



Technology Commercialization Initiatives in the Advent of Science Diplomacy: Philippine Government Perspective



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Introduction

The Department of Science and Technology (DOST) is dedicated in directing, leading and coordinating the Philippines' scientific and technological efforts in maximizing full potential of the country towards economic and social development. Acknowledging science and technology (S&T) as one of the major drivers for national growth, proven by research utilized by industries and policy bodies, Dost aims to strengthening ties with the public and private sectors. Consequently, the mandates ensure that the results therefrom are geared and utilized in areas of maximum economic and social benefits for the people.

Under the 1987 Constitution of the Republic of the Philippines, particularly Article XIV, focuses on S&T. It dissects its significant role in terms of economic progress, roles and responsibilities of involved sectors and other relevant matters. Section 10 asserts S&T as an essential driver for national development and progress, giving priority to research and development, invention, innovation, and their utilization, as well as science and technology education, training, and services. Section 11 details about the states' support and incentives in terms of S&T where provisions for incentives, including tax deductions to encourage private participation in programmes of basic and applied scientific research, are highly supported. Section 12 tackles with technology transfer and adaptation, which specifies regulation of transfer and promotion of technology from all sources for the national benefit. In line with this, Section 13 deals with the protection of Intellectual Property (IP) Rights, where protection and security of the exclusive

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rights to scientists, inventors, artists, and other gifted citizens for their intellectual property and creations, particularly, when beneficial to the people, for such an such period is provided by law.

The passage of the Philippine Technology Transfer Act of 2009 or Republic Act (RA) 10055 expanded DOST's function in calling for a regular national conference of government funding agencies and research and development institutes to promote multidisciplinary, joint and cross collaboration in research and development (R&D), to coordinate and rationalize R&D agenda, and to harmonize all R&D agendas and priorities.

The scope and objectives of the RA 10055 address three major components: First, it addresses technology transfer as a strategic mission of the research and development institutes (RDIs) facilitating transfer and utilization of IP and call upon government-funded RDIs to take on technology transfer as the mission to effectively translate research results into useful products and services that redound benefits of Filipinos. Second, the Act addresses transfer of technology through the management of IP rights and private sector collaboration. hence, it acknowledges that the successful transfer of government-funded R&D results depends on the proper management of IP, development of capacity by the RDI to become self-sustaining and competitive, and on enhancing interaction and cooperation with the private sector, particularly, small and medium enterprises (SME) through collaborative and contract research based on equitable, fair access, and mutual benefits for all involved partners. Lastly, the access to technologies and data establishes means to ensure greater public access to technologies and knowledge-generated from government-funded R&D, while enabling, where appropriate, management and protection of related IPs.

Efforts for Science, Technology and Innovation

The Technology Application and Promotion Institute of the Department of Science and

Technology (DOST-TAPI) has been a keen promoter of innovations since its inception in 1987. Serving as an effective and efficient dispensing body of deliverables to stakeholders and the general public, the TAPI has been a consistent ally and supporter of Filipino inventions and breakthroughs by providing assistance through grants, consultancies, and contract researches.

The Philippine government's support to science, technology and innovation (STI) through the DOST-TAPI, champions the welfare of the country's critical mass of scientific work-force and human capital by ensuring government assistance in the form of technical, administrative, and financial support.

This legal framework has created following platforms of support for inventors and innovators through cash rewards and awards for inventions, tax incentives and exemptions, invention development assistance fund, and invention guarantee fund. The application of loan assistance has been extended by government banks for the commercial production of an invention, either locally or for export and duly certified by the Filipino Inventors Society (FIS), while Screening Committee must meet the criteria in enhancing economy of the country such as profitability and viability, dollar-earning capacity, and generation of employment opportunities for Filipinos.

Aside from inventors and innovators programmes, the DOST-TAPI has also a number of need-based programmes and services under its umbrella. They include technology protection, testing, and enhancement, and technology promotion, transfer, and commercialization.

The IP Rights Assistance Programme harnesses protection of IP as a crucial preliminary step in technology transfer and commercialization in providing assistance in patent consultation and in giving grants for the payment of Patent Agents and IPO's fees. Also, the Technology Innovation for Commercialization (TECHNICOM) Programme provides holistic support to interested proponents with commercially-viable technologies through financial and technical assistance. Furthermore, the Invention-based Enterprise Development

(IBED) Programme covers pilot production, market testing, and formulation of systems and procedures considering large-scale production.

In terms of promotional activities, the Institutional Support for Trade and Exhibitions (ISTE) of the DOST Technologies and Services serves as a platform for dissemination, sharing and exchanging information and ideas involving S&T development for the benefit of different sectors.

Commercialization is the most common technology transfer pathway or modality that is practised in the Philippines for research to reach the market. The modalities of commercialization, on the other hand, include creation of spin-off or start-up companies, licensing of technology to private sector and industry, and direct sale or acquisition of the technology.

Change of Administration

DOST welcomed change when the Department transitioned from the DOST Eight Outcomes to the DOST Eleven-Point Agenda, as the government transitioned into a new administration in 2016 under President Rodrigo Duterte's Ten-Point Socio-Economic Agenda.

Authority (NEDA) recognizes important role of STI in advancing economic and social progress.

Moreover, "technology adoption allows country's firms and people to benefit from innovations created in other countries, and allow it to keep up and even leap-frog obsolete technologies".

However, there is a low level of innovation in the country owing to weak STI through human capital, low R&D expenditures, and weak linkages in the STI ecosystem. The promotion of technology adoption and innovation can ultimately provide visionary outcomes as an increase in STI utilization in agriculture, industry and services; can increase STI-based start-ups, enterprises and spin-offs by enhancing creative capacity for knowledge and technology generation, acquisition and adoption, and strengthening open collaborations among actors in the STI ecosystem.

In line with this, the Filipino values included in the DOST Eleven-Point Agenda comprise "compassion" in enhancing social fabric, "change" in reducing inequality, and "progress" in increasing potential growth; thus providing a strong foundation of an economy for inclusive growth, high-trust society, and globally competitive knowledge.

S&T initiatives contribute to the national socio-economic agenda through optimizing R&D investment outcomes, increasing competitiveness to address reduction risks brought by environmental calamities, promoting rural and value-chain development, and investing in human capital development. Thus, the DOST has been keen on implementing programmes satisfying its Eleven-Point Agenda, especially, in maximizing utilization of research and development results through technology transfer and commercialization, assistance to the production sector, and collaboration with industry, academe, and international institutions.

Translating Research to Technology Applications

There are many technologies that are transferred and commercialized through the DOST-TAPI programmes. For example, in the creation of spin-off or start-up companies, particularly from a state university or college (SUC), the Biotek-MTM Dengue Aqua Kit developed by Dr Raul V. Destura of University of the Philippines – Manila is one of the success stories.

Dengue, a disease transmitted by *Aedes* mosquito, causes a severe flu-like sickness posing lethal complications in humans. In the Philippines, it was reported that dengue had highest incidences lately. Moreover, the Department of Health (DOH) revealed 84,085 suspected dengue cases from January to August in 2016, and 372 people died from it.

This led the experts from the Institute of Molecular Biology and Biotechnology of the National Institute of Health (IMBB-NIH) to invent Biotek-MTM. This medical diagnostic technology for dengue poses opportunities for

its early detection, especially in marginalized communities, where often most cases are reported.

Commercialization and transfer of Biotek-M can pave the way for intervention to marginalized sector with its affordability and accuracy. It would also impact macro-economic growth as the development and commercialization of this very first Filipino-made medical diagnostic technology for the disease opened the door for other technologies in the field of health and biotechnology. This translates emergence of business and employment opportunities for S&T graduates in the sector, thereby contributing to macro-economic growth of the country.

Furthermore, the technology enables capacity-building through promotion of technology. The product was tested in 75 designated DOH hospitals and 25 private health institutions nationwide, and around 50 medical technologists and doctors participated in the hands-on training conducted nationwide. The team plans to capacitate about 50 doctors and 150 medical technologists and health-workers more to provide skill enhancement and promoting use of the technology. Lastly, there is an increased geographic reach when the team made negotiations for potential distribution of products to other Associations of the Southeast Asian Nations (ASEAN).

In terms of licensing of SUC-developed technology to private sector or industry, the BioGroe™ technology, developed by the team of Fe G. Torres and Ronilo Violanta, from the National Institute of Molecular Biology and Biotechnology (BIOTECH) of the University of Philippines – Los Baños, spearheaded.

Food loss occurs even before the food is placed on the table. According to the Food Agriculture Organization (FAO), more than 40 per cent of food losses are even in the production and post-production stages. Fertilizers have a crucial role in crop production and management as they improve soil fertility. The BIOTECH developed a user- and environment-friendly plant growth promoter, coined as BioGroe™, which can help increase farmers' yield in crop

production translating to increased income and purchasing power.

The technology, undoubtedly, has created a huge impact on the application of environmentally-friendly system reducing dependency on chemical fertilizers. With the reduction of dependency, the technology promotes environment-friendly system, stopping chemical leaching to fresh bodies of water and at the same time, mitigating climate change through reduced use of energy for inorganic fertilizer production.

The technology has also increased income generation; as was evidenced during technology demonstration trials. It increased income of farmers, involved co-operators through application of Biogroe™ on a per hectare basis for pechay, mustard and corn.

The project has strengthened the capacity-building of farmers and co-operators. In fact, 16 capacity-building activities (seminars and trainings) were conducted in the provinces of Cavite, Laguna, Batangas, Quezon, Tarlac, and Palawan for about 700 people to disseminate the technology at the farm level, and thereby promoting adoption of technology and capacitating target users with innovations in the agricultural sector.

As for the individual inventor-developed and commercialized technology, the Leak Sealing Valve (LSV) for Brake System of Motor Vehicle, developed by Melchor L. Heñosa of Heñosa Technologies, is a significant breakthrough. This is an anti-loose brake device attached along the brake fluid pipes of each brake assembly of wheels, particularly for public utility vehicle (PUV). It has an automatic lock system for damaged assembly, avoiding loss of brake, and maintaining driver's directional stability and control over steering. This allows control over stopping distance. The technology has promoted public safety in the transport industry. It is vital in the transport industry as well as for the security of passengers as this would lessen accident rate by loose brakes.

In the efforts of addressing pressing national concerns on disaster risk reduction (DRR) and

climate change, significant projects have been developed – such as the National Operational Assessment of Hazards (NOAH) and the Nationwide Disaster Risk Exposure Assessment for Mitigation (DREAM). These green technologies advocated by the Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD), make real-time weather predictions for easy access. In turn, citizens are empowered in making critical, life-saving decisions, including investments taking into consideration accurate weather scenario.

Furthermore, the Filipino-made Automated Guide-way Transport (AGT) provides alternative, efficient and cost-effective transport model for fast and reliable mass transport system in the country. The AGT addresses environmentally sustainable transport system in resolving greenhouse Gases emission. The technology has recently been adopted by the Philippine National Railways (PNR) to connect suburban areas closer to Metro Manila. Other notable green technology breakthroughs are on the rise with Philippine Nuclear Research Institute's (DOST-PNRI) disposal system in isolating waste from the environment; controlling releases of radionuclides and reducing obnoxious releases. A number of outstanding researchers and inventors are the beacon of hope in becoming game-changers in their respective fields – worthy to mention are works of Dr. Arturo Alcaraz in geothermal energy development; Dr. Ramon Barba in mango farming research and tropical tree physiology; and Dr. Fe Del Mundo, in inventing an improved incubator and jaundice relieving device, to name a few.

Science Diplomacy for Technology Promotion, Transfer, and Commercialization

The effort of each economy, especially of developing countries, in practising responsible entrepreneurship through the development, adoption, and commercialization of technologies as a means to uplift social and economic development as far as science and technology initiatives are concerned is noble in different ways.

With the launch of the Sustainable Development Goals (SDGs), covering a broad range of social issues primarily on poverty, hunger, health, education, climate change, gender equality, and social justice, it is but timely to establish a science diplomacy in reaching multi-sectoral collaboration and partnerships in an international scale through sharing of information, procedures and policy recommendations among various stakeholders. Through communication platforms, dialogues become a unique global getaway of information management and generation on various tools and mechanisms to support partner countries to achieve the SDG targets.

In the Philippines for example, as revealed in the Fifth Progress Report on the Millennium Development Goals (MDG) in 2014, published by the NEDA and the United Nations Development Programme (UNDP), there are a combination of misses and hits towards fulfillment of targets. Data showed that there was a slow progress in reducing extreme poverty in the country while universal access to primary education was likely to be achieved. The Philippines has already reached the target for basic sanitation, including access to safe water, and this could imply a faster progress as the people and the government would have more resources to meet needs.

With the international collaboration, such as the Asian and Pacific Centre for Transfer of Technology (APCTT) of the United Nations (UN) Economic and Social Commission for Asia and the Pacific (ESCAP) together with other institutions or organizations in the public or private sectors, there is a mean to deliberate on the international best practices and lessons learned in the adoption, adaptation, and development of technologies in fostering economic development. Subsequently, this facilitates the needed pondering on strategies to ensure sustainable management of natural resources and balancing of the social, economic, and environmental dimensions of development, especially on the new and emerging technologies, such as renewable energy and nanotechnology.

It is helpful to establish a process of technology strategies and transfer to meet global standards, and to build infrastructure for technology growth

among partner countries that can be attained from endless negotiations and compromises built by science diplomacy. Among others, the member-states can be advised on the formulation and implementation of the technology transfer, promotion, and commercialization programmes of work as well as needed logistics and financial status.

Moreover, through science diplomacy initiatives, the programme of work can develop more project collaborations with relevant industry players, which would strengthen capacity of STI and would enhance sharing of information for technology adoption and commercialization by member- states.

Recommendation and Conclusion

The Philippines has the necessary legal and policy framework to ensure development, exploitation, protection, transfer and utilization of technologies, which the structure and dynamics of the government agencies, involved in the S&T services, are designed to provide holistic and complete approach to technology, from the development of research ideas, to testing and enhancement, to commercialization and promotion.

The necessary programmes of the Philippine government on such transfer of technologies are in-line and adaptive to the needs of target beneficiaries in terms of stage of technology development and sectors involved. Since there are available modalities for transfer and commercialization of technology, and technology transfer landscape in the country is emerging, lessons from past experience must be considered.

The discussions fuelled by social and scientific mobilization would help create investments in technology transfer and commercialization, necessary in uplifting micro, small and medium entrepreneurs of the Asia and Pacific Region

through science and technology innovations for a productive population as support to achieving SDGs with science diplomacy at the very centre of the mechanism. International Collaborations within key economies can provide added value to the national strategies such as proactive engagements, S&T gaps mitigation, and people-to-people contact as tool for public diplomacy. At such a point, the pathways into which economies come into as an agreement through science diplomacy, whether through technology diplomacy, technology synergy, or technology acquisition, a harmonious mutual relationship can be established for stronger partnerships.

If only this kind of endeavour can be advocated in the international level with robust technology in helping other partner's economic growth by advocating innovative culture, then nothing is impossible.

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