Higher Education Science and Technology and Economic Competitiveness

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COMPETITIVENESS

“...the set of institutions, policies, and factors that determine the level of productivity of a country.”

— World Economic Forum
INNOVATION

“The design, invention, development and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm.”

2008 Advisory Committee report to the Secretary of Commerce, Innovation Measurement: Tracking the State of Innovation in the American Economy
The impact of innovation

The competitive and innovative capacity of the United States, 2012

- New industries
- New businesses
- Expansion of existing businesses
- Good jobs (high wages)
Philippine Government Priorities 2011-2016
NEDA’s MEDIUM TERM PHILIPPINE DEVELOPMENT PLAN (2011-2016)

- Strategic Approach, key products – agri., services
- Coordinated, avoid wastes/duplications
- No “Vanity Projects”
- Productivity is key

Bautista, 2014
ASEAN 2015

ASEAN Free Trade Area
APEC
Bogor Goals
1994

Free and open trade and investment by 2010 for industrialized economies and by 2020 for developing economies.

– further reduce barriers to trade and investment
– promote the free flow of goods, services and capital.

Source: Progressing towards the APEC Bogor Goals, Perspectives of the APEC Policy Support Unit, Nov. 2010
The Systems Approach

Connections

Interactions

Synergies

How components of a system affect each other
Figure 1. Agricultural research expenditures

Source: Chapter 1: Towards an Appropriate Level of Agricultural Research Finance, p. 6
Financing Agricultural Research: A Sourcebook
Steven R. Tabor – Willem Janssen – Hilarion Bruneau
ISNAR, April 1998
No new knowledge, no new wealth
Adequate Social Capability to Absorb and Manage Advanced Technologies

A technology explicit development agenda
Technological backwardness is not usually a mere accident. Tenacious social characteristics normally account for a portion, perhaps a substantial portion, of a country’s past failure to achieve as high a level of productivity as economically more advanced countries.

Abramovitz, 1986
TRAIN HIGHLY-SKILLED AND HIGHLY PRODUCTIVE WORKFORCE TO PRODUCE NEW WEALTH

• HEALTH CARE DELIVERY

• SCIENCE AND MATHEMATICS EDUCATION FOR ELEMENTARY AND HIGH SCHOOL

• TECHNICAL AND TECHNICIAN EDUCATION

• TERTIARY LEVEL SCIENCE AND ENGINEERING EDUCATION

• GRADUATE PROGRAMS IN SCIENCE AND ENGINEERING
IMPROVING S&T TRAINING AND RESEARCH CAPACITY OF HEIs

OBJECTIVE

- Excellence in developing INTELLECTUAL CAPITAL

- Develop Talented, Ingenious, Agile and Adaptive workforce

  - augment, facilitate, generate

  - “ability to anticipate, adapt, learn, and lead…”

  - “balanced breadth and depth of scientific knowledge and practical workplace skills for the productive and innovative application of that knowledge…”
Roadmap
Actively participate in improving STEM Education at all levels

Engage in Research in Teaching and Learning in STEM
Supplement student recruitment through the Mine-and-Sort approach

Proactively search of talent and genius
Actively recruit and develop highly-qualified faculty in STEM

Consider engaging foreigners
Balanced work-life environment
Provide opportunities for the faculty to retool

Support post-doctoral research postings in other institutions

Support attendance to international STEM conferences
Maintain functional basic science and mathematics departments

Strong science and mathematics base influences quality of instruction and research in STEM
Enhance S&T content of curricula

Ensure Updated S&T and Math content of GE
Upgrade STEM instructional laboratories and equipment

Laboratory classes are critical in developing skills and values
Update STEM degree programs

Benchmark to regional and global developments
Re-envision and reform Graduate Education

Anchor graduate degree programs on reputable sustainable research expertise
Terminate poorly-performing programs
Exercise caution in institution new programs and in partnering with offshore institutions
Develop sharply-focused research programs
Establish expertise niche of the institution

Encourage interdisciplinary team approach
Conduct collaborative projects with foreign and local institutions
Invest in state-of-the-art research facilities appropriate to the expertise niche

Research laboratories, Library, ICT network, reliable utilities, functional, secure and safe workplaces

Efficient service and procurement system for research materials and facilities
Establish a highly-efficient research management system

Research data
IPR
Scientific fraud
S&T-based Academe-Industry-Government Development Agenda

Ex-ante studies
Ex-post studies
Expert advice
Service laboratories
Subject institution and programs to periodic external reviews

Review panel must be independent and without conflict-of-interest
A TECHNOLOGY-EXPLICIT DEVELOPMENT AGENDA

• PROMOTE ECONOMIC EFFICIENCY
• FACILITATE TRADE
• ATTRACT INVESTMENTS
• ENSURE FOOD SECURITY
• ENHANCE ENVIRONMENTAL PROTECTION
• MITIGATE EFFECTS OF HAZARDS AND DISASTERS
• GENERATE TECHNOLOGY FOR NATIONAL DEFENSE
• ASSESS THE IMPACT OF PROGRAMS TO ENHANCE COMPETITIVENESS THROUGH THE SOCIAL SCIENCES
PROMOTE ECONOMIC EFFICIENCY

Efficient processes
Minimum disruption

• COMPETITIVE LIVELIHOOD ENTERPRISES

• ENERGY

• HEALTH AND NUTRITION

• PEACE AND ORDER

• TRANSPORTATION

• COMMUNICATION
FACILITATE TRADE
Enable TIMELY flow of goods and services

• COMPLIANCE WITH PRODUCT STANDARDS

• KNOWLEDGE BASE/CAPACITY TO HANDLE/DISPUTE TECHNICAL BARRIERS TO TRADE

• TECHNICAL SUPPORT FOR SANITARY AND PHYTOSANITARY REQUIREMENTS

• BIOSECURITY
ATTRACT INVESTMENTS
Reduce risks

• QUALITY OF WORKFORCE
  – HIGH LEVELS OF SCIENTIFIC AND TECHNOLOGICAL COMPETENCE ATTRACT HIGH-TECH INDUSTRIES

• FUNCTIONAL NATIONAL SYSTEM OF INNOVATION

• PREDICTABLE LEGAL ENVIRONMENT- PERMITS, CONTRACTS, DISPUTE SETTLEMENT, BANKRUPTCY LAWS
ENHANCE ENVIRONMENTAL PROTECTION
Natural Resource Management

- TECHNOLOGY FOR AIR, WATER, SOIL POLLUTION MONITORING
  - On-line, Real Time

- CONSERVATION STRATEGIES

- CLIMATE CHANGE
  - Adaptation
  - Mitigation

- POLLUTION ABATEMENT

- REMEDIATION TECHNOLOGY
  - Wastewater Treatment
MITIGATE EFFECTS OF HAZARDS AND DISASTERS

Manage Disruption of Goods and Services

• HUMANITARIAN EMERGENCIES: FOOD, WATER, MEDICINES, SANITATION

• EARLY WARNING SYSTEMS FOR WEATHER DISTURBANCES

• REAL TIME AND ONLINE MONITORING OF VOLCANIC ACTIVITY AND EARTHQUAKES

• IDENTIFICATION OF DISASTER-PRONE AND HAZARDOUS AREAS
GENERATE TECHNOLOGY FOR NATIONAL DEFENSE
Preserve Territorial Integrity, Peace and Order

- National ID
- Communications infrastructure
  - Reliable and secure
- Detection of drugs, explosives and other weapons
- New Materials and Weapons for Defense and Security
- Mobility
  - Land, water and air transport
  - Infrastructure
- Health
  - Combat rations
  - Medical devices for the field
- Intelligence
  - Information technology
  - Other devices
ASSESS IMPACT OF THE NATIONAL INNOVATION SYSTEM: HARNESSING THE SOCIAL SCIENCES

- IMPACT ASSESSMENT
- GEOGRAPHIC INFORMATION SYSTEMS
- MARKET ANALYSIS
- OTHER SOCIAL, ECONOMIC AND POLITICAL STUDIES RELATED TO THE NATIONAL INNOVATION SYSTEM
Imitation or Innovation?
Leapfrogging and Path Dependence

The emerging technologies on the platform of the basic industries
THE DEVELOPMENT AGENDA

GOOD GOVERNANCE

GOOD SCIENCE

- CONVERGENCE
- PARTNERSHIPS
- TIMELINESS
The ideal HEI research portfolio

• Maintenance Research Program
  – Long term, e.g. breeding, ecological impact
  – Biodiversity studies- systematics, gene banking, culture collections
  – The basic industries- iron and steel, cement, chemicals, fertilizers, textile, pulp and paper, petroleum

• Frontier, cutting-edge research using new tools of science and technology
  – Big data
  – Engineering
  – New biology
  – Emerging technologies

• High-risk, high science
The ideal HEI research portfolio

• Industrial Design

• Research in Teaching and Learning
  - Analysis of institutional profile- faculty, staff, students, budget and other resources
  - Tracer Studies

• Impact Analysis of research projects
  – Ex ante
  – Ex post

• Meta-analysis of research portfolio
  – Synoptic view of the profile of the research portfolio over time
  – Data mining- Secondary data analysis
Shall we rise or fall?
When Progress is moving as fast as it is now, recalling its victims is difficult.

Michael Lewis
Thank you