Harmonized National R&D AGENDA

2013-2020

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INTRODUCTION

Background

The Harmonized National Research and Development Agenda or HNRDA is prepared by the Department of Science and Technology (DOST) to provide innovative solutions that benefit Filipinos, particularly the poor, through a problem-focused approach to multi-disciplinary and multi-institutional research and development (R&D) collaboration. It is a product of a continuing process of consultations with stakeholders and partners from the academe, industry, people's organizations and other government agencies initiated years ago by the Presidential Coordinating Council for Research and Development (PCCRD). It is anchored on the administration's five key result areas (KRAs) of (a) Transparent, accountable, and participatory governance; (b) Poverty reduction and empowerment of the poor and vulnerable; (c) Rapid, inclusive, and sustained economic growth; (d) Just and lasting peace and the rule of law; and, (e) Integrity of the environment and climate change adaptation and mitigation. Specifically, the Agenda responds to the KRAs on inclusive economic growth, human development and poverty reduction, and climate change; and aligned with the national priorities enunciated in Philippine Development Plan 2011-2016. Moreover, it fleshes out the current National Science and Technology Plan (NSTP) 2002-2020.

The HNRDA provides an important step in enhancing the effective allocation and efficient use of public investments on R&D. It presents a paradigm shift that directs the use of government resources for R&D activities to issues and concerns that create the greatest impact towards addressing pressing national concerns and achieving socio-economic development. Further, it aims to strengthen public-private partnership and participation in directing public R&D investments to areas that would purposively build the innovation capabilities of local entrepreneurs and investors and enable them to move rapidly into strategic technology areas as well as build local capacity for technological self-reliance.

It is grounded in the belief that the nation must necessarily innovate, and always challenge ourselves to reach further. President Benigno Simeon Aquino III said during the launch of the Advanced Device and Materials Testing Laboratory (ADMATEL) that "Innovation is the engine of any modern economy and that this would not happen overnight, but if we put

a premium on innovation, in dreaming bigger, doing better, and always reaching further with Filipino talents - then it will only be a matter of time before we get there."

Consistent with the Millennium Development Goals and, accordingly, the Sustainable Development Goals of the United Nations, the HNRDA addresses the issue of poverty, promotes sustainable development and inclusive growth and tackles climate change.

Institutionalizing the PCCRD Initiatives

The PCCRD, created in 2007 through Executive Order No. 604, recommended the establishment of a system of establishing priority R&D areas where government funding should be directed. This was in response to the growing concern that public R&D funding had been lodged in different government agencies with each of them having its own system of R&D fund management and priority setting. The PCCRD called for the formulation of a National R&D Priorities Plan to serve as a guide in allocating government R&D funds.

Spearheaded by the DOST, the formulation of the National R&D Priorities Plan was undertaken through a participatory process involving an Inter-Agency Committee and ten Technical Working Groups with the end view of developing technologies that would provide solutions to the country's problems. The initial list of these R&D priorities had been subjected to a Delphi process involving experts in various disciplines and different stakeholders who undertake re-searches or grant funds for researches.

The initial list of identified R&D priorities included the following: 1) Agriculture; 2) Electronics; 3) Energy; 4) Environment and Natural Resources; 5) Disaster Mitigation and Management; 6) Health; 7) Manufacturing and Production; 8) Information and communications technology; 9) Biotechnology; and 10) Nanotechnology.

Alignment with the Updated Philippine Development Plan

The HNRDA is aligned with the updated Philippine Development Plan 2011-2016 which calls for "reforms in public R&D prioritization and funding system and the full implementation of the Philippine Technology Transfer Act of 2009 (RA 10055) to ensure social return on public R&D investments." Among the measures that need to be considered are a systematic national

research inventory, a clearinghouse for new major research investments, and a systematic effort to translate outputs of completed research into actionable policy measures or into potential product developments or innovations.

Substantiating the National Science and Technology Plan (NSTP) 2002-2020

The HNRDA updates and substantiates the NSTP 2002-2020 which has served as an indicative plan setting forth broadly the visions, goals, strategies, and R&D priority areas. The NSTP has provided the policy framework and directions for science and technology (S&T) efforts in the Philippines over the period 2002-2020.

The NSTP has identified twelve broad R&D priority areas that had been selected on the basis of various long-term S&T forecasts, which, although prepared mostly in the advanced countries, have been of more universal validity (i.e. they have been forecasts of likely technological developments). The forecasts were validated through a series of consultations with various sectors, including the private sector, government, academe, and NGOs or civil society. In deciding the broad R&D priority areas, consideration was given to the presence of a high level local S&T capability as well as potential for sustainability; contribution (or potential to contribute) to the resolution of pressing local problems; high potential for increased productivity as well as for developing world-class products/services; and potential to be developed as an enterprise, and especially as an export sector.

The 12 broad R&D priority areas under the NSTP include the following: 1) Agriculture, Forestry and Natural Resources; 2) Health/Medical Sciences; 3) Biotechnology; 4) Information and Communications Technology; 5) Microelectronics; 6) Earth and Marine Sciences; 7) Fisheries and Aquaculture; 8) Environment; 9) Natural Disaster Mitigation; 10) Energy; 11) Materials Science and Engineering; and 12) Manufacturing and Process Engineering.

Methodology

The continuous assessment and participative prioritization processes are undertaken by the DOST's Sectoral Councils – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), Philippine Council for Health Research and Development

(PCHRD), and Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD). The private sector and relevant government agencies are represented in each of the respective Governing Councils.

THE HARMONIZED NATIONAL RESEARCH AND DEVELOPMENT (R&D) AGENDA

The Harmonized National R&D Agenda is an outcome-based agenda where all R&D programs and projects to be funded by the government are envisioned to contribute to the attainment of at least three of the President's five (5) Key Results Areas (KRA)particularly responding to (i) poverty reduction and empowerment of the poor and vulnerable; (ii) rapid and inclusive, and sustained economic growth; and (iii) integrity of the environment and climate change adaptation and mitigation, as indicated in Figure 1.

It is focused on attaining two general outcomes:

1. Expanded and strengthened socio-economic development programs for all, particularly the poor, vulnerable and marginalized through science, technology and innovation; and

2. Safe and disaster/climate change-resilient infrastructure and communities empowered by science-based meteorological, hydrological and geological information, climate change scenarios with associated impact assessments, and decision support systems.

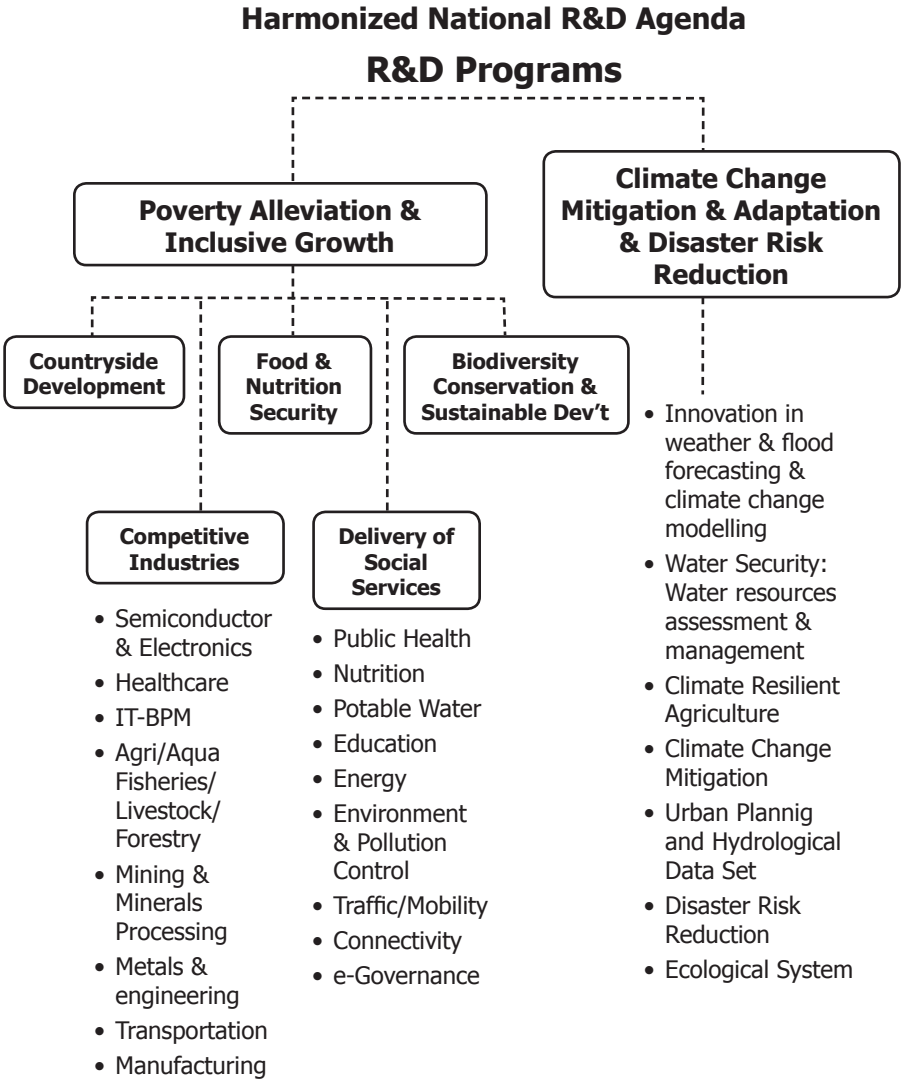

Figure 1. Summary of the Harmonized National R&D Agenda 2013-2020

PROGRAM AREA 1:
Poverty Alleviation and Inclusive Growth

Major Outcome

Expanded and strengthened the socio-economic development of the country, particularly the poor segment of the society, vulnerable and marginalized through science, technology and innovation.

The R&D Priority Areas under Focus Area 1 is composed of 1) Food and nutrition security; 2) Countryside development; 3) Competitive industries; 4) Delivery of social services; and, 5) Biodiversity conservation and Sustainable development. The expected outcomes for each of these areas are indicated in Table 1.

Table 1. R&D Priority Areas for Poverty Alleviation and Inclusive Growth

R&D Priority Area	Expected Outcome
1. Food and Nutrition Security	Quality, safe and affordable food for all, at all times
2. Countryside Development	More farmers, fisherfolks and MSMEs developing and producing competitive and world class products and services
3. Competitive Industries	More industries enabled by state-of-the-art R&D facilities, technologies and science-based policies, moving up the value chain and attracting foreign direct investments
4. Social Services Delivery	Innovative, accessible, affordable and efficient social services for all
5. Biodiversity Conservation and Sustainable Development	Science-based management of aquatic and terrestrial ecosystems for sustainable resource development and utilization

On Competitive Industries, the following eight industries where science, technology and innovation interventions can create major impacts have been identified:

Table 2. R&D Priority Areas on Competitive Industries

R&D Priority Area	Expected Outcome
1.Semiconductor and Electronics	Competitive Philippine companies capable of undertaking R&D, and designing and producing quality products for local and global market; Innovation-friendly business environment capable of attracting foreign direct investments
2. Healthcare	A global leader in healthcare capable of sustainably devel-oping products from the country's rich biodiversity and offering services that contribute to achieving universal healthcare
3. IT-BPM	A global leader in Information Technology-Business Process Management Services directly employing more Filipinos including those in the countryside
4. Agriculture	World class and highly productive agriculture enabled by science-based know-how and tools
5. Mining and Minerals Processing	Sustainable mining and minerals processing industry producing high value products through green technologies, responsible practices and science-based policies
6. Transportation	Modern and cost-effective mass transport systems through enhanced design, manufacturing, supply infrastructure, and support capabilities
7. Manufacturing	Globally competitive and robust manufacturing industries (e.g. food processing, automotive parts, tool and die, chemical, textiles and garments, and furniture) that generate high quality jobs, products and services through technologies, capabilities, state-of-the-art R&D facilities, quality infrastructure, and science-based policies
8. Metals and Engineering	Globally competitive metals and engineering industry capable of producing innovative and quality products for the local and export markets

On **Delivery of Social Services,** the following nine areas have been identified where S&T interventions can contribute significantly:

Table 3. R&D Priority Areas on Social Services Delivery

R&D Priority Area	Expected Outcome
1. Healthcare Products	World class healthcare products and services developed through science-based know-how and innovation to achieve universal healthcare
2. Nutrition	Elimination of malnutrition through innovation and science-based technologies, products and services
3. Potable water/ Sanitation	Safe, clean, affordable and reliable supply of water for communities
4. Education	Highly skilled and globally competitive Filipinos educated and trained through innovative and ICT-enabled learning methods and systems
5. Energy	Efficient, sustainable and reliable energy supply for all through innovative and green technologies and science-based policies
6. Traffic / Mobility	Improved mobility of people and goods through efficient and intelligent transport systems
7. Environment and Pollution Control	Clean and hazard-free environment for all through innovative and green technologies and science-based policies
8. Connectivity	Affordable and reliable broadband Internet for All
9. e-Government	World class e-Government systems and practices

PROGRAM AREA 2:
Climate Change Mitigation and Adaptation and Disaster-Risk Reduction

Major Outcome

Safe and disaster/climate change-resilient infrastructure and communities empowered by science-based meteorological, hydrological and geological information, climate change scenarios with associated impact assessments, and decision support systems

Science, Technology and Innovation (STI) has become the core of solutions in terms of addressing the impacts of climate change and disaster risks. This Agenda supports the following areas that create science-based approaches to mitigate, adapt, and reduce impacts of climate change and disaster risks.

Table 4. R&D Priority Areas on Climate Change Adaptation and Mitigation and Disaster Risk Reduction

R&D Priority Area	Expected Outcome
1. Innovations in Weather and Flood Forecasting and Climate Change Modeling	Timely delivery of accurate weather-related information, flood forecasts and climate projection and services; Improved climate change impact scenarios; Accurately predicted and simulated disaster-causing phenomena; and, Empowered partners to lead in reducing risks from weather-related hazards down to community level
2. Water Security: Water resource assessment and management	Water security through science-based technologies and policies for water resource assessment, conservation, and management in the light of climate change
3. Climate change-resilient agriculture	Adaptive and resilient agri-aqua ecosystems through innovative and green technologies and science-based policies
4. Climate Change Mitigation	Reduced greenhouse gas emissions and decreased carbon footprint through innovative and green technologies, and science-based policies

Table 4. R&D Priority Areas on Climate Change Adaptation and Mitigation and Disaster Risk Reduction	
5. Urban Planning and Hydrological Data Set	S&T-based planning, optimal use of land, and efficient water management
6. Disaster Risk Reduction	Adaptive and resilient infrastructure and communities equipped with accurate and scientifically-validated information on natural and man-made hazards and disaster risks
Adaptive Ecological Systems	Climate change-resilient ecosystems and communities, and inclusive sustainable economic growth as a result of S&T-based management and development decisions that are founded on enhanced knowledge and understanding of the complex dynamics of terrestrial and marine ecosystems as they respond to changing climatic conditions

THE NATIONAL S&T INFRASTRUCTURE

In order to implement the Harmonized National R&D Agenda, there is a need to establish a National S&T Infrastructure consisting of critical and strategic technologies and cutting-edge facilities that are responsive to the current and future socio-economic development challenges of the country. Collaboration among the key stakeholders, especially government R&D institutions and the private sector, is the key to establish the said facilities and to unify all efforts towards technological self-reliance. The fusion of advanced S&T human capabilities and S&T infrastructure opens up opportunities to achieve greater heights of technological breakthroughs by 2020.

Building the country's technological self-reliance capability requires a set of national S&T infrastructure with two (2) major components, namely the "Critical and Strategic Technologies" and the "Cutting-edge Facilities." Increased public investments on S&T infrastructure hedge technology risks and therefore, should be implemented in close consultation and coordination with S&T partners and stakeholders from the industry, academe, people's organizations, and other government agencies.

Among the Critical and Strategic Technologies and the Cutting Edge Facilities necessary towards the country's attainment of technological self-reliance are as follows:

A. Critical and Strategic Technologies

1. **Remote Sensing Technology** - the use of satellite and/or aircraft for acquiring geospatial and temporal information about an object or phenomenon, without making physical contact with the object.

2. **Light Detection and Ranging (LiDAR)** - a remote-sensing technique that uses lasers to measure distances to reflective surfaces and produce fine scale elevation and surface data.

3. **Biotechnology** - any technology application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific uses. It is an enabling technology in developing new products and processes useful for human and animal health as well as strengthening the sustainable

productivity in agriculture by discovering molecular markers resistance to biotic and abiotic stresses used in molecular assisted breeding.

4. **Genomics -** study of the complete genetic material of an organism and the function of single genes that has great importance in health, and agriculture.

5. **Advanced materials** - all new materials and modifications to existing materials to obtain superior performance in one or more characteristics that are critical for the application under consideration. It can outperform conventional materials with superior physical, chemical, electrical, mechanical properties, among others. The development of advanced materials can even lead to the design of completely new products.

6. **Nanotechnology** - an enabling technology that designs and controls matter at nano level or molecular level in order to create new materials with varied profiles for application in food and agriculture; energy; industrial materials; health and diagnostics; and electronics.

7. **Information and Communication Technology (ICT)** - the convergence of telecommunications and computers that allows the access, storage, transmission and manipulation of information thereby enabling promotion of socio-economic development and enhancing the productivity of communities.

8. **Big Data / Analytics** - the aggregation of data from disparate sources, provide emergency managers with advance warnings for extreme weather events, and gather breaking information on disaster conditions from first responders. In addition, this will enable more sophisticated disaster scenario planning that will help integrate and streamline responses.

9. **Advanced Climate Change and Weather Modeling** - the use of mathematical representations of the climate system, simulating the physical and dynamical processes that determine global/ regional climate. They range from simple, one-dimensional models to more complex ones such as global climate models

(known as GCMs), which describe the patterns of the atmosphere and oceans, and their interactions with land surfaces.

10. **Competitive Manufacturing Technologies** - technologies used for advance manufacturing of high quality products at competitive costs.

11. **Advanced Drive Technology** - used for the creation of alternative urban mass transit system that are safe and convenient to ride, cost effective to build and maintain, energy efficient and environmentally-friendly.

B. Cutting-edge Facilities

1. **LiDAR Facility** - Established at selected Higher Education Institutions in the country with state-of-the-art processing software and equipment with highly competent manpower that offers customized service and products for every Filipino. Remotely-sensed data typically from sensors on satellites or mounted on aircraft are being utilized toward the provision of real time, high-resolution, multi-color and infrared images for disaster risk management, environmental and resource management, governance, among others.

2. **Philippine Genome Center** - A core facility for DNA sequencing and bioinformatics is built at the University of the Philippines Diliman (UPD). It is envisioned to be a world-class center of excellence in gene discovery and genomics research that effectively translate knowledge in genomics into applications beneficial to the Filipino people and to humanity as a whole.

3. **Pilot Plant of the National Institute of Molecular Biology and Biotechnology** - used for the translation of laboratory-developed technologies into semi-commercial scale production. This facility is intended to help start-up enterprises in the commercialization of biotechnology products such as biofertilizers, microbial rennet, food and feed enzymes, plant growth promoting additives, animal vaccines, antibiotics, probiotics, and others.

4. **Advanced Device and Materials Testing Laboratory (ADMATEL)** - Equipped with advanced analytical instrument for failure analysis and materials characterization, the facility was established to address gaps in the semiconductor and electronics industry supply chain in order to promote more investment in the Philippines.

5. **Electronics Product Development Center (EPDC)** - The facility is equipped with hardware and software tools that can be used to design, develop, and test hardware and software for electronic products for their intended applications. Through the operation of this facility, it will strengthen the local electronics and semiconductor industries by enabling companies, start-ups and academe gain access to services for electromagnetic compatibility (EMC) testing, electrical safety testing, product prototyping.

6. **Solar Cell Characterization Facility** - It is located at UP Diliman, equipped with a special lamp that simulates the light output of the sun, the facility is used to compare the performance of locally fabricated solar cells with those developed by overseas research institutes and commercially sold locally.

7. **Nanotechnology Centers** - Established at the University of the Philippines Los Baños, the facility provide nanotechnology-based technical services as well as the enabling environment for interdisciplinary and collaborative research and development in nanotechnology applications in agriculture, forestry and other industries. A nanotechnology service or testing laboratory is also located at the Industrial Technology Development Institute (ITDI). The facility offers world-class equipment and devices meant to provide nanotechnology-related technical services to the public. By developing materials with structure at the nano-scale, researchers can explore their unique optical, electronic, or mechanical properties.

8. **Fuel Cell Testing Facility** - The facility is housed at the University of Santo Tomas is equipped with a station for testing both proton exchange membrane (PEM) and Direct Alcohol (e.g. Direct Ethanol) or liquid fuel cells. All aspects of handling and testing

PEM and Liquid fuel cells with built-in modules and devices that are housed in a compact system can be addressed. The fuel cell test station works within the power range of 10W up to 50W and electronic load of current from 0.5 A to 50 A.

9. **Biotechnology Center** - The facility offers advanced enabling technologies that can maximize biological systems or derivatives to improve products or processes with agricultural, industrial and medicinal applications thereby increasing national productivity and global competitiveness of products/processes such as but not limited to vaccines and other pharmaceuticals, bioethanol and lactic acid production, alternative products, bio-pesticides, bio-fertilizers, food and feed enzymes, and other alternative products.

10. **Advanced Manufacturing Facilities** - provide technical and testing services for automotive and other metal-related industries, such as hardness measurement of metallic material and rubber, thickness measurement for base metal, simulated crash analysis, tire endurance testing, and accelerated corrosion tests.

11. **Testing and Metrology Facilities** - These facilities adhere to a national standardized unit of measurement to aid the manufacturing and other business industries achieve global competitiveness. They establish and maintain national physical standards for basic and derived quantities such as mass, length, temperature, time interval, voltage and resistance.

12. **High Performance Computing Facilities** - provide supercomputers and parallel processing techniques to perform tests and run computationally intensive applications for numerical weather prediction, climate modeling as well as analytics and data modeling and archiving.

13. **Food Innovation & Packaging Centers** - These Centers serve as hubs for research and development and support services, including but not limited to product and process development, food testing, shelf life and sensory evaluation, consultancy, packaging and labelling, short-run production, incubator facilities, brokering, and information resources, among others, to enhance

the competitiveness of local food manufacturing enterprises in both local and export market.

14. **Remote Sensing Facility** - refers to the satellite-based technologies that are geared toward the provision of real-time, high-resolution, multi-color and infrared images for disaster risk management, agricultural and environmental management, among others.

15. **Drug Discovery Facilities** - refer to specialized facilities such as DNA Barcoding facility, Standardization facility, Drug Formulation Facility, and Bioactivity facility, and ADMetox Facility to address gaps in each drug discovery stage required to produce high quality and globally acceptable drug candidates.

16. **Environmentally-Controlled Facilities** - These provide the venue to simulate plant growth conditions, plant-insect interactions and projected climate change scenarios allowing researchers to investigate the impact of climate changes and and varying circumstances.

17. **Regional Standards and Testing Laboratories (RSTLs)** - The DOST RSTLs spread all over the country were upgraded to strengthen their testing and analytical capabilities to support the competitiveness of local industries. Moreover, the One Stop Shop Laboratory Services for Global Competitiveness (OneLab) Project linked the DOST RSTLs into a network of one-stop shop for DOST testing and other laboratory services across the country with harmonized processes, procedures and fees. The OneLab will also include in its network other public and private laboratories in the country.

18. **Radiation Processing Facilities at the Philippine Nuclear Research Institute** - include a C0-60 Gamma Irradiator and a 2.5 MeV Electron Beam Facility. These are used to degrade, graft, or crosslink polymers, monomers, or chemical compounds for industrial, agricultural, environmental, and medical applications.

19. **Isotope Ratio Mass Spectrometry (IRMS) Facility** - provides information about the geographic, chemical, and biological origins of substances. Disciplines which stand to benefit from the IRMS are those which require the ability to accurately and precisely measure variations in the abundance of isotopic ratios of light elements such as C, H, N, and S. It finds increasingly widespread use in disciplines such as hydrology, geology, agriculture, food authenticity, and forensic science.

To achieve the most impact and efficiency from these cutting edge facilities, a departure from the traditional way of providing fragmented publicly funded technology support has to be pursued. Instead, multi-disciplinary and multi-institutional hubs would have to be established and strengthened to be able to provide the critical technology solutions and services.

HUMAN RESOURCE DEVELOPMENT PROGRAMS IN SUPPORT TO THE HNRDA

The development of highly skilled and competitive engineers, researchers and scientists is an essential component for the establishment of a vibrant S&T ecosystem that stimulates and enables innovation in priority areas for national development.

Along this line, S&T scholarships will be continuously bolstered and scaled-up to produce highly skilled and globally competitive human resources to sustain R&D activities and in support of the national S&T programs and initiatives. Some of these scholarship programs are as follow:

1. S&T Graduate Scholarships

To pump up a knowledge-based economy, the following graduate scholarship programs will be carried on:

a) **Capacity Building Program in Science Education** - addresses the need for experts in Science, Technology, Engineering, and Mathematics (STEM);

b) **Accelerated S&T Human Resource Development (ASTHRD) Program** - aims to provide a continuing supply of scientists and technologists who are well-equipped to conduct cutting edge researches for the country's development; and

c) **Engineering Research and Development for Technology (ERDT) Human Resource Development Component** - provides the country a critical mass of globally competitive engineers and IT practitioners who can jumpstart high-value added activities in R&D.

2. Science Education Institute Undergraduate Scholarships

Through the DOST - Science Education Institute (DOST-SEI), following undergraduate scholarship programs, which aims to ensure a steady and adequate supply of qualified S&T human resources for national progress are being implemented:

a) **RA 7687 Science and Technology Scholarship Program** - which provides full scholarship to poor and deserving students;

b) **Merit Scholarship Program** - provides scholarship for the best-of-the-best students in Science and Technology; and the

c) **Junior Level Science Scholarship (JLSS) Program under RA 10612** - provides full scholarship to third year students enrolled in the Science and Engineering fields and are willing to teach in Science, Technology, Engineering, Agriculture and Mathematics (STEAM) subjects after graduation in private or public high schools.

3. Specialized Science Secondary Education Scholarship

The DOST-Philippine Science High School System (PSHSS) provides scholarship for the Specialized Science Secondary education nationwide. The scholarship program increases the competitiveness of Filipinos in STEM courses by developing the skills, knowledge and attitude of young scholars with high aptitude in science and mathematics to join the critical mass of S&T workers in the country.

S&T POLICY SERVICES

Appropriate policies will be formulated and existing policies will be updated as necessary to increase uptake of publicly funded R&D outputs into the market and pave the way for an ecosystem that encourages learning, creativity, and innovation.

Consistent with the Philippine Technology Transfer Act (RA 10055) which was enacted in 2009 and its Implementing Rules and Regulations (IRR), as well as the Guidelines on Intellectual Property (IP) Valuation, Commercialization and Information Sharing issued in 2012, the following technology transfer policies were issued:

1. **Guidelines and Procedures in the Establishment and Maintenance of Revolving Fund of Research and Development Institutions (RDIs) within the DOST System (Memorandum Circular No. 001 s. 2015) -** prescribes the guidelines and procedures in setting up DOST-RDIs' revolving fund from income generated from commercialization of IP and/or IPRs from publicly funded R&D.

2. **DOST Intellectual Property Policy (DOST Administrative Order No. 004 s. 2015) -** defines the engagements of government funding agencies (GFAs) and RDIs with stakeholders in the ownership, protection and management, utilization, transfer and commercialization of IPs generated from DOST-funded R&D activities.

3. **Guidelines on the Constitution of the Fairness Opinion Board (FOB) and Issuance of the Fairness Opinion Report (FOR) (DOST Memorandum Circular No. 006 s. 2015) -** provides the rules and policies on the constitution of the FOB and on the issuance of FOR which contains the statement expressing the opinion of the FOB as to the fairness to the GFA and RDI of the proposed transaction, particularly its financial terms.

4. **Technology Transfer Protocol of the DOST-Research and Development Institutions (DOST Administrative Order No. 009 s. 2015) -** defines the policies, strategies, and processes or procedures to be adopted by the DOST-RDIs to identify, protect,

manage, and commercialize IPs and/or IPRs generated from government-funded R&D. As a general rule and consistent with the DOST IP Policy, any issues on the IPs/IPRs generated out of DOST-funded R&D shall not impede the expedient transfer, roll-out or commercialization of the needed technology, as may be determined essential by the DOST Secretary in case of national emergencies or the need to advance national and local interests.

5. **Intellectual Property Management Protocol of the DOST-Government Funding Agencies (DOST Administrative Order No. 004 s. 2016) -** This is the counterpart protocol of the DOST Agencies that act as Government Funding Agencies such as the DOST Sectoral Councils and the DOST-Central Office, which manages the Grants-in-Aid Program, in the ownership, identification, assessment, protection, management disclosure, commercialization, utilization, or enjoyment of IPs and/or IPRs generated from DOST-R&D programs and projects.

With these policies in place, the DOST can finally realize the objective of RA No. 10055 which is to speed up the bringing of technologies generated from publicly funded R&D into the market. Other government agencies and higher education institutions that perform government-funded research activities are also enjoined to craft their own technology transfer related policies.

Other relevant policies were crafted such as:

6. **Data Sharing Policy (DOST Administrative Order No. 003 s. 2015) -** advocates the access and sharing of all research output and requires research data arising from DOST-funded programs and projects to be accessible to the public in a timely and responsible manner keeping in mind the protection of intellectual properties. This is consistent with the rationale of the Joint Memorandum Circular No. 2014-01 dated 22 January 2014 or the Open Data Philippines (ODP) issued by the Office of the Presidential Spokesperson (OPS), Department of Budget and Management (DBM) and the Presidential Communications Development and Strategic Planning Office (PCDSPO).

7. **Management and Transfer of Intellectual Properties Generated in the Food Innovation Centers (DOST Administrative Order No. 005 s. 2016)** – sets forth clear guidelines to be adopted in the FICs on the IP ownership and protection, technology transfer, data sharing, and revenue sharing.

CONCLUSION

The HNRDA is a significant step towards the full institutionalization of "Technology Self-Reliance" as a State policy. It seeks to leverage the convergence of multi-disciplinary R&D and innovation competencies and know-how with ample set of National S&T Infrastructure to enable local entrepreneurs and investors to achieve technology self-reliance.

To maximize the impact of the HNRDA and fully realize its perceived benefits, the following conditions have to be pursued:

1. Harmonization of support laboratories and facilities

2. Adoption of National Government Agencies (NGAs) of technologies and output from local R&D efforts

3. Data and know-how sharing policy among NGAs

4. Institutionalization of critical programs and technologies

5. Support and enable S&T institutions to achieve scientific excellence and world class standards

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