Concept Note on Philippine *Suprastructure* Development – Building the Philippine Advanced Technology Innovation Institute and Workforce*

Focus on addressing the most important present-day challenges in the Philippines, namely: improving food productivity and security, developing the agricultural-industrial manufacturing sector; in the context of environmental sustainability, averting the adverse impacts of climate change; alleviating and eventually eliminating abject poverty, hunger, malnutrition, physical stunting and mental disabilities of Filipinos in the regions; and through edukasyon and training, creating more jobs and livelihoods, thus significantly increasing the GDP per capita of the poorest farm and fisheries sectors of Philippine society;

Through a definitive, massive investment in Suprastructure - advanced S&T human capital development, recognizing its singular, most critical role in driving and sustaining over the long term, innovation-based competitiveness of Philippine industries.

Aligned with the top priorities of the Asian Development Bank and the administration of President Ferdinand R. Marcos, Jr.: Agriculture and Food Security, and Climate Change

(…for what good is "infra" without "supra"?)

* version 1 submitted to Dr. Justine Diokno-Sicat, ADB Director; this is version 3 with minor edits.

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BACKGROUND AND RATIONALE

National problems and challenges being addressed are poverty and hunger, malnutrition and undernutrition, resulting in physical stunting, mental disabilities of children, youth and adults in the regions, which can be traced to marginal agricultural productivity and food insecurity, exacerbated by the adverse impacts of climate change; a vicious cycle of many decades of the inability to develop agriculture and natural resources into high value, competitive commercial products leading to stagnation of the manufacturing industry sector that could otherwise provide massive jobs and livelihoods, alleviate poverty and raise the GDP per capita of the poorest of the poor – the farmers and fisherfolk.

Globally-linked local issues include lack of competitiveness of local products and services in the region and globally, i.e, trade deficits, import-export imbalances. In the agriculture sector, lack of economies of scale for agricultural productivity, is principally attributed to the parceling out of farmland under the agrarian land reform program, rendering investment in agricultural technological modernization and mechanization economically non-feasible. Related problems include gaps in supply, distribution and communication chains. Alternative setups such as cooperatives, farmers' associations and corporate farming, to consolidate farmlands and integrate operations, have been successful in limited cases, and there are now a few agro-industrial plants utilizing waste or side products from crop harvest and food processing as a source of renewable energy that are operating along the lines of an environmentally sustainable circular economy.

Potential niches or unique areas of competitive advantage for development must be vigorously pursued, and amidst the global threats of climate change, the Philippines would join nations of the world in the creation of resilient, long-term sustainable models of a

circular social economy built to strengthen the 5 pillars of the SDGs: people, planet, prosperity, peace and partnerships.

Major reasons these problems exist today are lack of investments in S&T-based knowledge, R&D, innovation and governance. The Philippines has direly lagged behind in these investments in comparison with other countries in the ASEAN region in the last half century. Coping with competition among nations, and at present, seeking out cooperation and resource-sharing among them, to address shared global and regional threats, requires that the Philippines be at par with its neighbors in terms of scientific and technological capabilities.

The critical role of S&T human capital development (S&T HCD) to sustain technological development and economic progress over the long term, improve the quality of life of a population, is recognized in all technologically advanced countries. The single most important, definitive investment for sustained progress is in the development of its human workforce or human capital resources – the advanced education and training of its brightest youth. All advanced countries of the world have this as their top priority. Data from WIPO, UNESCO, World Bank, Global Competitiveness Index, Global Innovation Index, show a strong positive correlation between GEHE, GERD and economic prosperity, global competitiveness and innovation rankings of nations.

Asian countries such as Japan, South Korean, China, Taiwan, India, Pakistan and ASEAN countries such as Singapore, Thailand, Malaysia, Indonesia, Vietnam have been investing heavily in S&T HCD sending great numbers of their brightest students to the U.S. and Europe for advanced studies. Data on the number of researchers (PhDs and non-PhDs) at present in ASEAN countries, shows the Philippines at 173.6 researchers/FTE per million population (rpmp), Thailand at 1,790.2 rpmp, and Vietnam at 756.7 rpmp. Notably, Thailand is far more advanced than the Philippines in agricultural productivity and food

security, and GDP per capita is significantly higher than the Philippines. Linked inextricably to the pipeline of tertiary and postgraduate education and S&T R&D is basic primary and secondary education for which Filipino children and youth are lagging way behind the Vietnamese in literacy and numeracy skills and competencies based on data from PIRLS, TIMSS and PISA. There is an urgent need to upgrade and address serious problems in the education system of Filipino children and youth.

The challenge in the Philippines is to directly link the creation of S&T knowledge and innovation with commercialization and economic prosperity. This can be met if successful models of such linkages found in foreign countries in Asia and Europe can be followed. There are Taiwan universities patterned after technological universities in Germany, where large innovation hubs are built within the university, and MS and PhD graduates are directly hired by major industries such as the semiconductor industry. In the Fraunhofer model of a public-private partnership for applied research in business innovation in Germany, the link between scientific research and entrepreneurial growth is very close and well-structured. Every euro of public expenditure invested yields 3-4 euros in GDP. In Taiwan, Japan and South Korea, science start-up and industrial parks are located near universities, and start-up labs are found within universities. Expertise in corporate and cooperative farming, organization and bargaining by farming association groups, development of agricultural crops, and farming, livestock and fisheries through AI-driven mechanization and other efficient technologies at every stage of the production process, can be learned from Taiwan, Denmark, and the Netherlands, where among the wealthiest sectors of society are farmers and fisherfolk.

The most innovative centers in the world are found in the United States, i.e., MIT-Harvard nexus and Silicon Valley-Stanford-UC System nexus. Small Business Innovation Research (SBIR) grants to researchers

are a major investment in innovation of the U.S. government which has yielded numerous commercialization success stories. The explosive growth of the biotechnology industry from the nascent stage in the last decades is attributed in large part to SBIRs. Successful cases of engagement of leading private U.S. universities with universities in foreign countries are well documented, e.g., NYU Genomics Institute in Abu Dhabi, UAE led by world-renowned Filipino plant genomics expert Michael Purugganan, PhD. Singapore's investment in the MIT SMART group in Singapore eventually led to the establishment of the highly successful Singapore University of Technology and Design (SUTD) currently graduating hundreds of engineers annually, with SUTD topping MIT's list of emerging engineering schools. New intellectual property (IP) regimes in some U.S. research institutes and Australian universities of outright sale of IP to industry without attachment of royalty have spurred commercialization and generated significant revenues for universities which in turn continue to receive more research funding from the government. This demonstrates a direct link between R&D and innovation and economic growth and prosperity.

Postgraduate studies programs can be modelled after those in Humboldt Institutes in Germany, RIKEN in Japan and Academia Sinica in Taiwan done in partnership with universities. For recruitment and support for scholars for foreign postgraduate studies and ensuring their return and reintegration to the sending country, there are successful models of Australian scholarship programs that can be adopted.

CONCEPT OF THIS PROPOSAL:

Build an Industry-focused innovation workforce and institute anchored on deep science as basis for advanced engineering and innovation of products, processes and systems for commercialization by industries; establish an ecosystem that removes barriers to innovation.

Component 1: Industry-oriented Master's and PhD Foreign Studies Program

1. Implement a massive Master's and PhD education and training program of the brightest Filipino youth under expert mentors in leading foreign universities to produce world-class Filipino experts in advanced technologies and high-level innovation in priority industry areas of development; establish a rigorous, targeted recruitment and competitive selection process for teams of scholars, not individuals, who will pursue complementary or interdisciplinary studies required for priority industry areas; secure the terms of the scholarship, providing highly attractive incentives, including work placement to ensure their return and reintegration into MSMEs and large industries, research and innovation institutes and universities in their regions of origin; provide SBIR (small business innovation research) grants managed by the proposed Philippine Advanced Technology Innovation Institute for Industry (PATIII) described below.

Component 2: The Philippine Advanced Technology Innovation Institute for Industry (PATIII):

2. Build infrastructure for a new independent Philippine Advanced Technology Innovation Institute for Industry (PATIII) with state-of-the-art R&D facilities and S&T expert human resources, IN PHASES; focused on the priority industry areas of development,

involving the use of local natural resources to produce higher value-added products for export as well as for local consumption; in a PEZA Zone/R&D Park, i.e., to remove disabling bureaucratic procedures of procurement and hiring, and to provide internationally competitive salaries and incentives to the PATIII S&T workforce; strategically and centrally located, e.g., in Central Luzon, where there is a growing concentration of local and foreign manufacturing industry locators delivering high quality products both for the export and local markets.

3. Recruit and relocate a critical mass of complete, foreign-based expert research teams, of Filipino and/or foreign nationality, instead of individuals, in the identified priority industry areas; provide internationally competitive compensation and incentives, to serve as the frontline operational workforce of PATIII; recruit Rigoberto Advincula, PhD, a world-renowned Filipino materials scientist-engineer and research mentor, also with innovation management expertise, with strong links to local and foreign industries, as PATIII leader to serve as a strong magnet for world-class research teams to relocate to PATIII.

4. Offer research-based Master's and PhD degree programs and postdoctoral fellowships in partnership with leading universities with strengths in technology and engineering, such as De La Salle University, Mapua University, Technological Institute of the Philippines, UP Engineering, Batangas State University, Bataan Peninsula State University; implement a hybrid model of online courses on concepts and principles and live hands-on training on experimentation and instrumentation, and conduct of thesis and dissertation research focused on industry problems; where postgraduate students are integrated into PATIII research groups consisting of senior investigators, senior and junior researchers, and postdoctoral fellows. Engagement with private universities

which have expressed interest in this concept note would constitute the first level of Public-Private Partnerships (PPPs) of this program.

5. Embark on advanced technology and innovation projects aligned with the priorities of the Philippine Development Plan and the Asian Development Bank, namely: agricultural productivity and food security, in the context of climate change and environmental sustainability; establishing agricultural biotechnology and industrial parks that provide models for corporate farming and fisheries, that can be adapted to the surrounding region and other parts of the country, with an end in view to alleviating poverty, hunger, malnutrition and mental disabilities in poor, far-flung communities, and significantly increasing the GDP per capita in the agriculture, livestock and fisheries sectors in the regions.

6. Pursue advanced technology and cutting-edge innovation projects in the fundamental research fields of energy, electronics and ICT/AI engineering, and metallurgical and materials engineering, adding high value to extracted Philippine natural resources, which would serve as underlying critical technologies to support the growth and ensure the long-term sustainability of agricultural and other manufacturing industries.

7. Create new social innovation paradigms to pursue a unique, holistic approach to the development of Philippine regional communities (to satisfy simple aspirations of *matatag, maginhawa at panatag na buhay*) and undertake technology-empowering training for people-centered, regional-level governance and management of large industries linked to local supply chains with MSMEs and cooperatives, and with local and foreign markets through digital and material/real connectivity; prioritize production of high-quality, high-value niche exports

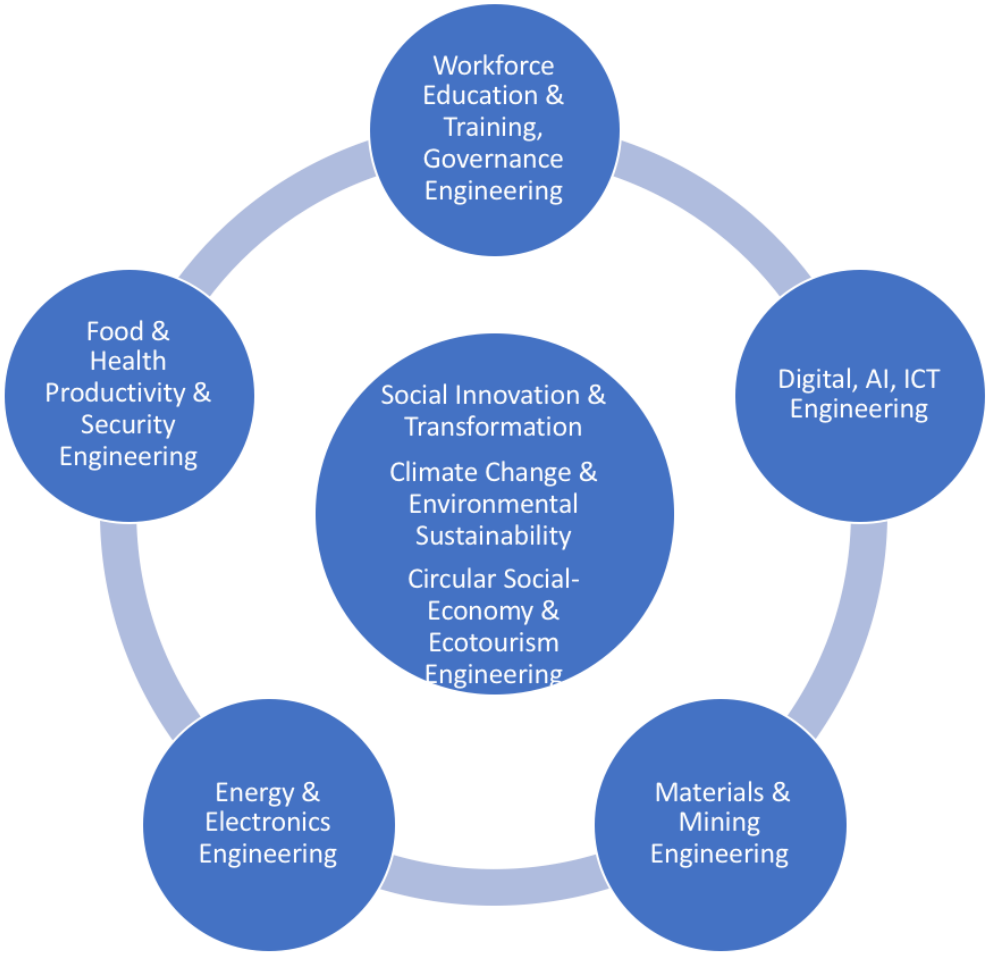
produced in large quantities by large industries and MSMEs from a region, and at the same time balance out to provide for local consumption, ensuring self-sufficiency in food and other products for local communities.

8. Integrate the above supply chain innovation with a plan to develop a culturally and environmentally sustainable, efficient circular social economy, focused on waste reduction and recycling, aimed at net zero carbon emissions through increased use of renewable energy; anchored on the creation of a nationwide niche-based creative ecotourism industry (with unique ethnic-cultural-historical-biodiversity-food-health niches in various localities, using technological innovations to help preserve Culture and Nature and create ecotourism niches of high international standards) that would satisfy discriminating local and foreign tourists.

9. Engage in contractual research and consultancies with MSMEs and large industries, also government agencies including LGUs; PATIII would provide innovative solutions to problems, and new products, processes and systems prototypes to these stakeholders; implement a new intellectual property (IP) regime where the IP for innovative output developed at PATIII can be sold to or developed in partnership with industry, and this would then generate substantial revenues for PATIII.

10. Manage, monitor, evaluate projects according to key performance productivity indicators and outcomes; benchmark would be significant increases in GDP per capita of marginalized sectors (poverty alleviation) directly impacted by the PATIII technologies, GDP per MSME sector and GDP per large industry sector (moving to middle- to upper-income country category).

CONCEPTUAL FRAMEWORK OF PHILIPPINE ADVANCED TECHNOLOGY INNOVATION INSTITUTE FOR INDUSTRY (PATIII)



PHILIPPINE TECHNOLOGY INNOVATION INSTITUTE (PTII) Seed and Expansion Plan