oceanography in the Philippines.

e) Encourage U. S. industries knowledgeable in fishing technology to train Philippine technologists.

f) Increase the availability to the Philippines of world oceanographic data from Philippine seas.

g) Encourage the establishment in the Philippines of a marine specimen sorting center.

h) Assist in obtaining equipment for Philippine marine research.

i) Encourage and assist Philippine participation in international oceanography and in the International Biological Program.

Participants further agreed on the need to

bring the NSDB Committee on Marine Sciences into contact with the U. S. National Academy Committee on Oceanography.

Following implementation, the NAS and NSDB should consider holding a jointly sponsored marine-science conference in the Philippines to discuss the possibility of establishing a binational or international oceanographic and fisheries research institute in the Philippines.

RECOMMENDATION V: Creation of a Subcommittee to Study the National Science Development Board

Purpose: a) To analyze the present organization and operation of the Philippine National Science Development Board in relation to the estimated research and development needs of the Philippine Republic.

b) To examine the relationships between the NSDB and departments and other agencies of the executive branch of government, the legislative branch of government, the universities and industry.

c) To make recommendations to the Philippine government, through the NSDB, toward increasing the effectiveness of the Board and placing it in a better position to cope with the problems of strengthening Philippine science for economic and social development.

Duration of study: Twelve months with interim report to be given at next workshop.

Composition of subcommittee: Four persons designated by the NSDB and an equal number designated by the NAS. The Philippine group should include the Chairman of the National Science Development Board, a representative of the Development Council, and one representative each from the industrial and university communities. With the exception of the Chairman of the NSDB, none of the subcommittee members should be a member of the NSDB. The U. S. group should include persons from government, industry and the universities.

Chairman: Co-chairmen, one each designated by NSDB and NAS.

Staff: The NSDB and the NAS will each designate a staff member to work with the subcommittee.

Frequency of meetings: It is estimated that the staff members will meet three times during the course of the study. The subcommittee will meet twice in the Philippines for a total of four weeks.

Travel: NSDB will pay for travel of delegates to the U. S. and expenses of meetings in the Philippines. NAS will pay for U. S. travel to the Philippines and for expenses of meetings in the U. S.

Implementation: Subject to adequate financing being obtained by the NSDB and the NAS.

Agenda

Sunday, 6 November	Reception and Dinner, Welcome and Opening Remarks Dr. Harrison Brown, Dr. Juan Salcedo, Jr., and Dr. John C. Warner
Monday, 7 November	
Session I	Progress of Programs and Activities Since First Workshop Chairman: Dr. John C. Warner Rapporteur: Dr. James H. Jensen
Session II	Industry and Industrial Research Chairman: Dr. Juan Salcedo, Jr. Rapporteur: Mr. Venancio Alcantara
Tuesday, 8 November	
Session III	Agriculture and Natural Resources Chairman: Dr. Athelstan Spilhaus Rapporteur: Prof. Frank Golay
Session IV	Natural Resources Chairman: Dr. Athelstan Spilhaus Rapporteurs: Prof. Frank Golay Mr. Jorge Juliano
Wednesday, 9 November	
Session V	Oceanography and Fisheries Chairman: Dr. Konrad Krauskopf Rapporteurs: Dr. Canuto Manuel Dr. I. Eugene Wallen
Session VI	A) Communication and the Scientific and Technical Community B) Formulation and Implementation of National Science Policies Chairman: Dr. Konrad Krauskopf Rapporteur: Mr. W. Murray Todd

Agenda

Thursday, 10 November
Session VII

Areas for Joint Cooperation

1. Weather
2. Oceanography
3. Energy Sources
4. Water Resources, Desalination

Acceptance of Reports and Recommendations and Discussion of Future Plans

Chairman: Dr. Harrison Brown
Rapporteur: Dr. Kenneth Turk

Opening Remarks by Juan Salcedo, Jr.
at Philippines—U. S. Workshop Dinner
November 6, 1966
Asilomar, Pacific Grove, California

We in the Philippine Panel are extremely delighted to be here to be reunited with our American friends and cooperators in the First Philippines-U. S. Workshop on Scientific and Technological Cooperation and Development, held in Manila in November last year, and also to meet the new adherents to this historic binational program of cooperation whose interest in the continuing dialogue between American and Philippine scientists, economic planners, educators, industrialists and administrators is, we are sure, equally stimulating.

To be sure, we have learned a great deal from the discussion of the first workshop and thus, today, in this Second Philippines-U. S. Workshop on Science Cooperation we feel encouraged to seek wider areas of collaboration with our American colleagues in achieving a more effective interaction between scientific and technological priorities and the imperatives of a national development plan.

It is indeed a most auspicious occasion for us to come here, nine thousand miles away from home, weeks only after the complementing visits between President Ferdinand E. Marcos and President Lyndon B. Johnson. For together they reaffirmed once more the growing concern of both our countries to fully harness the recent advances in science technology in the great task of nation-building. We are here, therefore, in many ways, to translate into concrete projects this reaffirmation of mutual interest in the maximum application of the new knowledge gained in the various fields of science to the development and execution of programs for economic growth and national prospects.

We realize that this kind of discussion and interchange of experience, resources and expertise will be required before we achieve our end-purpose of jointly identifying many of our problems of development and having identified them, of jointly and positively providing the necessary solution to these problems.

In closing, may I, on behalf of the Philippine Panel, extend to each and every one of you in the U. S. Panel our sincerest greetings and fondest hopes for a very successful Second Philippines-U. S. Workshop on Science Cooperation.

Session Reports

I. Progress of Programs and Activities Since First Workshop

II. Industry and Industrial Research

III. Agriculture and Natural Resources

IV. Natural Resources

V. Oceanography and Fisheries

VI. Science and Public Policy

- A. Communication and the Scientific and Technical Community
- B. Formulation and Implementation of National Science Policies

Resolution Regarding Funds for Science

VII. Areas for Joint Cooperation

- A. Weather
- B. Energy Sources
- C. Water Resources and Desalting
- D. Air and Water Pollution

SESSION I: Progress of Programs and Activities Since First Workshop

Chairman: Dr. John C. Warner Rapporteur: Dr. James H. Jensen

The Second Philippines—U. S. Workshop on Cooperation in Science and Development was called into session at Asilomar Conference Grounds, Pacific Grove, California, on Monday, November 7, 1966. In the opening session special attention was devoted to reviewing the progress made since the first workshop held in November 1965 in Manila.

Dr. Juan Salcedo, Jr., Chairman of the National Science Development Board and Chairman of the Philippine Delegation, in a prepared paper reviewed the attention given the recommendations of the first workshop. On January 3, 1966, in a report to President Marcos all aspects of the workshop report were discussed. Details of this report, the level of funding, the priorities of proposed projects and reference to ongoing research projects are included in the paper.

Mr. Alejandro Melchor, Deputy Director General of the Presidential Economic Staff, in a prepared paper reviewed the specific efforts and planning that have taken place during the past ten months. The four-year program has been revised many times. It includes an analysis of the Philippine economy, the makeup of the Philippine population, the rate of population growth, unemployment, international trade and an outline of the proposed irrigation-highway construction program. The broad objectives of the program include a marked increase in the gross national product and reduction in unemployment.

By 1970 the Philippine Government hopes that significant progress can be made in solving the food problem, improving transportation, dredging of harbors, installation of facilities for instrument landing at the international airport, increasing power generation and distribution, improving telecommunications networks, upgrading agricultural extension, reducing depletion of natural resources, improving housing and modernizing national defense establishments.

In the workshop discussion of the fate of authorized research and development projects it was pointed out that government projects approved by the Congress in recent years involve a total outlay of 4.4 billion pesos but only 2.2 billion were available. The Philippine participants cited many instances of failure to proceed because of unavailability of funds.

Mr. Melchor continued the discussion of the mechanisms used in bringing the fullest government resources to bear on resolving problems. These included meetings of the Development Council, the Undersecretaries' Council and the Council of Bureau Heads.

In the discussion of procedures used in reviewing proposals Dr. Salcedo described in detail the review mechanisms of agencies, including the NSDB. It was brought out that the initiative for planning came from the agencies and that the NSDB acted only on proposals presented.

Dr. Warner emphasized the excellent attitude toward science that has developed in the Philippines and contrasted this with that found in many other developing countries. There are now 25 universities and 40 colleges in the Philippines and the country ranks second in the world for college-age youth in colleges of higher education. Some of the Philippine delegates indicated they felt this gave an unrealistic picture, as not all of these institutions are of the same quality.

The session adjourned on the general note that much preliminary work had been accomplished and that now mechanisms should be developed for identifying and selecting priorities, possibly by forming joint working committees to evaluate projects and procedures.

SESSION II: Industry and Industrial Research

Chairman: Dr. Juan Salcedo, Jr. Rapporteur: Mr. Venancio Alcantara

Mr. José Marcelo recommended implementation of the September 1966 joint communiqué of Presidents Marcos and Johnson. The workshop considered specifically the provisions on: science cooperation, space technological training, typhoon warning and tracking systems, typhoon damage control, and the general subject of economic development.

The typhoon warning system in the Philippines is inadequate, tracking methods are far from accurate, and aerial observation is mainly provided by the U. S. military force stationed in the Philippines. The U. S. group reported that the U. S. Department of Commerce has agreed to send two of their experts to conduct a comparative study of the warning systems in the two countries. This U. S. proposal awaits the approval of the Philippine government.

The applicability of space technology was considered. Since the Philippines does not possess the manpower to conduct space research, the consensus was Philippine participation in this field should be limited to training of qualified people. NASA offers approximately three Philippine scholarships every year for this purpose.

Dr. Canuto G. Manuel read a prepared report reviewing last year's workshop accomplishments, defining problem areas in industrial research and citing existing facilities in the Philippines and the role of the National Institute of Science and Technology (NIST) in industrial research.

Assessment of industrial development in the Philippines was discussed. A U. N. team of experts conducted such a survey last year, but no report is yet available. Dr. Manuel suggested that a NAS-NSDB follow-up team be formed to evaluate the study when it becomes available.

Because of the high cost of production, growing industries cannot afford to finance research vital to their production. To provide for this need, an adequately equipped and staffed government-sponsored industrial research center was suggested. NIST could supply the growing demand for technical research if it were provided the necessary equipment and personnel.

Several export industries now need the facilities of a research center. Existing efforts directed at finding possible by-products and research conducted to improve product quality are insufficient. Possible sources of financial support (foundation, governmental and industrial) for such a center were considered.

A recommendation for the establishment of a NSDB-NAS subcommittee on industrial research (Recommendation II) was formulated.

SESSION III: Agriculture and Natural Resources

Chairman: Dr. Athelstan Spilhaus Rapporteur: Prof. Frank Golay

Secretary Isosceles Pascual surveyed the present Philippine national objectives for agriculture and natural resource development and discussed the basic features of Philippine subsistence and commercial agriculture which determine the hierarchy of objectives. He concluded by listing the ongoing research and the research plans of the NSDB in support of the national objectives.

In subsequent discussion, the workshop recognized the basic need for an improved "research atmosphere" and for better integration of the scientific programs of the various branches of the government with the activities of the International Rice Research Institute and of the universities. Priority needs for research and extension support are in the areas of: rat control, high protein foods, multiple cropping, cadang-cadang infestation of the coconut, processing of forest products, and in development of extension techniques utilizing developments in mass education.

The workshop discussed again the serious situation in the Philippines with respect to rat control and strongly endorsed all reasonable efforts to establish major research projects in this area of need. The possibility was discussed of establishing an international vertebrate pest control institute, perhaps on an island, so that all variables, ranging from ecological to economic, might be brought under control and studied quantitatively. Representatives of the NSDB and the NAS agreed jointly to explore possibilities along these lines with their respective governments and with international agencies.

SESSION IV: Natural Resources

Chairman: Dr. Athelstan Spilhaus Rapporteurs: Prof. Frank Golay
Mr. Jorge Juliano

Secretary Pascual discussed the mineral resource situation in the Republic of the Philippines emphasizing the availability of a broad range of metallic and non-metallic ores. Particular emphasis was placed on the need for metallurgical research leading to efficient extraction of nickel from laterite deposits. Discussion among participants indicated that research efforts in the U. S. in this area have been unsuccessful even though considerable sums of money and professional time have been spent; thus, the likelihood of success in such an effort did not seem high.

Conservation and utilization of forest resources received considerable attention. The workshop expressed the view that there was need for greater research on the utilization of forest products so the great export potential of this resource might be more fully realized. Concern was expressed for the lack of well-trained foresters and related technical personnel. The need for improving the situation was also noted as was the need for forest resource studies.

Marine and fresh-water fish resources received attention with the view expressed that there was a need for more studies, particularly with an ecological basis. Research on methods of efficient utilization of fish resources was emphasized, including the possibilities afforded by an expansion of artificial fish culturing.

Subsequent discussion revealed support for the "systems" approach to the over-riding Philippine problem of food supply. Such an approach must involve the integration of nutritional, demographic, geological and hydrological as well as directly productive aspects of food supply and requirements. Recognizing the urgency of the problems of food and nutrition, including food protection, in providing for the needs of a growing population, the workshop recommended the creation of a joint U. S. —Philippines study group to examine ways in which the extensive, but dispersed, efforts which are presently underway could be integrated and expanded.

The workshop also considered the possible need for an "internationalized" approach to the research requirements of the coconut industry, the principal source of foreign exchange in the Philippines. This led to the recommendation for the creation of a study group to consider, in greater detail, coconut research and development, and the need for establishing a coconut research center.

The workshop briefly discussed the potential support for Philippine economic growth in mineral exploration and processing and concluded with limited discussion of the need for scientific support of reforestation and forestry conservation in the Philippines. The workshop recognized the need for solutions to these problems and endorsed the need for surveys to identify their basic dimensions as a prerequisite to the organization of more closely focused research efforts.

SESSION V: Oceanography and Fisheries

Chairman: Dr. Konrad Krauskopf Rapporteurs: Dr. Canuto G. Manuel
Dr. I. Eugene Wallen

Problems in the general area of oceanography and fisheries were discussed. The utilization of marine resources toward a solution of the problem of protein deficiency is limited principally by lack of knowledge about the life histories of fish and invertebrate populations. The large capital and government investment required for fisheries and oceanographic research was felt to be justifiable for fisheries, but not for open-ocean work.

The workshop noted the apparently favorable location and environment of the Philippines for greatly improved fisheries production in open-ocean, near-shore and inland waters. It recommended increased U. S.—Philippines cooperation in research and development activities leading to fuller exploitation of fisheries resources in Philippine and adjacent waters. A broad theoretical basis for this exploitation should be developed and appropriate projects should be undertaken in basic and applied research leading to increased fisheries production.

The Philippine representatives should pursue the following objectives:

a) Maintain and increase efforts in fisheries exploration. Exploitable populations of marine fishery organisms may be transient in Philippine waters or undiscovered because of the opacity of the water. New techniques and equipment as well as extensions of older techniques should increase the chance of finding and exploiting these populations.

b) Encourage the private sector to exploit new fisheries. Wide dissemination of information concerning populations and distributions of marine fishery resources should lead to more intensive exploitation by private individuals and companies.

c) Improve fisheries technology with special reference to catching, preserving, processing, and marketing the catches. Much technological improvement is possible in the harvesting and marketing of marine fishery resources. To increase food production for profit, the conversion of raw fishery organisms to fish meal, fillets, fish protein concentrate, and fish sauce, requires that new techniques be developed for the species living in Philippine waters.

d) Develop techniques. Expertise in practical fish culture exists in much of the Philippines. The encouragement of research and publicity on successful techniques for fertilizing of waters, spawning of fishes, management of water levels, etc., will increase the profit potential of fish culture, increase production, and help the protein shortage in the Philippines.

e) Gather environmental data related to fisheries from adjacent seas and near-shore water. U. S. and other foreign ships work in seas adjacent to the Philippines. Many of these ships can offer space for participation in research and for training of Philippine nationals. Oceanographic data from these vessels go to national data centers. Use of vessels of the Philippine Navy, Coast and Geodetic Survey, and other agencies to gather additional data would add to the international pool of information which could be tapped by Philippine scientists.

f) Participate actively in Intergovernmental Oceanographic Commission marine planning and operations. Already a part of the Commission, Philippine scientists should become more vocal participants and originate ideas for implementation through the IOC with international funding.

g) Request participation of Peace Corps representatives and consultants in fish farming and marine activities. Peace Corps volunteers have been trained for fish culture work in Togo. A request for similarly trained volunteers would add manpower for activities of research value to Philippine science. U. S. consultants in fish culture techniques could also add to the research effort.

h) Bring the NSDB Committee on Marine Sciences into contact with the U. S. Academy Committee on Oceanography. In helping to implement the above and similar suggestions, the NAS Committee on Oceanography might be asked to use its staff and expertise for joint projects with the NSDB Committee on Marine Sciences.

The U. S. representatives should pursue the following objectives:

a) Increase the availability of fellowships, traineeships and courses open to Philippine applicants.

b) Make space available and encourage participation of Philippine scientists on U. S. oceanic vessels in waters near the Philippines. Systematic advertising of the need for this would encourage U. S. vessels in taking Philippine scientists aboard for research and training.

c) Encourage the training of Peace Corps personnel for work in fish farming and oceanographic activities in the Philippines.

d) Publicize the need for participation of U. S. scientists and engineers in fisheries and oceanography in the Philippines.

e) Encourage U. S. industries knowledgeable in fish technology to train Philippine technologists.

f) Increase the availability to the Philippines of world oceanographic data from Philippine seas. The U. S. National Oceanographic Data Center should be encouraged to assist with the collection and processing of Philippine data and to release data already collected.

g) Encourage the establishment in the Philippines of a marine specimen-sorting center. The Smithsonian Institution should be urged to assist the Philippines in the development of a specimen-processing center in the Philippines.

h) Assist in obtaining equipment for Philippine marine research. Obtaining oceanographic equipment is a world-wide problem. The U. S. should make a strong effort to assist the Philippines and other countries in meeting this need, possibly by developing a surplus equipment center.

i) Encourage and assist Philippine participation in international oceanography and in the International Biological Program (IBP). Already a member of the Intergovernmental Oceanographic Commission (IOC), the Philippines could consult with U. S. delegates to the IOC to provide useful input to further Philippine interests. Cooperation in the IBP should be increased.

j) Bring the National Academy of Sciences Committee on Oceanography (NASCO) into touch with the Philippine Committee on the Marine Sciences for the purpose of implementation of the above plans as appropriate.

The workshop recommended investigation of the possibility of establishing a binational or international oceanographic and fisheries research institute in the Philippines as an extension of the implementation of these recommendations. This might be discussed at a NAS-NSDB sponsored conference on marine sciences to be held in the Philippines. The implementation of these recommendations was agreed to be necessary to stimulate awareness of the opportunities for oceanographic research in the Western Pacific Ocean.

The funding of such an institution was discussed; the workshop agreed that agencies, such as the U. S. Bureau of Commercial Fisheries, non-governmental institutions, and the U. N. family might be suitable sources. The U. N. might provide assistance to carry out a pre-investment survey.

The problems of fish technology, processing and marketing were discussed further. It was noted fermentation of fish products was being investigated by the National Institute of Science and Technology (NIST) and because of the high nutritive value of fermented fish sauce and the export market potential for this product, the cooperation of private U. S. pharmaceutical industries, which have extensive experience in fermentation technology, might be sought to explore possibilities of increasing production.

A need was expressed for assistance in the development of fish preservation technology, particularly canneries, and the utilization of hitherto neglected fish, such as the shark.

The establishment of a Philippine-Japan commission on cooperation was noted with interest in view of the Japanese expertise in the area of fisheries in the Western Pacific.

SESSION VI: A. Communication and the Scientific and Technological Community

Chairman: Dr. Konrad Krauskopf Rapporteur: Mr. W. Murray Todd

Two particular aspects of scientific and technological communication are relevant:

1) between scientists of different institutions—an informal procedure, and

2) among institutions and scientific societies—the formal elements of the transmission of knowledge.

In the Philippines there are four areas of communication of special concern to the NSDB:

1) among scientists themselves,

2) between scientists and the public,

3) between scientists and industry,

4) between scientists and the legislative and executive branches of the Philippine Government.

An inventory of the major scientific journals and their distribution in the Philippines was presented. The disparity between the circulation of the major scientific journals and the readership among Philippine teachers was noted and it was concluded communication among scientists may be adequate, but that between scientists and Congress is weak and that between scientists and the public and between scientists and the teaching profession is in need of improvement.

Another area of communication of special interest is that fostered by the scientific societies. The character of the Philippine Chemical Society was described and the participants agreed it would be extremely useful to this society to have a working relationship with the American Chemical Society. NSDB representatives will provide the U. S. workshop panel with a list of Philippine scientific and professional societies with membership figures in order that the NAS might review the possibilities for cooperation with American counterpart societies.

The need for Philippine institutions to improve their library facilities in both quantity and character of books and journals was examined. A separate Philippine national documentation center was discussed and the need for textbooks—a need AID is helping to overcome—mentioned.

Library planning and consolidated acquisition programs were also mentioned and it was explained there are inter-library loan procedures, but no collaborative buying exists among the different agencies in the Philippines.

NAS and the NSDB representatives agreed to collaborate on the strengthening of Philippine professional societies insofar as cooperative arrangements with U.S. professional societies might serve this purpose and that the NAS would keep the Philippine group informed of NAS science book program developments as they relate to Philippine scientific and technological library needs.

SESSION VI: B. Formulation and Implementation of National Science Policies

Chairman: Dr. Konrad Krauskopf Rapporteur: Mr. W. Murray Todd

Discussion by the workshop centered on a bill pending in the Committee on Scientific Advancement of the Philippine Senate providing for a steady source of funds for scientific and technological research and development and manpower training and development on a national scale, through the levy of a special tax of 2% on every foreign exchange transaction and the alternative method of financing through the levy of a special tax on the net income of corporations prior to income tax.

The workshop discussed and agreed on the urgent need for a specific measure to raise as rapidly as possible the level of government expenditures for scientific and technological research to about one percent of the GNP (see Recommendation No. 1, Group V, First Philippines—U. S. Workshop, Manila, November 22-26, 1965).

The U. S. group noted it would be inappropriate to comment on Philippine tax procedures and science financing methods, but lent support to the concept that current financing is, in all likelihood, seriously inadequate.

The workshop group questioned and reviewed the capacity of Philippine scientific institutions to absorb substantially increased sums of money for scientific and technological programs in light of the shortage of scientific manpower. It was made clear the Philippine Congress has appropriated funds for significant numbers of programs and projects which, because of budgetary limitations, have not been implemented, but which could immediately be undertaken without significant increases in available manpower. Much of this absorptive capacity, nowever, could be created through the scientific manpower training program and provision of physical plant and equipment.

The political will to support science in the Philippines and the relationship of scientific to other social values was discussed in relation to the means used to finance this support. Although no conclusion was reached it was clear all members of the workshop were in sympathy with the need of the NSDB to achieve, with other organizations and institutions in the Philippines, a broadened public and parliamentary backing for the concept of science and technology as an essential element of national development policy and programming.

A resolution relating to the current proposed Philippine legislation was drafted by a selected panel.

Resolution Regarding Funds for Science

Background

Discussion centered on the urgent need to develop an expandable source of funds for scientific and technological research and development, including manpower training, to promptly raise the level of government expenditures in science and technology through the Philippine National Science Development Board. The national goals should be to raise, as rapidly as possible, aggregate expenditures on research and development to a level of about one (1) percent of the GNP per year. This was the essence of the recommendation made in the First U. S. — Philippines Workshop (see Recommendation No. 1, Group V, First Philippines—U. S. Workshop, Manila, November 22-26, 1965).

Resolution

The workshop notes that there is an urgent need to raise, as rapidly as possible, the level of expenditures on scientific and technological research and development to about one percent of the GNP and urges that the means to finance scientific and technological activities, including the possible use of new tax sources, should be given priority consideration by the Philippine Congress and by the executive branch of government.

SESSION VII: Areas for Joint Cooperation

Chairman: Dr. Harrison Brown Rapporteur: Dr. Kenneth Turk

The Chairman welcomed Congressman George Miller to the workshop and described Mr. Miller's contribution to science in the United States, especially in his present role as Chairman of the House Committee on Science and Astronautics. The Congressman generously indicated his committee would be privileged to work with workshop panels and expressed his strong personal feeling that science is a common language and can be the catalyst to bring the peoples of the world together. He feels his committee has improved the dialogue between the scientific community and Congress and that this is equally important for other countries.

In addition to the joint programs described in earlier sessions, the following areas were considered for U. S. —Philippines cooperation:

A. Weather
B. Energy sources
C. Water resources and desalting
D. Air and water pollution

A. Weather: The Director of the Philippines Weather Bureau has already proposed a program for U. S. —Philippines cooperation in research on tropical meteorology. U. S. facilities exist for weather tracking in the Philippines and an increased cooperative program of sharing these facilities and resulting information is desirable. In addition, it would be valuable to have experts in meteorology from the Caribbean sent to the Philippines to describe their experience in weather prediction and to suggest possible programs for the Philippines. An offer was extended by Dr. Brown to put U. S. Government agencies, particularly the Inter-agency Commission on Atmospheric Sciences and the National Academy's Committee on Atmospheric Sciences, in touch with appropriate Philippine commissions to consider possibilities for cooperative research programs, including training programs. Dr. Salcedo recorded his acceptance of the scientific aspects of the joint communiqué issued by Presidents Marcos and Johnson and offered Philippine assistance in the establishment of joint programs.

B. Energy Sources: Hydroelectric sources of power in the Philippines are limited and there is need for alternatives, possibly geothermal, nuclear or solar. A geothermal plant with a potential output of 20 MW is under construction, and the Republic of the Philippines is evaluating the feasibility of using nuclear energy as a power source in Northern Luzon. A small experimental nuclear reactor of 1-3 MW capacity is available for training technical personnel.

The urgency of a decision on the use of nuclear power within the year was emphasized if a 300 MW capacity is to be realized by 1971, and second and third reactors, giving a total of 1000 MW, are to be built in 1973 and 1975 respectively. It is envisaged these should be obtained through private contracts.

Recognizing that the provision of adequate energy sources is principally an economic matter rather than a research problem, the representatives of the NAS offered assistance in facilitating contact between the appropriate U. S. and Philippine agencies.

C. Water Resources: Two water problems are flood control and the provision of fresh water for irrigation and human consumption. More information regarding the extent of underground water resources is needed. Expansion of the present limited irrigation by artesian water in Central Luzon was suggested and it was noted the U. S. Bureau of Reclamation is studying the problem of flood control.

Various methods of removing salt from sea water were discussed briefly with concurrence that solar energy distillation is most pertinent to Philippine experimentation. In view of the rapid expansion of research in this field in other parts of the world and the cost of establishing similar programs in the Philippines, the workshop suggests activity in this field of research be limited to the acquisition of information by a small number of Philippine specialists.

The workshop concluded that the Hydrological Decade offers an excellent opportunity for cooperative studies of problems of water resources in the Philippines. Possibly the training of hydrologists might be undertaken by appropriate U. S. agencies and institutions.

D. Air and Water Pollution: The problem of air and water pollution in the Philippines was discussed and concern expressed regarding the urgency of determining the nature and solution of these problems before they reach unmanageable proportions.

The NAS representatives agreed to investigate the possibility of sending U. S. scientists and engineers to the Philippines to cooperate with Philippine scientists in assessing problems and recommending programs leading to their solution. Fellowship and scholarship possibilities in U. S. institutions and establishment of air and water pollution control centers should be explored. Prompt action is essential in view of the rapid expansion of industry in the Manila Bay area and around Laguna de Bay.

The participants agreed this subject might be discussed at the next workshop within the general context of problems resulting from industrialization and urbanization.

Contributed Papers

REPORT ON PROGRAMS AND ACTIVITIES

Dr. Juan Salcedo, Jr.

It is my privilege to make a report to you on the programs and activities for science development in our country since the First Philippines-U. S. Workshop on Scientific and Technological Cooperation and Development held in Manila 20-26 November 1965.

In retrospect, we wish to state that the first workshop was a most inspiring and rewarding experience for all of us in the Philippine Panel and we hope that our colleagues in the U. S. Panel found it equally thought-provoking and profitable.

With the advent of the new administration on 30 December 1965, under President Ferdinand E. Marcos, we felt it imperative to report to him on the conclusions and recommendations of the first workshop which we did on 3 January 1966.

We like to believe that the Summary of Conclusions and Recommendations has provided the basis and impetus for the science program of the new administration and, in a modest sense, the stimulation for its overall national development plan.

In the funding of research activities in the public sector at least, the level of support from the government remains the same. Steps have, however, been taken in the direction of raising the present level, averaging 1/10 of one percent of GNP, to one percent of GNP. A bill is now pending in Congress that would provide the NSDB and agencies under it with a continuing research fund amounting annually to 50,000,000 pesos generated from a system of levies on selected exports and imports. The bill has so far received the endorsement of our officials. It passed the House of Representatives last April and is calendared for Senate action at the next regular session early in 1967. The Secretary of Finance, the business and banking sectors are behind the move to raise the government support for science and technology.

Consideration has been given to the need to give more emphasis to applied research and to allocate to this area more funds, approximately 90% of research and development funds, and 10% thereof to basic research.

Our official arrangement with the Budget Commission for the NSDB to undertake the evaluation of requests for research funds from government agencies is being pursued with encouraging results in terms of achieving a current inventory of research projects in the government sector and maximizing the utilization of public funds in priority undertaking through the coordination of government research programs. There is national cooperation in this regard from other government research agencies.

The NSDB continues to give grants-in-aid to research agencies, educational institutions and individual investigators, including financial arrangements for participation of Filipino delegates to international scientific meetings, seminars and conferences.

Facilities of the NSDB have, in fact, been offered and utilized in the assessment and development of the potentialities of our forest, marine and mineral resources. Efforts are being exerted towards the early implementation of the recommendations of a Rats and Other Agricultural Pests Control Study Group. It is our hope and, yours, too, we know, that perhaps in the interim some workable arrangements of binational cooperation may be explored for the establishment of an international institute in this field.

Closer attention is being focused on the need for some system of drawing back to the Philippines our specialists who have completed their training abroad and of providing them with incentives to stay on in their specialized fields. It is realized that further consideration should be given to "structuring" our foreign scholarship program in the sciences in relation to the needs and demands of the economy.

The NSDB scholarship program in the undergraduate to graduate level is being given full supervision. The Philippine Science High School is now in its third year of operation. In cooperation with the Department of Education, the NSDB is pursuing a program of summer institutes for science teachers and a reassessment of science curricula.

Manila and some of our provinces very recently were in the throes of an outbreak of H-Fever and while government concern for the matter falls within the functional responsibility of the Department of Health, the medical research facilities of the NIST have invariably been made available to interested medical groups. For its part, the NSDB through its facilities, is paying closer attention this fiscal year to the related research activities in agricultural products, nutrition, biology, industrial research, nuclear energy, and engineering spread over 199 separate research and development projects.

The research centers of the NIST, particularly the Industrial Research Center (IRC), are now embarked more vigorously on the full industrial utilization of our major crops and resources, namely, coconut, sugar and forest products. The results are encouraging in the work on an integrated coconut product industrialization process on oil, husk, charcoal briquettes and coconut protein. What needs yet to be done is the economic feasibility study.

A study is now being made for the expansion of the facilities of the NIST's Division of Documentation to make it a more useful tool to scientists, researchers, technologists, and others who are interested in scientific library services.

The NSDB has recently expanded its area of communication to and from the provinces with the establishment of additional regional offices which now, among others, assume responsibility for the effective dissemination of results of research; holding of regional seminars and science fairs; and more importantly serves as liaison between NSDB and the scientific, educational and industry groups in the provinces. This month it is sponsoring twelve regional science fairs to be climaxed by a national competition among winners in Manila next month.

The operation of the NSDB has been expanding with the establishment within its organizational structure of additional institutes, namely, Philippine Inventors Commission, Philippine Coconut Research Institute and the Textile Research Institute and also with its interrelated activities with the National Air and Water Pollution Control Commission and the Philippine Science High School.

We are deeply pleased with the arrangement that this second workshop should now address itself to the treatment of problem areas in priority fields and that out of the discussion we are about to participate in, there should emerge positive agreements, on binational scientific cooperation on specific priority projects for development.

In addition to those fields which received our attention in the first workshop, it is our belief that an opportunity has now presented itself as a result of the joint communique issued at the close of the recent state visit in September of President Marcos with President Johnson to consider specially the potentialities for a joint program in oceanography, tropical meteorology including typhoon damage control and space technology. In the latter part of the week, the Philippine Panel will welcome a more detailed consideration of these activities.

AN OVERVIEW OF THE PHILIPPINE ECONOMIC DEVELOPMENT PROGRAM IN RELATION TO THE ROLE OF SCIENCE AND TECHNOLOGY

Alejandro Melchor

This paper proceeds on the assumption that it is the responsibility of students of science to offer new perspectives to the solution of old problems. It submits that contemporary science in the Philippines must substantially reorient its attitudes and ambitions if it is to take a realistic role in the issues most vital to our country: those of development.

Let me first give an overview of the Four Year Economic Development Program for the Philippines (fiscal years 1967-1970) in relation to the role of science and technology.

1. The basic problems to which the Program addresses itself are:

   a) the dualistic character of the Philippine economy, i.e., the large rural sector, with its backward agriculture supporting 72% of the country's population in a manner where nature rather than technology remains dominant as against the smaller, though more prosperous and modern, export and industrial sector. The existence of these disparte systems has created problems which require immediate solutions. Inefficient and subsistence agriculture has resulted in low farm incomes, made few resources available as inputs for industry, and has not provided the mass market needed for industrial expansion.

   b) a population growth rate of 3.2% annually which is creating great pressures on our food crop production which has been growing at an annual average rate of 3.5%.

   c) a substantial and growing unemployment problem estimated to be 13% of the labor force.

   d) adverse terms of international trade.

   e) the large requirements for investment in infrastructure facilities (3.09B pesos), especially in irrigation and roads.

2. The aggregate goals of the Program are:

   a) an annual rate of growth of GNP at 6.2% from 20.5B pesos in FY 66 to 26.14B pesos in FY 70.

b) an annual rate of growth of national income at 5.7% from 17.4B pesos in FY 66 to 21.7B pesos in FY 70.

c) an annual rate of growth of per capita income of 2.4%.

d) reduction of the unemployment rate from the present 13% to 7.2% of the labor force in 1970.

3. To attain these objectives, a total investment of 20.3B pesos would be required by the Program. This will necessitate an increase in the rate of investment from 14.6% of GNP in FY 62-66 to 21.3% during the Program period. Of this investment, the national government will account for 3.5B pesos or 17% of the total required investments, while the private sector will account for 16.9B pesos or 83% of the total investment.

As a corollary, the Program calls for an increase in the rate of savings from the current 16% of GNP to 19% by 1970. With this projected increase in the savings rate, domestic savings will cumulate to 17B pesos during the Plan period as against the investment target of 20.3B pesos. To attain the investment target, the savings-investment gap will have to be filled by external assistance in the amount of 3.3B pesos or $851 M.

Properly implemented, the Economic Development Program must have accomplished the following by the end of 1970:

1. solved the serious food-population problem confronting the country.

2. increased the extent and the efficiency of the country's transportation system through the construction and improvement of the principal highways, bridges, ports and airports.

3. increased the extent and the efficiency of the country's irrigation systems.

4. solved the serious flood problems of the country.

5. expanded the capacity for power generation and distribution.

6. improved and extended the country's telecommunication network.

7. established essential industries and agricultural projects to fill the most urgent gaps in the productive structure.

8. improved and expanded the agricultural extension machinery.

9. effectively stopped the wanton and destructive use of the country's natural resources, particularly forest and fish resources.

10. expanded the country's educational facilities to meet the requirements of an increased population and enhance the quality and excellence of the present educational system.

11. adequately relieved the need for housing and health facilities both in urban and rural areas.

12. adequately provided for the maintenance of the country's internal and external security.

Science and technology have been identified as an important adjunct to the economic development process. Accordingly, a four-year program of applied research and development studies has been drafted, involving agriculture, industry and engineering, medicine, nutrition, atomic energy, and the development of scientific manpower. 57.8 million pesos has been allotted for the Program Period, for operating expenses, surveys and research and training grants, to support the dissemination of results of scientific studies, as well as the funding requirements of foreign-assisted projects.

This role is only consistent with a recognition of the direct contributions of science and technology to development. Discussing this briefly:

1. Economic development, or the process of increasing per capita income levels, has frequently been viewed only from the central problem of capital formation.

2. While this build-up of productive capacity is surely crucial to growth and therefore cannot be overemphasized, still, one feels that too much of growth economics theory has been directed toward the problem of physical capital formation and its financing to the exclusion of other equally important factors.

3. Comparatively little empirical research on the other hand has been undertaken and made available to the policy-maker on the investment in terms of human capital—and science and technology as an adjunct, perhaps even a conditio sine qua non, to physical capital information.

4. It is self-evident that acceleration in the building-up of productive capacity must be accompanied by more efficient manpower and technology so that desired higher levels of productivity and output may be attained. Otherwise the conditions of space-age technology would be obstructed by primitive labor power and techniques.

5. Extensive studies have shown the following in the United States between 1929 and 1957:

   a) 23% of growth in real national income was generated by increased education.

   b) 20% of growth in real national income was generated by the advance of scientific and technological and managerial knowledge, which permitted greater production out of a given quantity of resources.

   c) Significantly, the increase in inputs of physical capital contributed only 15% of the total growth in real national income.

6. This is convincing proof that the generally accepted concept of capital formation misses this essential element of progress— investment in human resources as a truly productive agent.

7. Clearly, rather than being limited to net increases in land, structures, durable equipment, commodity stocks and investments overseas, capital stock must also be measured to include the body of knowledge available to the people and their capacity and training to use that body of knowledge effectively.

Just as a solid physical base of infrastructure facilities is essential to growth, it is also necessary to build a scientific and technological infrastructure— not only to undertake researches, but to disseminate the results, and to demonstrate the feasibility of their application. This infrastructure would be necessary to complete the continuing innovation.

I have listed some problems with respect to Philippine science and technology:

1. Limited resources to finance scientific research.

2. Inadequate physical facilities.

3. Isolation of the scientific community from the mainstream of other major disciplines, particularly politics and economics. Instead of having reached some interdisciplinary approach by this time, the community has become more and more indrawn, with agruments among its members. However, it must be

appreciated that this conference marks a purposeful effort to remedy this situation.

4. Relative to this, inadequate lines of communication exist between the scientific community and the proper implementing agencies in both the government and private industry. To give an example, certain proposals of the last RP-US Workshop on Scientific and Technological Cooperation and Development would probably be unacceptable as unrealistic, if presented right now to such implementing agencies. To cite one: that "government investment in research be raised from the present 1/10 of one percent of GNP to one percent of GNP as rapidly as possible." One may question how well a nation like the Philippines can afford it. Certain areas, of course, will require heavy research investments, including those mentioned in our project listing. Most certainly, these investments must be kept. But to increase, across the board, the present figure by ten times is not fully realistic. This is not an argument about figures and statistics, for it may involve sacrificing other equally important and perhaps more immediate developmental requirements.

5. A revolution of rising expectation has swept the country. There is is pressure for the government to do the most with the least and soonest. This has resulted in Congress passing appropriations far in excess of government resources.

Among others, I would suggest the following for consideration as possible solutions:

1. the export of technology from industrialized countries to developing economies on a scale larger than the present, with specific reference to giving substance to the Johnson-Marcos Joint Communiqué in mid-September, 1966.

2. the pooling of the resources of private industry to match the financial requirements of large-scale industrial research.

3. the expansion of present training programs for scientists and technicians from developing countries.

4. the initiation of socially valuable researches, including, as proposed by the last workshop:

   Area I. Researches directed at increasing the utilization of natural resources to produce substitutes of imports.

Area II. Researches directed at upgrading and expending the nation's export products.

Area III. Researches directed at processing the waste products of agriculture and industry to develop consumer goods and export commodities.

Area IV. Measures directed to develop scientific and technological manpower, promote social science research and science consciousness.

Like most developing countries, the Philippines is witnessing the phenomena of declining death rates and of sustained birth rates at high levels with the result that population is rising at the rate of 3.2% per annum.

In its rich resources, the Philippine economy finds a vast potential; in the rapid expansion of its population, it finds its biggest challenge. In meeting this challenge, President Marcos announced last week that the government policy would be to follow the measures suggested by the Vatican and the FAO in coping with the mounting population problem. Thus, instead of limiting the number of people at the banquet table, the Economic Development Program seeks to put more food on the same table to feed the millions still to be born (300,000 laborers and 500,000 school children every year).

The role of science and technology in the national quest for general welfare and economic progress is clear; the problem is how, within the many given constraints, its effort can be stepped up.

PROBLEM AREAS IN INDUSTRIAL RESEARCH

Canuto G. Manuel

As in many developing nations, scientific and technological research and development in the Philippines have been directed mainly to accelerate industrialization. This present industrial trend has been bolstered by the Philippine Five-Year Integrated Socio-Economic Development Program (FY 1962-1967) and a recently updated Four-Year Science and Technology Development Plan (FY 1966-1970), prepared by our National Science Development Board (NSDB). The latter, particularly, has given high priority to industrial and engineering research and development.

The whole science development program is subdivided into specific program areas: (1) Research and Development Program, (2) Scientific Manpower Development Program, (3) Science Promotion Program, (4) Capital Investment Program, (5) Financial Program, and (6) other science programs.

The Research and Development Program covers the fields of industrial research, engineering research, agricultural and natural resources research, atomic energy research, medical and allied research, foods and nutrition research, social science research and basic research. Of special significance, however, to applied industrial and engineering research is the inclusion of a multi-purpose pilot plant project in the aforementioned capital investment program. It is also noteworthy that in the implementation of the current Science and Technology Development Program, the enactment of a law establishing a Pilot Plant Research Center in the Philippines has been recommended.

INDUSTRIAL RESEARCH

In order to be able to utilize our country's abundant raw and waste materials for the production of substitutes for imported raw materials and intermediate and finished products as well as the development of exportable manufactures, the following objectives of the program have been set:

a) to explore more thoroughly the physical and chemical properties of locally available raw materials,

b) to explore the possibilities of producing from local raw materials and basic and/or intermediate imported products,

c) to investigate alternative cheaper sources of raw materials for the needs of industry,

d) to adapt known manufacturing methods of local materials and conditions,

e) to develop improved and cheaper methods of production,

f) to develop methods for quality standardization of industrial products,

g) to develop new consumer products utilizing local raw materials,

h) to develop processes of upgrading the local raw materials, and

i) to develop equipment and processes of manufacture for use of industries on the cottage level.

After considering the status of research facilities, manpower, economic impact, funds and actual needs, the areas of research in industry, in order of their priority, have been developed as follows:

a) Primary metal and mineral industries;

b) Chemical industries;

c) Pulp and paper;

d) Wood technology;

e) Textile technology;

f) Food technology, including food manufacture;

g) Agricultural industries;

h) Cottage industries;

i) Miscellaneous, industrial microbiology, etc.

ENGINEERING RESEARCH

To realize the benefits of properly designed and engineered projects, the Engineering Research Program (also under Area Program of Research and Development) has set the following objectives:

a) to develop metallurgical and chemical engineering processes for local materials;

b) to improve the design of facilities and structures on irrigation, flood control and drainage;

c) to develop means of deriving power, fuel and water from available sources for urban and rural areas;

d) to improve the quality and develop new engineering construction materials;

e) to develop methods of fabricating scientific instruments, engineering equipment and machinery using local raw materials; and

f) to develop new materials for and to improve the efficiency of transportation and communication facilities.

Consistent with the above-mentioned objectives and considering the present status of research, developmental work has been carried out in several areas in the following order of priority:

a) Metallurgy;

b) Chemical engineering processes;

c) Sanitary engineering;

d) Irrigation, flood control and drainage;

e) Water supply development;

f) Power and fuels;

g) Surveying and mapping;

h) Engineering and construction materials;

i) Instrumentation, engineering, equipment and machinery;

j) Transportation and communication facilities.

Consequently, in view of the objectives of the industrial and engineering research programs and the order of priorities in carrying out development work as envisioned in the Area Program of Research and Development of the NSDB, the said industrial and technological researches were in effect directed specifically as follows:

I. Researches directed at increasing our major export products, namely: coconut products, sugar and related products, lumber and timber, fibers and fiber manufactures, minerals and metals, fruits and preparations, tobacco and maufactures, and others —by developing better manufacturing methods, processes, techniques and devices aimed at improving the quantity and quality of the products, reducing the cost of production of the products, developing new uses for the products, upgrading the products by further processing and developing uses for by-products and wastes resulting from production of these export products.

II. Researches directed at decreasing our major import products, namely: textiles, food products, fuels and lubricants, machinery, metals, transportation equipment, manufactured metal products, paper and paper products, rubber manufactures, medical and pharmaceutical preparations, tobacco, chemicals, nonmetallic manufactures, dyeing and tanning materials and others —by exploring the probability of using domestic raw materials to produce any of these import products; by exploring the possibilities for producing the raw materials for making the products locally if they are not already available; by developing manufacturing methods for making these products locally, if presently known manufacturing methods are not applicable to local materials and conditions; and by developing substitute products from local raw materials.

III. Researches directed to increase production of domestic products for local consumption, i.e., food products, vegetable oils, starches, portland cement and others— by investigating alternative and cheaper sources of raw materials for these products, developing improved and cheaper methods of producing the products, establishing standards of quality of the products and developing new uses for these products.

RESEARCH AND DEVELOPMENT PROBLEMS

Industrial and engineering research in the Philippines is still partly lacking direction and up-to-date pilot plant equipment, hence very meager benefits are derived from the results. There is a need to train research directors or competent research managers in order to gain the desired direction in research and to obtain more beneficial results from research and development endeavors. Other problems are:

Lack of proper motivation for scientists and technologists

The lack of competent government scientific and technical staff is another problem area. If industry is to come to the government research agencies, it must have confidence in them. The causes of this problem are many-fold but the main cause is the lack of proper incentives, chiefly, monetary and, secondarily, the very frustrating and cumbersome procedures involved in undertaking government research projects.

Lack of techno-economic evaluation of research projects

Applied industrial research projects require constant techno-economic evaluation. The National Institute of Science and Technology (NIST) is sorely in need of competence in this area. This gap must be filled as soon as possible in order for the research program of the NIST to be effectively applied to industry. An economic analysis of a new or improved process or product is the cornerstone for decision making by prospective investors.

Autonomy in scientific and technological institutes

The NIST or any government research agency, in order to be an effective instrument for industrial and economic growth through research in science and technology, must be a fully autonomous body, i. e., free from the usual government rules and regulations. Research institutions in the Philippines have not quite attained this status.

Need for modern and complete library facilities

One of the fundamental needs in a research undertaking is an up-to-date library. Anyone involved in research realizes the importance of this service. A lot of research projects are "terminated" and costly duplications avoided by way of initial literature surveys. There is therefore an urgent need to upgrade, update and complete the library facilities in our country.

Need for scientific and technological manpower

While it is true that every year Philippine universities turn out thousands of graduates in science and engineering, these graduates are more "textbook-oriented" than "laboratory or research oriented". One of the main reasons for this is inadequate laboratory facilities together with the lack of competent, research-minded and trained instructors. This is also the reason for the poor quality of some of our graduate education in the sciences.

Application of science and technology to rice production

The Philippines has one of the lowest average production per hectare (29 cavans) of its basic staple, rice, when paradoxically the world's best research institute on rice production is situated in our country. The problem is threefold: (a) lack of proper education of rice farmers in modern farming techniques, (b) resistance to innovation and (c) lack of necessary capital to obtain the needed equipment and materials.

Imported technology

Another problem area is the importation of technology from the more developed countries. In most instances, modern technology and equipment are imported without priority study as to their adaptability to local conditions. It may be that for a particular industry, the local environment may not require the latest model of equipment. On the other hand, adequate and up-to-date pilot plant equipment and facilities of the "multi-purpose" type will prove indispensable and can facilitate research work in industry and engineering.

AREAS OF COLLABORATION

The following suggested specific areas for collaboration may yield fruitful discussions among the experts representing each country:

Communications among research directors of the two countries:

1. organization of an annual international conference on the administration of industrial and engineering research institutes.

2. organization of an association of research directors, international and/or local chapters to sponsor symposia and seminars on research management and on other selected topics on industrial and engineering research and development.

New challenges and potentialities for science and technology:

1. to have a techno-economic evaluation group in the appropriate level or levels to conduct plans, estimates of costs, survey of the economics and market research before indulging in profit-boosting projects utilizing the vast natural resources (explored and unexplored) of the regions.

2. the establishment of a science and technology museum that will include industrial design.

Scientific manpower needs and problems:

1. direct collaboration with leading research agencies or companies in some developed nations for the training of research and development managers.

2. abundance of raw materials but lack of technical know-how in processing or manufacturing them.

3. improvement of the salary rates of the research personnel.

4. the program of getting highly competent men to do research and service activities—improvement of manpower.

5. research and development institutions should be made autonomous—make them free from civil service rules and regulations and reduce red tape in their activities.

6. lack of incentives to attract competent researchers, especially those sent to train abroad who, for obvious reasons, prefer to stay abroad instead of returning home to their respective countries.

7. hiring of experienced engineers, local or foreign, on contractual basis when needed.

8. definite attractive policies on patents and invention royalties and participation.

9. lack of attraction in the field of science, many prefer the fields of law, education, business and others—lack of students in science and technology in the graduate and postgraduate levels.

10. proper orientation of the educational system to the local needs of industrial research and technological innovation.

Requirements for applied and basic facilities:

1. to encourage the importation of research and development machineries and facilities.

2. putting up of more pilot plants, specifically, multi-purpose pilot plants for the projection of the many bench-scale results accumulated from various research projects.

3. the need for improvement and expansion of scientific libraries and documentation in order to cope with the advances and new developments in science and technology;

4. tax exemption for equipment and machinery used in research and development as well as in education.

Science in the remote areas—communication, extension, local applications:

1. intensive promotion work should be done such as the preparation of appropriate brochures, and pamphlets for distribution to laymen.

2. further efforts at dissemination of information to the people in the rural areas to make them accept new trends in science and technology.

Further possibilities for cooperation:

1. cooperative research work between the two countries utilizing the host country's raw materials.

2. exchanging scientific technical literature from private and government research agencies, including soft copies of patents.

3. conducting joint research projects between the two countries in line with the policy of fostering international cooperation in science and technology.

WORKING PAPER FOR PRELIMINARY DISCUSSIONS

PROBLEM AREAS IN INDUSTRIAL RESEARCH WITH REFERENCE TO POSSIBLE JOINT UNDERTAKING OF SELECTED PROJECTS THROUGH RESOURCES, FACILITIES AND EXPERTISE AVAILABLE IN THE PHILIPPINES AND THE UNITED STATES

Cantuo G. Manuel

Background

A year ago, we were the hosts in Manila during the first workshop meetings on Philippines—U. S. cooperation on scientific and technological development. This workshop we are holding today is a sequel to the one held in Manila. We are glad for this change of venue where we are now the guests and your distinguished Panel hosts, because this is at once indicative of the sincerity that has motivated our common interest and objective of achieving a mutually workable system of scientific cooperation between our two countries.

Furthermore, recent developments in our friendly international relations have brought about a more or less concrete basis that agurs well for our second workshop discussions, i. e., the recent "communique" issued jointly by the illustrious Presidents of our beloved Fatherlands during our own President Marcos' working visit to this country last September, wherein science and technology was specifically cited as one of the projected areas of bilateral cooperation between the Philippines and the United States.

Discussion Guidlines

You will recall that during our first exploratory workshop in Manila, each of the five working groups was able to outline and identify several broad areas of possible cooperation in science and technology development and the attendant problems of each area, which need further elaboration as to how these could be resolved. The findings and the pertinent recommendations of the previous working groups, we believe, can initially be utilized now, unless we wish to spell them out further. We may use them as working outlines and reference during our preliminary discussions with the end in view of further categorizing in more detailed and precise terms the said areas and later drawing up the corresponding work plans and the appropriate mechanics for the joint implementation of these work plans, which we hope shall in all judicious aspects be premised on a "give and take" or a "two-way street" basis that transcends narrow fringes of national interests.

I would like to address myself to the Working Group in which I participated, Group II—Engineering Technology and Industrial Development, which group was, at the Manila meetings, headed by Dr. J. C. Warner of the U. S. Panel and Dr. G. Y. Zara of the Philippine Panel.

In the report of Group II several areas of possible P. I. – U. S. cooperation were identified but outlined broadly thus:

1. Scientific-technical manpower planning, training and administration, including the need for autonomy in research management.

2. Philippine needs for national scientific and technological library services.

3. Development of competence in research management and economic analysis.

4. Expansion and modernization of research and development facilities.

It will be noted that there were overlappings or similar areas and problems reported by the previous Working Groups in very broad categories.

However, during our plenary sessions we might try to minimize these overlappings, by breaking down the previous disciplinary group listing into more specific program areas and sectors, following the pattern and objectives in the Science and Technology Development Program of our National Science Development Board as follows:

I. Research and Development Program

II. Scientific Manpower Development Program

III. Science Promotion Program

IV. Capital Investment Program

V. Other Government Research and Development Programs and we may add another area for broader representation, which is

VI. Industrial Development Programs of Private Sectors.

A more detailed outline indicating the specific sectors covered by each of the above program areas is attached hereto as ANNEX A.

If we adopt the above program areas as bases for identifying and narrowing down the particular sectors where possible cooperation between our countries can be worked out and pinpointed, it can be noted again that our former Group II and the other groups as well, are similarly concerned with the first four programs above-cited and some sectors under the fifth and sixth programs, so that after all, I believe that there is need for another manner of reconstituting our previous working groups in order to minimize overlappings, although we shall take into account the initial Manila reports.

If I may be permitted to suggest further, there is another allied guideline which we may wish to include in our workshop meetings. I am presenting this, perhaps more in my capacity as head of the National Institute of Science and Technology, one of the implementing research agencies of our National Science Development Board, because there are specific ongoing industrial research projects of this agency, which, because of their techno-economic feasibilities, have significant bearing on our national economy. Other members of our Panel, who are also representing their respective science agencies, may desire to present their important institutional projects where collaboration may be needed.

I may mention here our priority development project— a pilot plant for the integrated processing of coconut, a major export crop of the Philippines, in order to industrialize our coconut industry and diversify its by-products into marketable products through utilization of all the coco components— husks, shell, meat, oil and water. I am submitting a separate paper on this project.

Another is our project on algae, its cultural propagation and possible processing for human food and for medicinals.

Another is the need for the expansion and sustained updating of our scientific library resources and documentation facilities, including exchange of science information.

Another is our need for modern flexible types of pilot plants for industrial research and development in our Institute. There is still a development lag in our country in the transfer of technology from the research laboratory to the industrial plants, so that pilot plants are necessary to bridge this gap, including the exchange of sciertists or fellowship grants for the upgrading of our technical personnel for research and development work.

Another is the need to expand and upgrade our Food Research Laboratory (FRL) through adequate technical skills and facilities (particularly food pilot equipment and instruments needed in the testing of food products). The FRL carries out research on methods of food processing, economic utilization of local produce and by-products of the industry, preservation of perishables and storage and packaging of foods. This research is designed to improve food supply qualitatively and quantitatively. The FRL also renders consultation services on food technology to private individuals and local food industries.

We hope that as we go on with our deliberations we can arrive at more defined mutually beneficial "translatory action plans" and the specific terms and phasing of technical cooperation and mutual assistance in kind appropriate for each of the problem areas we may agree upon in order to integrate science and technology into our country's national development plans and policies on a more constructive and realistic projection.

ANNEX A

I. RESEARCH AND DEVELOPMENT PROGRAM

a) Industrial Research

b) Agriculture and Natural Resource Research

c) Engineering Research

d) Atomic Energy Research

e) Medical and Allied Research

f) Foods and Nutrition Research

g) Social Science Research

h) Basic Research

II. SCIENTIFIC MANPOWER DEVELOPMENT PROGRAM

a) Basic Science Education and Training of Scientific Personnel and Research Administrators

b) Education and Training in Atomic Energy

c) Improvement of Science and Mathematics Curricula and Science Teaching

III. SCIENCE PROMOTION PROGRAM

a) Science Publications

b) Documentation and Technical Library Services

c) Mass Media Science Promotion Activities

IV. CAPITAL INVESTMENT PROGRAM

a) Multi-Purpose Pilot Plant

b) Philippine Atomic Research Center Development

c) Scientific Instrumentation Center

d) Tests and Standards Laboratories

e) Scientific Library

f) Food and Nutrition Research Center

g) Philippine Science High School

h) Philippine Community of Science and Technology

V. OTHER PROGRAMS

a) Pre-Investment Study of Nuclear Power in Luzon Grid

b) Scientific Conferences— National and International

c) Technical Assistance—Local and Foreign

d) Survey of Research and Development Activities

VI. PRIVATE INDUSTRY SECTORS

REQUEST FOR TECHNICAL ASSISTANCE FOR COMPLETION OF RESEARCH AND DEVELOPMENT OF THE N. I. S. T. INTEGRATED COCONUT PROCESS

Canuto G. Manuel

I. Introduction:

The coconut ranks foremost among our resources in potential for industrialization. With the rapid increase in our population and the growing international trade competitions and restrictions, the tremendous potential of the whole coconut as an industrial raw material must be fully exploited. The industry must be oriented in a new direction of development and growth. The vast food product potential of the coconut must be developed to the limit, not only for increased and more stable income but also to take care of our food problem due to increasing population. Our population is increasing at the rate of one million a year, so that the problem of food supply will become acute before it is minimized.

Coconut oil is presently facing stiff competition from synthetics. The duty-free quota for coconut oil exported to the United States under the Laurel-Langley Agreement will expire on December 31, 1973. Expanding coconut plantations and corresponding increases in production in other coconut-producing countries (such as Indonesia, South Pacific Islands, Ceylon and some countries in Africa) threaten the Philippines' share in the world's coconut and coconut products export market.

Knowing these problems of the coconut industry and facing them squarely and realistically poses therefore a great challenge not only to our government economic planners and the people directly engaged in the coconut trade, but also to scientific research and technological development and the dedicated men behind it.

Increasing the area planted to coconuts, improving horticultural practices, control of pests and diseases and plantation management techniques will surely result to the production of more copra, coconut oil and dessicated coconut. These and the possible trade preferentials from our limited foreign markets may be considered helpful measures. To us who represent the sector of science and technology, however, we believe that the most serious problem to be solved is the tremendous waste in the industry. Today, coconuts are mostly processed into copra by antiquated methods. This process involves the use of only 35% of the whole coconut. The husks, shells and coconut water which constitute about 65% of the weight of the coconut are largely discarded. Utilization of these by-products is presently limited to a small volume.

The quality of Philippine copra is among the lowest in the world market. Copra meal is fit only for animal consumption. If processed properly, dehydrated coconut meat with its essential amino acids is an excellent source of food for the hungry millions of the world. This will help solve the serious food problems in Asia.

The crying need therefore of the local coconut industry is product and by-product diversification and waste utilization through an intensified industry-oriented research and development program. Considering the vast industrial potential of the coconut, the NIST launched a concentrated two-pronged approach to these problems. First, the development of an efficient and economical method for processing the whole coconut into marketable products and by-products and second, the exploitation of the excellent food product potentials of the coconut kernel or meat.

As a result of an intensive research and development program on coconut processing and with the combined efforts of the NIST researchers and a group of AID technical consultants, an integrated process for the full utilization of the whole coconut was developed at the NIST Industrial Research Center. In this process, the coconut meat and the coconut water are utilized in processing granulated coconut product which may be marketed for the same uses as dessicated coconut. The advantage of granulated coconut over the dessicated coconut lies in the fact that the former is less fibrous and contains all the added nutrients from coconut water which makes it more palatable and nutritious. Because of the partial rupturing of its oil cells, which is inherent in the process of its manufacture, granulated coconut besides being an end-product for food purposes may also be a suitable intermediate product for a solvent-extraction process of producing edible oil and coco-flour. The husks and shells together are passed through a decorticator where useful fibers are separated. The coconut shell together with coir dusts and short fibers are converted into charcoal briquettes, distillate product and fuel gas. Figure 1 illustrates the materials and products of the NIST Integrated Coconut Process and shows the major operating sections.

II. Status of the Project:

This process is now undergoing pilot plant tests to determine its technical and engineering and also its economic feasibilities. These studies will lay the bases for the eventual use of the process on a commercial scale. To date, research and development work has been completed only on the fluidized-bed dryer process of producing granulated coconut. Technical information and relative data obtained from the pilot plant production of granulated coconut is now being evaluated by the Economic Development Foundation.

Because of lack of funds, research and development work on the other phases of the Integrated Process had to be suspended. It is precisely for these phases of the work that assistance is being requested. Although we have proven by previous laboratory studies the possibility of utilizing fully the entire coconut by the production of diversified products, it is necessary to conduct further development studies on these processes.

It may be pertinent to mention here that a product or a process may be shown to be technically feasible but before any commercial venture is undertaken, the economic feasibility of the process must be tested and proven by rigid pilot plant tests and evaluations. This point can be over-emphasized. There are many productions that may be shown to be obtainable from a simple raw material but this information will remain academic in nature unless the process for producing these products can be proven to be economically feasible and competitive in the market. Thus, while we have successfully prepared in the laboratory high-protein coconut flour, coconut protein concentrates, carbonized coconut shell and coir dust briquettes, activated carbon from coir dusts, detergents and other chemical derivatives from the coconut oil, chemicals from the distillates of carbonization of coconut shells, all these have to be developed beyond the laboratory stage.

III. Recommendations:

In connection with further development studies on the various phases of the Integrated Coconut Process financial assistance is being requested for the following sub-projects:

1. A market study for granulated coconut as a food product to assess the acceptability of the product by European and Asian export markets. (Acceptability by U. S. markets can be deduced from statistics on dessicated coconut.)

2. Pilot-plant scale studies on the solvent-extraction process of producing edible oil and flour from granulated coconut.

3. Pilot-plant scale studies on the production of protein concentrates.

4. Pilot-plant scale studies on chemical derivatives from coconut oil.

5. Pilot-plant scale studies on activated carbon from coir dusts and shells.

6. Development studies, design and fabrication of the following plant equipment:

a) coconut husk decorticator and cleaner

b) carbonization retort and tube filler for carbonized coconut shell and coir dust briquettes

c) nut-splitter

d) picker-block (for separating meat from shell)

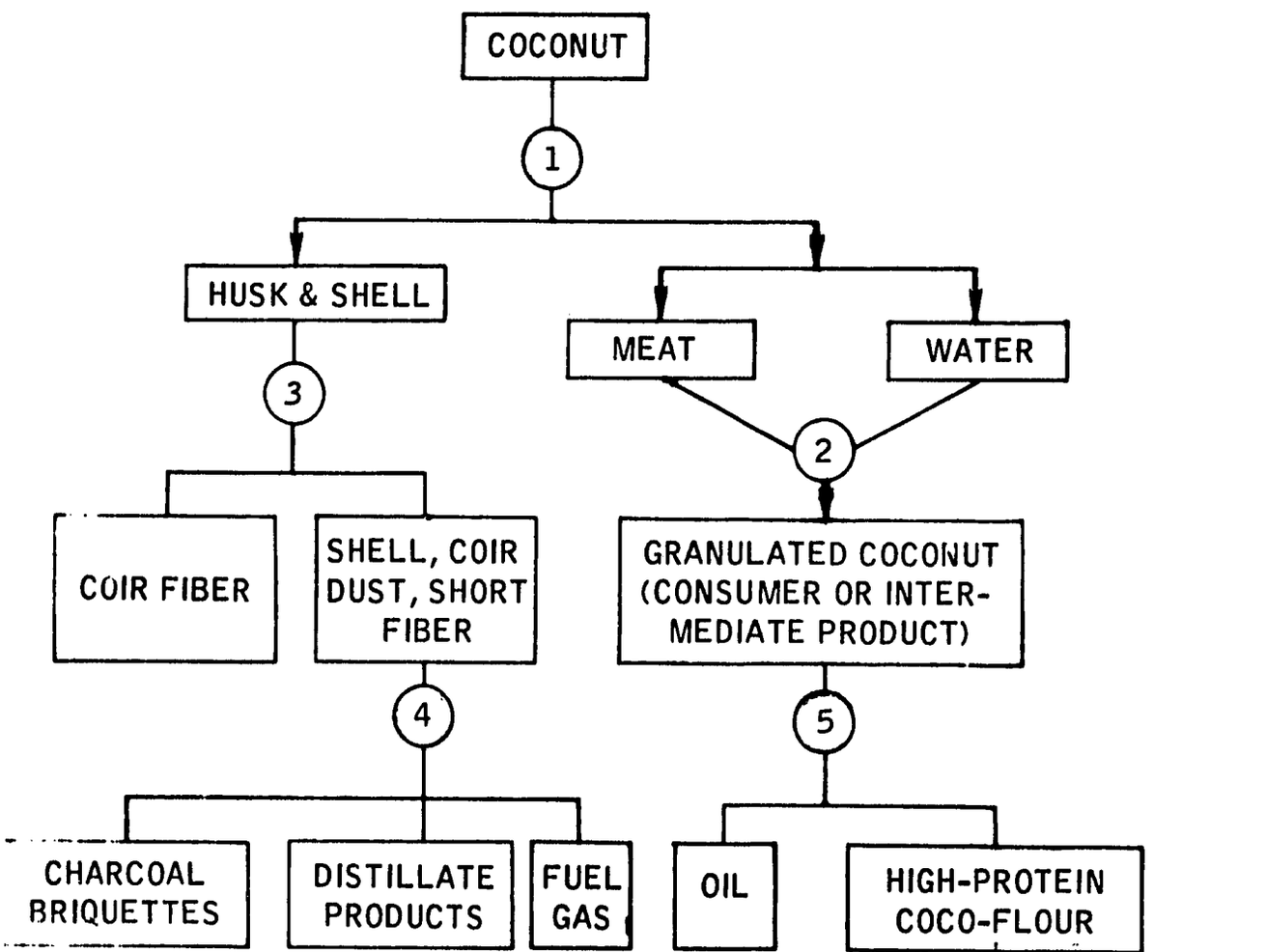
e) paring machine

IV. ESTIMATED FINANCIAL REQUIREMENT FOR NIST INTEGRATED COCONUT PROCESS:

(In U. S. Dollars)

	Pilot Plant Scale	1966-67	1967-68	1968-69	1969-70	TOTAL
1.	Granulated Coconut	21,000	19,000	7,000	3,000	50,000
2.	Coconut Flour (Solvent Extraction)	53,000	47,500	19,000	5,500	125,000
3.	Coco-Protein Concentrates	10,500	9,500	3,500	1,500	25,000
4.	Activated Carbon	10,000	5,000	2,000	2,000	19,000
5.	Further Development Studies on the Pilot Plant equipment					
	a) Decorticating Machine	8,000	3,000	2,000	2,000	15,000
	b) Carbonization Retort	10,000	3,000	2,000	2,000	17,000
	c) Nut Splitter	5,000	3,000	2,000	2,000	12,000
	d) Meat Picker	5,000	3,000	2,000	2,000	12,000
	e) Paring Machine	8,000	3,000	2,000	2,000	15,000
	f) Fiber Dryer	5,000	3,000	2,000	2,000	12,000

FIG. I MATERIALS AND PRODUCTS OF THE NIST INTEGRATED PROCESS



1. PRELIMINARY PROCESSING
2. FLUIDIZED BED DRYER (GRANULATION)
3. DECORTICATION
4. CARBONIZATION
5. OIL EXTRACTION
6. FLOUR PROCESSING

RESEARCH PROGRAM IN AGRICULTURE AND NATURAL RESOURCES

Isosceles Pascual

The National Science Development Board has envisioned applied research and development studies in the fields of agriculture and natural resources since its establishment in 1958. It has tried to help narrow the gap between science and actual practice of farmers. Its researches are aimed to raise the standard of living of farmers through an increase in their incomes, thus increasing their buying power which in turn will prove beneficial to the manufacturing industries.

In general, the research projects in agriculture and natural resources are designed to improve the quality and quantity of the nation's agricultural production in order to meet requirements for direct consumption and provide raw materials for local industries as well as for exports. Effective and systematic ways of conserving and improving our natural resources are also programmed. This includes studies on fish production, soil fertility, and natural flora and fauna.

Research studies in agriculture and natural resources usually take a long time to accomplish their objectives. In view of this, the National Science Development Board has tied up some of its funds in the implementation of ongoing projects while new proposals have already been made for future implementation depending on the availability of funds.

A brief summary of each of the ongoing projects is presented below:

RESEARCH PROJECTS ON CROP PRODUCTION

Breeding For Trichomeless or Non-Prickly Varieties or Strains of Kenaf (Hibiscus cannabinus)

The Philippines has been trying to develop kenaf-growing to supply raw materials for the sack manufacturing industry, but it has not met with success because laborers employed in kenaf culture dislike the presence of spines or trichomes on the plant which cause itchiness and prick the skin. The project has already produced mutants without these offending parts and these plants are now being field tested.

The estimated value of the demand for gunny sacks, which may be made out of kenaf fiber, is valued at 35,000,000 pesos annually. Of this amount only 37% is being supplied locally.

The Control of Coffee Rust

Coffee rust is one of the important diseases affecting coffee plants. This study is aimed at determing the protective properties of new fungicides against coffee rust, such as copper compounds, colloidal sulfur, carbonates, tin compounds, nickel salts, cooper, zinc-chromate complex, guanidine, glycoxalidine and captan. The results so far obtained indicate that some fungicides are phytotoxi, and that the coppers are generally more effective for the control of coffee rust. Collection, selection, isolation and breeding for the most resistant of the promising Arabica strains from different parts of the world are also being undertaken.

Studies on Soybeans, Peas and Other Legumes

Legumes such as soybeans, peas, mungo, peanut and navy beans are potential agro-industrial crops that could be mass-produced profitably. Increased soybean production will have an impact on the soybean oil manufacturing and canning industry, which is relatively new in the Philippines. This project involves the search for high-yielding varieties by the establishment of an extensive collection of germplasm from local and foreign sources. Promising lines are inter-crossed in order to incorporate into a new line important agronomic characters of several varieties. Two high-yielding soybean varieties from Japan and the U. S. A. have been isolated. A soybean hybrid that is less sensitive to short photo-period and highly resistant to bacterial pustule, a major disease of soybean, has been produced. A number of mungo hybrids and promising lines of peanut are being tested, and a navy bean variety, introduced from the U. S. A., has been found to be adaptable in the Philippines and suitable for canning purposes.

Coffee and Cacao Cultural Management Studies

Coffee, chocolate, candy and other kindred manufacturing industries, aside from the coffee and cacao farmers, stand to be indirectly benefited from the results of this research undertaking. This research study is aimed at increased production of coffee and cacao beans by determining the best cultural management practices to be applied in raising these plants. Initial findings show that addition of complete fertilizer increases the size of cacao pods and beans while controlled plants produce more water sprouts and smaller pods.

Researches on Citrus

This project is aimed at saving the citrus industry in the Philippines. Presently, there is an alarming decline of citrus trees in many plantations in Luzon and this research project is aimed at studying the various factors, pathological or otherwise, that are causing this decline.

Five new diseases of the citrus trees in the country have been found. One of these diseases, "greening" appears to be the cause of the malady attacking severely the citrus orchards in the Philippines.

Rate and Efficiency of Various Nitrogenous Fertilizers for Rice, Sugar Cane and Coconut

Soils in various regions in the Philippines, particularly those with wet climate, are generally acidic. This state is disastrous to economic plants. To remedy this situation, this research project is investigating the applicability of other less acidic nitrogenous fertilizers, such as anhydrous ammonia, aqua ammonia, and urea, using rice, sugar cane and coconut as indicators.

On the rice fertilization studies, results tend to show that ammonium sulfate and urea are better sources of nitrogen for rice over aqua and anhydrous ammonia under lowland conditions. Significant responses were obtained from anhydrous ammonia treatment on CSE #3 variety of sugar cane.

Insecticide Residue Problems of Rice Production with Emphasis on Gamma-BHC

This research project is being conducted in cooperation with the International Rice Research Institute. It has been proven through experiments that gamma-BHC (isomer of benzene hexachloride) could control rice stem borer effectively. However, its use is complicated by residue problems. This research aims to investigate these problems which may lead to the formulation of recommendations for the proper use of this agricultural chemical. The results will not only benefit the rice-farmer but also the agricultural chemical manufacturers.

Initial findings (first six months) show that gamma-BHC residue in rice grain is well within the safety limit set by a joint FAO-WHO committee which is 0.0125 mg/kg body weight.

RESEARCH PROJECTS ON ANIMAL PRODUCTION

Swine Improvement Through Breeding

This research project aims to develop a new breed of swine having a combination of characteristics that would be superior to the old breeds now raised locally. The goal is to combine the qualities of bacon and lard types with the disease-resistance of the indigenous swine. The Landrace breed is being used because of its efficiency in feed conversion and leanness, while the Large White is included in the program mainly for fast growth rate and sturdiness. Results already gathered indicate that the final blood composition of the new breed to be formed will be 1/2 Large White x 1/4 Landrace x 1/4 Native.

Development of a Strain of S. C. White Leghorn for High Egg Production, Livability and Hatchability

Presently, many of our large poultry raisers depend on imported stocks to replace their degenerated ones. Replacement of stock is important as later-generation-birds tend to be costly to maintain while production keeps decreasing. The success of this project not only will boost the poultry industry in the Philippines but also save valuable dollars being spent for the importation of new stocks.

A Comparative Study of Some Cattle Breeds and Grades for the Production of Milk

The result of this project will have an impact on the dairy industry of the Philippines. The local dairy industry at the present stage is still in its infancy. It needs to be developed in order to cope with the demand for dairy products and to reduce, if not stop altogether, tne heavy importation of dairy products.

A Comparative Study of Some Cattle Grades for the Production of Beef

Cattle raisers will benefit most from the results of this experiment. This project seeks to enlighten cattle raisers on the comparative beef production performances of different grades of cattle.

A Comparative Study of Santa Gertrudis, Brahman, Hariana and Batangas Strain of Philippine Cattle for Beef Production

This study is directed towards the determination of the comparative rates of growth, carcass qualities and costs of production of the said breeds. Cattle raisers in this country have been raising exotic and native breeds for quite a long time. Not knowing the most efficient breed for this purpose, they produced various kinds of beef cattle that differ markedly in size and quality. To enable our cattle raisers to produce more and better quality beef for our ever-growing population, the breeds mentioned are being studied for determination of the type best suited for the purpose.

Chemical Analyses and Digestion Coefficient of Philippine Feed

This project is a comprehensive investigation to determine the proximate analyses of feeds in the Philippines, particularly forages which have, heretofore, not been reported. Vitamin contents, such as carotene, thiamine, riboflavin, niacin and panthothenic acid, will be determined. The results of this work will facilitate formulation of feed mixtures for the proper and intelligent feeding of

livestock and poultry. So far, proximate constituents of 55 species of soilage were already determined.

Utilization of Fine Milled Rice Hull as Concentrate Feed for Livestock

Feeds constitute the greatest single item in the cost of production of animals. This project was started to study the utilization of fine milled rice hull, a cheap substitute for rice bran, as concentrate feed for ruminant animals. Rice hull is the by-product of the rice industry. Palay when milled in a cone-type rice mill yields 24 to 25 percent rice hull which is usually burned or dumped into the rivers as waste. If the result of this research project is positive, the cost of production of animals will not only be reduced but it would also boost the rice industry because of the economic utilization of its by-products. Results so far obtained indicate that rice hull can be a good substitute as concentrate feed for livestock.

RESEARCH PROJECTS ON NATURAL RESOURCES

A Study of the Microbial Population of Philippine Soils

This project deals with the qualitative and quantitative study of soil microbial organisms since they affect considerably the physical and chemical properties of the soil. The specific objectives of this study are the following: to study and determine the occurrence of the microbial population of Philippine soils and to correlate these microorganisms to pH, organic matter and other chemical characteristics, such as nitrogen, phosphorus, potassium, calcium, magnesium and manganese.

Biological and Taxonomic Studies of Chironomidae in Laguna de Bay and its Tributaries and Toxicological Evaluation of Insecticides Against the Lake Fauna

The chironomid (gamu-gamo) problem is a recurring one in the towns near Laguna de Bay like Binan, Cabuyao, and San Pedro in the province of Laguna and Muntinlupa and Taguig in the province of Rizal. The chironomid population of the lake has been increasing during the last three years and it has become particularly serious during the first three months of 1966.

This study is aimed towards the abatement of the gamu-gamo menace. The information that will be gathered in this study may be useful also in the control of chironomids in other areas of the country.

Ecological Studies of the Aquatic Stages of the Gamu-gamo

This research project is studying the life cycle of the midges to determine their ecological requirements. It is intended to solve the present gamu-gamo infestation in Laguna and to prevent similar occurrences in the future. Studies on food habits of fish will provide information on what species of fish in the lake utilize midges as food. Biological control measures of the insect could be made on this basis.

The proposed research projects are, likewise, briefly summarized, as follows:

PROPOSED RESEARCH PROJECTS ON CROP PRODUCTION

1. Production of Useful Mutations in Plants

Production of useful mutations in plants through treatment with mutation-causing agents has become an important tool for crop improvement research. With a systematic and practical scheme of selection and screening, the value of a mutant line can be evaluated.

2. Cabbage and Onion Production Studies

This study seeks to determine whether or not cabbage and onion seeds can be produced in the area represented by the Mountain Agricultural College, Mountain Province, to stop the yearly importation of these seeds.

3. Wheat Production Studies

This is a proposal to conduct a nationwide study of the regional adaptability of different varieties of wheat to stop or reduce to the minimum the yearly importation of wheat.

4. Researches on Tea Production

The possibility of growing tea in commercial scale in Mindanao is the objective of this study.

PROPOSED RESEARCH PROJECTS ON ANIMAL PRODUCTION

1. Philippine Dairy Cattle Breeding Development

The proposed study is aimed at developing a Philippine breed of dairy cattle combining adaptability to local climatic conditions with high milk performance using native cattle for its prolificacy and early maturity, temperate breed

for its high milk performance and tropical breed for its adaptability to Philippine conditions.

2. Grassland Research for Livestock and Soil and Water Conservation

This research project is aimed at minimizing accelerated flood flows utilizing pasture grass possessing desirable qualities as feeds for planting in open lands and range thus promoting livestock raising in idle lands at the same time conserving water, minimizing soil erosion, reducing floods, and using the conserved water for irrigation, power and municipal purposes.

3. Grass-Legume Pasture Introduction and Productivity Trials

The objective of this study is to develop a kind of pasture possessing high nutritive value and increased carrying capacity per unit area by introducing exotic grasses and legumes planted alone or in combination with indigenous species.

PROPOSED RESEARCH PROJECTS ON NATURAL RESOURCES

1. A Survey of the Spawning Grounds of Prawns (Penaeidae) with Special Emphasis on the Biology of Sugpo (Penaeus monodon Fab.) in Minsupala Region

The objective of this study is to bolster the sugpo fishpound industry, and to encourage financial institutions to extend liberal credit facilities based on the results of these studies.

2. Biological Studies on Bañgos with Emphasis on the Propagation of Bañgos Fry

This study is aimed at determining the methods of rearing the bañgos fry commercially, with emphasis on correlating environmental factors and the natural propagation characteristics of bañgos.

3. Effect of Fertilizer on Fish Production in Brackish and Fresh Water Ponds

This research work is composed of two sub-projects namely: Effect of Fertilizers on Fish Production in Brackish Water and Ponds; Effect of Fertilizers on Fish Production in Fresh Water Ponds. It aims to accentuate fish production in ponds with the use of fertilizers.

4. Honeybee Culture Research Project

The objectives of this study are: 1) to develop bee farming as an industry; 2) to study the effect of bees as pollinators for the reforestation projects around Mt. Apo National Park and improvement of fruit production in the Davao Institute of Agricultural Foundation; and 3) to determine the utility of honey for nutritional and industrial uses.

5. Sediment Study of Philippine Streams and Flood Channels

The purpose of this work is to obtain the data which will be used as guide in the design and maintenance of reservoirs, flood channels, and erosion control.

6. Physical Characteristics of the Soils of Major Watershed Areas

The conservation of water, soil and forest are directly related to watershed management. This study seeks to determine the physical conditions of the soils of major watershed areas with the ultimate aim of conserving water and soil.

7. Feasibility of Local Materials for Irrigation Canal Lining

This study aims at exploring the use of some local materials like clay and sawali, sprayed with asphalt, etc., in order to determine the following: cost feasibility, durability of each kind of material and effectiveness of each in controlling seepage losses in projects of the Irrigation Service Unit where water delivery is by means of pump—a costly method of irrigation.

8. Genesis and Morphology of Major Soil Types in the Philippines

The answer to many of the questions on the behavior of many soils in tillage, irrigation, lime requirements, fertility and a host of other problems in crop production and other engineering aspects may be obtained from the data that will be gathered from this research which will be implemented by the Bureau of Soils.

9. Isolation and Identification of Soil Microorganisms

To collect, study, isolate, and identify microorganisms present in the Philippines, and to determine whether the microbes are beneficial or pathogenic in relation to the crops grown or the soil.

The total cost of this Four-Year Research Program (both ongoing and proposed) amounts to 2,517,000 pesos. The sum of 392,000 pesos is required for FY 1967.

FOREST RESOURCES OF THE PHILIPPINES

FOREST MANAGEMENT

Isosceles Pascual

The present policies of the Bureau of Forestry are geared toward conservation of the remaining forests under the following important programs:

a) Intensify the delineation and establishment of permanent forest areas. The quicker this is done, the sooner will we obtain real control over our forests;

b) Inventory forests throughout the nation to gather vital statistics on our forest resources;

c) Implement and enforce selective logging for the sustained yield management of our public forests;

d) Grant, regulate and control timber licenses for the continued productivity of the forests; and

e) Formulate policies and regulations relative to the scientific management, including research work, of the forests. Field studies and experiments are being conducted to help improve the conditions, quality and growth of residual trees in logged-over areas.

FOREST INVENTORY

During the early stages of development, the Bureau's activities along this line were limited to small-scale and sporadic ground forest surveys which gathered rough estimates of forest extent and timber increased tremendously after World War II, a modern forest inventory program was implemented in 1962 with the assistance of the U. S. Agency for International Development and the National Economic Council. Aerial photographs flown and processed by the Philippine Air Force are used in the current forest inventory. The present nationwide inventory has completed the survey of Mindanao, where the bulk of our forests are.

The following charts and tables show the present state of our forest resources:

a) Land Use Chart for Mindanao (1963):

	Hectares	Percent
Forest	6,638,719	67.0
Cultivated croplands	1,538,017	16.0
Plantation croplands	682,783	7.0
Open lands	874,222	9.0
Marsh & small water areas	78,304	0.6
Urban and others	57,215	0.4
Total	9,869,260	100.0

The forest lands contain stands of all sizes, ranging from seedlings, saplings, young poles, residual trees from cut-over lands as well as mature virgin timber.

b) Land Use Chart for Luzon and Visayas (1957):

	Hectares	Percent
Forest	7,964,720	40.7
Brushland	1,076,600	5.5
Cultivated and other lands	7,944,020	40.6
Open lands	2,192,590	11.2
Marsh or swamps	412,460	2.0
Total	19,590,390	100.0

c) Timber Volume for Mindanao (1963):

	Million Cubic Meters	Percent
Western Mindanao	148.4	12.9
Central Mindanao	353.5	30.7
Eastern Mindanao	649.2	56.4
Total	1,151.1	100.0

d) The Timber Volume for Luzon and Visayas (1957):

	Million Cubic Meters	Percent
Western Luzon	95.1	18.5
Eastern Luzon	155.2	30.3
Southern Luzon	74.4	14.5
Western Visayas & Palawan	119.4	23.3
Eastern Visayas	68.7	13.4
Total	512.8	100.0

e) Annual Volume Growth, Mindanao (1963):

	Cubic Meters
Western Mindanao	1,523,261
Central Mindanao	6,156,449
Eastern Mindanao	10,852,369
Total	18,532,079

f) Average Annual Drain from Authorized Logging, Mindanao:

	Cubic Meters
Western Mindanao	1,147,488
Central Mindanao	964,146
Eastern Mindanao	2,700,485
Total	4,812,119

The table shows that an average of 4.8 million cubic meters of timber is drained annually from Mindanao forests. The sustained yield management program of the Bureau strives to maintain a balance between wood drain and wood growth. In other words, the volume cut from the forest per year ideally should not exceed the volume growth per year.

A comparison between the growth table and the authorized logging drain table shows that the cut is way below the growth. This is a clear indication that much of the blame alluded to the legitimate loggers for forest denudation is misplaced.

g) Average annual drain from clearing, illegal kaingin, illegal logging and other causes (Mindanao):

	Cubic Meters
Western Mindanao	5, 369, 960
Central Mindanao	5, 254, 221
Eastern Mindanao	4, 658, 483
Total	15, 282, 664

While there is a very favorable growth-drain balance with regards to authorized logging operations, the same cannot be said of the growth-drain balance involving land clearing, illegal kaingin, illegal logging and other causes totaling to over 15. 2 million cubic meters. The overall growth-drain balance tips over unfavorably when both drain due to logging and drain due to clearings and other causes are thrown together. Total annual growth is 18. 5 million cubic meters; drain from all causes is 20. 1 million cubic meters.

h) There seems to be a yearly deficit of 1. 6 million cubic meters. What matters most, however, is the growth and drain in the permanent forests, not in the alienable and disposable areas which are intended for agricultural productions that are subsequently cleared. Proportionately, the growth and drain in permanent forests would be less. Eventually, by more intensive protection and forestry practices, the unfavorable balance will become less and less. The figures just show the real existence of a conservation problem which we must solve with speed.

FOREST RESOURCE OUTLOOK

The result of this forest inventory shows that the forest resources are still large, of tremendous economic value and of importance to the future prosperity of the Philippines.

Meanwhile, based on the forest resource in Mindanao, and using the present rate of cut (drain by authorized logging operations), the old growth or virgin forests of Mindanao should be able to meet the demands of local and export timber markets for at least 70 years even assuming that there is no wood growth at all. This length of time is almost two times the estimated 40 years it takes for trees in adequately stocked logged-over areas to attain harvestable (exploitable) size and volume ready for another cutting operation.

This is so because trees grow and reproduce, and as we pegged the allowable annual cut to equal the net growth, then it is only logical to conclude that

we can have a continuing source of forest goods and services, so long as we follow sound forest management practices with adequate protection from destruction.

FORESTS AND THE NATIONAL ECONOMY

1. The lumber industries rank second among the major dollar-earning industries of the country today. Figures compiled by the National Economic Council show that the Philippines supplied about 29 percent of the wood requirements in the international market.

2. Starting from scratch at the end of World War II, timber production has been steadily increasing from the early fifties, reaching a peak in 1963 when 7.7 million cubic meters of timber were produced. However, in 1964, the Central Bank issued Circular No. 182, which contained provisions considered to be too stringent by log buyers, specially those from Japan.

3. The Central Bank Circular 182 almost brought a paralyzation of log exportation with the cancellation of log-buying contracts by Japan. Many producers were forced to reduce or stop operations. A new set of grading rules (Forestry FAO No. 19-s) was adopted in lieu of C. B. Circular 182, which was acceptable to the logs buyers. Log exportation subsequently resumed. Timber production, nevertheless, still was feeling the adverse effect of the circular up to 1965. Timber production decreased as a result of the Administration's policy of issuing temporary 3-month cutting permits to licensees. Many licensees had to suspend their operation as a result of the policy then.

4. The present Administration's ban on the issuance of new timber licenses; the non-renewal of licenses expiring this year; the suspension of granting of additional or adjustment of allowable cut and the cancellation of log dealer's permit for those exporting logs who are not concessioners and actual producers, may continue the downward trend of timber production which started two years ago.

5. Wood producers are being encouraged to engage more in local manufacture and processing. At the same time, log exportation is being discouraged. The establishment of more bandmills, plywood and veneer mills, pulp and paper mills is expected to maintain the brisk business of the wood-using industries, continue to provide employment to thousands and continue to earn dollars for the country's economy.

CONCLUSION

The expected population increase in the coming years is going to exert pressure on all the physical and natural resources of the Philippines and not the least to feel this pressure are the forests. There are already many provinces in the country deficient in forest area today. The threat to the remaining areas still verdant with forests is mounting with the growing demands for more land

and space which a developing country like ours requires.

It is our difficult task to see to it that the public forests shall be conserved and wisely utilized. There is still a widespread and prevailing notion that once virgin forest is logged or cut, it is a wasted forest unless it is replanted with trees. In reality, such a forest, even if carelessly logged, remains as forest and is self-replenishing without planting because of the abundance of reproduction consisting of seedlings, saplings, poles and young trees that may be saved from the operation.

Our problem is the apprehension of those who destroy or attempt to destroy our forests. The Bureau's program of forest conservation should be fully supported. The future prosperity, economic well-being, and security of our nation depends on how well we take care of the important replaceable resources in our FORESTS.

MINERAL RESOURCES OF THE PHILIPPINES

Bureau of Mines - Republic of the Philippines

I. Present Utilization of Philippine Mineral Resources

Except for gold which is bought by the Central Bank at subsidized prices and utilized by the Government as part of the country's International Reserve, the bulk of the Philippines production of metallic minerals are exported abroad (mainly to the United States and Japan). Small amounts of battery-grade manganese (for use in the manufacture of locally made batteries) and mercury (utilized by the chemical industry), are retained in the local market to meet the domestic demand but this is a small portion compared to that which is exported. On the whole, mining of Philippine metals subsists from returns of sales abroad.

On the other hand, the growing complement of Philippine non-metallics are mainly the support of such burgeoning local industries as: glass manufacture which makes use of silica sand and feldspar; the construction industry which finds a wealth of materials locally—among them, marble, adobe, rocks and stones of great variety, sand, gravel, earth, etc.; the ceramics and refractory industries which employ the different types of clay available locally; fertilizer manufacture which finds such raw materials as guano, pyrite and rock phosphate in abundance; cement manufacture which makes use of limestone, silica sand and gypsum; and other small-scale industries which are slowly finding their way into the developing economy. More and more there is a perceptible effort to make use of local resources that will replace imports and, thereby, conserve the nation's dollar reserves, and with the proper incentives, it is anticipated that this will not take too long now.

II. Potential Mineral Resources that May Be Tapped

1. Extensive nickel-iron deposits in Surigao, Davao and Samar which have been explored but still await development. The government has offered the Surigao reservation for development by the private sector but, so far, the bids received have not proved adequate.

2. Extensive deposits of aluminous laterite reserves in Bucas Grande and Nonoc Island in Surigao. There are enough raw materials here to supply the needs of an integrated aluminum industry in the Philippines, but the project needs large inputs of capital not presently available and awaits perfection of a modified beneficiation process which would extract alumina from available laterites.

3. Scattered but substantial deposits of manganese in Ilocos Norte, Misamis Oriental, Negros Oriental, Nueva Ecija, Quezon, Tarla Zamboanga del Sur, Cagayan, Palawan, Leyte, Isabela, Camarines Sur, Bohol and Marinduque. Some of these operations have gone into production but have been discontinued because of lack of sufficient capital.

4. Extensive coal reserves in Zamboanga del Sur which are presently being explored and studied under a joint CEPOC-UN-Bureau of Mines project.

5. Low-grade deposits of copper, particularly in Marinduque and Mt. Province, which await more efficient methods of recovery as well as adequate financing.

III. Utilization

1. The nickeliferous laterites found in the country are essentially iron-nickel deposits associated with some cobalt, manganese and chromium. An increased supply of iron is essential if the planned steel complex in the Philippines is to be pushed through. Nickel, on the other hand, is at a premium in the world market at this time.

2. The aluminous laterite reserves may prove significant in the future development of the country considering the importance of aluminium metal in such basic industries as transportation, building and construction, electrical industry, commercial and household supply, etc.

3. The development of the country's manganese deposits would boost the integrated steel project since manganese is put to use principally in the production of steel.

4. Small amounts of local coal are presently utilized in the manufacture of cement, but studies are now being made to make use more extensively of the country's coking coal deposits, especially the Malangas, Zamboanga del Sur reserves for the manufacture of coke essential in the steel process.

5. As more efficient methods of recovering copper from low-grade deposits are discovered, the Philippines is bound to increase its production and thereby enhance its position in the world market for copper. This would also strengthen the drive for the establishment of a copper smelting and refining plant in the country which would utilize those vast reserves.

IV. Defects and Dangers of Present Methods of Utilization

1. Minerals are wasting assets and, as the Philippines continues to export its more important and strategic minerals, it is bound to deplete its supply in the period when such materials may be badly needed as a complement in its industrial development.

2. As a net exporter of raw materials and a net importer of finished products, the Philippines finds itself at a disadvantage in terms of prices. Even as it faces depletion of resources, the exporter of primary products at the time suffers from the low level of prices received by raw materials in the world market, while the

exporter of finished products reaps the benefits of premium prices for its produce. The result in terms of the country's balance of international payments is a trade deficit aggravated, as it were, by unfavorable terms of trade.

3. Among the non-metallics the proliferation of small scattered operations is often wasteful and suffers from lack of organization. The unsystematic method of mining observed in this sector often results in wasteful mining and this is caused mainly by the smallness of operations triggered by insufficient supply of capital.

V. Recommendations

1. Encourage research and experimentation in the treatment and extraction of low-grade deposits and indigenous ores in order to promote and enhance our stock of mineral resources.

2. Promote the use of local minerals in our industries by providing the proper climate and incentives for domestic investment.

3. Assist in the establishment of basic industries which will process ores and concentrates presently exported in raw form to developed countries. Especially for iron and steel, copper, and aluminium, the country has a sufficient local demand to fill and is in a good competitive position in the world market.

4. Provide the necessary infra-structures such as roads, piers, and power facilities so as to lessen the burden on mining operators who have had to bear the entire costs of building such facilities thus unduly increasing their overall costs and limiting capital for operation. Small-scale mining, mostly in construction materials, ceramics raw materials, and other non-metallics, is fairly well developed in accessible areas, but construction of roads, piers, power plants and other facilities will encourage the development of many more modest mineral deposits.

5. Provide sufficient credit arrangements as source of badly needed capital, particularly to large ventures; and also, there is need to assist in organizing small operations and enhance their ability to obtain capital for their ventures.

The rapid development of the mining industry is a factor in the growth and progress of rural areas. This becomes evident as mining ventures bring jobs, business opportunities, electric power, housing, better accessibility, and additional income from taxes with which the community may finance local improvements.

VI. Present Mineral Resources of the Philippines

A. Metallic Deposits

1. Gold
2. Silver
3. Copper
4. Chromium
5. Iron
6. Manganese
7. Mercury
8. Zinc
9. Nickel
10. Cadmium
11. Platinum
12. Alumina
13. Cobalt
14. Antimony

B. Non-metallic Deposits

1. Asbestos
2. Asphalt
3. Bentonite
4. Diatomite
5. Marble
6. Perlite
7. Pumice
8. Talc
9. Barite
10. Gypsum
11. Phosphate rock and guano
12. Pyrite
13. Sulphur
14. Dolomite
15. Feldspar
16. Fireclay
17. Magnesite
18. Pottery and China clay
19. Silica stone and silica sand
20. Bloating shale
21. Limestone

C. Mineral Production CY 1965

		Quantity		Value (pesos)
1.	Precious Metals			86,837,602
	a. Gold	437,474	oz.	82,582,870
	b. Silver	933,938		4,254,732
2.	Base Metals			289,605,205
	a. Copper	62,740.34	MT	184,884,880
	b. Iron	1,437,778	DMT	52,766,679
	c. Refractory Chromite	458,131	DMT	30,226,414
	d. Metallurgical Chromite	96,421	DMT	7,214,650
	e. Quicksilver	2,384	Flks.	5,076,839
	f. Lead	104.53	MT	128,252
	g. Zinc	2,059	MT	2,363,089
	h. Molybdenum	77.32	MT	1,138,076
	i. Cadmium	9.57		190,902
	j. Pyrite Cinders	19,438		410,741
	k. Manganese Ore (Met. & Chem. grade)	49,72-	DMT	5,103,437
	l. Manganiferous Ore	2,021		101,246
3.	Non-Metals			203,731,544
	a. Clay, refractory ceramics and other clay products			6,619,680
	b. Construction materials (adobe, marble, stones, etc.)			8,505,443
	c. Lime & limestone for cement agriculture & industries			1,468,215
	d. Fertilizer material			
	1) Pyrite	69,151	MT	2,120,692
	2) Guano	3,332	MT	9,912
	3) Rock phosphate	505	MT	41,300
	e. Cement, coal, gypsum			
	1) Cement	8,966,759	Bbls.	134,316,431
	2) Gypsum	27,488	MT	88,219
	3) Coal	94,541	MT	2,374,965
	f. Others			
	1) Silica sand	279,589	MT	3,035,567
	2) Salt for Sea H_2O	225,213	MT	14,246,258
	3) Carbide	6,719	MT	14,001,770
	4) Feldspar	10,230	MT	835,634
	5) Dolomite	6,783	MT	246,876
	6) Talc	593	MT	57,607
	7) Alumina sand	16,744		36,597
	8) Others (sulfur, ammonium sulphate barite, etc.)			17,110,742
	Total Mineral Production			580,174,351

OCEANOGRAPHIC RESEARCH AND DEVELOPMENT PROJECT

Republic of the Philippines
Department of Agriculture and Natural Resources
PHILIPPINE FISHERIES COMMISSION
Manila

I. Status of Philippine Oceanography

The Philippine waters have been visited by several international scientific research vessels that made important observations. The most extensive and latest expedition around the Philippine and adjacent waters under the Philippine Fisheries Program of the U. S. Fish and Wildlife Service was during the U. S. M. V. Spencer F. Baird Expedition in 1947 to 1950 which covered 800, 000 square miles, occupying 1, 100 hydrographic stations. Partial results from this survey have been published in several scientific publications.

Beginning in the late twenties the Bureau of Coast and Geodetic Survey vessels made some physical observations in some areas. Most of these observations were made in conjunction with the charting of Philippine waters. All oceanographic observations of this Bureau are confined to physical aspects.

Actually there is no single agency in the government that undertakes oceanographic investigations as its principal task. The Coast and Geodetic Survey undertakes charting of our waters, takes tide measurements and does some physical studies of the sea. The Philippine Fisheries Commission (P. F. C.), formerly Bureau of Fisheries, undertakes oceanographic surveys of some fishing areas. The investigations involve determination of some physical, chemical and biological features in the area. The College of Fisheries of the University of the Philippines includes general oceanography among their undergraduate courses for fish capture majors.

II. Projects:

A. Philippine Participation in Oceanographic Investigation of International Nature.

1. International Cooperative Study of the Kuroshio (CSK)

2. International Cooperative Study of the South China Sea

The Philippine participation will be jointly undertaken by the Coast and Geodetic Survey, Philippine Fisheries Commission, Weather Bureau and U. P. College of Fisheries.

B. Philippine Fisheries Commission Project

1. Fishery oceanographic investigations of the different fishing grounds (exploited and non-exploited fishing grounds and big bays).

2. Fishery oceanographic investigations of the bays and gulfs (including all near shore areas).

C. Bureau of Coast and Geodetic Survey Project

1. Systematic coverage of Philippine territorial waters with physical oceanographic observations.

2. Sea gravity survey of Philippine waters.

D. Establishment of an Oceanographic Institute

This will be a research and academic, graduate level, institution, preferably to be implemented after enough man-power has been trained from the different agencies involved in the study of the ocean. Perhaps this could be established on the third or fourth year of the project.

III. Brief Description of Projects:

A. International Oceanographic Investigation. The International Cooperative Study of the Kuroshio and the South China Sea is a joint project of several nations being coordinated by the Intergovernmental Oceanographic Commission (IOC) of the UNESCO. The CSK started in 1965 and will continue up to 1968. The Philippine participation is being delayed by the lack of equipment and other necessary specialized materials and supplies. Some equipment from the UNESCO has already arrived but still other equipment requested from the other agencies has not arrived.

The study will cover the waters east and north of the Philippines, where the origin of the Kuroshio current is generated, up to its main body and branches in the northern Pacific. Not only physical, chemical and meteorological aspects will be investigated but likewise biological aspects particularly plankton and fish. This current system and water areas covered have great influence on the migration and distribution of fish in this part of the globe and greatly affect the conditions in the area, its environment, climate, and industry, and navigation.

B. Philippine Fisheries Commission. The fishery oceanographic investigations of the Philippine Fisheries Commission is partly operating. The studies being made in the investigations are temperature, transparency, salinity, oxygen and other physio-chemical aspects and the biological aspects, the plankton and

benthos, together with some fish-caught data when the operations were performed simultaneously with fishing demonstrations. The Philippine Fisheries Commission up to May 1966 has only a 110 GT fishing vessel.

Since 1965 due to limited funds, personnel and facilities synoptic surveys of the following areas were conducted: (a) Lamon Bay - Bicol waters, (b) Tayabas Bay, (c) Manila Bay, (d) Southern Mindanao - Sulu waters, and (e) waters along Zamboanga City - Santa Cruz - Sacol Islands.

In May 1966, the Philippine Fisheries Commission had acquired through the Reparation Program two 130 GT fishing boats and sometime in October 1966 a 350 GT research vessel will be acquired through the same program. Though the project could use any of the three fishing vessels of the Commission, they are not equipped and most of the present oceanographic equipment badly needs replacement. The 350 GT research vessel is also minimally equipped, so that there is a great need for additional equipment in order to be able to conduct more extensive and intensive investigations. In addition to equipment, manpower and funds are vitally necessary to successfully carry out the objectives.

The two major oceanographic projects of the Philippine Fisheries Commission have no clear boundary lines. The investigation of fishing grounds will include, aside from widely exposed areas and seas, also large bays. These areas do not necessarily have to be the already exploited areas, but likewise other areas which may perhaps be new fishing grounds. Some of the known major fishing areas are:

1. Lingayen Gulf and coastal areas of Ilocos region
2. Manila Bay - well exploited
3. Balayan-Batangas Bay - well exploited
4. Tayabas Bay - Ragay Gulf - well exploited
5. Bicol waters - less exploited
6. Lamon Bay - less exploited
7. Mindoro - Palawan area - well exploited
8. Visayan Waters - well exploited
9. Mindanao sea
10. Southern Mindanao - Sulu area

Our marine area is very large and it will be impossible for even two teams from the central laboratory to investigate thoroughly the other bays and coastal areas that are the major source of livelihood of the local populace and which may also be natural fish nursery areas and where most of the invertebrate and seaweeds are found.

The invertebrates range from ornamental as the corals and others, to ornamental and edible as most mollusks like mother-of-pearl, "kapis", oysters, tahong, etc.; to edible as holathurians or sea cucumber or "trepang", crabs and others.

There is a large seaweed population in the country which due to its physiological processes abound only in shallow areas. Most of them are edible, like the "gulaman", "agaragar or a galagel", these two common names are used interchangeabley in different areas for various species of seaweeds, as Gracillarea, Fucus, Hypnes, Eucheuma, etc., other edible seaweeds are pukpuklo (Codium), "Culot" (Acanthopora), "Cawatacawat" (Chaetomorpha), etc. Since local consumption is small, most of the seaweeds are exported in the dried crude form. The potential is great as shown by an increase in the number of seaweeds concessions being applied for in the Commission indicating that since there is a market for them, people get interested and try to discover good areas. But those must be managed and regulated, and that is where real farming in the sea could be started to maintain sustained and quality yield. To ensure this, the favorable and unfavorable environmental condition for these plants should be known, thus establishment of regional laboratories to study near shore areas for the near shore inhabitants becomes important. This will of course include the fisheries in the area, for most of these regions are perhaps near spawning areas so that the current carry the fish eggs and larvae to the more sheltered coves and bays. Thus five to six regional laboratories are proposed. Two of these laboratories are existing, the others had been programmed but only one is operating. All of them need equipment and water craft. The proposed laboratories to be equipped are:

1. Lucap, Pangasinan Fisheries Laboratory
2. Malampaya, Palawan Fisheries Laboratory
3. Mercedes, Camarines Norte Fisheries Laboratory
4. Salay, Misamis Oriental Fisheries Laboratory
5. Zamboanga City Fisheries Laboratory
6. Cebu or Iloilo Fishery Laboratory (not yet established)

Aside from these regional laboratories the establishment of a well-equipped modern central laboratory is proposed.

C. The Coast and Geodetic Survey

The Bureau of Coast and Geodetic Survey plans an oceanographic project that will systematically cover the Philippine territorial waters. Although this project will be primarily for observations on physical oceanography, it may be coordinated with the activities of other agencies that are interested in the other aspects of oceanography.

It is also envisioned to conduct a sea gravity survey of Philippine waters. Aside from its purely scientific purpose of obtaining information on the values of gravity, of the shape of the earth, this survey will also yield commercially important information on the presence of oil and mineral deposits under our sea beds.

D. Institute on Oceanography

The institute should be included during the third or fourth year of the project for implementation immediately. It should be a research and academic institute on a graduate level. It shall work in close collaboration with the various agencies particularly the Philippine Fisheries Commission, Bureau of Coast and Geodetic Survey, the Weather Bureau and the U.P. College of Fisheries, which all together shall form a pool from which the trained scientists to form the nucleus of the institution may be taken. These top scientists may b absorbed by the institute, or better in order not to paralyze the still developing three year-old projects, started on a "loan", part-time schedule on semester basis; these scientists would teach, and be available for consultation at any time.

Proposed Departments under the Institute:

1. Physical Oceanography
2. Dynamic Oceanography
3. Chemical Oceanography
4. Bio-chemical Oceanography (including marine physiology)
5. Marine Geology
6. Biological Oceanography
7. Meteorology

IV. Objectives:

A. The CSK project is aimed at learning the oceanographic feature of the region in order to better understand its effects, how it influences the surrounding areas and the conditions in them; the fishery around the area and the ground topography of this part of the Pacific for navigation and communication.

B. The major objectives in fishery oceanography investigations are:

1. To establish and know the physio-chemical and biological features of the environment supporting the marine life that greatly influence behavior such as the distribution, migration, availability of fish, feeding habits, spawning habits, development of eggs and larvae, growth of fish, and others.

2. To gain knowledge about the relation of these oceanographic conditions to the concentration of fish to help better understand and manage the effects of the changes in season in relation to the productivity of the different regions.

3. To determine, particularly for local near-shore conditions, the relation of the environmental conditions in the water to the fisheries so that adequate measures can be taken to maintain their productivity if not also to improve the condition in the water area.

4. To develop and promote effective output from the local marine water areas.

5. To promote the development of fisheries through scientific investigation and application.

C. The main objectives of the projects of the Bureau of Coast and Geodetic Survey are:

1. To obtain complete information on the physical characteristics of Philippine seas—such information to include temperatures, salinities, oxygen content, color, etc.

2. By synoptic observation, to determine changes in their values in time and geographical distribution.

V. Implementations:

Long-range project

VI. Funding:*

A. Grant-in-Aid (Five-year Period)

1. Training and Fellowship

	Field of Training	No.	Type	Period yr. each
a.	Physical Oceanography P. F. C., B. C. G. S. and U. P., one scholar each**	3	Academic MS or PhD	2 - 4
b.	Physical Oceanography Use of instruments, general methods and compilation, 2 scholars for each 3 agencies	6	Training	1
c.	Chemical Oceanography one scholar each agency	3	Academic MS or PhD	2 - 4
d.	Chemical Oceanography P. F. C. - 6 (one for each regional lab.) B. C. G. S. - 1 U. P. - 1	8	Training	1
e.	General Oceanography P. F. C. - 6 (one for each regional lab.) B. C. G. S. - 1 U. P. - 1	8	Training	1
f.	Bio-chemical Oceanography (plankton and bacteria) P. F. C. - 2 U. P. - 1	3	Training	1

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* Tabulated Funding for 5-year project, Grant-in-Aid and local counterpart, appended.

** P. F. C. - Philippine Fisheries Commission; B. C. G. S. - Bureau of Coast and Geodetic Survey; and U. P. - University of the Philippines, College of Fisheries or College of Geology.

	Field of Training	No.	Type	Period yr. each
g.	Marine Geology U. P. - 1 B. C. G. S. - 1	2	Academic MS	2 - 1
h.	Plankton (Bio-oceanography) P. F. C. - 1 U. P. - 1	2	Academic MS or PhD	2 - 4
i.	Plankton P. F. C. - 7	7	Training	1
j.	Benthos P. F. C. - 7 U. P. - 1	8	Training	1
k.	Observations and/or research grant	3	Research grant	1/2 - 1
	Total No. of Fellows	55		

2. Experts and Specialists

Technical assistance in the form of services or experts. This would enable and give a chance for the staff of the P. F. C. and the B. C. G. S. who shall not be involved in the study grants to be trained and/or receive additional training. In addition this will facilitate work in establishing and developing the nation's waters and natural resources.

3. Equipment

a. P. F. C.: For the updating and expansion of the laboratory and field equipment for an expanded oceanographic research, 500, 000 pesos, and for regional laboratories (6-75, 000 pesos each) 450, 000 pesos and an additional 50, 000 pesos yearly for all laboratories.

b. B. C. G. S.: For one new oceanographic survey vessel—complete, 10, 000, 000 pesos; and for oceanographic equipment to be installed aboa. d one of the Bureau's existing ships, 400, 000 pesos.

4. Supplies

These are specialized materials needed in carrying out operations of certain instruments for research. 100, 000 pesos a year.

5. Oceanographic Research Laboratory and Institute

Laboratory facilities for research and institutional courses.

6. Research Vessel

With the establishment of the Institute of Oceanography, and to supplement needs of the different institutions involved in the study of the ocean, a bigger ocean-going research vessel, about 1,000 gross tons, is proposed. The vessel should be provided with complete and modern navigational, geological, meteorological, oceanographical, and biological equipment, and instruments. There should be at least 5 laboratories: physical, chemical, biological, geological, and wet laboratories. Accommodation for about 20 scientists and technicians aside from the regular officers and crew members is needed.

7. Participation in Regional Oceanographic Activities of International Nature

Assistance is needed for some specialized instruments and materials not included above and other expenses, for example, the analysis of the primary productivity samples at one of the U.S. laboratories equipped with isotopes counting, computers, etc.

Priority for this project is requested in order to enable Philippine participation in the CSK and the South China Sea.

8. Cooperative Expedition in the Philippine Waters

In connection with the research and development project on the Philippine waters, a joint extensive oceanographic survey of the Philippine waters is proposed. This may be undertaken by a foreign vessel and foreign scientists together with the local scientists. This will be a follow-up of the expedition of the U.S.M.V. Spencer F. Baird to determine whether great changes have taken place and to update the charting of Philippine water.

B. Local Counterparts

The Section of Oceanography of the P.F.C. has submitted a proposal for additional manpower for the next fiscal year. This, if granted, will double the very much undermanned technical staff of the Section.

There must be a year-to-year increase in the scientific staff of the agencies involved in the Project.

The counterpart of the Bureau of Coast and Geodetic Survey will be the present salaries and allowances of about 85 personnel. Most of these personnel are the crew of two of the Bureau's ships which will be assigned to oceanographic survey projects.

When the Institute of Oceanography is established, administrative, technicians, and honoraria for the scientists must be provided.

FIVE (5) YEAR OCEANOGRAPHIC RESEARCH AND DEVELOPMENT PROJECT—GRANT-IN-AID

ITEMS	1st yr. FY 68	2nd yr. FY 69	3rd yr. FY 70	4th yr. FY 71	5th yr. FY 72	Total
	Note: Dollar ($) values underlined-					
I. Training and Fellowships fifty five (55) Fellows	₱580,000	440,000	340,000	240,000	100,000	₱1,700,000
	$145,000	110,000	85,000	60,000	25,000	$ 425,000
II. Technical Assistance, Experts three to five (3 to 5) Experts for a period of one to three (1 to 3) years each	₱400,000	300,000	300,000	200,000	200,000	₱1,400,000
	$100,000	75,000	75,000	50,000	50,000	$ 350,000
III. Equipment	₱1,200,000	260,000	100,000	100,000	100,000	₱1,760,000
	$ 300,000	65,000	25,000	25,000	25,000	$ 440,000
IV. Supplies (Specialized materials)	₱100,000	100,000	100,000	100,000	100,000	₱ 500,000
	$ 25,000	25,000	25,000	25,000	25,000	$ 125,000
V. Oceanographic Research Institute			1,000,000	200,000	200,000	₱1,400,000
			250,000	50,000	50,000	$ 350,000
VI. Research Vessel		10,000,000				₱10,000,000
		2,500,000				$ 2,500,000

- more -

(Oceanographic Grant-in-Aid)

	ITEMS	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	Total
VII.	International Oceanographic Participation (CSK and Adjacent Waters)	₱ 400,000	200,000	200,000	200,000	200,000	₱ 1,200,000
		$ 100,000	50,000	50,000	50,000	50,000	$ 300,000
	SUB-TOTALS	₱2,680,000	₱11,300,000	₱2,040,000	₱1,040,000	₱900,000	₱17,960,000
		$ 670,000	$ 3,575,000	$ 510,000	$ 260,000	$225,000	$ 4,490,000
VIII.	Cooperative expedition in Philippine Waters				To be fully financed by the organization granting aid		

LOCAL COUNTERPART (PHILIPPINE GOVERNMENT)

ITEMS	FY 68	FY 69	FY 70	TOTAL FOR 3 YEARS	
	Note: Total for each item underlined			Each Agency	Grand Total
I. Man-power (Personal Services)	₱ 462,700	₱ 639,800	₱ 774,500		₱ 1,877,700
PFC (Oceanography Section)	163,700	190,800	215,500	₱ 570,000	
BCGS	299,000	299,000	299,000	897,000	
Research Vessel		150,000	160,000	310,000	
Institute of Oceanography			100,000	100,000	
II. Maintenance and Operating Expenses	866,700	1,320,000	1,490,000		3,676,700
PFC (Oceanography Section)	566,700	620,000	670,000	1,856,700	
BCGS	300,000	300,000	300,000	900,000	
Research Vessel		400,000	420,000	820,000	
Institute of Oceanography			100,000	100,000	
III. Equipment	100,000	100,000	200,000	400,000	400,000
IV. Capital Outlay	1,000,000	3,000,000			4,000,000
PFC (Laboratory)	1,000,000			1,000,000	
Institute of Oceanography, Building and Lot		3,000,000		3,000,000	
Totals	₱2,429,400	₱5,059,800	₱2,464,500	₱9,953,700	₱ 9,953,700
Summary for each Agency					
PFC	₱1,730,400	₱ 810,800	₱ 885,500		₱ 3,426,700
BCGS	599,000	599,000	599,000		1,797,000
Research Vessel		550,000	580,000		1,130,000
Institute of Oceanography		3,000,000	200,000		3,200,000
Equipment	100,000	100,000	200,000		400,000

FORMULATION AND IMPLEMENTATION OF NATIONAL SCIENCE POLICY

Angelesio C. Tugado

The main policy on science in the Philippines is enunciated in Section 4, Article XIV of the Philippine Constitution which reads: "the State shall promote scientific research and invention . . . ."

This policy is amplified in the Science Act of 1958, the primary provision of which states that "in consonance with the provisions of Section 4, Article XIV of the Constitution, it is hereby declared to be the policy of the State to promote scientific and technological research and development, foster invention and utilize scientific knowledge as an effective instrument for the promotion of national progress." (Sec. 2, R.A. 2067).

Formulation of science policy in the Philippines dates back to as early as 1931 when Representative Manuel Gallego presented House Bill 876 creating the National Research Council of the Philippines. This bill was approved on December 8, 1933 and became Act No. 4120.

Act 4120 authorizes the NRCP to (1) stimulate research in the mathematical, physical, biological and social sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, starting studies of problems of the national defense, and of contributing in other ways to the public welfare; (2) survey the larger possibilities of science, formulate comprehensive projects of research, and develop effective means of utilizing the scientific and technical resources of the country in dealing with these projects; (3) promote cooperation in research at home and abroad in order to secure concentration of effort, minimize duplication and stimulate progress; (4) gather and collect scientific and technical information at home and abroad, in cooperation with governmental and other agencies and to render such information available to duly accredited persons.

Next to the NRCP came the creation of the Science Foundation of the Philippines under R.A. 770, approved in May 1952. Among the purposes of this Foundation are (1) to initiate, promote, stimulate, solicit, encourage and support basic and applied scientific research in the mathematical, physical, medical, biological, engineering and other sciences, by means of grants, loans, and other forms of assistance to qualified persons and institutions; (2) to award scholarships and graduate fellowships in the mathematical, physical, medical, biological, engineering and other sciences.

Next to the Science Foundation came the National Science Board, created under R.A. 1606 approved in August 1956. This board was to be the stimulus to push further the plan for a central agency responsible for national planning,

execution and evaluation of science policies and activities which culminated in the passage of the Science Act of 1958 (R.A. 2067, July 1958) and the creation of the National Science Development Board.

The NSDB is now the central agency of cabinet level which acts as the mechanism for undertaking government efforts in the area of scientific and technological research and development. One of its primary objectives is to coordinate and integrate such efforts "in order to secure concentration of effort, minimize duplication and thereby achieve maximum progress" (Section 3, R.A. 2067).

After the enactment of the Science Act of 1958, Congress approved more science measures in line with the spirit of the Science Act. These were:

(1) Republic Act 3661 (June 22, 1963), creating the Philippine Science High School to prepare talented boys and girls for a science career. The school's Board of Trustees is chaired (ex-officio) by the NSDB Chairman or, in his absence, by the NSDB Vice-chairman and Executive Director.

(2) Republic Act 3850 (1964), creating the Philippine Inventor' Commission under the supervision of the NSDB.

(3) Republic Act 3931 (May1964), authorizing the establishment of the National Water and Air Pollution Control Commission. This Commission is also chaired by the NSDB Chairman.

(4) Republic Act 4059 (June 1964), authorizing the organization of the Philippine Coconut Research Institute. Under this law, the NSDB Chairman also acts as the Chairman of the Institute's Board of Trustees.

(5) Republic Act 4086 (1964), creating the Special Textile Research Fund, based on the collection of 1% of gross sales of all textile manufacturers in the Philippines, to be disposed of and disbursed by the NSDB for research, experiment and study in such projects as will contribute to the local growth, production or manufacture of raw materials needed by the industry and to the improvement or invention of machinery, equipment, processes or production methods for the industry.

How are national science policies formulated? A problem involving scientists or their science activities comes up and is presented to Congress. A bill is drafted and introduced either in the House of Representatives or the Senate, or both. Both chambers approve the bill. Congress sends the approved bill to the President of the Philippines who approves or vetoes it. If approved, the bill becomes a law and the national policy.

A more detailed procedure can be shown in the case of the Senate. Under the present chairmanship of Senator Manuel P. Manahan, the Senate Committee on Scientific Advancement has adopted a systematic approach to the formulation and implementation of national science policies.

First, the Committee conducts a thorough study of a problem involving science, through public hearings, personal interviews with scientists, government officials or businessmen, or ocular inspection of science agencies and institutions.

From this study, a bill is formulated and introduced (by the Committee or any member of the Senate). The Senate refers the bill to the Committee. Formal public hearings are then conducted and amendments (when necessary) to the bill are introduced. The Committee approves the bill and reports it out to the Senate. The bill is then subjected to debate and the Senate votes on it on second and third readings. The approved bill is sent to the House of Representatives for concurrence. If both chambers approve, the bill goes to the President of the Philippines for his action.

Main problems involved in the implementation of national science policies are (1) the difficulty in coordinating research activities, (2) administrative roadblocks, (3) inadequate incentives to scientists, and (4) inadequate funds.

In one of the public hearings of the Senate Committee on Scientific Advancement, the NSDB Chairman said that he is having difficulty in coordinating research activities in government institutions and more so with private research agencies. To solve this difficulty, Senate Bill 489 was introduced in the Senate providing that government funds may be expended for research purposes by government institutions only upon prior clearance (primarily for coordination) by the NSDB. This bill passed the Senate but remained unacted upon by the Committee on Science and Technology of the House of Representatives because of opposition from certain government institutions.

Proper implementation of science policies is retarded by administrative roadblocks. Government research agencies are having difficulty in acquiring supplies and equipment needed by scientists. Valuable man-hours are lost because of inadequate or nonworking equipment, or late arrival of supplies.

Inadequate incentives to scientists is also a serious problem. Filipino scientists are poorly paid compared to those in developed countries. They find the Philippine environment not conducive to the development of their skills. Poor pay and hostile environment are, perhaps, the principal causes for the "brain drain" in the country. Scientists and technologists have left, are leaving, or are preparing to leave the country for more attractive and lucrative jobs in the United States

and Europe. This erosion of scientific manpower is a problem that needs immediate solution.

Inadequate funds constitute the most serious problem in the implementation of science policies. The NSDB, NRCP and other science agencies in the government are receiving funds released by the Budget Commissioner which are too inadequate to meet their needs. Congress has appropriated sufficient amounts to meet the needs of government science agencies but the main roadblock is in the release of funds by the Budget Commissioner.

To meet this problem, a bill (House Bill 3808) has been introduced in Congress to allow the collection of a two (2) percent special tax on every foreign exchange transaction through the Central Bank of the Philippines or any bank or financial institution.

The proceeds of this special levy will accrue to a Science and Technology Development Fund which will be used exclusively "for the promotion, expansion and sustenance of scientific and technological research and development and manpower training and development."

Opposition to this tax came from certain sectors of the country but the Secretary of Finance came out with a solution: the imposition of a special levy on the net income of corporations prior to the computation of income tax. Decision on what percent this levy should be and how the amount should be distributed is still in Congress. Should this levy be approved, an acceleration of scientific and technological effort in the Philippines is to be expected.

Remarks by Harold J. Coolidge
at Informal Discussions with Philippine Delegation
November 14, 1966
National Academy of Sciences

Ever since its establishment in 1946 the Pacific Science Board has had an interest in encouraging science cooperation between our Academy-Research Council and the scientists of the Philippines, especially dealing with our opposite number, your National Research Council. I have had the good fortune to visit Manila several times since 1948, and have always been most warmly received and given opportunities to talk with many of your scientists and to visit many of your institutions.

For more than half a century we have had a paternal interest in laying the foundations for the development of your science. As Dean Knowles Ryerson has said, in the plant field such names as Merrill, Baker, Copland, Edwards, Pemberton, Bartlett, Pendleton and others played a part in laying the foundations for your colleges, institutions, and the famous Bureau of Science. E. D. Merrill started his work in the Philippines in 1902.

Perhaps the way we have been able to be of greatest assistance has been in connection with the successful Eighth Pacific Science Congress, which was held in November 1953 under the Secretary-Generalship of our friend, Dr. Patrocinio Valenzuela, where 700 delegates from 30 countries took part in meetings that ranged over 20 fields of specialized knowledge. One hundred twenty-four scientists from the United States attended, and I shall long remember the opening session at the University of the Philippines when Presiden Vidal Tan gave his memorable address on "The Role of Man in Science" to a group of more than 4,000 that included faculty members and students in addition to the Congress participants. At that time Dr. Tan noted that in spite of progress in the biological, physical, and chemical field the behavioral sciences lagged behind. He made a plea supporting the French Count, De Novy, who felt that man must not only use his reason, but also listen to his heart. Dr. Tan said, "We must choose the way of science and the heart."

Out of the Congress came many developments of benefit to the Philippines. Included among the resolutions were ones recommending support for the rebuilding of the National Museum, and the establishment of a Rice Research Institute. You will know better than I which of the resolutions resulted in action. The publication of the seven large volumes of Proceedings from the Congress was a mammouth task, and a lasting monument to the Congress.

There were many profitable field trips following the Congress, but of particular interest to me was a symposium on conservation planning in relation to power developments with special reference to Ambuklao Dam, then under construction. Twenty of us, including Sir Julian Huxley, invited by the National Power Corporation, examined the site and prepared a report. This exercise underlined the importance of multiple use advanced planning in connection with development involving natural resources. I am sure much more could be garnered as fringe benefits when scientific meetings are held in both our countries.

It was gratifying that my friend, Dr. Salcedo was the head of a group of 56 scientists from the Philippines who played a significant role in the Tenth Congress in Honolulu in 1961. Dr. Maranon headed a group of, I believe, 65 Philippine scientists to the Eleventh Congress in Tokyo last August, where the Hatai Medal in Marine Biology was awarded for the first time, and was given to your distinguished colleague, Dr. Villandolid.

There was a strong feeling in the Pacific Science Council, the governing body of the Pacific Science Association, that this organization could play an even wider role than it has in the past in the fast-developing science picture in the Pacific. For this reason, three new Standing Committees were authorized to deal with the subjects of Science Education, Population Problems, and Ecosystems of Pacific Islands. In all these fields I am sure the Philippines can play a significant part, and I look forward to our joint efforts to have these committees carry out a program that will in no way duplicate that of the multiple existing international agencies such as UNESCO, FAO, WHO, etc.

There are many new fields of scientific cooperation between our two countries that are awaiting cultivation. We face great new dangers in such matters as air and water pollution, destruction of our forests, vegetation, and wildlife, and the loss of our precious soil through unwise land use practices. It would help if we could lessen the distance between our shores, or lower the price of the air tickets to make it easier for a greater interchange of scientists. In spite of all this there has been a heartening progress over the past 20 years, and we expect a great deal of support from the cordial relations that have been established between our two Presidents.

A final word relates to a strong conviction that we all have to strengthen the structure of national parks and reserves in your country, as well as the protection of endangered wildlife, such as the Monkey Eating Eagle and the Tamarau. Look at the narrow escape we have had with the American Bison, and now have with our Whooping Crane. These are some of the species that are outstanding in the eyes of the scientific world, and require special studies of their ecology, and enforced laws to save them from probable extinction. We welcome the plans for your part in the International Biological Program which we heard about in Tokyo, and especially hope that areas can be identified for long-range ecological study representing samples of your rich and varying biota under the Terrestrial Communities Section of the IBP.

Remarks by Harrison Brown
at Philippines—U. S. Workshop Dinner
November 16, 1966
National Academy of Sciences

We are gathered here tonight to celebrate the successful completion of the second phase of a completely new experiment in international relations. It is an experiment designed to establish a framework for long-term cooperation between the scientific and engineering communities of the Philippine Republic and the United States. The ultimate goal of that cooperation is the elimination of hunger, disease and misery in the Philippines and to make it possible for the Philippine people to share the wealth which modern technology is creating in the world. We recognize that only if there is a strong and effective scientific-technological community in the Philippines—one which is well-supported by its government and its industries—can these changes, in the long run, be brought about. Our two groups are working together, attempting to help create that community.

Few persons fully comprehend the magnitude of the revolution which is taking place in the world today. In the more technologically advanced countries change is taking place so rapidly that we lead lives which simply were not imaginable as recently as a quarter of a century ago when the United States and its Philippine allies suddenly found themselves fighting together in the most destructive and cruelest war in history. These changes, of course, are rooted in the technological explosion of the past few decades, which has given rise to nuclear energy, computers, jet engines, synthetic fibers, oral contraceptives, and a fantastic outpouring of chemical, metallurgical, agricultural, medical and electronic innovations. These developments are completely transforming our ways of life.

Ironically, however, the poorer countries of the world are largely being bypassed by these developments. Per capita food production increases slowly, if at all. Populations increase rapidly and the principal cities grow like uncontrolled cancers. Technically trained persons are desperately needed to help solve these mounting problems. Yet too few of them are being trained. Inadequate use is made of those who are trained. There is a continuing debilitating flow of technical people from the poorer countries, where they are badly needed, to the wealthier countries, where they are not needed.

When I attempt to examine this world-wide situation as objectively as possible, I reach two major conclusions. First, the way things are going now, the gap between the rich and the poor will continue to widen in the foreseeable future. Our objective of eliminating hunger, disease and privation in the world will not be reached. Indeed, I believe that unless something drastically new is injected into the world picture, misery will be considerably more widespread a quarter of a century from now than it was at the time of the outbreak of World War II.

Secondly, I conclude that this situation is inexcusable. Science and technology have given man unprecedented power. For the first time in his million or so years

of existence he is in principle liberated from most of the basic constraints imposed upon him by nature. He has the power to do what he chooses to do. He has but to mobilize his technology, whether it be to win a war or fly to the stars.

Yet, in the critical area of economic development we in the richer nations choose to ignore the lessons we learned during World War II when we developed the atomic bomb and radar. We ignore the lessons we learned in the post-war years when we developed ICBM's, the hydrogen bomb, nuclear submarines and space probes. We ignore the lessons we learned when we stimulated the creation of a multiplicity of profit and not-for-profit corporations and agencies to deal with military and space matters. We ignore the lessons we learned when we tapped, for military and space purposes, the vast intellectual resources of our universities. These approaches have given rise to ideas and programs of enormous effectiveness.

By comparison foreign assistance programs of the more technologically advanced countries, as well as the internal development programs of developing countries, are, more often than not, destitute of ideas—not to mention money. Frankly, I often look upon the world of economic development as a world of cliches. At one end of the spectrum are the peoples who think in terms of money—often in such abstract terms that they are unable to relate money to the technological developments which make economic growth possible. At the other end of the spectrum are those who think in terms of technical assistance. All too often, I believe, these persons are possessed of what I call a "Mr. Chipps" complex. Mr. Chipps, if you remember, was a teacher who was terribly nice to students—one might say even patronizing. His mission was to bring education to the heathen, no matter whether they wanted it or not. He did this with almost overbearing grace, good humor and intelligence. And history testifies that he was unable to prevent the fall of the British Empire. Although I have a certain emotional attachment to Mr. Chipps, I don't believe that this approach is basically the answer to the major problems confronting us today.

In my opinion we should approach the problems of economic development as we would approach the problem of waging a major war. We must mobilize our resources. We must mobilize our technology.

I fear that the task of impressing upon our respective governments the need to really mobilize our technological resources for this war on human misery is not an easy one. Much lip service is given the concept. But usually this lip service is given within the framework of "gimmicks". Use atomic power or desalt your water or join the space effort and your problems will be solved. Our Philippine and American panels know that this view is superficial—that our real problem is that of building technology in depth. Our respective governments need much education concerning the realities of today's world. For one thing the ideas of most leaders, both in your country and mine, were crystallized at least a quarter of a century ago and the world has passed them by. For another, our science and our technology are creating a world within which we will either collectively perish or thrive as cooperative brothers. There is little middle ground.

I hope that we will keep this exciting experiment going in the years ahead. Above all, I hope that in coming together in this way we are setting an example for the world to follow.

BRIDGING THE GAP*

Remarks by Juan Salcedo, Jr.**
at Philippines—U. S. Workshop Dinner
November 16, 1966
National Academy of Sciences

Dr. Brown, Dr. and Mrs. Spilhaus, Distinguished Members of the American Panel, My Colleagues in the Philippine Panel, Ladies and Gentlemen:

I have been requested by our very good friend and Co-chairman of the American Panel, Dr. Harrison Brown, the genial host of this Banquet, to deliver a few remarks on this momentous occasion. On behalf of the Philippine Panel and on my own, I would like to express to Drs. Brown, Warner, Spilhaus and the other equally outstanding members of the American Panel of this workshop and to the staff of the Foreign Secretary of the National Academy of Sciences our deep gratitude and very sincere appreciation for the very warm hospitality and extremely cordial friendship bestowed to each and everyone of us during our stay in your beautiful and highly progressive country. We have come here to learn and we did learn a lot. The experience is truly beneficial and worthwhile. The manner the workshop was conducted is indicative of the new trend in American-Philippine science relationships. It is indeed a new trend, a new social invention designed to make articulate ideas and philosophies, in the various spectra of thought, concerning the improvement of the economy of the developing nations through the use of the modern tools of science and technology.

While I stand here before you, I cannot help but think of the increasing gap in the socio-economic levels of two poles of human society in the world today. We have on the one hand, the highly developed countries utilizing more or less fully the benefits of science and technology and on the other, the developing peoples, including my own, grappling problems of economic development with largely undeveloped technology and invention. It is apparent, my friends and colleagues,

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* Reconstructed from the extemporaneous remarks delivered at the Banquet tendered by the Foreign Secretary of the National Academy of Sciences in honor of the Philippine Panel to the Second Meeting of the Philippines—U. S. Workshop on Scientific and Technological Cooperation and Development at the Great Hall, NAS, Washington, D. C., November 16, 1966.

** Chairman, National Science Development Board, Republic of the Philippines; and Chairman, Philippine Panel to the Second Meeting of the Philippines—U. S. Workshop on Scientific and Technological Cooperation and Development held in Asilomar, California, and Washington, D. C., November 6 - 16, 1966.

that I cannot help but speak for the developing nations in this evening, the last of our meetings in this workshop. Perhaps my own impressions would be those contained in the words of the Foreign Minister of the State of Israel, the Honorable Abba Eban, who in 1960 during the First Rehovoth Conference as president of the Weizmann Institute and Chairman of the Conference asked the following questions: What does the age of power, of nuclear and solar energy, hold in store for the planners of new economics? What is the impact of science and technology on man's basic resources, the land and water which nourish his life? How can our massively growing populations be maintained through a corresponding growth of resources? What is the message of medical research to those who live short, stunted, diseased lives across the expanses of three continents? How can new communities be socially and economically prepared to absorb the benefits of modern techniques? Above all—how can the leaders of new states fashion educational programmes, which will end the exclusion of half of the world from the domain of scientific inquiry and efforts? At the centennial celebration of the Massachusetts Institute of Technology in April of 1961, the former British Prime Minister Harold Macmillan, speaking as a representative of highly developed countries utilizing science and technology to the maximum, gave some of the answers when he said:

> "In these years the application of scientific techniques to the methods of production, distribution, transport, and communication of ideas has set the whole race on the march. This process will go on, until it has revolutionized the whole conduct of human life upon this planet and perhaps beyond."

There is no doubting the admissability that science will pave the way to man's salvation in the face of expansive tendencies on many fronts: disease, food problems, increasing population, illiteracy, poverty and efforts to influence man's thoughts for or against certain ideologies. These then are the problems which science must face in the developing countries in order that the promises of tomorrow do not become too remote; and likewise, so that today we may be able to experience a certain amount of fulfillment.

We from the Philippines earnestly hope that your efforts and will to promote an internationalization of science would be highly beneficial for all men so that we can all be happy and contented through the technological means for adequate provisions for food, clothing, shelter and medicines. All these together with serenity of mind and peace in his heart make man free from the ills of the flesh and of the spirit. We are objective enough to realize that American science and technology would be of great value to Philippine economy. At the same time we are of the belief that findings and observations in science and development in the Philippines would be of easy application to American needs and to your frontiers beyond your geographical boundaries as we all strive to build a One World.

We like to take the forward look that science is a vehicle that knows no frontiers of race, sex, political beliefs, religious persuasions or geographical

boundaries. We hold the concept that, when properly utilized and when developed horizontally and vertically, science and technology constitute the primary and vital vehicle of international goodwill and friendship. We likewise hold the view that whether it is in Thailand, Australia, Germany or Israel, or in this great country, science and development will bring about friendship and understanding, peace and prosperity for all men, for posterity beyond our time.