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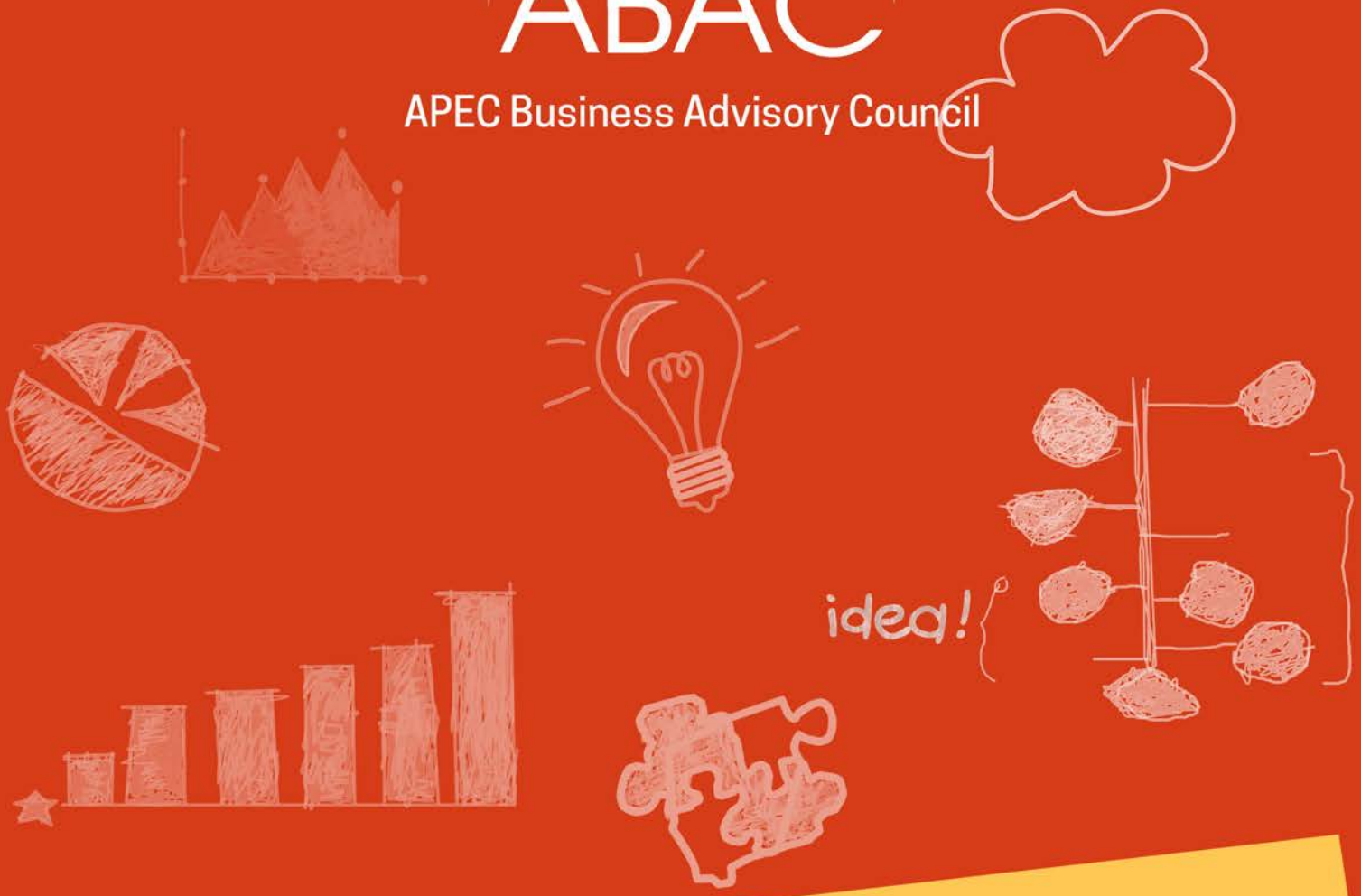

Pushing Boundaries Through Innovation: Just Do It

A POLICY PAPER

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MBC
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THE FORUM FOR CONSTRUCTIVE IDEAS

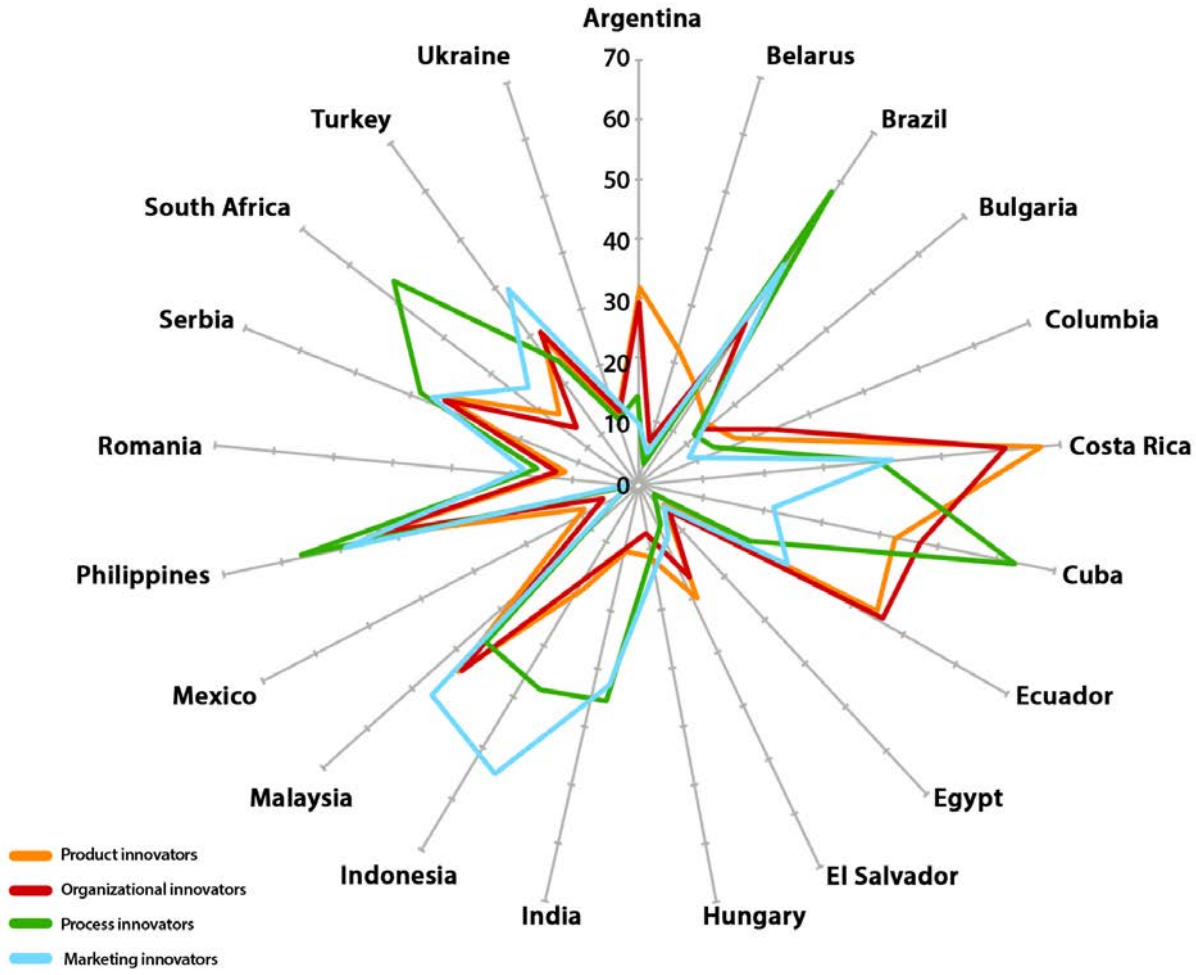
Makati Business Club
2nd Floor, AIM Conference Center
Benavidez Street corner Trasierra Street
Legaspi Village, 1229 Makati City, Philippines
Tel: 751-1137 to 38
Fax: 750-7405 to 06
Email: makatibusinessclub@mbc.com.ph
Website: www.mbc.com.ph

"The best way to predict the future is to invent it."

— ALAN KAY

Innovation is a key driver of economic growth and helps build the foundations of a more inclusive future. It is important that it is placed at the center of development policies to enable the country to move with or get ahead with the fast-paced changes in today's world. The Philippines, however, is lagging behind.

Forms of innovation vary across economies. In the Philippines, process innovators prevail.



Source: UNESCO Institute for Statistics, September 2014

A culture of innovation produces a highly skilled workforce, active enterprises, and competitive technological advances that translate to more vibrant economic activity, employment opportunities, solutions to social problems, and overall growth.

The country's innovation ecosystem has been plagued by various limitations—from the overarching, like absence of a long-term innovation vision for the country, lack of an integrated and coherent strategic priorities, and disjointed innovation governance issues, to the more specific, like poor performance in a host of innovation indicators and lack of research budget and research professionals.

The results have been inevitable. The Philippines has long been outstripped by its Asian neighbors and other developing economies in terms of technological, industrial, and commercial development.

Various government initiatives have sought to address this situation and have made certain gains, but more strategic and concerted efforts still need to be done to build on these gains and cultivate a truly functioning and thriving national innovation system.

Historically, the Philippine innovation system has been described to follow the "linear" model, which assumes that technological change follows along linear process from research/invention, development/transfer, and on to diffusion or commercialization. This model has led to policies that promote either the "science-push" (emphasis on supporting basic research or the supply side of the science, technology, innovation system) or "market-pull approach" (emphasis on pursuing only technologies that answer market needs or conform to comparative advantages).

IN MORE RECENT YEARS, HOWEVER, THE WAY OF THINKING HAS EVOLVED TO RECOGNIZING THAT INNOVATION HAPPENS WITHIN A MORE COMPLEX AND DYNAMIC ENVIRONMENT

Placing undue emphasis on one or the other of these approaches can lead to consequences that limit overall innovation and hinder growth. The science-push approach can lead to a lot of wasted resources because only a small percentage of basic research can make it to full diffusion/ commercialization, while the market-pull approach

David Plouffe of Uber speaks at APEC SME Summit 2015 in Manila, Innovation and Big Ideas: Pushing Boundaries

can lead to a stunted local science and technology industry and dependence on imported technologies (Posadas 2010).

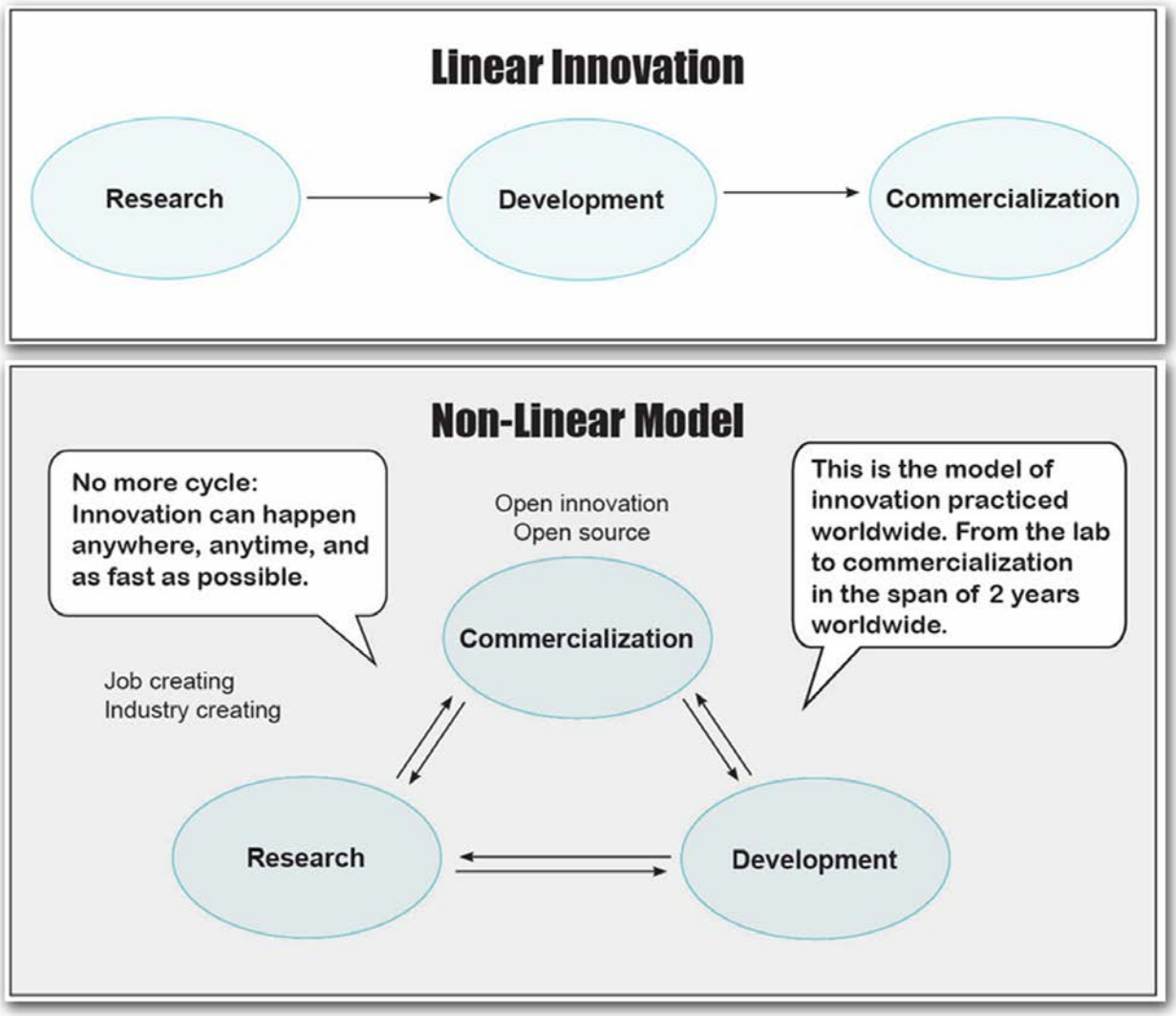
The linear model was an early innovation model and was predominant in many economies' policies in the 1960s and even up to the 1980s.

The concept of a non-linear innovation system emphasizes the importance of interactions among the different components or players of the system, such as universities, government institutions, research institutes, and businesses. Within such an active environment, innovation can happen more quickly (Figure 1). Facilitating linkages between and among these innovation players is the main challenge facing economies seeking to build a competitive innovation economy.

WHY INNOVATION?

Innovation is a key driver of economic growth and helps build the foundations of a more inclusive future. Innovation needs to be anchored on the long-term view of what we want to achieve as a nation. It helps spur job creation and productivity, promote knowledge creation and diffusion, improve economic performance, address societal challenges and enhance welfare. It is imperative that the government make a firm and explicit strategic commitment to innovation as a strategy to achieve inclusive growth.

Figure 1. Models of Innovation



Source: Tangonan, 2015. Strategic Planning in the Context of Philippine Science and Technology Competitiveness (presentation)

Innovation helps develop solutions to some of the most pressing environmental, health and social challenges facing the world today. We need to harness our unique strengths to ensure that innovation serves the country's most vital needs. Innovation has brought about greater access to drinking water, eradicated diseases, reduced hunger, promoted energy security, enabled MSMEs to access global value chains, to name a few. While it is tempting to direct our innovation strategies on a wide range of areas, it is important that we focus on areas where we have distinct advantage.

Unlocking the remarkable potential of entrepreneurs needs robust innovation ecosystems. Innovation and entrepreneurship are inextricably linked.

Micro, small, and medium enterprises, which account for 99.6% of businesses in the country can gain significantly from a strong innovation ecosystem that facilitates access to finance, internationalization of MSMEs, promotes human capacity building, supports product development, and delivers a strong R&D program.

Strong governance, improved policy coherence, and a "whole of government approach" will allow innovation to unlock the potential of more inclusive, stronger growth. Innovation is essential for development work. Since development spans various sectors and agencies of the government, it is vital that a "whole of government" and collaborative governance approach is adopted in laying down the foundations — setting the long-term goal, priorities, strategies, and policies — and in delivering the country's innovation programs. Development issues, as complex as they are, need to be looked at and addressed collectively by the agencies concerned. This will allow for aligned priorities thereby enhancing service delivery.

THE PHILIPPINE INNOVATION SYSTEM

POLICIES AND PROGRAMS

The Philippine Constitution recognizes science and technology as "essential for national development and progress" and gives priority to research and innovation. Key constitutional mandates on this include (Article XIV, Sections 10–13):

- Priority on research and development (R&D), invention, innovation, and their utilization

- Priority on science and technology education, training and services.

- Incentives to encourage private participation on scientific research

- Scholarships or other incentives to deserving science students, researchers, scientists, inventors, technologists, and specially gifted citizens

- Regulation and promotion of technology transfer and adaptation for the national benefit

- Multi-sectoral participation in the generation and utilization of science and technology

- Protection of intellectual property rights

Key laws enacted addressing these mandates are shown in Table 1, as well as special laws that promote science, technology, and innovation (STI) for specific sectors like agriculture, health, and energy.

The table shows that most of the laws enacted in the past three decades—all 32 of them—have been mostly on supporting R&D activities (by providing research incentives, establishing research institutes, or recognizing importance of R&D for the growth of a sector) and improving education or human capital (by providing grants or scholarships, improving the school system).

Advances in information technology have spurred the enactment of laws on e-commerce and data privacy. The protection of intellectual property rights was also given due attention through the Intellectual Property Code of 1997.

In comparison, the commercialization side of STI has not been given as much focus in terms of legislation, although special laws on areas like the Micro, Small, and Medium Enterprises Act; Sugarcane Industry Development Act; and the Agricultural and Fisheries Mechanization Act gave due importance to the role of R&D and provided appropriate incentives.

Institutions-wise, although there are sectors like agriculture that have their own independent research institutes, the Department of Science and Technology (DOST) has largely remained as the agency with the main task of leading the country's efforts on science and technology. The department was created in 1987, as reorganized from its precursor agencies the National Science and Technology Authority (created in 1982) and National Science and Development Board (created in 1958).

The DOST has 3 sectoral policy councils, 7 R&D institutes, 7 S&T service institutions, and 2 collegial bodies with different roles and priorities in support of the country's S&T thrusts (Table 2). In addition, the Department has 16 regional offices and 79 provincial S&T centers that provide S&T services to the local populace and coordinate with other government agencies and other stakeholders on S&T matters.

WIPO
WORLD INTELLECTUAL PROPERTY ORGANIZATION

Global Innovation Index 2015

In a perfect world for innovation who would do what?

Top ranking countries/economies for selected indicators from the Global Innovation Index 2015. #GII2015

INFRASTRUCTURE

Denmark
Use of information technologies
Germany
Logistics performance
Uruguay
Online e-participation
Mongolia
New infrastructure investment as share of GDP

INSTITUTIONS

Finland
Government effectiveness
Singapore
Regulatory quality
New Zealand
Ease of starting a business

KNOWLEDGE & TECHNOLOGY OUTPUTS

Sri Lanka
Growth rate of per capita GDP
USA
Quality of scientifc publications
Hong Kong (China)
New business creation
India
Computer service exports
Malaysia
High-tech exports

BUSINESS SOPHISTICATION

Luxembourg
Knowledge-intensive employment
USA
University & industry research collaboration
United Arab Emirates
State of cluster development
Belarus
Women with advanced degrees
Rep of Korea
R&D financed by firms

CREATIVE OUTPUTS

Paraguay
Domestic resident trademark applications
Estonia
Information technologies & organizational innovation
Serbia
Export of creative industries
Australia
Printing and publishing industry size

MARKET SOPHISTICATION

Bolivia
Microfinance as a share of GDP
Colombia
Ease of getting Credit

HUMAN CAPITAL AND RESEARCH

Lesotho
Education expenditure as share of GDP
Iran
Graduates in science and engineering as share of graduates
Israel
R&D expenditure as a share of GDP
China
Performance of pupils in reading, math & science
Georgia
Pupil-teacher ratio in secondary school
UK
Quality of universities

WORLD INTELLECTUAL PROPERTY ORGANIZATION (WIPO). SOURCE: GLOBALINNOVATIONINDEX.ORG. DESIGN: LARGENETWORK.

Table 1. Key Laws on Science, Technology and Innovation (1987–2015)

Law	Year	Policy Governance	Human Capital Dev't	Strategies	R&D	Business Innovation	Created/Reorganized entity
EO 128: Reorganizing the National Science Authority	1987	x	x	x	x		DOST
RA 6959: Establishment of Provincial Centers for S&T	1990	X		X	X		S&T Centers
RA 7459: Inventors Incentives Act	1991		x		x		
RA 7722: Higher Education Act	1994		x		x		CHED
RA 7796: TESDA Act	1994		x				TESDA
RA 8293: Intellectual Property Code	1997	x			x	x	Intellectual Property Office
RA 8435: Agriculture and Fisheries Modernization Act	1997	x	x	x	x	x	
RA 8439: Magna Carta for Scientists, Engineers, Researches and other S&T Personnel	1997		x	x	x		
RA 8496: Integrating PSHS campuses (amended by RA 9036)	1997	x	x				
RA 7687: S&T Scholarship Act	1997		x				S&T HRD Council
RA 8503: Health Research and Development Act	1998	x			x		Nat'l Institutes of Health
RA 8550: Fisheries Code	1998	x					Fisheries and Aquatic Resources Mgt. Council National Fisheries Research and Development Institute
RA 8792: E-commerce Act	2000			x		x	
RA 8980: Early Childhood Care & Development Act	2000		x				
RA 9107: Philippine Science Heritage Center Act	2001			x			
RA 9036: Philippine Science High School System	2001		x				
RA 9168: Plant Variety Protection Act	2002			x		x	National Plant Variety Protection Board
RA 9500: UP Charter	2008		x		x		
RA 9501: Magna Carta for MSMEs	2007	x		x	x	x	MSMED Council Small Business Guarantee and Finance Corporation
RA 9513: Renewable Energy Act	2008				x		National Renewable Energy Board
RA 9729: Climate Change Act		x			x		Climate Change Commission
RA 10055: Technology Transfer Act	2009	x			x	x	
RA 10089: Philippine Rubber Research Institute Act	2010				x		Philippine Rubber Research Institute
RA 10173: Data Privacy Act	2012			x			National Privacy Commission
RA 10601: Agricultural and Fisheries Mechanization (AFMech) Law	2013	x			x	x	DA-Bureau of Agricultural and Fisheries Engineering
RA 10612: Fast-Tracked S&T Scholarship Act	2013		x		x		
RA 10659: Sugarcane Industry Development Act	2015	x	x		x		
RA 10533: Enhanced Basic Education Act (K-12)	2013		x				Joint Congressional Oversight Committee
RA 10557: Philippine Design Competitiveness Act	2013	x		x		x	Design Center of the Philippines Design Advisory Council
RA 10532: Health Research System Act	2013	x			x		
RA 10647: Ladderized Education Act	2014		x				
RA 10692: PAGASA Modernization Act	2015		x		x		
Total		14	16	10	19	8	

Legends:

x – MSME area of concern that is directly addressed by the law

** - MSME area of concern that is indirectly addressed by the law

Figure 2. DOST Organizational Set-up

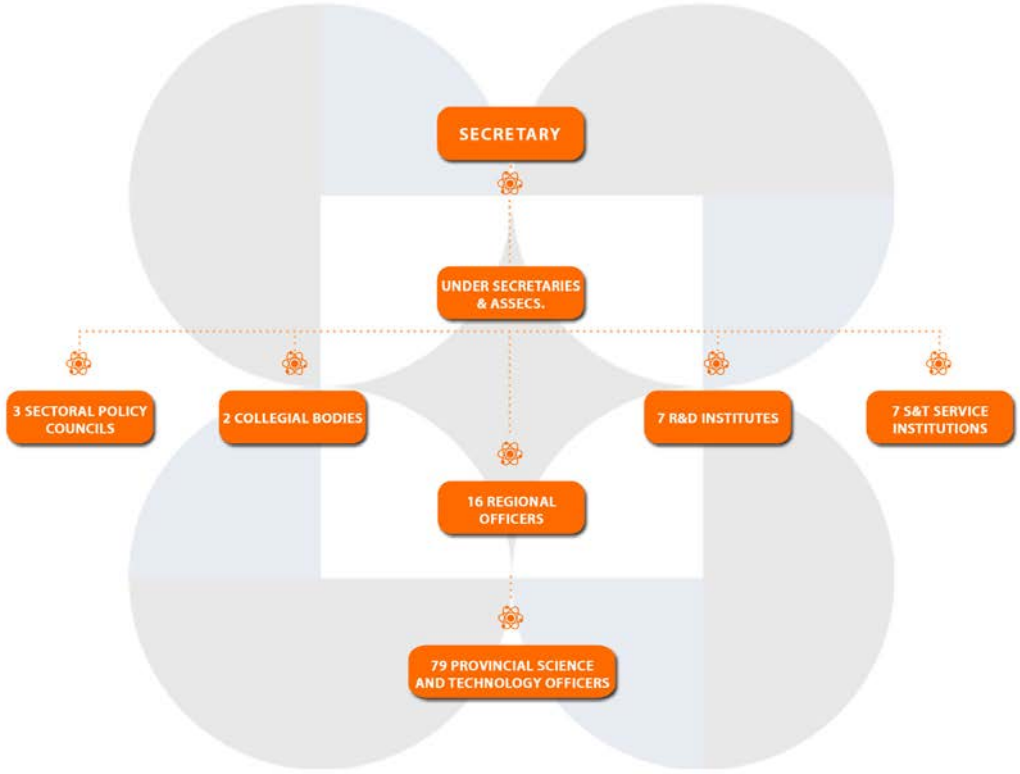


Table 2. Attached Agencies of the DOST

Agency type	Purpose	Agency name/focus
Sectoral Planning Council	Planning, policy making, monitoring, fund allocating, fundraising	• Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARD) • Philippine Council for Health Research and Development (PCHRD) • Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD)
Research and Development Institute	Basic and applied research	• Advanced Science and Technology Institute (ASTI) • Food and Nutrition Research Institute (FNRI) • Forest Products Research and Development Institute (FPRDI) • Industrial Technology Development Institute (ITDI) • Metal Industry Research and Development Centre (MIRDC) • Philippine Nuclear Research Institute (PNRI) • Philippine Textile Research Institute (PTRI)
Scientific and Technological Research Institute	S&T Services	• Information and Communications Technology Office (ICTO) • Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) • Philippine Institute of Volcanology and Seismology (PHILVOCS) • Philippine Science High School (PSHS) • Science Education Institute (SEI) • Technology Application and Promotion Institute (TAPI) • Technology Resource Centre (TRC)
Advisory Body	Assistance, recognition, advisory, international linkages	• National Academy of Science and Technology (NAST) • National Research Council of the Philippines (NRCP)

Figure 3. National Science, Technology, and Innovation Plans and Programs (1987-2015)

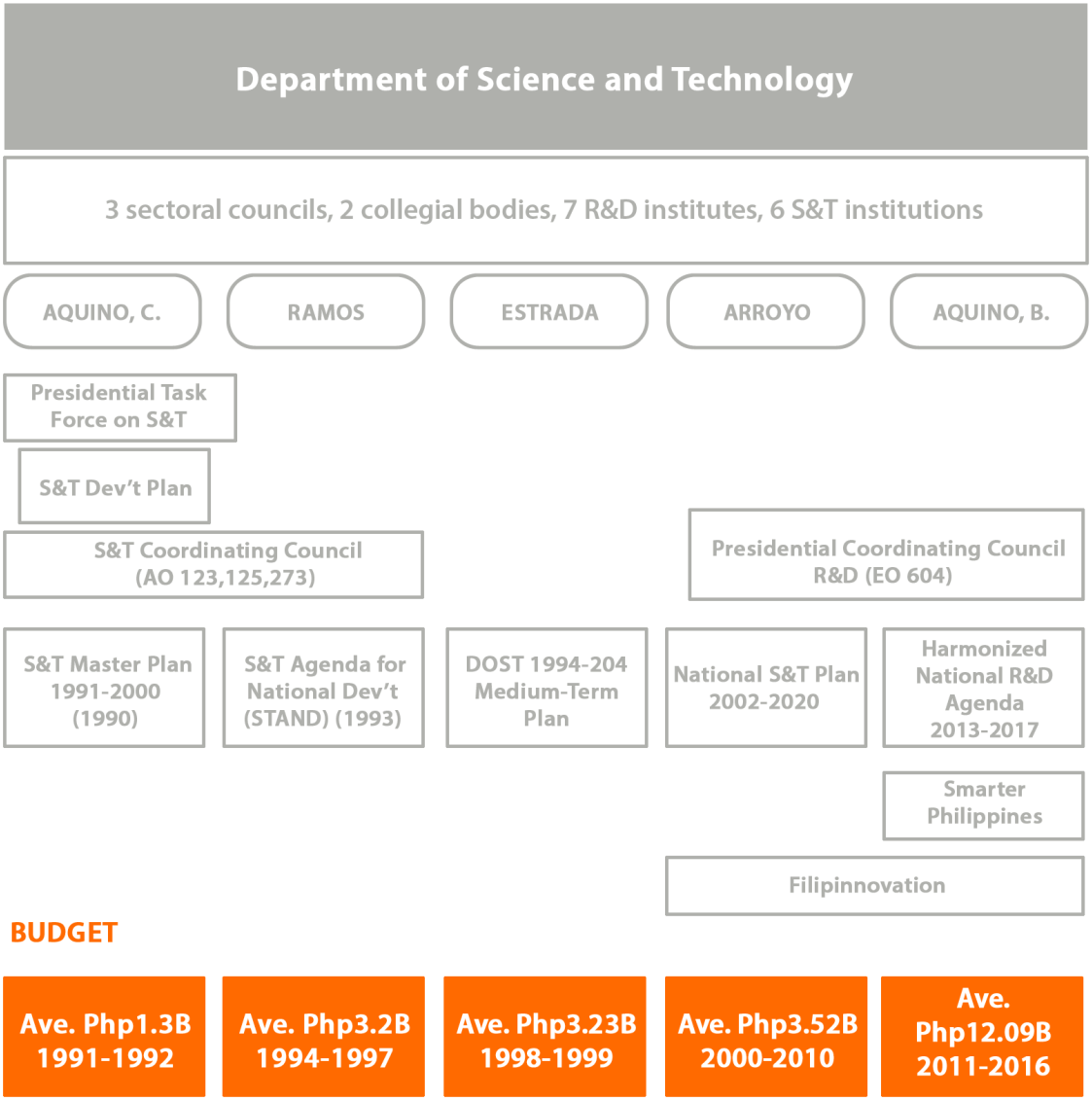


Figure 4. DOST Budgetary Appropriations, 1990-2016

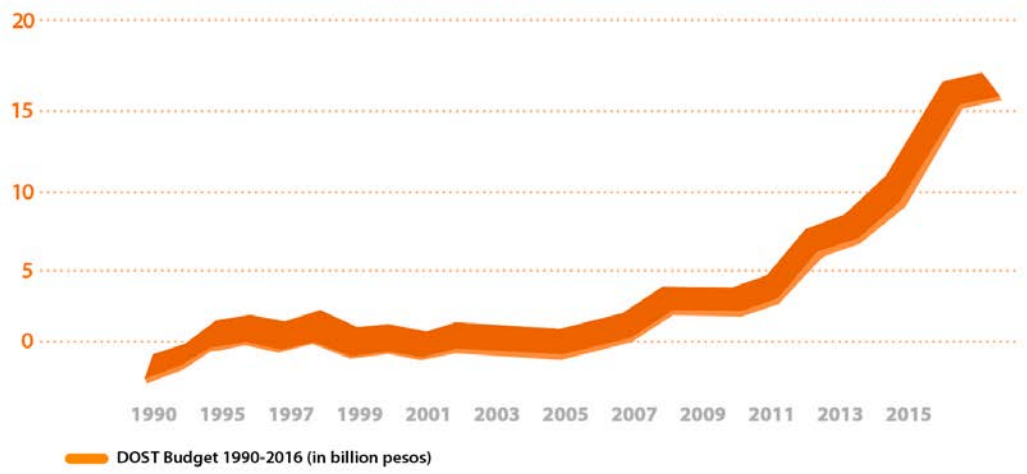


Figure 3 shows the time series evolution of DOST's overarching plans and programs since the department was formed in 1987. The figure shows that while a long-term perspective is needed in S&T planning, political/administration changes often influence the implementation and development of these plans.

The country's current innovation strategy, branded as "Filipinnovation," was first developed in 2007 following a DOST-led multi-sectoral consultation and policy review. The Filipinnovation strategy aims to foster a culture of innovation to make the country globally competitive. Under the Philippine Development Plan 2011–2016, the national innovation strategy is recognized as an important component of the overall vision for inclusive growth, and its implementation is key to achieving the action agenda to improve productivity and efficiency. More specifically, advancing STI is one of the program thrusts to enhance the competitiveness of micro, small and medium enterprises (MSMEs), which are viewed as the engines of inclusive growth (Chapter 3, PDP 2011–2016). The focus on inclusive growth is also reflected in the National Science and Technology Plan 2020 and the Harmonized National R&D Agenda 2013–2017, which also address pressing national concerns of poverty alleviation, climate change, and disaster risk reduction.

In 2013, the DOST also launched the Smarter Philippines, described as its "technology-based inclusive growth program," and is the overarching framework for initiatives on technology, R&D, innovation, and related efforts.

Figure 4 shows the increasing level of budgetary appropriations for the Department of Science and Technology. The DOST budget was pegged at Php920 million in 1990 under the term of President Corazon Aquino who was responsible for establishing the DOST. Its budget rose significantly in 1991, registering the highest budgetary increase for any Department during the said fiscal year at Php800 million, thus ushering the first time that the DOST enjoyed more than a billion pesos in budget at Php1.7 billion.

The DOST budget increased steadily over the years, but experienced a significant decline in 1999. The Asian Financial crisis triggered massive belt tightening measures in most economies, including the Philippines; thus stringent budgetary controls were effected.

It was in 2006 that the DOST budget steadily rose again, with the Arroyo Presidency, bringing the DOST budget at the level of more than Php5 billion pesos.

It was, however, during the term of President Benigno Aquino that the DOST budget was tripled from its 2011 budget, hitting Php18.02 billion in 2016. The infusion of more funds into the S&T portfolio signifies stronger focus on S&T in recent years, but a stronger governance system to achieve an even greater focus on the vital priorities that build on the country's strengths and advantages.

HUMAN CAPACITY BUILDING

The Philippines' education system has three broad focal areas, each with its own governing body: basic education under the Department of Education (DepEd), technical-vocational and middle-level education under the Technical Education and Skills Development Authority (TESDA), and tertiary and graduate education through the Commission on Higher Education (CHED).

TESDA and CHED were created in 1994 as part of a broad agenda of reforms for the country's education system. The basic education also recently went through some reforms with the enactment of the Early Years Act, which aims to raise the standards of early childhood education, and the K-12 Act.

Charged with leading the country's higher education system, CHED formulates plans and programs on higher education and research, sets standards on higher learning, offers grants and incentives to researchers and universities with research programs, and monitors performance of higher learning institutions, among other functions.

Both TESDA and CHED also interface with employers/industry in initiatives such as matching curricula and courses offered with industry needs.

INDUSTRY LINKAGES AND POINTS OF CONVERGENCE

DOST has initiatives like the Small Enterprise Technology Upgrading Program (SETUP) and Technology Innovation for Commercialization (TECHNICOM), which are flagship programs that support commercialization or transfer of technological innovations in various industries, especially among small and medium enterprises (SMEs).

TECHNICOM provides support in technology assessment/commercial prototype development, business plan/feasibility study preparation, intellectual property rights protection, technology valuation and licensing, and semi-commercial production assistance.

SETUP, on the other hand, provides equipment and technical assistance to help qualified SMEs "increase sales and production, streamline and improve overall company operations, upgrade the quality of products and services, conform to national and international standards of excellence, and be competitive in their respective fields." [1]

The Department of Trade and Industry (DTI), for its part, focuses on supporting SMEs and startups that already have marketable technologies or products. The department is working on ways to address barriers in the country's startup scene, including concerns on starting a business, accessing capital, and building capacities.

DTI also has overseas offices that promote Philippine trade and investment worldwide, and thus can connect local companies to overseas markets, investors or potential partners. Through the Board of Investments and the incentives offered by the Omnibus Investments Code and other laws, the DTI also offers fiscal incentives to companies' R&D activities, as well as establishment of research/testing laboratories, centers of excellence, and technical-vocational education and training institutions.

DOST and DTI also work together in areas like product development and technology intervention. DOST's SETUP program, for example, is also part of DTI's overall program for MSMEs and the country's overall development plan, because failure to engage in innovation and R&D is one of the reasons for the low productivity of the country's MSMEs.

Some universities have successfully partnered with industry in pursuing research or commercialization of research results in fields such as engineering, transportation, information technology, marine science, and agriculture. Such partnerships are being encouraged by government initiatives such as those of the Intellectual Property Office of the Philippines, which has been training universities in patent search and drafting. It is envisioned that a stronger IP system is important in developing more industry-academe linkages, ultimately generating knowledge and research that industries need and can adopt.

Various public-private or inter-government partnerships are also formed to pursue special projects.

Figure 5 shows the basic functional set-up of the innovation ecosystem in the Philippines.

In an ideal non-linear innovation scenario as described in Figure 1, innovation and collaboration should be actively happening among these various players.

The current status of the country's STI scene, however, shows a different picture, which will be discussed in the succeeding sections.

PHILIPPINE INNOVATION GOALS

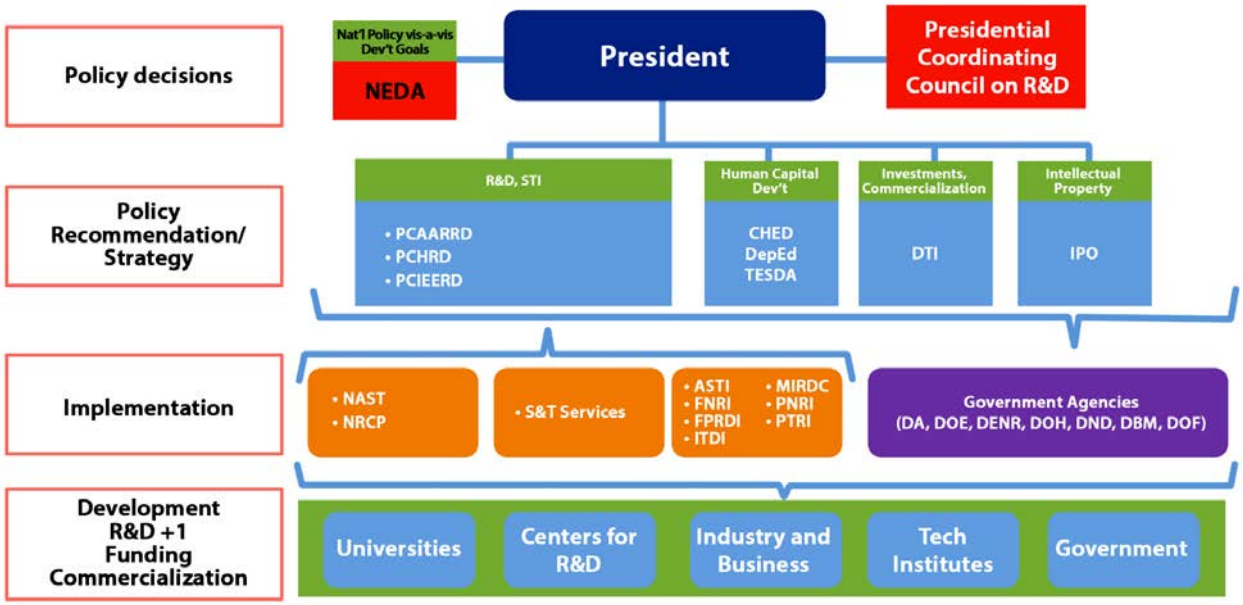
The current Philippine Development Plan covers the planning period 2011–2016. In anticipation of the end of the Aquino presidency and the next mid-term development planning that will be led by the incoming administration, the National Economic and Development Authority (NEDA) recently released the results of its long-term vision project called AmBisyon Natin 2040, which describes the aspirations and sentiments of the Filipino people for the future. The project is intended to promote a long-term vision and help guide development planning across administrations.

According to the study, as much as three-fourths of Filipinos envision "a stable and comfortable life" for themselves and their families by 2040, with a country that is free from hunger and poverty, and a fair and just society "governed with order and unity." Study respondents' confidence of achieving these goals, however, tend to be lower among the poor.

However, according to the NEDA, it is possible to achieve this vision with the right policies and programs, and with government enabling economic growth, investing in its people, and providing protection against instabilities.

NEDA identified innovation as one of three major components of fostering economic growth, along with infrastructure and competition. Translating this vision into specific goals and milestones, and implementing these through the next four medium-term plans, is the challenge for the next administrations and all stakeholders.

Figure 5. Philippine Innovation Ecosystem by Functional Area



[1]www.dost.gov.ph

THERE ARE THIRTY-TWO SPECIAL AND RELATED LAWS ON SCIENCE, TECHNOLOGY, AND INNOVATION. THE CHANGE WE WANT STARTS WITH HARMONIZING THESE.

THE CASE FOR REFORM

The Philippines ranked 47th among 144 countries in the 2015–2016 Global Competitiveness Index (GCI) of the World Economic Forum, an annual assessment of the factors driving productivity and prosperity among the world's economies. This was a five-step improvement from its ranking of 52 in the previous year and as shown in Figure 6, an even bigger improvement of its ranking from a decade ago when it ranked 75th.

The improvement in the Philippines' competitiveness ranking was driven mostly by what the GCI dubs as "basic requirements" for efficient production, namely the "pillars" of quality of institutions, infrastructure, macroeconomy, and health and primary education. The country's scores in the innovation pillar have also improved steadily over the past decade, going up from 2.97 in 2006–2007 to 3.50 in 2015–2016.

These rankings made the Philippines one of the most improved economies in the GCI and puts the country among the upper half among the economies assessed. However, steady improvements were also made by neighboring countries, and the Philippines still lags behind economies like Malaysia (ranked 18th), Thailand (32nd), and Indonesia (37th).

In another global ranking which looked specifically at innovation, the Philippines also ranked 47th, this time among 56 economies assessed in a 2016 report released by the Information Technology and Innovation Foundation. The report focused not on the impact of economies' innovation policies on their own development, but rather on the extent to which these policies generate benefits for the global innovation system.

Compared to other emerging Asian economies, the Philippines ranked behind Singapore (4), Japan (14), and Malaysia (39).

The Philippines achieved an overall negative score, along with Malaysia and lower ranked neighbors Vietnam (49), Thailand (53), India (54), and Indonesia (55). Negative scores indicate that the country has policies that detract from or have low constructive impacts on the global innovation system.

"The greatest danger for most of us is not that our aim is too high and we miss it, but that it is too low and we reach it."

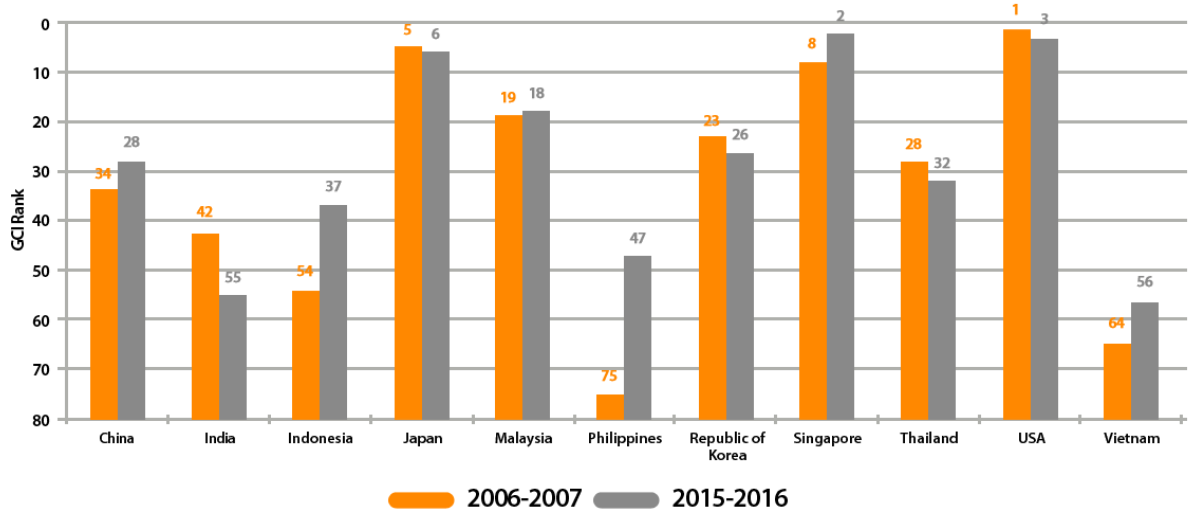
- MICHELANGELO

A look at more STI-specific indicators yields more compelling evidence on the need for more vigorous action to strengthen the Philippines' innovation system.

Five economies devoted more than 1% of their GDP to higher education, with the Philippines lagging far behind having allocated only 0.32% (2009). In 2012, the Philippine education spending for education as a percentage of GDP was at 2.3%, lower than its 2009 performance and way below the UN-recommended level of 6%. It is also a far cry from the 3.8% level in 1997. Timor-Leste, Thailand, Vietnam, and Malaysia were spending between 5.94% to 9.42% of their GDP for education.

619 US patents originated from the Philippines from 1977–2015. This total is equivalent to only 23% of

Figure 6. Global Competitiveness Index Ranking, 2006-2007 and 2015-2016



Malaysia's patents for the same period and just over half of Singapore's 1,048 patents for 2015 alone. It is also estimated that most of these seemingly Filipino inventions turn out to be inventions made by Philippine subsidiaries of foreign multinational corporations (Posadas 2010).

While the importance of innovation and research is recognized as a priority in the Philippine Constitution and there are policies and institutions tasked to implement the mandate to develop science and technology, there are various reasons why these interventions have failed to stimulate a thriving, growth-fueling innovation system. These difficulties are highlighted in observations given by experts.

Table 3. R&D Expenditures (percentage of GDP and per capita)

Country	GERD as % of GDP	GERD as per capita (current PPP$)
China[a]	2.01	244.8
India[b]	0.82	38.5
Indonesia[a]	0.08	8.5
Japan[a]	3.47	1,261.9
Malaysia[c]	1.13	253.3
Philippines[d]	0.11	5.4
Republic of Korea[a]	4.15	1,383
Singapore[c]	2	1,543.1
Thailand[b]	0.39	49.4
USA	2.81	1,440.7
Vietnam[b]	0.19	8.8

Notes: a = 2013; b = 2011; c = 2012; d = 2007
Source: UNESCO Institute for Statistics

R&D expenditure

As of 2007, the Philippines' GERD to GDP ratio, or gross expenditures on R&D as a percentage of GDP, was only 0.11%, way below the UNESCO recommendation of a minimum of 1% to support a healthy innovation system.

Per capita GERD was $5.4 in 2007, way below advanced economies like Singapore ($1,543).

Human Resources

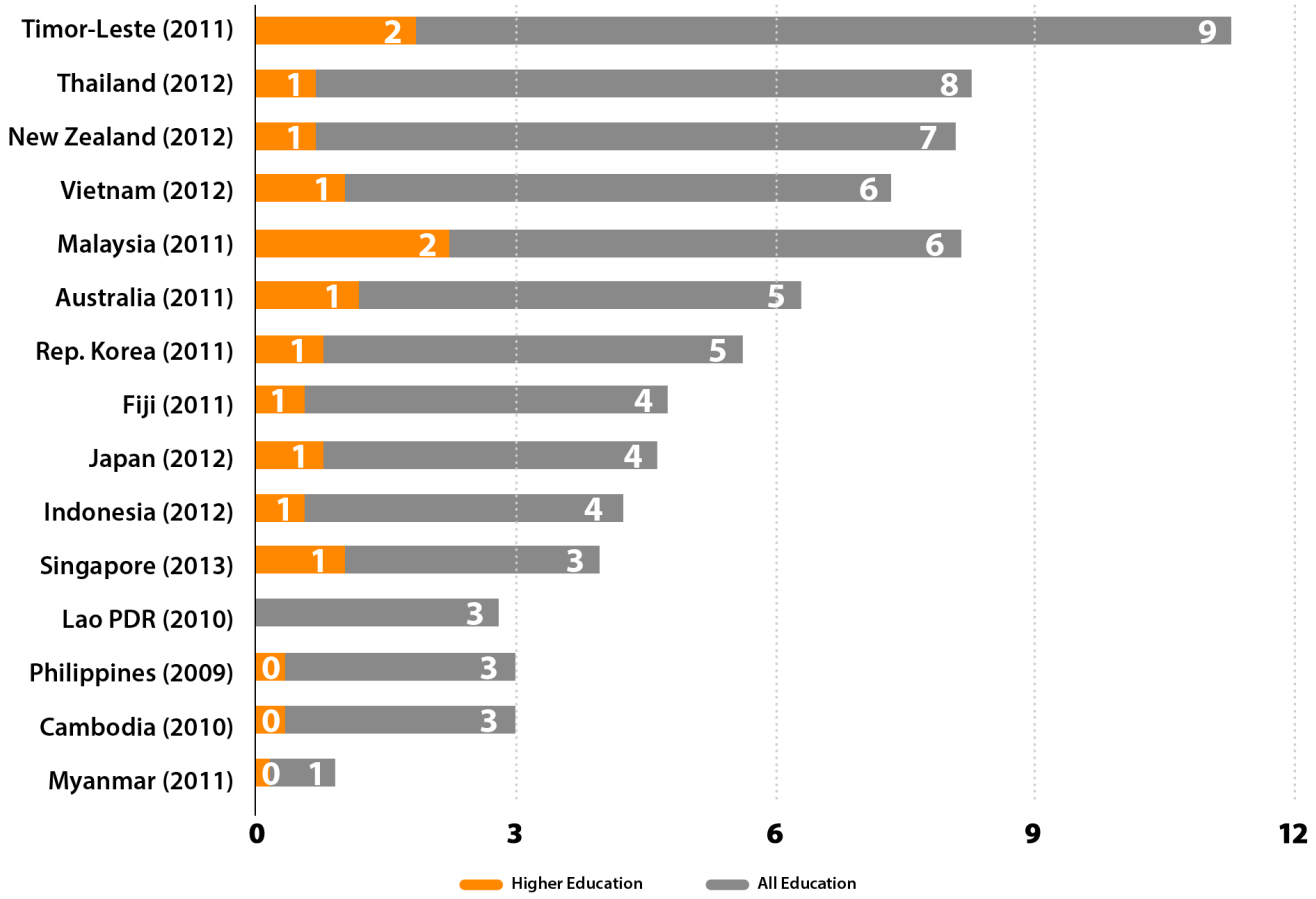
The Philippines had only 78 FTE (full time equivalent) researchers per million inhabitants based on 2007 data, placing the country among the lowest in Asia.

Table 4. Researchers by country

Country	FTE Researchers Total	FTE Researchers per million inhabitants	Total Head Count Researchers
China	1,484,040[a]	1,089[a]	2,069,650[g]
India	192,819[b]	157[b]	-
Indonesia	21,349[c]	90[c]	41,143[c]
Japan	660,489[a]	5,201[a]	892,406[a]
Malaysia	52,052[d]	1,794[d]	75,257[d]
Philippines	6,957[e]	78[e]	11,490[e]
Republic of Korea	321,842[a]	6,457[a]	410,333[a]
Singapore	34,141[d]	6,442[d]	38,432[d]
Thailand	36,360[f]	543[f]	51,178[f]
USA	1,265,064[d]	4,019[d]	-
Vietnam	9,328[g]	114[g]	105,230[f]

Notes: a = 2013; b = 2010; c = 2009; d = 2012; e = 2007; f = 2011; g = 2002
Source: UNESCO Institute for Statistics

Figure 7. Education Spending as Share of GDP in Southeast Asia and Oceania



Source: UNESCO Institute for Statistics

Higher Education

The Philippines spends barely 3% of its GDP on education, and only 0.3% of GDP is spent on higher education.

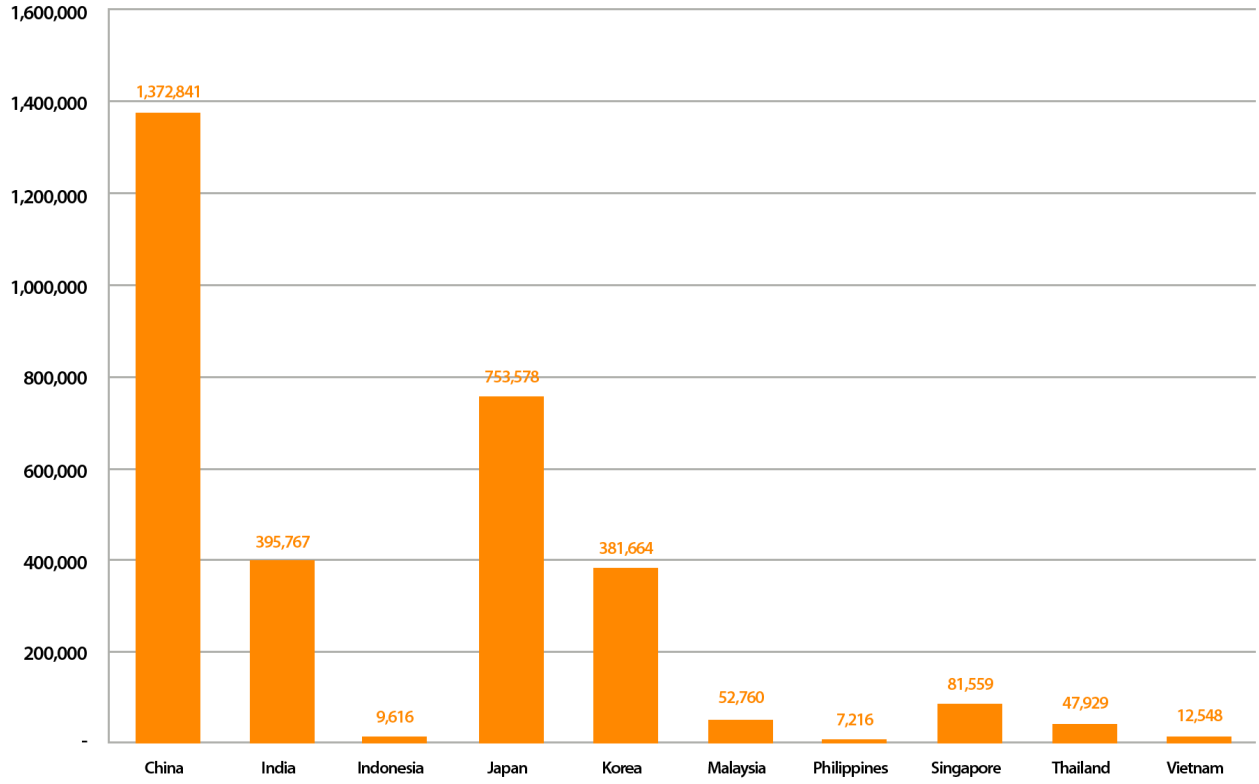
Only 1 out of every 27 university enrollees are in PhD/masters programs, placing the Philippines in the bottom five in Southeast Asia. (UNESCO Science Report)

According to CHED, only 9% (equivalent to 18,028) of graduate students in academic year 2014–2015 are enrolled in STEAM programs (science, technology, engineering, agri-fisheries, mathematics). In baccalaureate programs, only 18.57% (or 707,819) are enrolled in STEAM programs in academic year 2014–2015.

Patents and Publications

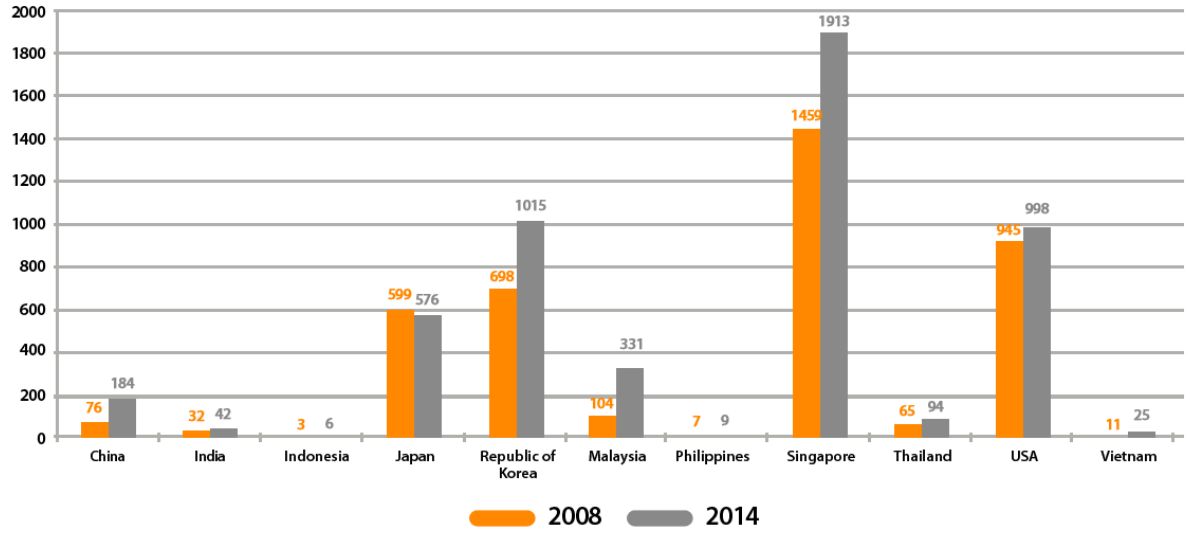
The lack of research professionals is also reflected in the country's scientific outputs in terms of indicators such as publications (Figure 8 and 9) and US patents (Figure 10), where the Philippines also lags behind.

Figure 8. Scientific Publications, 2005-2014



Source: UNESCO Institute for Statistics

Figure 9. Scientific Publications, 2008 and 2014



Source: UNESCO Institute for Statistics

Patents in Innovation Breakthroughs

Only five economies have been driving patenting in 3D printing, nanotechnology and robotics since 1995. They account for the top 10 patent applicants—China, Germany, Japan, Republic of Korea, United States (WIPO, 2015).

Table 5. Philippine Patent Applications

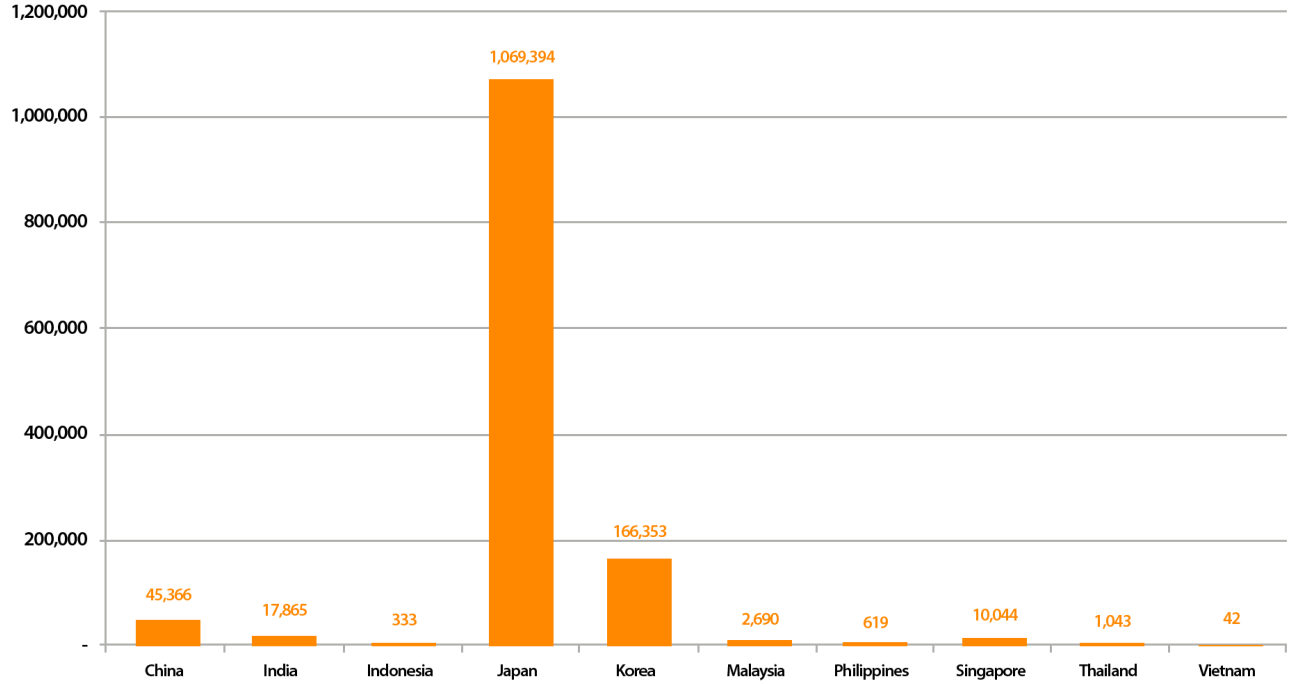
Year	Resident	Rank	Non-Resident	Rank	Aboard	Rank
2000	151	55	3,482	27	4	70
2001	135	59	2,470	30	3	80
2002	149	60	705	40	2	94
2003	141	61	1,732	29	53	62
2004	158	57	2,538	26	92	57
2005	210	54	2,762	26	70	61
2006	223	54	3,034	24	79	55
2007	225	58	3,248	24	105	61
2008	216	58	3,097	25	97	60
2009	172	60	2,825	23	81	63
2010	170	61	3,223	23	105	62
2011	186	59	3,010	24	115	65
2012	162	59	2,832	24	128	64
2013	220	58	3,065	24	130	67
2014	334	51	3,255	24	273	56

Notes: Resident = domestic filings; Non-resident = filings coming in from other countries;

Patent Applications

334 patent applications filed in the Philippines by residents in 2014 (of which 27 were granted), overwhelmingly dominated by 3,255 patent applications by non-residents and 273 filings going out to other countries. On the upside, the 2014 applications was the highest since 2000. Patent applications by residents from 2000 to 2013 never reached 300 per year (WIPO)

Figure 10. US Patents by Country of Origin, 1977-2015



Source: WIPO

DOST's 2007 innovation policy review identified the main flaws in the national innovation system (NIS):

- weak public-private collaboration in R&D
- weak technology transfer system
- issues on technology ownership and information sharing
- weak support to science and technology and lack of resources for technology transfer
- weak IP culture
- declining human capital in R&D
- policy setbacks

In many ways, the hindrances cited above are still very much valid in the country's national innovation system today.

There are not enough resources to pour into human capital and R&D, while industry linkages to spur activity on the demand side are also crucially inadequate.

LIKE ANY SYSTEM, EACH COMPONENT HAS ITS OWN ROLE TO PLAY AND MUST BE KEPT HEALTHY SO THAT THE INTERACTIONS OF THESE COMPONENTS CAN DELIVER THE FULL FUNCTIONS OR SERVICES OF THE SYSTEM

There are numerous policies or programs that answer various needs of the innovation system components, but much of them can be described as having a small-scale or piecemeal approach (e.g. scholarships) or responding to immediate needs (e.g. disaster risk reduction technologies) but there is a lack of clear and strategic direction geared towards fostering strong linkages or interactions among the various components of the innovation system. ■

One of the most strategic issues facing the Philippines has not yet been addressed: the key role of science and technology in the Philippine development plan.... All progressive countries in the world have put STI as a centerpiece of their strategy. The Philippines has failed to do this. This national election must address this question and the new administration must correct this failure.

— NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY, PHILIPPINES 18 MARCH 2016

The issues faced today by other developing countries are quite different; their baseline resources are different and their strategies must be different as well. The post-2015 STI development community thus faces the task of rethinking STI policies to produce inclusive and sustainable development.

— UNCTAD ISSUES PAPER ON STI POST-2015 DEVELOPMENT AGENDA

Designing structures for creativity and innovation begins with a vision...but without the proper structures in place, we have no way of transforming this energy into concrete, realistic actions, and progressive results. They include policies and political structures, social structures, and institutions, systems and processes. Our culture is part of this vast structure... [it] exerts the most influence on whether or not we welcome creativity and innovation.

— ALFREDO PASCUAL, PRESIDENT, UNIVERSITY OF THE PHILIPPINES 18 APRIL 2016

"Innovation improvement efforts can easily become a grab bag of much-touted best practices: dividing R&D into decentralized autonomous teams, spawning internal entrepreneurial ventures, setting up corporate venture-capital arms… rapid prototyping…. You need an innovation strategy."

— HARVARD BUSINESS REVIEW, JUNE 2015

SEIZING THE OPPORTUNITIES

Every country in the world today is working hard to either stay "on top of the game," or to catch up with others that lead the innovation race. For the Philippines, the challenge rests in the fact that we are not just seeking to adjust our strategies, but we are at a stage wherein we need to clearly define the vision upon which our innovation thrusts and strategies will be rooted.

Filipinnovation, as an innovation strategy, was adopted nine years ago to encourage technological innovation. It was premised on the assumption that market-driven innovation would make the country more globally competitive. This strategy remains at the forefront of our drive to do "catch up" with the rest of the world. Clearly, the country is not running against itself in the innovation race; but rather with the rest of the world.

New technologies are being created each day, with tremendous economic and social impacts. The Philippines, however, cannot just be users of these technologies. It needs to create them.

There are a number of opportunity areas that need to be harnessed through innovation, including those outlined in this paper.

PUSHING MSME GROWTH THROUGH INNOVATION

In recent years, the Philippines has become one of the fastest growing economies in Asia—averaging 6.2% growth rate over the past five years—mainly on account of a strong domestic demand. It is projected that micro, small and medium enterprises (MSMEs), accounting for 99.58% of local enterprises, will help sustain the long-term economic growth of the Philippines.

In 2015, the Philippine APEC Business Advisory Council (ABAC) has actively pushed the MSME agenda in APEC, recognizing the vital role of MSMEs in the region's development.

Global value chains (GVCs) has shifted perspectives particularly on how corporations do business with MSMEs. Over the years, a growing number of big businesses are seeking to engage and involve MSMEs in their value chains in order to respond to their commercial requirements, as well as for sustainability considerations and social contributions. [2]

The proliferation of innovative tools has also increased the ability of business enterprises to expand and outsource their operations beyond their physical borders. It has not only opened opportunities to cater to new markets, but additionally offered businesses, including MSMEs, access to a wider group of suppliers from various locatiotns. GVCs also allow for the vertical transfer of capabilities to MSMEs through the supply chain of multinational enterprises.

MSMEs need to innovate so that they can penetrate regional and global value chains. Information and communication technologies, which have redefined the way people interface and businesses are run, need to be fully harnessed by MSMEs. A case in point would be the use of innovative marketing and distribution systems such as e-commerce as a viable and highly effective way of entering and competing in the global market.

IN 2015, THE COUNTRY RANKED 47TH OUT OF 144 COUNTRIES IN THE WORLD COMPETITIVENESS RANKING — REPRESENTING A 30-STEP JUMP FROM THE COUNTRY'S 77TH RANKING A DECADE AGO.

WHAT IS TELLING, HOWEVER, IS THAT THE PHILIPPINES STILL LAGS BEHIND COUNTRIES LIKE MALAYSIA (RANKED 18TH), THAILAND (32ND), AND INDONESIA (37TH).

Innovation is key to enhancing MSMEs' global competitiveness.

CREATING TRANSFORMATIVE IMPACTS THROUGH INNOVATION

Innovation directly provides novel solutions to social problems.

The Global Opportunity Report 2016 identified 15 opportunities that create the most positive impact to societies—from smart farming, the digital labor market, futurepreneurs, regenerative ocean economy, precision treatment to low transport cities. These opportunities were identified by stakeholders and sustainability experts from business, academia, and civil society.

The opportunities were ranked based on global survey involving more than 5,500 private and public sector leaders from across the globe. The Report recognizes that there are opportunities to be pursued in every crisis, including those that the global community currently faces in the onslaught of climate realities.

Innovation, according to the report, plays a major role in enabling economies to fully exploit and harness these opportunities.

[2] *Nancy Lee, Presentation on "Global Value Chains and Development: A Roadmap to Integrated Economic Growth."*

The report highlights the importance of right framework and the vital role of government in helping drive the change through innovation.

Recent researches also show that corporate accelerator programs are shifting to Asia for innovation opportunities. Of the 85 accelerator programs worldwide, eighteen are based in Asia.[3] The shift to Asia is projected to continue as companies look for diverse and new ideas. Asia has also been a major focus among companies wanting to diversify, in view of its huge market.

SUPPLYING THE GLOBAL MARKETPLACE THROUGH INNOVATION

Trade and investment liberalization and facilitation have also created a lot of opportunities for businesses brought about by increased access of goods and services to foreign markets. APEC—home to around 2.8 billion people and accounts for approximately 57% of world GDP—make up 49% of world trade in 2014 alone.

Trading in APEC has increased more than seven times to USD22 trillion from 1989 to 2013. Such a huge market place, with 21 economies competing, would constantly require new and better products and services that will efficiently and effectively respond to present and anticipated needs.

Competition, while providing incentives for innovation for the more efficient domestic firms, serves as a disincentive for the less efficient ones.

The Philippines needs to constantly upgrade its competencies and to innovate so it can supply products and inputs with significant value addition, thus enabling it to capture a bigger share of global revenues.

The pressures of globalization require that we do more in the innovation sphere or we will miss out on the opportunities presented by globalization.

PURSUING INNOVATION TO PROMOTE INCLUSIVE GROWTH

The country's GDP grew by an average of 6.2% over the past five years, but the poverty incidence remains high at 25%. The country's growth dynamics will ultimately have to translate to more inclusive growth. Can innovation help correct this imbalance?
Innovation is a critical driver for growth, but it needs to be pursued with the broader interests of society in mind to ensure that it becomes an instrument for inclusive growth.

Innovation, while seen by many as a means to promote inclusive growth, is also said to impact on income distribution, as innovation favors the highly-skilled and risk takers.

THE OPPORTUNITIES PRESENTED BY FREER FLOW OF GOODS AND SERVICES ARE COUNTERBALANCED BY FORBIDDING CHALLENGES BROUGHT ABOUT BY INCREASINGLY FIERCE COMPETITION AMONG ENTERPRISES. THOSE WHO FAIL TO INNOVATE WILL BE LEFT OUT.

A central belief is that technology is skill-biased—it requires and rewards skilled people more than the non-skilled.

Innovation without human capacity development results in greater inequality. As such, human capital development is a vital element of an innovation policy. Failure to factor this in an innovation policy will only create wider inequalities.

A second consideration is employment.

Innovation—whether technological or process innovation—may result in lower demand for labor. This will have to be considered in the light of any innovation policy that may be developed as employment impacts may be significant, particularly for labor-intensive economies like the Philippines.

THE BOTTOM LINE IS HUMAN CAPACITY DEVELOPMENT NEEDS TO KEEP UP WITH AND DRIVE THE MOMENTUM FOR TECHNOLOGICAL CHANGE AND INNOVATION. DOING OTHERWISE WOULD ONLY RESULT IN RISING LEVELS OF INEQUALITY.

[3] *Falguni Desai, "Corporate Accelerator Programs Look To Asia For Innovation Opportunities", Forbes Asia, December 10, 2015.*

Taking those vital elements into consideration, innovation plays a key role in driving productivity growth in developing economies.[4] Productivity growth, on the other hand, contributes to employment generation and entrepreneurship opportunities.

Innovation, with the right set of policy mechanisms, can help promote inclusive growth in the country. Experiences of other economies such as India (Narayana Health and Foldscope), Kenya and Tanzania (MoneyMaker irrigation pump), Colombia (Empresas Públicas de Medellín) illustrate how the right set of innovation policies can promote greater equity and promote inclusive growth.[5]

"Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow."

—WILLIAM POLLARD

[4] Aghion, P, U Akcigit, and P Howitt (2014), "What Do We Learn from Schumpeterian Growth Theory?", in Handbook of Economic Growth, ed. by P Aghion and S Durlauf, Vol 2B: 515-563.
[5] OECD 2015. Innovation Policies for Inclusive Development. Scaling Up Inclusive Innovations.

LESSONS FROM OTHER ECONOMIES

It is instructive to look at the experiences of other economies as guideposts in efforts to develop a relevant and responsive innovation ecosystem.

This paper examines the experiences of Finland, South Korea, Chile, Canada, Taiwan, and other economies in innovation governance, processes, and approaches.

INNOVATION GOVERNANCE

Innovation, even if backed up by the best policies, does not happen by itself. Governance shape and define innovation activities and their outcomes.

Governance covers the institutional set-up that governs the relationship and coordination among various elements of the national innovation system (NIS), the processes that shape policies, and the institutions that implement these policies.

SETTING THE NATIONAL INNOVATION AGENDA IS A KEY ELEMENT OF THE INNOVATION GOVERNANCE SYSTEM, AND IN MANY ECONOMIES, THIS TASK IS DONE BY THE NATIONAL INNOVATION COUNCIL.

Governance structures differ considerably across economies. What is evident though is the fact that top level national innovation councils (NIC) or entities are thriving across the globe. A study by the Information Technology and Innovation Foundation shows that about 50 economies have established national innovation foundations or enterprises that are specifically charged with promoting innovation. These entities are mandated to discharge any one or a combination of functions along the following spheres—policy, SME investment, research, network development, and management. There is wide divergence in the nature (temporary versus permanent), role (which in some cases include budgetary allocation), and membership across economies, but where they converge is in the breadth and scope of representation which includes the scientific, academic, research, and business sectors. In some cases, they also perform coordination function, especially in more complex innovation systems involving various mi- nistries/departments, government agencies, the research/academic/scientific community, and business sector.

The establishment of these councils is necessitated by the presence of a highly fragmented formal governance system that is characterized by the existence of numerous agencies charged with carrying parts of the innovation mandate. The NIC facilitates horizontal interaction and consultations with stakeholders beyond the official circle of government functionaries, thus avoiding too much focus on "top-down planning" that stifles broad-based participation in the development of the national innovation agenda.

As such, many of these NICs are chaired by no less than the President or the Prime Minister, underscoring the great import attached by governments to the role of these Councils. Decision-making is facilitated and cross-ministry collaboration is enhanced by the direct involvement of the highest officials of the land in setting their countries' vision and agenda for innovation.

Regardless of a country's state of governance and policy make-up, they share the same challenges that innovation seeks to address, including the implications of globalization, the problems of demographics, environmental demise, climate change impacts, and poverty.

DECISIVE LEADERSHIP WITH CLEAR-CUT GOALS IS VITAL IN THE INNOVATION SPACE.

Without meaning to compare, Table 6 shows some of the features of NICs in different economies.

Collection of concrete examples of governance models from different economies would be instructive.

This paper will present some of key highlights of economies in the innovation sphere.

Innovation policies have assumed a new character in many economies, broadening its reach to cover wider social and economic issues. This, ultimately, has rendered innovation policies more complex, requiring increased convergence and horizontal coordination of efforts.

Table 6. Examples of National Innovation Councils

	Canada	Finland	S.Korea	Japan	Thailand	Chile
Name of Council	**Science, Technology, and Innovation Council**	**Finnish Research and Innovation Council** **(Precursor: S&T Policy Council, 1978 and the Science Policy Council 1963)**	**National Science & Technology Council**	**Council for Science, & Technology Council**	**National Science, Technology and Innovation Policy Committee**	**National Council for Innovation and Competition**
Year Est.	2007	2009	1973 (first NSTC) 2011 and 2016 (revamp)	2014 (2001)	2008	2005
Chaired by PM/ President	No	Yes, PM	Yes, President	Yes	Yes, PM	No, but receives advice
Mission	Advice	Advice Develop NIS Coordination	Policy Decision Coordination R&D Plan	Policy Strategy Coordination	Policy	Advice to NIS (chaired by PM)
Controls budget	No	Directional	Funding support	Allocation	No	No
Members	19	20	20	15	22	25

FINLAND

Finland, the birth place of NOKIA and Angry Birds, offers a good practice in innovation governance. From an agricultural-based economy in the 1960s, Finland transitioned into an innovation-based knowledge economy, aided to a significant extent by its "broad-based and engaging approach to formulating the education, research, and innovation policy agenda." [6]

It achieved much success as a knowledge economy through coordinated policy efforts. The Research and Innovation Council of Finland, headed by its Prime Minister, plays a crucial high-level role in coordinating education, research, science & technology, and innovation policies. The Council is responsible for the strategic development and coordination of the Finnish national innovation system as a whole. It is an independent, multi-stakeholder advisory body that shapes Finland's innovation strategy. Its members include representatives from government, academe, and industry.

Its precursor, the Science and Technology Policy Council, set the stage for a shift in the old Finnish paradigm of science and technology policy which focused on universities and research funding on the one hand, and technology programmes on the other.

It bears underscoring here that the NIS in Finland evolved, not as a matter of rhetorical exercise, but first as an organizing concept, which was then elevated as the single most important instrument of structural policy, and finally, as "a domain for interaction in the production and utilization of knowledge and know-how built on cooperation between all producers and users of new knowledge." [7]

Coming off from a severe economic recession in 1993, the National Innovation System (NIS) was adopted as an economic strategy. Guided by a clear objective—to become one of the leading information societies in the world—Finland focused on creating a knowledge-based society, "where knowledge and know-how are central factors for economic, social, educational, and cultural development." After much debate and scrutiny by the Council, the NIS was subsequently viewed as an arena for interaction between producers

[6] *The World Bank. 2014, Finland as a knowledge Economy 2.0 Lessons Policies and Governance, Washington, DC.*
[7] *Rajo Miettimen, Innovation, Human Capabiities, and Democracy: Towards and Enabbling Welfare State, 2012, P.57*

and users of knowledge which had to be made more efficient.

THE FINNISH EXPERIENCE HIGHLIGHTS AN INTRINSIC GOVERNANCE REQUIREMENT IN INNOVATION — THAT OF A HIGHER-ORDER CAPACITY TO STEER POLICIES AND INITIATIVES FOR CUTTING-EDGE KNOWLEDGE-BASED ECONOMY OUTCOMES.

The process facilitated by the Council allowed all stakeholders to recognize that it had to leverage on knowledge and know-how to build its long-term competitive advantage in the international market.

Today, the Finnish innovation ecosystem is characterized by strong and substantial regional and international technological cooperation and the internationalization of private sector enterprises. The private sector plays a key role in the Finnish innovation ecosystem.

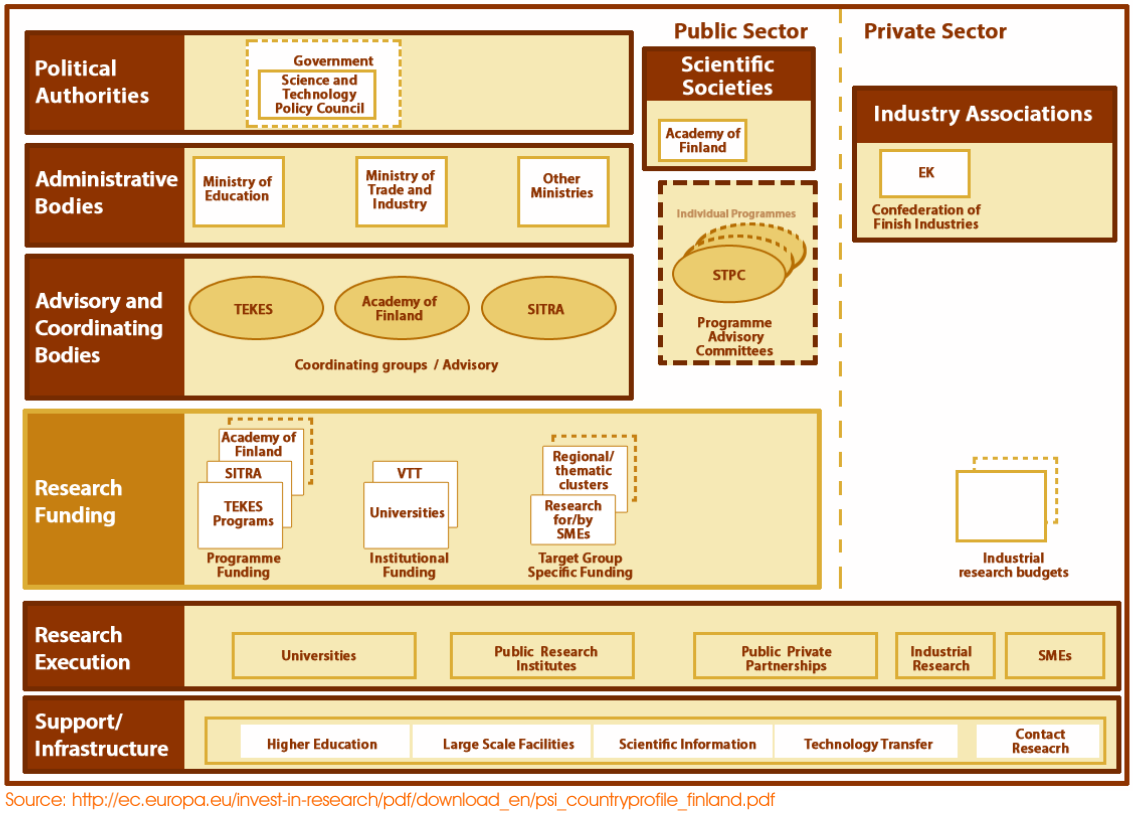
REPUBLIC OF KOREA

South Korea's transformation from a country in ruins after the war into one of the richest economies in the world today is rooted in its systemic approach to building a knowledge-based innovation economy.

Korea's experiences are made interesting by the fact it has evolved from its technological catch up status (which relied on an imitation strategy), into one that has assumed a technological leadership in certain areas through massive support to the build up of indigenous knowledge base.

The Korean experience highlights the vital role of government leadership in building and promoting a knowledge-based and innovation strategy, while at the same time, involving the private sector in R&D efforts. Seventy-five percent (75%) of Korea's GERD is financed by the private sector—one of the highest levels in the world.[8]

Figure 11a. Decision Structure of the Finnish National Innovation System



Source: http://ec.europa.eu/invest-in-research/pdf/download_en/psi_countryprofile_finland.pdf

[8]*OECD,Statistics, Gross domestic expenditures on R-D lay sector of performance and source of funds, 2014*

Korea's ascent to economic power was propelled by well-coordinated industrial policies led by the government. In the midst of pursuing a labor-intensive, low-cost manufacturing export strategy after the war, the government established the Korea Institute of Science and Technology (KIST) and the Korea Advanced Institute of Science (KAIS). The Ministry of Science and Technology (MOST) was established in 1967—the first developing country with a ministry-level organization for S&T. Science education in secondary schools and universities was also established, eventually providing a solid foundational base for its S&T requirements.

While innovation was of less importance in this period than industrial development, the Korean government had the foresight to expand its higher education system along with government funded research institutes.

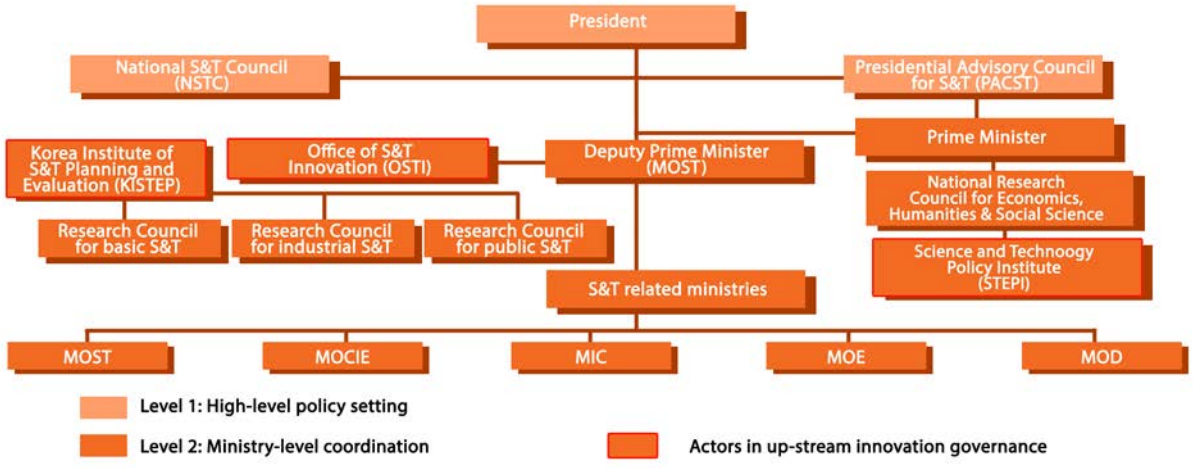
The emergence of Korean conglomerates, known as "chaebols," was instrumental to the economic transformation of Korea, which ushered in a new phase of growth driven by innovation. The construction of world class physical infrastructure and a parallel effort to customize education programs to cater to the human capital needs of specific industries and corporations set the stage for private sector leadership and investment in later years. Between 1994 and 1995, 35% of all tertiary Korean graduates earned degrees in engineering, manufacturing, and construction disciplines.

In an attempt to coordinate S&T efforts across Ministries, a Council for Science and Technology (CST), chaired by the Prime Minister, was established in 1973. Its task was to undertake planning for Korea's science system. The Council was largely ineffective as a coordinative body since various Ministries insisted on their respective priorities and most of the decision-making powers were vested in the President.

Korea's S&T governance is now led by the President who is head of the National Science and Technology Council (NSTC) which acts as the highest decision-making body for S&T in Korea. In 2011, the Council was strengthened to improve efficiency and accountability of R&D projects that in the past were controlled by various ministries. The Council allocates funding and conducts evaluation on all state-funded R&D projects. Further efforts to strengthen it are planned, as announced by President Park Geun-hye in March 2016. The government continues to exercise strategic oversight over the country's innovation agenda, having established in 2014 the Ministry of Science, ICT, and Future Planning to sustain the Republic of Korea's leading position as a KBE.

South Korea currently ranks second globally in terms of how much its policies contribute to global innovation. It leads the world in national R&D intensity (R&D as a share of GDP) at 4.7%.

Figure 11b. Decision Structure of the Finnish National Innovation System



Note: MOST - Ministry of Science and Technology; MOCIE - Ministry of Commerce, Industry and Energy; MIC - - Ministry of Communication; MOE - Ministry of Education; MOD - Ministry of Defence

Source: Dominik F. Schlossstein. Recent changes to Korea's innovation governance

CHILE

Chile offers one of the most interesting experiences in promoting start-ups. Its vision is "to transform Chile into a global innovation and entrepreneurial hub.

In 2010, Chile invited foreign entrepreneurs on a six-month "paid visit" to Chile. The package included $40,000 allowance plus free office space, internet access, mentoring, and networking. In exchange, the participants would need to interact with local entrepreneurs and help promote entrepreneurship in Chile.

CURRENTLY CONSIDERED THE BIGGEST STARTUP COMMUNITY IN THE WORLD, START-UP CHILE CONTINUES TO ATTRACT MASSIVE INTEREST, GENERATING 2,400 ENTRANTS IN ITS 12TH GENERATION RUN. CHILE'S GOAL IS TO TRANSFORM ITSELF INTO THE INNOVATION AND ENTREPRENEURIAL HUB OF LATIN AMERICA.

The initiative, called, Start-Up Chile, opened a floodgate of applications accumulating a total of 12,268 applications from 112 countries as of 2014. Of this number 810 (from 65 countries) were admitted into the program. As of January 2015, Start-Up Chile has graduated over 1,000 startups from its accelerator program.

The success of this initiative has yet to be fully evaluated, but it has achieved creating a cultural stir particularly with respect to promoting an entrepreneurial and innovation culture.

The governance structure to support startups has developed over time in Chile. It has had a long experience in innovation, although it was not until mid-2000 that it became a priority development strategy. The CORFO (Corporation for the Development of Production) was established way back in 1939 to promote production development and innovation. Fundacion Chile, which is now part of CORFO, provides seed money for the creation of new firms. Chile's institutional framework for innovation further developed in the past decades, tripling its innovation budget between 2005 and 2013.

As in the case of many economies, Chile's innovation governance is complex, brought about by the preponderance of government agencies that have a stake in the innovation agenda. In 2005, the National Innovation Council for Competitiveness (CNIC) was established to strengthen Chile's institutional framework for innovation. The Council, which reports to the President of Chile, is responsible for formulating Chile's long-term innovation strategy.

A Ministerial Committee for Innovation, consisting of the Ministry of Education, Ministry of Economy, and other Sectoral Ministries serves as a platform for horizontal coordination across Ministries.

Implementation of programs are carried out through different agencies such as the CORFO, the Corporation for the Development of Production (set up in 1939) as an innovation and development agency; and CONICYT, the National Commission for Science and Technology Research (set up in the 1960s) which is charged with the promotion of human capital formation and strengthening the country's scientific and technological base.

Start-up Chile is a product of an innovative governance structure bolstered by a clearly defined vision, the availability of funding and openness to ideas.

PROCESS AND APPROACH: COUNTRY EXPERIENCES

Innovation models have evolved over time, from the supply-push (driven by producers), to the demand-pull (driven by market), to the Integrated Model (linked

Among the steps Chile undertook to strengthen its innovation drive are as follows:

- **Improved and strengthened its innovation governance structure;**
- **Developed its innovation vision for the long term and adopted strategic priorities that built on its strengths;**
- **Established the Innovation for Competitiveness Fund and tripled its innovation budget**
- **Introduced R&D tax incentive to motivate private-sector participation in research and development activities;**
- **Strengthened human capital formation and the country's scientific and technological base.**

research, technology, and marketing), and lastly, the National Innovation System. The latter, promoted by the OECD, highlights the relationships between and among industry, government, and the academe. Indeed, successful innovation stories highlight the fact that the linear model of supply and demand no longer works.

What is evident in the experiences of economies studied is the fact that each one of them had undertaken a process that helped define the vision and goals, enabling them to identify the strategic priorities for their country's STI agenda.

DEFINING THE VISION

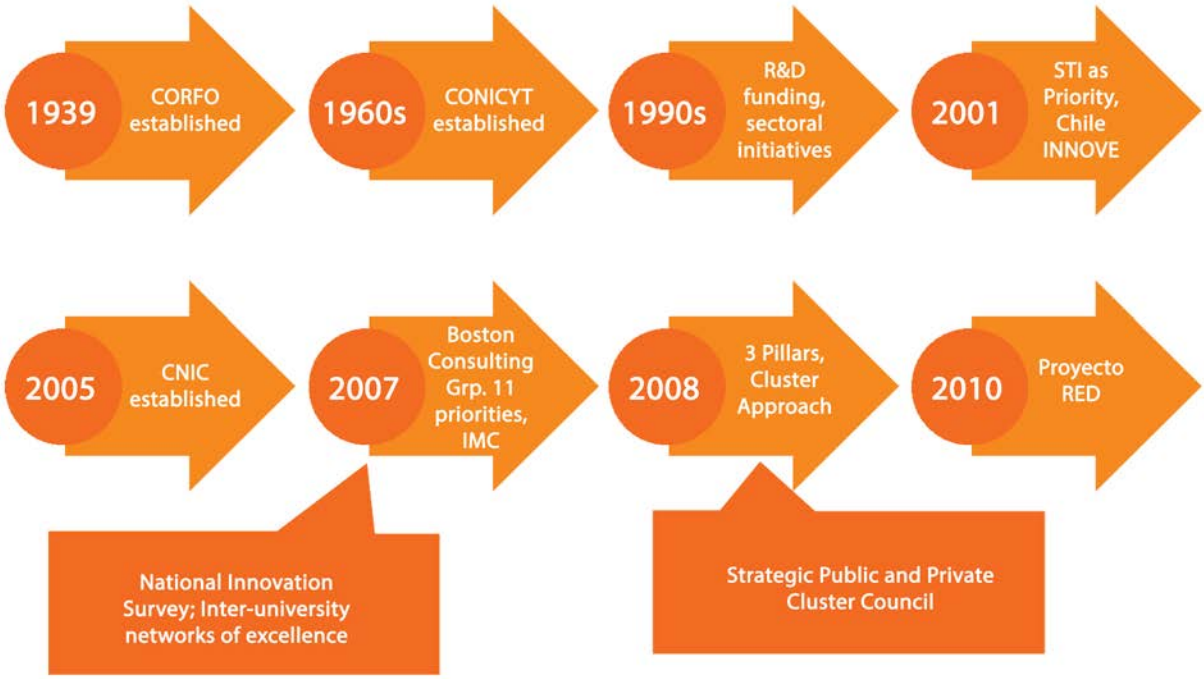
A strategic set of priorities is always dictated by a valid vision—one that takes into account global trends and domestic capabilities, the overarching national goals, potential growth engines, and focus areas.

Finland undertook a series of "foresight exercises" between 2004 and 2010 as part of the process of defining and refining its innovation policy objectives. These were done through organized discussions of working groups or panels. Participants to these exercises were government representatives, technology funders, and the private sector. Sitra, one of the Finland's innovation funds and reputed to be the libero of the innovation system, organized discussions to achieve a common understanding on the future of Finland. Strategic visioning took place at sectoral, regional, and national levels in Finland. Part of the exercise involved the analysis and evaluation of key drivers of change and their impact on Finland.

AN OVERARCHING, GENERAL ECONOMIC GOAL WILL NOT BE HELPFUL IN SETTING PRIORITIES. A CERTAIN LEVEL OF SPECIFICITY WILL HAVE TO BE OBSERVED IN DEVELOPING THE VISION.

Chile, which is one of the largest agricultural producers in Latin America, employed an iterative, highly consultative process in defining the vision that will direct Chile's agricultural innovation system towards 2030. Its government sees Chile as a "food and forest power," and as such, it has set a national goal to become an important actor in global agro-food markets. To achieve this, Chile has to strengthen its agricultural innovation system.

Figure 13. Timeline of evolution of Chile's innovation system



SETTING THE STRATEGIC PRIORITIES

Priorities have to be identified before policy objectives are framed. Priority setting process is rarely a top-down process. Developing a reasoned set of priorities require a strategic process that includes the business, government, academe, and research organizations. The bottom-up process, involving these key stakeholders is central to priority setting. The existence of NIC does not necessarily suggest a top-down process for priority setting; although some economies employ a highly government-driven priority setting process.

In developing the national innovation system, including its processes, it is important to reflect on the following challenges that have faced other economies:

- **Bureaucratic inertia;**
- **Lack of congruence/ alignment in the vision and goals of the public and private sectors, including the academe;**
- **Dominant role of the linear innovation model (either producer / supply push or market pull);**
- **Over-reliance on foreign direct investment;**
- **Network failures;**
- **Mistrust between the private sector and the academe;**
- **Weak human capacity building program and diffusion system; or**
- **Simply, the lack of a vision.**

Some economies frame their priorities in general terms (e.g. Promote Biomedicine); while others define them in more specific terms (e.g. Promote a Biomedicine Cluster focusing on Healthy Aging and Regenerativte Medicine). Effective articulation of priorities into policies, however, require sufficiently specific priorities.

Many economies, such as Finland, Japan, Austria, Korea, Sweden, Canada, New Zealand, The Netherlands, the United Kingdom, Chile, have employed a formal process for setting strategic priorities. New Zealand, for example, undertook a strategic priorities-setting exercise which involved a review of existing policies, consultations, analyses, and formulation of a foresight program which led to the setting of priorities for 140 sectors.[9]

South Korea provides a different experience in that it employs a strongly formalized, top-down & government driven priority setting process. Today, many of South Korea's investments in science, technology, and innovation are driven by national security priorities such as energy efficient and green technologies, high-energy physics, and space.

POLICY SETTING

Once vision and priorities have been defined, policies are then set. NICs are involved in the process of articulating priorities into policies.

The policy-setting process is not a linear process and derives much of its inputs from the strategic priority setting process.

China, for example, employed a foresighting process from 2002–2003 which eventually produced the Technology Forecast and Critical Technology Selection in High-Tech Fields of China. This was followed by a more comprehensive exercise, led by its Ministry of Science and Technology, which focused on 8 fields, 62 sub-fields, and 737 technology topics and developed scenarios for "achieving a broad-based medium level wealth society." [10]

Numerous studies conducted by the government in the area of S&T, and consultations with scientists, generated medium and long-term plans for S&T development. These eventually served as key references for policy makers, including the National People's Congress.

Policies are ultimately given form through policy instruments, including legislations or special laws, regulations, and financial incentives.

In considering the experiences of other economies, one needs to be conscious of the fact that the situation of the Philippines, as a catching up economy, and the conditions prevailing today, are

[9]Gassler, H.; W. Plot; J. Schindler; M. Weber, S. Mahroum, K. Kuberczko and M. Keenan 2004, "Priorities in Science and Technology Policy-an International Comparison", Joanneum Research Forschungsgesellschaft mbH, Project Nr. RTW.2003.AF.014-01, Commissioned by the Austrian Council for Research and Technology Development.

[10]RTW.2003.AF.014-01, Commissioned by the Austrian Council for Research and Technology Development.
Chan L., Dalim T. Exploring the impact of technology foresight studies on innovation: Case of BRIC countries. 2012..

quite different from those that other economies were faced with decades ago.

THE INNOVATION MODELS ADOPTED BY OTHER ECONOMIES CANNOT JUST BE TRANSPLANTED GIVEN THAT LOCAL ECONOMIC, SOCIAL, AND CULTURAL REALITIES NEED TO BE CONSIDERED AS WELL.

The following will highlight case studies that feature the processes employed by economies as they developed their NIS.

CANADA

Canada's academic community is pursuing an ambitious vision on the heels of Canada's 150th founding anniversary in 2017: *"to be the most innovative country in the world by 2030. "*

In pursuit of this vision, they seek to build a "stronger culture of innovation that permeates all sectors of Canadian society."[11] By setting this vision, the Canadian academic community aims to stir up a dialogue across the different sectors of Canada.

The Canadian government, on the other hand, has come to the recognition that Canada needs to leverage its "strengths and expand" its "strong entrepreneurial spirit into a broader business innovation culture." The government sees the need to progress from its successes in creating innovative new startups into mobilizing Canadian firms "to foster innovation-based growth and to expand into global markets." It proceeds from its acknowledgement of its current challenges, including its comparatively low rate of productivity growth, comparatively lower business expenditures on R&D as a percentage to GDP, just to name a few.

Canada is also challenged by its highly regionalized and dispersed industries brought about by the unique relationship of its federal and provincial governments. To address this, Canada adopted the model of networked clusters. This allowed the adoption of policies and frameworks, taking into consideration regional and provincial constraints. As as result, specializations within localized industries were fostered through collaboration among universities, SMEs, and government.

The innovation clusters ultimately became innovation hubs and research beds across Canada, but limitations of the framework failed to consider the commercialization aspects of the innovation outputs.

TAIWAN

Taiwan is currently ranked 14th globally by the World Economic Forum (WEF) in terms of global competitiveness and 10th in terms of capacity for innovation. The report describes Taiwan as an innovation-driven economy mainly on account of its strong capacity to innovate, its highly efficient goods market, its world-class infrastructure, and strong higher education.[12]

From an agro-exporter, it had transformed itself into the world's largest producer of laptops and desktops. The industry, however, has been overtaken by smartphones and tablets worldwide, necessitating a new strategy to revitalize the economy. Innovation is seen to play a major role in reversing the situation—from one where no new industry has developed in a span of 30 years into one where its SMEs and businesses will be capable of significant innovation.

It will be instructive to look at how Taiwan reached its status as an industrial power in the ICT industry.

Taiwan has always focused on manufacturing efficiency in the past, pursuing an "original-design manufacturing (ODM)" approach in production. It is basically manufacturing products that are designed someplace else. In essence, what Taiwan had in innovative manufacturing, they lacked in product design and development.

Taiwan's Ministry of Economic Affairs (MOEA) is a powerful one-stop ministry for industrial policy. It leads in policy content development and industrial policy coordination. Many of its policy making functions are outsourced to thinktanks created by MOEA, such as the Taiwan Institute of Economic Research and the Chung-Hua Institution for Economic Research. Committees are organized for consensus building among ministries, business, and experts.

[11] *U15 Group of Canadian Research Universities. Canada 2030 Making Canada the Most Innovative Country in the World. July 2015.*

[12] *WEF Competitiveness Report 2014-2015*

These are produced through a lengthy process that starts with establishment of task forces, an MOEA-lead brainstorming process, public hearings, inter-ministerial meetings, final drafting by the MOEA, and ultimately, approval by the National Assembly. The 2010 Industrial Statute took three years to complete.

TAIWAN DOES NOT PRODUCE 5-YEAR PLANS. IT PRODUCES TWO - TO THREE-DECADE PLANS.

Taiwan has 19 state-created research institutes that contribute to designing (8 institutes) and implementing industrial policy (11 institutes).

Among Taiwan's industrial research institutes, the Industrial Technology Research Institute (ITRI) has been recognized as a successful model of how a public research institute could generate real impacts in promoting local industry development.

ITRI, founded in 1973, is said to be Taiwan's largest institute for commercialization of R&D. It conducts R&D, operates open labs for joint R&D with foreign and local firms, and works closely with universities. It helped improve technology core competence and supplied well-trained, experienced human resources specializing in various high-tech fields.

It is credited for helping many industries reach their status as advanced and critical industries. Among its notable spin-offs include the United Microelectronics Corporation (UMC group) and the Taiwan Semiconductor Manufacturing Company (TSMC).

More than 97% of firms in Taiwan are SMEs; therefore, without support, they are in no position to develop new products and technologies. ITRI helped bridge this gap through R&D support and serving as a hub of R&D network.

ITRI produced a number of milestones because it pursued a very focused agenda, centering its work on six core technology areas: Information and Communications Technology (ICT); Electronics and Optoelectronics; Materials, Chemicals, and Nanotechnology; Biomedical and Medical Devices; Mechanical and Systems; and Green Energy and Environment. It focused heavily on the development of applied technologies to bolster the competitiveness of Taiwan's increasingly technology-based economy.

ITRI holds more than 14,571 patents and its personnel produce an average of five new patents every day.[13] In 2014, ITRI was granted 1,862 patents.[14] ITRI ranked number 53 in terms of entities receiving U.S. patent grants in 2009 and was the leading patent applicant in China from 2008 to 2009, applying for 490 patents.[15]

Learning from Taiwan's experiences require a serious look into its innovation alliances—a coordinated approach to developing and diffusing technology. Through institutions like ITRI, the government, from 1980s to the 1990s, mobilized innovation alliances in specific technologies as a means of spreading R&D risks between firms and securing first mover advantages. The Notebook PC Joint Development Alliance produced one of Taiwan's biggest success stories. Tsai and Wang succinctly described the process and the outcome in their paper:[16]

ITRI LOOKS AT ITS ROLE BEYOND CREATING NEW TECHNOLOGIES. ITS EXPERIENCES HIGHLIGHT ITS TRANSFORMATIVE ROLE AS CREATOR OF ENTERPRISES THAT SERVE AS BREEDING GROUND FOR NEW, INNOVATIVE TECHNOLOGIES AND SOLUTIONS.

One should also not overlook the role of the Taiwan Diaspora in the evolution of Taiwan as an industrial power. Thousands of technical experts of Chinese ancestry, after completing their studies overseas, returned to Taiwan to work in their industrial sector.[17]

Their work in the R&D and production sector—introducing overseas technology—have contributed greatly to raising the level of technology in Taiwan.

Taiwan's experience offers lessons on the importance of long-term view and planning in the pursuit of development policies. It has shown the benefits of having a powerful, central authority supported by highly equipped and capable specialized institutions in the policy and research fronts. More

[13]Information Technology and Innovation Foundation, The Global Flourishing of National Innovation Foundations, April 2015. ITRI Annual Report, 2014.
[14]TRI, The Global Flourishing of National Innovation Foundations. April 2015.
[15]Kuen-Hung Tsai and Jiann-Chyuan Wang . An Examination of Taiwan's Innovation
[16]Ibid.

The Computer and Communications Laboratories of ITRI and the Taiwan Area Electrical Equipment Manufacturers Association invited forty-six companies to form this alliance in the early 1990s. The main achievement of the alliance was in terms of the efficient use of time and group resources. Motherboard development was completed within just three months; technology standards and specifications were developed, and a prototype produced. The collective strengths of the alliance were used to create a promotional effect, announcing to the world that Taiwanese companies now had the capability to produce notebook computers. This allowed Taiwanese firms to secure first mover advantages and obtain overseas orders, and by 1998, Taiwan had overtaken Japan to become the world's largest producer of notebook computers. Indeed, by 2000, Taiwan accounted for almost 50 per cent of the total global notebook computer output.

importantly, Taiwan's experience highlights the need to evolve and level up innovation policies to meet the challenges and opportunities of today.

BETWEEN 1990 AND1995, RETURNING TAIWANESE REACHED 30,238 WHICH IS 56.5% OF THE NUMBER OF PEOPLE OBTAINING MASTERS OR PHD DEGREES IN TAIWAN DURING THE SAID PERIOD.

Notwithstanding its gains during the past decades, Taiwan's MOEA sees the need for Taiwan to "extend the industrial value chain to areas of logistics and R&D." Taiwan's policy objective, it adds, is to "refine Taiwan's industrial structure" to "accelerate technological innovation.

"Never before in history has innovation offered promise of so much to so many in so short a time."

— BILL GATES

[16]*Ibid.*
[17]*TRI, The Global Flourishing of National Innovation Foundations. April 2015.*

A REVIEW OF PHILIPPINE STANDING IN THE GLOBAL COMPETITIVENESS AND INNOVATION ARENA

The state of the Philippine innovation ecosystem is best summed up by the following assessment results on the Philippines in the competitiveness and innovation spheres:

- **Ranked 47th out of 144 in Global Competitiveness Index. The same report ranked the Philippines 68th in terms of technological readiness and 47th in terms of innovation factors (World Economic Forum Global Competitiveness Report 2015–2016)**
- **Ranked 83rd out of 141 economies on a range of global innovation indexes that include institutional environment, human capital and research, infrastructure, business sophistication, knowledge and technology outputs, and creative outputs (2015 Global Innovation Index, World Intellectual Property Organization, INSEAD, Johnson Cornell University)**
- **Ranked 47th out of 56 economies in terms of total impact on global innovation (Ranking Countries' Impact on Global Innovation 2016, Information Technology and Innovation Foundation)**
- **Ranked 103rd out of 189 economies in the 2016 Doing Business Report. The country is down 8 ranks from 2015 in the "starting a business index" (The World Bank Group)**
- **Lowest in terms of researchers per capita at .07 per 1000 population (Information Technology and Innovation Foundation, 2016)**
- **2nd to the lowest in terms of government funding of university research at $8 per capita (Information Technology and Innovation Foundation, 2016)**

The Philippine innovation ecosystem is replete with challenges that need to be addressed if it were to reap the benefits of an innovation-based strategy that ensures strong, long-term growth.

"Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world!"

— JOEL ARTHUR BARKER

THE WAY FORWARD AND RECOMMENDATIONS

Key reform areas that need to be considered include the following:

- Harness innovation as a key driver of economic growth and as part of a long-term development plan. Innovation must be at the centre of that plan.
- Identify priorities that build on the country's unique strengths and advantages
- Strengthen innovation governance and improve policy coherence by adopting a "whole of government approach"
- Provide an ecosystem that facilitates and supports
- Tap Filipino Diaspora for innovation
- Strengthen education delivery
- Deepen partnerships among government, business, and academia
- Develop a robust communication and advocacy plan to rally everyone around the country's innovation strategy and priorities

HARNESS INNOVATION AS A KEY DRIVER OF ECONOMIC GROWTH AND AS PART OF OUR LONG-TERM DEVELOPMENT PLAN

The role of innovation and knowledge in generating comparative advantage has been well-established in many economies. The ability to innovate, however, requires an ecosystem that permits active and continuing learning, stimulates the entrepreneurial spirit, and incentivizes the creation of new knowledge and technologies.

The government needs to make a firm and explicit strategic commitment to innovation as a strategy to achieve inclusive growth. This needs to be embraced by the whole of government and duly incorporated in the strategies of all government departments and agencies.

THE PHILIPPINES NEEDS TO DEVELOP A WELL DEFINED, EXPLICIT VISION FOR THE COUNTRY THAT PLACES INNOVATION IN THE CONTEXT OF ITS GOALS.

The Philippine government's approach to innovation is linear, highly sectoral, and programmatic. These innovation initiatives are directed at broad national development outcomes such as (1) a better life for the Filipino through science, technology, and innovation and (2) globally competitive capacity for science, technology, and innovation.

Given the vital role of innovation to building inclusive growth, innovation should be part of the government's long-term vision. Examples of these include those of Canada's ("To be the most innovative country in the world by 2030"), Chile's ("To transform Chile into a global innovation and entrepreneurial hub"), and Singapore's ("A leading global city of enterprise and talent, a vibrant nation of innovation and opportunity"), just to cite a few.

A precondition for identifying priorities is that of a well developed vision that takes into consideration global trends and opportunities, as well as local capabilities.

THE PHILIPPINES NEEDS TO ADOPT A CLEAR AND INSPIRING INNOVATION VISION THAT WILL SERVE AS A GUIDEPOST FOR PRIORITY AND STRATEGY SETTING.

IDENTIFY PRIORITIES THAT BUILD ON THE COUNTRY'S UNIQUE STRENGTHS AND ADVANTAGES

The current Philippine innovation priority areas—all 12 of them—are rooted on the country's mediumterm development goals of inclusive growth, poverty reduction, and resilience to climate change and natural disasters.[18] They refer to very broad development areas such as countryside development, delivery of social services, climate change mitigation, disaster risk reduction, ecological systems, and competitive industries.

In 2009, the Presidential Coordinating Council on R&D identified ten priority areas, many of which continue to be in the priority list of the DOST today.

These include:

- Agriculture and Food
- Energy
- Environment
- Health
- Manufacturing and Industry
- Information and Communications Technology
- Electronics
- Nanotechnology
- Biotechnology
- Disaster Mitigation and Management

AS A POLICY GUIDEPOST, IT IS IMPORTANT TO APPLY A HIGHER LEVEL OF SPECIFICITY IN PRIORITY FORMULATION. EVEN IF STATED AS BROAD PRIORITY AREAS, THESE SHOULD FOCUS ON AREAS OF UNIQUE STRENGTHS AND ADVANTAGES.

The Congressional Joint Commission on Science and Technology in the 15th Congress identified priority program areas that are thematic and multi-technology need categories, including:

- Disaster Science and Management
- Remote Sensing and Supply Chain Management for Agriculture
- Biotechnology for Food Security and Health
- Health Systems for Remote Areas
- Renewable Energy, Green Transport, and Energy Efficiency
- Innovation Clusters to build national competitiveness

Some of these areas are more specific, which greatly helped in resource allocation. The danger of couching priorities in general terms invites competition among government departments and could fatally lead to misallocation of resources.

A KNOWLEDGE-BASED STRATEGIC ANALYSIS OF THE COUNTRY'S STRENGTHS AND ADVANTAGES, AS WELL AS NEEDS, WILL HELP LEAD TO THE IDENTIFICATION OF REASONED PRIORITIES.

This process is best carried out with inputs from the government, business, academe, and research institutions.

In some economies, reasoned priorities are products of close interaction and consultation between government and stakeholders.

Bureaucratic inertia has strategic implications and its solution emanates from the highest level of governance.

STRENGTHEN INNOVATION GOVERNANCE AND IMPROVE POLICY COHERENCE BY ADOPTING A "WHOLE OF GOVERNMENT APPROACH"

The Department of Science and Technology (DOST) has the primary mandate to lead the country's efforts on science and technology. There are, however, other agencies whose mandates cut across the innovation arena, including the Department of Agriculture (Food Security), Department of Energy (Sustainable energy), Department of Health (Biotechnology), Department of National Defense (Disaster Resilience), Department of Trade and Industry (MSME, Investment Promotion, etc.), Department of Transportation (Inclusive Mobility), Commission on Higher Education (Human Capacity Building, Academic Research), among others. The National Economic and Development Authority has a clear stake in the innovation agenda given that its planning functions permeate across various sectors and agencies of the government.

These agencies, as operational policy institutions, set their respective priorities, sometimes unaware

of how related priorities are taking shape in other departments. Worse, a viable priority might suffer from willful neglect only because a department is avoiding an imagined view that they might be encroaching on another department's turf. This is bureaucratic inertia and this needs to be addressed if the country is serious about its innovation agenda.

This is one of the problems which a high level innovation policy council seeks to overcome. A National Innovation Council will provide a strong strategic resource on innovation at the center of government.

The NIC, as an independent entity, will orchestrate the generation of a valid vision and coherent set of priorities and policies. It will need full authority and support at the highest level of government. In many economies, the council is chaired by the President or the Prime Minister.

In the interim, this can be created by virtue of an executive fiat on the basis of the powers of the President under the Administrative Code. A similar body, the Presidential Coordinating Council on R&D was created through Executive Order No. 604 by then President Gloria Arroyo, to prioritize and coordinate all research projects in government; but unlike the said council, the proposed NIC will be the source of strategic policy analysis on innovation priorities and strategies on a continuing basis. This can be likened to the approach undertaken by many economies of today, including Chile, South Korea, Japan, Finland, to name a few.

A KNOWLEDGE-BASED STRATEGIC ANALYSIS OF THE COUNTRY'S STRENGTHS AND ADVANTAGES, AS WELL AS NEEDS, WILL HELP LEAD TO THE IDENTIFICATION OF REASONED PRIORITIES.

Its composition, however, will need to be carefully considered in view of its strategic role as adviser to the government and may very well serve as a conduit for international learning.

A new office need not be created as its support staff may be sourced from existing agencies with S&T and innovation mandate.

Implementation of policies and operational activities will need to be pursued with a "whole of government" approach through an inter-agency coordinating body that can be chaired by the NEDA or the Office of the President. It is further proposed that government departments and agencies appoint an innovation focal person, with the rank of no lower than Assistant Secretary, to ensure greater coherence in innovation policy objectives and programs across all agencies of government.

PROVIDE AN ECOSYSTEM THAT FACILITATES AND SUPPORTS

Innovation cannot exist in an ecosystem that is not enabling.

The Philippines currently ranks 103rd out of 189 economies in the 2016 Doing Business Report (The World Bank Group), down six ranks from 2015. It ranked lower in 9 out of 10 indexes compared to its 2015 performance.

AN ECOSYSTEM THAT FACILITATES AND SUPPORTS INNOVATION AND ENTREPRENEURIAL GROWTH IS ESSENTIAL. EXCELLENT INVESTMENT CLIMATE AND SUPPORTIVE REGULATORY ENVIRONMENTS BOOST INNOVATION.

On the other hand, other ASEAN countries fared better—Singapore emerged on top of the ease of doing business list for the 10th consecutive year, Malaysia (18th), Thailand (49th), Brunei Darussalam (84th), and Vietnam (90th).

This highlights the challenges that entrepreneurs and innovators face under the present ecosystem.

The Science, Technology, Research and Innovation for Development (STRIDE) program of the USAID reported that interviewees in their study identified burdensome bureaucratic requirements as one of the serious limitations in the enabling environment.[19] The report cited in particular the slow business formation process resulting from this condition, thereby serving as a serious deterrent to would-be entrepreneurs.

This is illustrated by the experiences of Singapore, New Zealand, Denmark, South Korea Finland—all of which are among the successful innovation-driven economies in the world and are among the top 10 best performing economies in The World Bank's

[19] *USAID. Science, Technology, Research and Innovation for Development (STRIDE)Philippines Innovation Ecosystem Assessment. November 2014.*

Doing Business Report for 2016.world and are among the top 10 best performing economies in The World Bank's Doing Business Report for 2016.

Investments in human capacity building and in R&D are also important, but this needs to be strategic. No matter how substantial, funding will not boost innovation if these are not directed at strategic priorities that build competitiveness.

AN ENABLING ENVIRONMENT ALSO PROVIDES QUALITY INFRASTRUCTURE.

The establishment of an Innovation Fund may be considered to support risk funding for R&D and innovation activities of growth-seeking, innovative SMEs.

Action needs to be directed at improving the Philippines' ICT infrastructure to facilitate technology uptake. The Philippines ranks 103rd among 166 countries in the ICT Development Index based on the Measuring the Information Society Report 2014 of the United Nations' International Telecommunication Union. In Asia, innovation-driven economies, including Hong Kong, Japan, Australia, and Singapore ranked highest, showing clear disparity between developed economies and developing economies.

The Philippines cannot lag behind in this department if it wants to expand its market for entrepreneurs and facilitate access to global knowledge.

TAP FILIPINO DIASPORA FOR INNOVATION

Accessing global knowledge also requires an openness to tap the country's rich resource base overseas—the Filipino Diaspora which makes up 10% of the Philippine population.

Filipino migration is characterized by high skills level covering at least 120 countries. Overseas Filipinos can be mobilized to form part of the country's corps of economic agents or direct participants in technology and knowledge transfer programs of the government.

In the United States alone, 9% of the Filipino diaspora possessed a master's, a doctorate degree, or an advanced professional degree.[20] With the right policy environment and innovation ecosystem, they, together with other Filipino high level technology experts from other countries, can provide the much needed knowledge and technical boost to the country's drive towards an innovation-driven growth strategy.

Key learnings may be derived from the experiences of Ireland, Taiwan, Korea, India, China, just to name a few.

Korea has long been pursuing a strategy to develop local knowledge through foreign education, training, and by attracting its technical Diaspora back and investing heavily in R&D. The Korean government also supports new startups by members of the Korean Diaspora in the Silicon Valley. Korean private companies such as Samsung and Hyundai have also funded R&D in Silicon Valley, creating opportunities for collaboration and linkages between Korea and institutions overseas.

China and India have also benefitted extensively from its Diaspora talents. The Chinese technology industry is dominated by the Diaspora, while India has maintained strong linkages with its Diaspora community overseas. Indian computer scientists in Bangalore, for example, constantly exchange ideas with their colleagues in Silicon Valley.

The Caribbean Diaspora for Science, Technology, and Innovation was established with the view to facilitating networking that will bring resources from the Caribbean Diaspora to the Region. A number of economies in Europe and Latin America support some of the Caribbean Diaspora initiatives.

THE PHILIPPINES SHOULD NOT ONLY BENEFIT FROM KNOWLEDGE SPILLOVERS FROM FILIPINO DIASPORA. THIS RICH SOURCE OF KNOWLEDGE AND EXPERTISE NEEDS TO BE PART OF THE COUNTRY'S INNOVATION ECOSYSTEM.

STRENGTHEN EDUCATION DELIVERY

Strategic investments in basic, secondary, and tertiary education and skills development are vital to raising the country's innovation capacity.

The Philippines spends barely 3% of its GDP on education, and only 0.3% of GDP is spent on higher education. Only 1 out of every 27 university enrollees are in PhD/masters programs. According to the Commission on Higher Education (CHED), only 9% (equivalent

[20] *National S&T Agenda 2013-2020, Philippines.*

to 18,028) of graduate students in academic year 2014-2015 are enrolled in STEAM programs (science, technology, engineering, agri-fisheries, mathematics). In baccalaureate programs, only 18.57% (or 707,819) are enrolled in STEAM programs in academic year 2014-2015.

The impact of this underperformance is evident in the fact that growth in the country's high-tech exports has declined by 27% between 2008 and 2013 even as growth in this sector for the Southeast Asia and Oceania was registered at 28%. All countries, except for the Philippines and Samoa increased the value of their exports. Malaysia and Vietnam's increase was most significant, with the latter's export value increasing by almost ten-fold.

A review of the experiences of economies that have been successful in their innovation strategies highlight the fact that massive strategic investments in human capacity building and research, good secondary and tertiary education, well-trained scientists and engineers, strategic R&D, and an effective program for continuing development and retention of human capacity and skills make up the backbone of an effective national innovation system.

The list can go on and on, underscoring the indisputable role of human capacity building, R&D, and the role of the academia in the innovation space.

Investing in high level human capital to improve innovation capabilities and development of well-trained scientists and engineers as basic inputs into more sophisticated R&D activities are key lessons that the Philippines needs to absorb and apply in creating the ideal and well-functioning innovation ecosystem.

DEEPEN PARTNERSHIPS AMONG GOVERNMENT, BUSINESS, AND ACADEMIA

The conventional view suggests that R&D plays a preeminent role in innovation. Such is no longer the case today. In many economies, the academe is interfacing and working with business on a host of initiatives that fall under the realm of non-technology/non-science-based innovation. Innovation in creative arts, services, media, business processes, just to name a few, have become widespread and in huge demand, thus underscoring the changing scope and reach of innovation.

The role of human capital in many economies' innovation policies is very pronounced:

Australia: A More Skilled Labour Force, Industry Innovation and Competitiveness Agenda, An Action Plan for a Stronger Australia

Canada: Growing Canada's Talent, Seizing Canada's Moment, Moving Forward in Science, Technology, and Innovation 2014

Chile: The capacity to innovate ultimately comes from the People, National Innovation Policy 2010-2014

Finland: Strengthening Human Resources as part of Finland's Strategic Development Policies, Research and Innovation Policy Guidelines 2011-2015

Taiwan: Deepening Cooperation with Academia, Thinking Ahead, Innovating A Better Future, 2014

Norway: Creating human beings as one of three key focal points of innovation policy, 2008

China: Massive investments in tertiary education, particularly for scientists and engineers to become a major innovative power

THIS REALITY REQUIRES A NEW PERSPECTIVE AND APPROACH TO DEVELOPING AND IMPLEMENTING INNOVATION POLICIES AND INITIATIVES.

The success of the country's innovation thrusts will be heavily influenced by the government's capacity to engage and promote interaction and cooperation among all stakeholders, including academe and business.

Some recommendations to strengthen the delivery of education include the following:

• Establish an innovation agenda for education, including a comprehensive and coherent vision for the future of tertiary education in the country;

• Make higher educational learning more responsive to labor market needs;

• Develop a strong infrastructure for education delivery;

• Build links between tertiary institutions, research institutions, and industry towards creating avenues for knowledge diffusion;

• Create adequate research infrastructure and provide direct funding to strategic research priorities;

• Vocational education and training needs to be guided by labor market needs and strategic innovation priorities;

• Foster Government-Academic-Business Research Collaborations that will help give rise to future innovations.

It will also be influenced by the degree and level of trust that stakeholders have for one another.

Collaboration among and between government, academe and business is sometimes hampered by a pervading trust deficit among stakeholders.

The research findings of the USAID/Philippines Science, Technology, Research and Innovation for Development (STRIDE) Program on the Philippine Innovation ecosystem assessment (2014)[21] succinctly pictures the situation:

"The national innovation ecosystem as a whole is characterized by widespread mutual mistrust and dismissiveness between university and industry communities, and more competition than collaboration, perhaps reflecting the historic conglomerate structure of the Philippine economy. Government departments were also described by several interviewees as being preoccupied with bureaucratic competition, to the detriment of collaboration and resource sharing. These factors introduce significant friction into the innovation ecosystem, limiting the growth of innovative research and businesses."

Low levels of trust would have a significant impact on innovation.

Government plays a major role in promoting predictability in the economic environment that is necessary for long-term and risk-laden investment decisions linked to innovation. It has a role in steering discussions towards sound public policies to manage the risks associated with innovation. This is the first crucial step to building trust.

The 2010 Innovation Strategy of OECD underscored the importance of "sound framework conditions for innovation, including sound macroeconomic policy, competition, well-functioning product and labor markets, openness to international trade and investment, innovation-friendly tax systems, and financial systems that enable resources to flow to innovative activities."

Innovation is inherently risky, and relevant stakeholders need to be able to operate in an environment that mitigates some of the risks of innovation. Stakeholder engagement is key to making this happen.

Clearly, the Government has to build an effective arena for consensus building and public engagement. The research and science communities, together with business, will also have to work with government in articulating the beneficial impact of innovation on the society.

This will help breed a public that supports and understands how innovation is relevant to their lives. This is a fundamental requirement to building an innovation culture.

[21] *USAID. Science, Technology, Research and Innovation for Development (STRIDE)Philippines Innovation Ecosystem Assessment. November 2014.*

DEVELOP A ROBUST COMMUNICATION AND ADVOCACY PLAN TO RALLY EVERYONE AROUND THE COUNTRY'S INNOVATION AGENDA AND PRIORITIES

Communication and stakeholder engagement is a vital component of any government's development strategies. Before a new strategy can be executed, one needs to align the team around the new direction that is being set. As such, the government, in partnership with the private sector, needs to effectively communicate why innovation matters in the country's quest for inclusive growth.

Innovation needs to be seen and appreciated, not just as a new "buzz word," but as a strategy that will create value for everyone, create jobs, develop technological breakthroughs, open up markets for micro-small and medium enterprises, and even deepen human capital development in the country.

Understanding and appreciating personal stakes why innovation matters would be the first big step towards rallying and uniting everyone toward building a culture of innovation.

Finally, everyone needs to understand their role in the country's innovation agenda. This builds a solid foundation for engagement and strategic support from, business, academe, and the base of the pyramid.

THE STRATEGIC CHANGE WE WANT TO SEE IN THE INNOVATION ARENA IS ONLY POSSIBLE IF WE ARE ABLE TO INSPIRE AND RALLY OUR PEOPLE AROUND A SHARED COMMITMENT TO BRING ABOUT INCLUSIVE DEVELOPMENT THROUGH INNOVATION.

CONCLUSION

Strategic reasoned priorities, that are embraced by the whole of government, together with the academe/ scientific community and the business sector, are needed. The country cannot anymore afford to take half-steps in its bid to fuel sustainable and inclusive growth.

A government structure that is well-supported by broad expert advice, with adequate authority to consolidate and harmonize inter-agency roles and contribute to the country's innovation agenda, is a necessary element of an effective and efficient innovation ecosystem.

AN INNOVATION VISION THAT INSPIRES IS URGENTLY NEEDED, BACKED UP BY POLITICAL COMMITMENT AT THE HIGHEST LEVEL OF GOVERNMENT.

Funding is needed; but these need to be allocated strategically. No amount of deep funding for R&D and innovation projects will produce meaningful results if these are not done on the basis of well-targeted priorities that are founded on the basis of the country's strategic strengths and capacities.

A National Innovation Investment Fund may be considered to ensure that limited resources of government, with the support of the private sector, will be directed to areas of key strategic priorities.

There also needs to be recognition that our innovation ecosystem is made up of salient interacting parts that need to be well-coordinated. A strategic space that allows coordination, information exchange, resource sharing, and more importantly, cooperation, needs to be created.

THE GOVERNMENT NEEDS TO MAKE SURE THAT IT CREATES THE SPACE FOR THE BUSINESS SECTOR, THE ACADEME/ SCIENTIFIC COMMUNITY, THE PUBLIC SECTOR, AND THE EXTERNAL STAKEHOLDERS TO INTERACT AND PURSUE OPPORTUNITIES FOR COOPERATION TOWARDS BUILDING AN INNOVATION ECONOMY.

Innovation does not happen in a vacuum. Innovation is never about solving today's problems. It is about creating something — which we probably have not yet imagined, to serve the needs of the future.

"The innovation point is the pivotal moment when talented and motivated people seek the opportunity to act on their ideas and dreams."

— WILLIAM POLLARD

"Small opportunities are often the beginning of great enterprises."

— DEMOSTHENES

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