National Integrated Basic Research Agenda

Department of Science and Technology
NATIONAL RESEARCH COUNCIL OF THE PHILIPPINES
General Santos Avenue, Bicutan, Taguig City
Tel. Nos.: 8376141-43; 8390275; 8370409; 8372071 loc. 2341-46
E-mail Add: nrcpinfo@yahoo.com; nrcpinfo@dost.gov.ph
URL: http://www.nrcp.dost.gov.ph

Rationale

Research underpins competitiveness and economic growth by advancing knowledge and skills, which sustain innovation. It also plays a vital role in tackling national problems and in establishing structural priorities such as those in the economic, social and cultural realm. It is now therefore widely recognized that economic growth and competitiveness in the global market are increasingly becoming dependent on the generation and diffusion of knowledge and technologies. To this end, the **Department of Science and Technology** (**DOST**) has formulated as one of its **MAJOR FINAL OUTPUTS** -- a terminology used by the Department of Budget and Management - the "***generation of new knowledge and technologies***."

While most countries have allocated the greater portion of their R&D funds to applied research, particularly in the last few decades, there are some that opted to maintain allocations for basic research at a "healthy" level.

Many developing countries, the Philippines included, devoted most of their scarce resources to applied **R&D** describing these efforts as market-driven. As an indicator, funding for basic research coming from the **DOST** budget will probably not reach the 10% level.

Looking back, however, scientific and technological development over the past two to three hundred years, demonstrated the importance of basic research like the role played by mechanics and thermodynamics in the early phase of the industrial revolution, by electromagnetism in the development of electrical machinery and telecommunications, by optoelectronics in network communication, and by molecular biology in many modern technologies.

As society evolves, the trend of development relying on basic science has become increasingly clear and the problems of capital and labor allocation in traditional capitalism have now been transformed into complex issues based on new forms of knowledge.

In May 2000, fifty-one (51) of the world's scientific academies, almost half from developing countries, met in Tokyo to discuss a transition to sustainability in the 21st century. Its number two (out of three) recommendation is to "actively generate new knowledge by sustaining long-term basic research and linking it to social goals."

Developed, developing (the Philippines included), and underdeveloped countries now realize that advances in fundamental knowledge broaden the possibilities for productivity in applied research and opportunities for technical innovations. They also recognize that results of basic research are never ending sources of new ideas and new knowledge for fuller understanding of a subject matter of problem (for comprehension, analysis, and solution of emerging issues and problems).

Perhaps the statement of **Dr. Manuel Peimbert**, then Vice President of the Third World Association of Sciences in 1999 would be relevant to the current Philippine situation. He said that "***third world countries must support basic science ---***

1. to establish scientific capacity for dealing with pressing problems of no immediate concern to developed countries;
2. to reduce the science and technology gap between developed and developing countries;
3. to participate effectively in the solution of global problems;
4. to raise the quality of education at the undergraduate and graduate levels; and
5. to create new knowledge for improving our understanding of the world in which we live.

NRCP and Basic Research

History has shown that breakthroughs are the products of pioneering studies or basic research. Within the **NRCP**, there are a number of these recorded breakthroughs, foremost of which were those which led to the utilization of GEOTHERMAL ENERGY for power generation in the country, to the establishment of the CUTFLOWER INDUSTRY, to the commercial-scale utilization of some MEDICINAL PLANTS, to the isolation of the first CONUS PEPTIDE which had potentials as antidote for cone stinging cases, to the identification of BACILLUS ISOLATES which had potentials as seed treatment biocontrol agent against major root pathogens of corn, and to the identification of certain carriers of the NITROGEN FIXING BACTERIA from talahib which led to the commercial bio-n fertilizer.

When the sectoral R&D council system was institutionalized in the country in 1982, the NRCP was given primary responsibility for basic research. Its level of funding, however, is the lowest among the research councils with an annual budget of **only P21Million** – the greater part of which goes to running the affairs of the council as a collegial body not only concerned with research but also with the provision of policy advice to government and the dissemination of research results and information.

When **DOST** announced in May this year that its priority **R&D** areas up to **2010** will be **Pharmaceuticals**, **Biotechnology**, **Environment**, **Information and Communication Technology** (**ICT**) and **Basic Research** within research councils assigned specifically for each area, NRCP was given the responsibility for basic research. The formulation of a plan for basic research, therefore, becomes imperative.

To formulate a plan for basic research with the objective of generating new knowledge the **NRCP Governing Board** passed a resolution as early as ***January 27, 2006*** creating a **Technical Working Group** to spearhead the

activities to fulfill the task. Considering the collegial nature of NRCP, it was later agreed that a consultation be done to formulate criteria for distinguishing a basic research project from other types of research projects, and to come up with suggested topics or areas for basic research.

The National Science and Technology Plan (2002 – 2020)/Basic Research

In formulating the plan for basic research, it is best to consider the **S&T area thrusts** enumerated and described in the **National Science and Technology Plan** (**NSTP**), which covers the period up to **2020**. These are as follows:

1. Agriculture, Forestry and Natural Resources;
2. Health/Medical Sciences;
3. Biotechnology;
4. Information and Communication Technology;
5. Microelectronics;
6. Earth and Marine Sciences;
7. Fisheries and Aquaculture;
8. Environment;
9. Natural Disaster Mitigation;
10. Energy;
11. Materials Science and Engineering; and
12. Manufacturing and Process Engineering

These are described in some details in the NSTP (2002-2020) document. It is to be noted that the DOST priority R&D areas for the medium term (2002-2010) namely: Pharmaceuticals, Biotechnology, Environment and ICT are included in the 12 S&T area thrusts (Pharmaceuticals is under Health/Medical Sciences) and of course basic research cuts across the area thrusts.

NRCP has its own **Medium Term Plan** (**2005-2010**) but the listed priorities are all consistent with the NSTP priorities.

It is important to mention at this point that the plan for basic research should also include areas or topics covered by the divisions of NRCP devoted to Policy, Government, Education and International Affairs**,** Social Sciences**, and** the Humanities**.**

Basic Research is determined and qualified by the following criteria and features:

1. It seeks to understand the nature, structure and scope of its subject, guided mainly by the conceptual structure of the subject

2. It aims to acquire new discovery and/or confirmatory knowledge about concepts, structures, compositions, functions, and interrelationships of various systems

3. It includes pioneering research in cases where the basic structure of the knowledge is not yet available

4. It seeks fundamental knowledge for its own sake and its outcomes may have potential application in the future

5. The main benefits of its results are the advancement of frontiers in the discipline itself

The National Integrated Basic Research Agenda (NIBRA)

Responding to the need to prioritize basic researches that will maximally benefit the nation, the NRCP has embarked on a series of consultative fora to generate and formulate the National Integrated Basic Research Agenda or NIBRA. In 2006 in UP Diliman, the initial consultation was done involving the broad spectrum of research stakeholders- that include research funders, research producers and research implementers from both the government and private sector. Most recently in September 2008, the NRCP revisited the basic research agenda taking into consideration the rapid developments in science and technology such as the emergence of new fields like nanotechnology and the increasing interest of government in basic knowledge that can be translated into specific applications and technology.

The NIBRA specifies the areas of priority that will be the focus of basic research up to 2010. This is envisioned to be an evolving document that has to be continually revised and updated to respond to the changing times and needs of society. Therefore, these identified research topics are not meant to be final and all-inclusive.

The NIBRA will hopefully:

- Provide the roadmap for basic research in the country
- Serve as a guide in identifying priority research areas for national funding agencies
- Focus the country's limited resources for R and D on significant and relevant basic research
- Enable synergy and coordination of research initiatives among research institutions and agencies
- Serve as a platform for advocacy for national and international funding and collaboration

The NIBRA is divided into clusters namely:

CLUSTER I (Governmental, Educational, and International Policies, Social Sciences, and Humanities)

Cluster I is composed of three divisions: Division I (Governmental, Educational, and International Policies); Division VIII (Social Sciences); and Division XI (Humanities). Division I is represented by competent researchers that can provide professional advice and assistance to policy-makers concerning national and international interests, issues and concerns. As one of the biggest in the Council, Division VIII is made up of seven sections: Sociology, Social Work, and Demography, Public Administration and Political Science, Education and Communication, Psychology and Philosophy, Linguistics and Anthropology, History and Geography, and Economics. Division XI is made up of scholars and academics in the field of research in humanities, culture and the arts and letters.

A. NEW PARADIGMS IN TEACHING

1. National and local models for good governance in education
2. New perspectives in the teaching of science, mathematics, and the arts
3. Science culture formation geared towards critical thinking and problem solving
4. Emotional literacy
5. Ladderized education and equivalency programs
6. Language teaching (verbal and non-verbal)
7. International issues and crises of other countries

B. SURVIVAL IN THE PHYSICAL ENVIRONMENT

1. Adapting to climate change
2. Disaster management and mitigation
3. Poverty-alleviation
4. Human migration

C. GOOD GOVERNANCE, HUMAN SECURITY, AND SOCIO-CULTURAL ENVIRONMENT

1. Developing indicators of good governance
2. Indigenous peoples issues
3. Illegal/informal settlers

D. UNDERSTANDING AND APPRECIATING PHILIPPINE CULTURE

1. Arts and material culture
2. Media and ICT literacy
3. Ethics, values and moral development of Filipinos

E. LOCAL AND REGIONAL SOCIO-ECONOMIC DEVELOPMENT MODELS

CLUSTER II (Mathematical Sciences, Engineering and Industrial Research, Physics, and Earth and Space Sciences)

Cluster II gathers together researchers investigating the atmosphere, and climate and earth scientists. It also includes Physics and Mathematics. Together with the Engineering and Industrial Research Division, a dynamic mix for innovation is envisioned.

A. NATURAL SCIENCES

1. Mathematical Sciences
   a. Analysis of differential equations
   b. Group Theory
   c. Graph theory and combinatorics
   d. Number theory, coding theory and cryptography
   e. Optimization and approximation
   f. Mathematical modeling
   g. Fundamentals of computer science

h. High-performance computing
i. Numerical analysis
j. Fundamentals of statistics and mathematical statistics

2. Physical Sciences
   a. Optics and photonics
   b. Complex systems and non-linear dynamics
   c. Mathematical and computational physics
   d. High-energy physics and field theory
   e. Condensed matter physics
   f. Gravitational and astrophysics
   g. Plasma physics
   h. Medical and biological physics
   i. Advanced and smart materials

3. Earth and Related Environmental Sciences
   a. Computational meteorology, hydrology and geology
   b. Simulations/modeling
   c. Numerical analysis
      - Diagnostic
      - Predictive
   d. Basic observations
      - Sensors
      - Nanotechnology
   e. Astronomy, GIS, and remote sensing
      - Declouding techniques
      - Methods of observation
   f. Alternative sources of energy
      - Wind
      - Solar
      - Ocean

B. ENGINEERING AND TECHNOLOGY

1. Nanotechnology
2. Biosensors
3. Bio-Lubricants/Biofuels
4. Energy Storage and Conversion
5. Characterization of new materials
6. Resource Management

C. INFORMATION AND COMMUNICATION TECHNOLOGY

1. Development of national and local models for good governance in ICT

D. MULTI-DISCIPLINARY RESEARCH

1. Environment and Climate

CLUSTER III (Medical Sciences, Pharmaceutical Sciences, and Chemical Sciences)

Cluster III is composed of the divisions of Medical Sciences, Pharmaceutical Sciences and Chemical Sciences. United as a cluster, the three divisions seek to foster basic and multidisciplinary research in the health and health-related sciences. Their efforts shall contribute to the government's agenda for the improvement of health.

A. NATURAL SCIENCES

1. Chemical Sciences (Chemistry, other allied subjects)
    a. Natural products chemistry, chemistry of plants, marine organisms and microorganisms
    b. Analytical Technology, including sensors, method development, and metrology
    c. Molecular modeling and computer applications in chemistry (computational chemistry, chemometrics, chemo-informatics)
    d. Chemistry of new materials; designer chemistry, nanochemistry, organic and inorganic synthesis, characterization of local and indigenous materials, including wood chemistry
    e. Food chemistry
        e.1. Food composition tables: Analysis of food constituents (nutrients, toxicants and contaminants)

B. MEDICAL SCIENCES/PHARMACEUTICALS/HERBALS

1. Extraction and pre-formulation studies of natural products/pharmaceutical products
2. Pre-clinical, pharmacological screening/evaluation of potential/possible drug materials such as plants, animals or marine products for their therapeutic use in humans/animals
3. Pharmaceutical assay design and validation
4. Pharmacogenomics and Toxicogenomics

C. MULTI-DISCIPLINARY RESEARCH

1. Scientific substantiation of health claims of food supplements – chemical/physical/toxicological studies on food supplements
2. Human metabolic studies to provide basis for setting nutritional requirements and dietary standards
3. Clinical/subclinical studies on new/novel food for setting safety standards
4. Rational drug design and emerging technologies in drug discovery and development
5. Development of method for assessment and management of nutrition and food safety problems
6. Development of national and local models for good governance in health management

7. Social determinants of health
8. Proteomics, Metabolomics, Lipidomics, Glycomics, Nutrigenomics
9. Neuroscience

CLUSTER IV (Biological Sciences, Agriculture and Forestry)

Cluster IV of NRCP is composed of Division V – biological sciences and Division VI, agriculture and forestry. Research undertaken by this cluster focus on basic research that seeks to understand the nature, structure and scope of the subject, guided mainly by the conceptual structure. It also seeks to acquire new discovery and/or confirmatory knowledge about concepts, structures, compositions, functions, and interrelationships of various systems including pioneering research in cases where the basic structure of the knowledge is not yet available. Thus, research is undertaken for knowledge for its own sake where outcomes may have potential application in the future; and that the main benefits include the advancement of the frontiers in the discipline itself. The depth and breadth of research initiatives hope to create opportunities that will benefit knowledge itself (i.e. knowledge for knowledge's sake) and/or solve problems in the different fields of endeavor.

A. NATURAL SCIENCES

1. Environment, natural resources, conservation, sustainable use and biodiversity

B. AGRICULTURAL SCIENCES

1. Agriculture, Forestry and Natural Resources
   a. Crop Science, Crop Protection, Agricultural Systems
   b. Animal Science
   c. Food Science
   d. Forest Biological Sciences
   e. Wood Science and Forest Products
   f. Silviculture
   g. Social Forestry, Agricultural Policy, and Economics
   h. Hydrology/Watershed
   i. Soil Conservation
   j. Marine Sciences
   k. Fisheries and Aquaculture
   l. Fisheries Management
2. Bioremediation/Pollution Control, Integrated Pest Management
3. GIS, remote sensing and databasing of biological resources, agriculture, forestry including indigenous knowledge systems
4. Biomass production via seawater

a. Development of salt tolerant species/crops to reduce freshwater requirement
b. Development of plant varieties that transpire less water

5. Bioremediation
   Strategies for water quality control and water quality monitoring
6. Biotechnology
7. Bioinformatics (microbial, plants, animals and medical)
8. Bamboo
9. Veterinary Medicine
   - Anatomy, physiology, microbiology, parasitology, food hygiene, pathology, characterization of viral and bacterial pathogens, vaccine development and diagnostics

C. MULTI-DISCIPLINARY RESEARCH

Development of national and local models for good governance in environment, agriculture, forestry and bioresource management