Transactions National Academy of Science & Technology Philippines
ISSN 0115-8848 (print)
ISSN 2815-2042 (online)

Vol. 40 No. 2 (2018)
doi.org/10.57043/transnastphl.2018.1086

Building the Philippine Innovation and Entrepreneurship Ecosystem for Poverty Reduction and Economic Transformation

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ABSTRACT

While the Philippine economy had at an average rate of 6.4 percent from 2010 to 2017, with manufacturing and services growing at 7.6 percent and 6.7 percent respectively, the performance of agriculture, fisheries, and forestry had an average growth of only 1.4 percent during the same period. Since most of the regions are dependent on agriculture, fisheries, and forestry, regional economic imbalances have continued to persist, along with poverty, unemployment, and underemployment. To sustain a high level and inclusive growth, the government has started to implement a growth model where a modern industrial sector plays a key role in generating investment and employment. This new industrial policy known as Inclusive Innovation Industrial Strategy or i^3S, has innovation at its heart, and aims to grow and develop globally competitive and innovative industries with strong forward and backward linkages. The strategy focuses on three major areas: creating an innovation and entrepreneurship ecosystem, removing obstacles to growth to build industry clusters, and strengthening domestic supply and value chains to deepen the country's participation in global and regional value chains and networks. The strategies and recommendations include: (a) development of human capital towards innovation and entrepreneurship; (b) strong government-academe-industry linkages; (c) enabling program and policy environment to accelerate innovation; (d) an entrepreneurship culture and support programs for start-ups, micro, small, and medium enterprises (MSMEs); (e) creation of funding & finance programs to incentivize innovation; and (f) growth and development of industry clusters. It is hoped that the Inclusive Filipinnovation and Entrepreneurship Roadmap will be able to activate innovation and entrepreneurship as the main levers to reduce if not completely eliminate poverty in the country.

Keywords:
Inclusive Innovation Industrial Strategy (i^3S), competition-innovation, entrepreneurship-productivity

Citation: Aldaba RM. 2018. Building the Philippine innovation and entrepreneurship ecosystem for poverty reduction and economic transformation. Transactions NAST PHL 40 (2): doi.org/10.57043/transnastphl.2018.1086

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Plenary paper presented during the 40th Annual Scientific Meeting (July 2018) of the National Academy of Science and Technology Philippines.

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INTRODUCTION

The Philippine economy has been growing at an average rate of 6.4 percent from 2010 to 2017. Although it slowed down during the first half of 2018, the economic outlook has remained positive given the country's strong macroeconomic fundamentals. Manufacturing has continued to be one of the important growth drivers, posting an average growth of 7.6 percent during the 2010-2017 period while services grew by 6.7 percent on the average. The manufacturing resurgence that the country is experiencing has been attributed to its growing domestic market, growing middle class, low and stable wages, abundant, young, highly trainable, English-speaking workforce, and rising costs in China.

The performance of the agriculture, fishery, and forestry has remained lackluster, lagging behind services and industry with an average growth of only 1.4 percent from 2010 to 2017. Since most of the regions are dependent on agriculture, fishing, and forestry, regional economic imbalances have continued to persist, along with poverty, unemployment, and underemployment. The Autonomous Region of Muslim Mindanao (ARMM) has the highest poverty incidence at 54 percent, followed by CARAGA and Eastern Visayas at 39 percent, SOCCSKSARGEN and Northern Mindanao at 37 percent, Bicol (36 percent), and Zamboanga (34 percent).

To sustain a high level and inclusive growth, the government is implementing a growth model where a modern industrial sector plays a key role in generating investment and employment. Innovation is at the heart of the new industrial policy known as Inclusive Innovation Industrial Strategy or i^3S, which aims to grow and develop globally competitive and innovative industries with strong forward and backward linkages (Figure 1). The strategy focuses on three major areas: creating an innovation and entrepreneurship ecosystem; removing obstacles to growth to build industry clusters; and strengthening domestic supply and value chains to deepen our participation in global and regional value chains and networks. The implementation of the strategy relies on strong government-industry-academe collaboration, with the government acting as main coordinator and facilitator in addressing the most binding constraints that prevent industries from growing. Central to the new industrial policy framework is the process of competition-innovation and entrepreneurship-productivity that serve as channels through which investments, employment, and growth are generated.

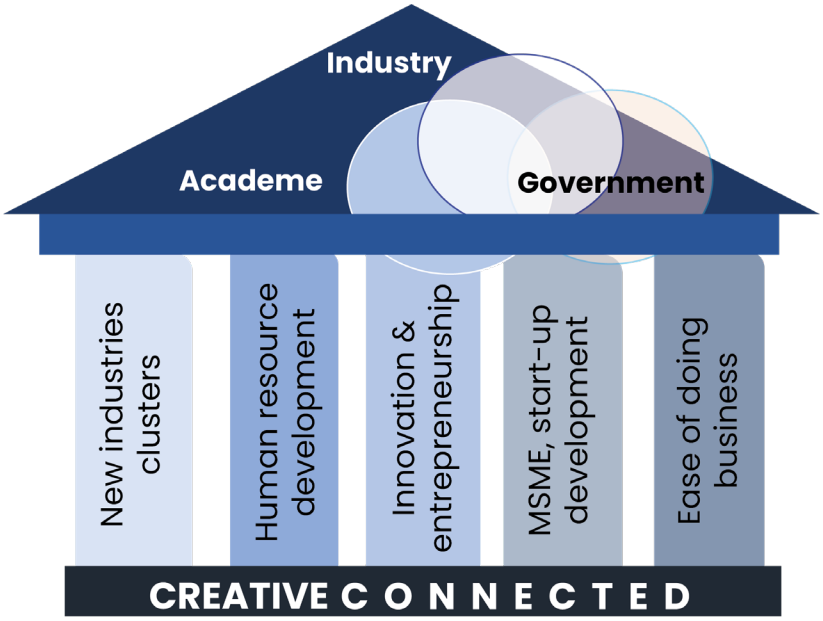

Figure 1. Inclusive Innovation Industrial Strategy or i3S Major Pillars.

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The industry priorities of the i[3]S cover electrical and electronics, automotive, aerospace parts and maintenance, repair and overhaul of aircraft, IT-Business Process Management (IT-BPM), E-commerce, tool and die, iron and steel, chemicals, agribusiness, shipbuilding, garments, furniture, creative industry, construction, transport and logistics, tourism, innovation, research and development (R&D) activities, climate change, and parts and components supply development (Figure 2). These industries were selected based on a discovery process that assessed the industries' strengths, weaknesses, and growth opportunities and their contribution to the following objectives that are crucial for economic transformation: technology upgrading, promotion of innovation, closing of the infrastructure gap, addressing of regional imbalances, generation of more and better jobs, sustainability, creation of spill-over and multiplier effects, and strengthening of supply and value chain linkages.

Innovation is at the heart of the Philippine i[3]S. Thus, the main objective of this paper is to assess our innovation and entrepreneurship ecosystem and recommend effective innovation strategies and policies. The analysis looks at the different elements of the ecosystem and their interaction using innovation studies and indicators from various sources. A total of 12 consultation workshops and focus group discussions with 1,038 participants were conducted in seven key cities covering Manila, Angeles, Legazpi, Cebu, Davao, and Cagayan de Oro from 2017 to 2018. The innovation strategy and policy recommendations are crucial towards making our industries more innovative and globally competitive, providing solutions to societal and industry issues and challenges, supporting economic transformation, and leapfrogging to industrialization.

Figure 2. Priority Activities and Industries.

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AN ASSESSMENT OF THE INNOVATION AND ENTREPRENEURSHIP ECOSYSTEM

Innovation refers to a wider perspective that covers the implementation of new or significantly improved products, services, or processes, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD 2007) in response to problems, challenges, or opportunities arising in the social and economic environment. Such innovation is the result of new combinations of existing knowledge, capabilities, and resources, and is regarded as inclusive because it can lead to economic transformation both in the developed and underdeveloped areas in the country. In addition, innovation involves both low-tech and high-tech activities, and can occur across all industries, both in public and private sectors. Innovation may not necessarily mean *"new to the world"*, but can also refer to something that is new to producers or users. It does not have to be disruptive, like a product that makes use of artificial intelligence or robotics, but it may be an incremental improvement or upgrading of a process or product, like making more energy-efficient motors or engines.

Innovation policy focuses not only on the creation of new solutions or inventions but also on their exploitation and diffusion, including the many feedbacks that occur between the various phases of the innovation process. Given the emphasis on the entire innovation cycle and adoption and subsequent commercialization, the approach integrates the importance of connecting innovation with entrepreneurship, building an inclusive innovation and entrepreneurship ecosystem, and creating an environment that is conducive to innovation and enabling and supporting the active engagement and interaction of the different players and stakeholders. The approach emphasizes a market-oriented research policy with a focus on the promotion not only of R&D but also the commercialization and diffusion of these R&D investments. The ultimate goal of the country's innovation and entrepreneurship policy is to reduce, if not completely eliminate, poverty in the country. With the right policy framework and innovation-centered strategies and programs, domestic firms and industries can address the challenges, take advantage of market opportunities arising from new technologies and serve as an engine for sustainable growth, job creation, and poverty reduction especially in regions and rural areas where poverty incidence remains persistently high.

The elements of the innovation and entrepreneurship ecosystem include universities and research institutions, companies, government innovation agencies, funding and finance sources, services providers, regulatory framework and infrastructure, culture, markets, education and training, support mechanisms, and human capital and workforce. In the Philippines, the ecosystem players include large multinational companies, micro, small, and medium enterprises (MSMEs) and startups, industry associations, universities as research partners and developers of future workforce, and key government agencies like the Department of Trade and Industry (DTI), Department of Science and Technology (DOST), Commission on Higher Education (CHED), Department of Education (DepEd), Department of Agriculture (DA), National Economic and Development Authority (NEDA), and Department of Information Communication and Technology (DICT). These stakeholders should interact to create and transfer knowledge that would enable new products and new business models to catalyze economic transformation and development.

Figure 3 presents a framework developed by RTI on the innovation and entrepreneurship ecosystem and the inherent linkages between the stakeholders. It builds on the following interrelated blocks: elements of human capital, research and knowledge creation, knowledge transfer, intellectual property (IP), and a collaboration infrastructure. The health and development of the ecosystem requires the connections between the knowledge economy (driven by research) and the commercial economy (driven by the marketplace) and it is in this intersection that the Philippines, like most countries, is facing difficult challenges (RTI 2017).

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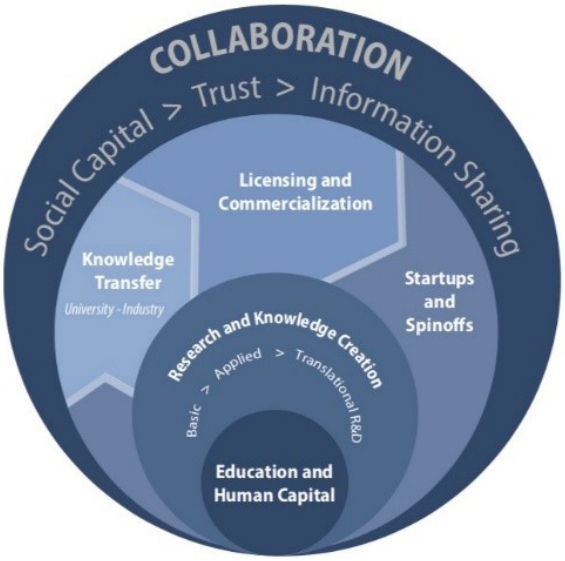

Research and knowledge creation (basic, applied, translational activities) stem from a strong core of education and human capital. For the ecosystem to function, new knowledge must be transferred into commercial applications. The paths to commercial use are:

- direct service agreements where universities provide direct assistance to commercial clients on discrete tasks
- commercialization through licensing where the IP rights are transferred to an outside organization for further development
- spin-offs and start-ups that transition IP to small firms

The elements of the ecosystem function only in an atmosphere of collaboration, which is dependent on social capital, trust, and information sharing (RTI 2017).

Figure 3. Innovation and Entrepreneurship Ecosystem. Source: RTI 2016 and 2017.

Currently, the Philippines has a low level of innovation (Figure 4). The country ranks 73rd of 126 countries in the latest Global Innovation Index (GII 2018: xxi) behind Malaysia, Thailand, and Vietnam. Moreover, compared to our neighbors, our ranking has not changed significantly in the last three years.

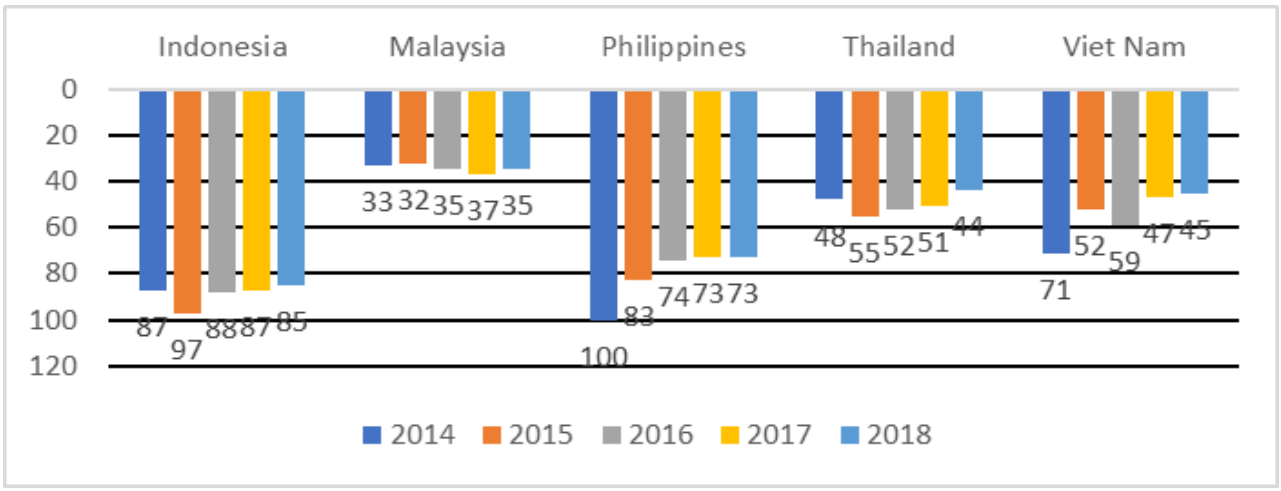

Figure 4. Global Innovation Rankings of Selected Southeast Asian Countries, 2014-2018. Source: GII, various years.

The GII Report indicated that the areas where the Philippines has been consistently weak are in ease of doing business, government operating expenditures in education, government expenditure per pupil ((% Gross Domestic Product (GDP)/capita)), pupil-teacher ratio, and Gross Expenditure on Research and Development (GERD, % of GDP), and ease of protecting minority investors.

In the last four years, GERD in the national budget has not reached 0.1 percent of GDP (Table 1). The United Nations Educational Scientific and Cultural Organization's (UNESCO) recommendation is to allocate at least 1 percent of GDP for R&D support.

Comparative data on R&D expenditure shows that the Philippines is investing far less than other countries on activities that drive innovation (Figure

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Table 1. Philippine Expenditure for R&D.

	2014	2015	2016	2017
Total Government Budget	2,019,062,065	2,414,640,618	2,682,814,855	3,350,000,000
GERD	11,004,493	10,977,253	10,511,248	12,255,388
R&D Econ Affairs, DOST	4,497,742	3,663,423	4,312,008	5,257,940
GERD as % of Total Budget	0.55	0.45	0.39	0.37
GERD as % of GDP	**0.09**	**0.08**	**0.07**	**0.08**

Source: Department of Budget and Management.

5). Front runners of innovation like Korea, Japan, Israel, China, and Singapore allot a considerable part of their budget on R&D, while neighbors Thailand and Vietnam also invest much in R&D.

The Philippines also lacks the manpower needed to support innovation and commercialization activities. Along with Vietnam, it exhibits low availability of scientists and engineers, in comparison with countries like Indonesia, Malaysia, Japan, Israel, and Singapore (Figure 6).

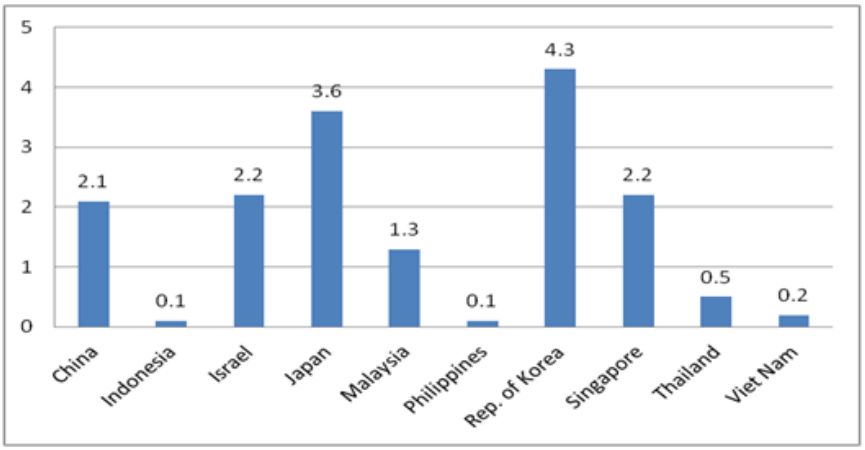

Figure 5. R&D expenditures (% GDP). Source: WEF Readiness for the Future of Production Report 2018.

Correspondingly, data from UNESCO shows that total R&D personnel in the Philippines is very miniscule in comparison with innovation leader

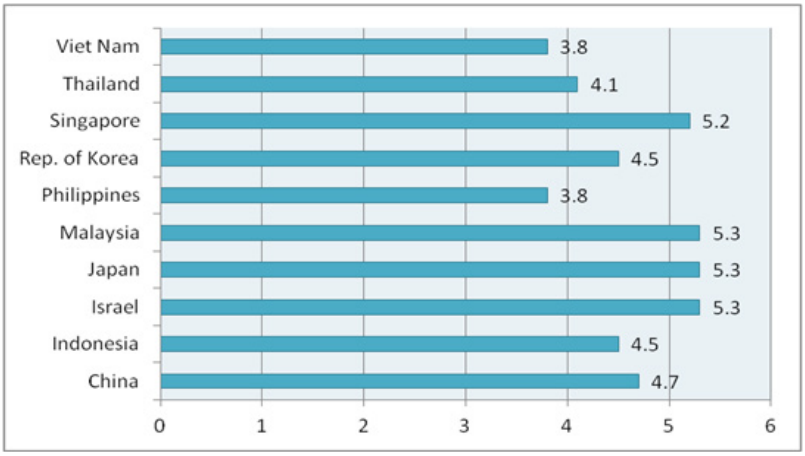

Figure 6. Availability of Scientists and Engineers. Source: WEF Readiness for the Future of Production Report 2018; 1-7 best; weighted average.

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countries like Korea, Singapore, and Japan (Table 2). This goes to show that base support for innovation and commercialization remains comparatively weak in the Philippines.

Likewise, the Philippines does not fare well in terms of research productivity. The country's ratio of scientific and technical publications relative to GDP is around 1.6, while Thailand and Vietnam produce

Table 2. Total R&D Personnel per Thousand Total Employments (FTE) 2013.

China	4.619
Japan	13.768
Philippines	0.671
Republic of Korea	15.998
Singapore	13.994
Viet Nam	1.494

Source: UNESCO Institute for Statistics.

more than three times of this value (6.5 and 5.6 respectively) (Figure 7). The research productivity of Israel, Korea, and Singapore is notably high. It also appears that Malaysia (12.3) is catching up with China (14.1) and Japan (15.1).

Patent applications are also low, even when compared with other Asian countries like Malaysia or Thailand. Data in Figure 8 refers to the average number of patent applications for the period of 2012-2014, divided by the average population of

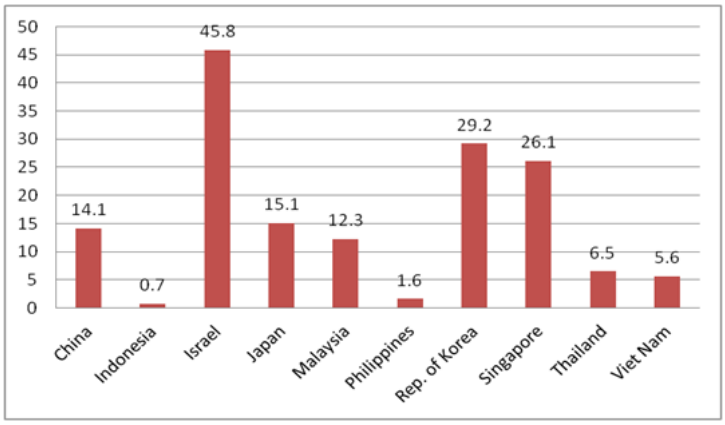

Figure 7. Scientific and technical publications (number per Billion PPP$ GDP). Source: WEF Readiness for the Future of Production Report 2018.

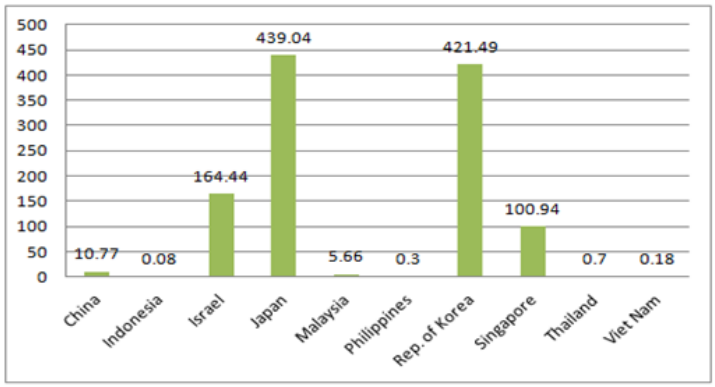

Figure 8. Patent Applications (applications/million population). Source: WEF Readiness for the Future of Production Report 2018.

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the same period. [Patent application data are from five major five (IP%) offices namely: the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), and the United States Patent and Trademark Office (USPTO).]

The data imply that incentives for research productivity must be improved; and there should be a balance between the incentives for basic and applied research such that university faculties would also be willing to engage in collaboration with businesses/industries and pursue commercialization of their research outputs, instead of solely focusing on journal publications.

Over the years, the country's score and ranking on the university-industry collaboration in R&D[1] indicator of the Global Competitiveness Index has not improved as much as desired (Figure 9).

Studies and stakeholder consultations have shown that linkages between industry and academe in the Philippines remain weak (STRIDE 2014). Universities generally do not see research collaboration as part of its core mission as opposed to teaching and publishing journal articles. Faculties have a sense of aversion towards consulting services or work for hire due to issues with Intellectual Property (IP) ownership. To exacerbate these issues, financial gains from academe-industry collaboration do not accrue quickly to faculty members, who are highly taxed, and are relatively small when compared with the financial gains from independent consulting arrangements. Conversely, there are prevailing perceptions from industry that dealing with the academe is too complicated. The lack of legally sanctioned payment mechanism for financial contributions also erodes the interest of companies to support government-funded research. The academe's desire for full control of IP and their lack

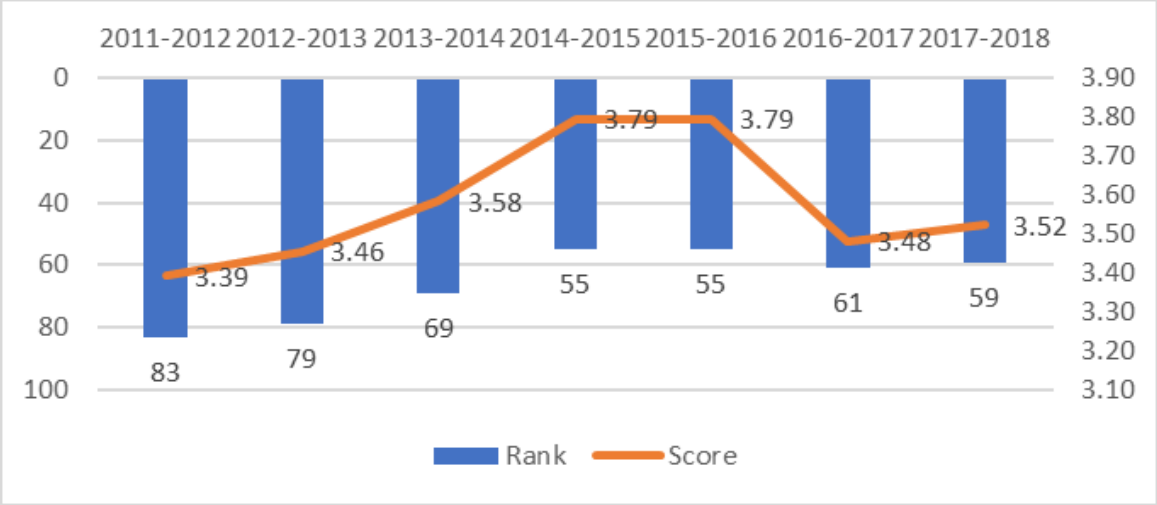

Figure 9. University-Industry Collaboration, PH Score and Rank. Source: Global Competitiveness Report, various years.

of familiarity and trust on legal mechanisms for licensing likewise discourages companies to pursue such collaboration. Overall, the academe-industry environment in the Philippines is characterized more by competition rather than collaboration. This limits the commercialization of potentially useful research outputs and seriously impacts the overall innovation performance of the country.

Philippine universities generally remain detached from problems as signaled by the market and often fail to appreciate the importance of

[1] In your country, to what extent do business and universities collaborate on research and development (R&D)? [1 = do not collaborate at all; 7 = collaborate extensively] | 2016–17 weighted average

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commercialization. Some institutions are also unable to respond timely to the commercialization intent of some businesses because of their onerous processes or the lack of mechanism to deal with such. University researchers also do not consider commercialization as part of their core mission because their performances are evaluated based on the number of their research publications.

Research activities in universities usually do not end up being commercialized due to the lack of personnel with the capability to deal with technology transfer and commercialization. Researchers also need to be acquainted with business plans, conducting market research and feasibility studies, and valuing technology because these are sometimes part of the requirements for IP filing. Additionally, financial constraints limit the commercialization of university technologies because IP management entails high transaction cost and consumes much time due to the complexity of the process and requirements.

It is also important to note that there is limited awareness of and clarity about government policies and programs for R&D. Some researchers who tried to avail did not qualify or did not choose to take advantage of such programs because they saw it as restrictive (e.g., limited to specific industries, repayment conditions) or that the process to access it is arduous and complex (STRIDE 2017: 32).

[Note: The rules and guidelines on government procurement (Republic Act No. 9184) cover State Universities and Colleges (SUCs) and the state-funded research activities conducted by its faculty and researchers. Republic Act 9184, otherwise known as the Government Procurement Act, prescribes the necessary rules and regulations for the modernization, standardization, and regulation of the procurement activities of the Philippine government. (Source: http://www.officialgazette.gov.ph/images/uploads/20160826-IRR-RA-9184-procurement-reform.pdf)]

Problems arise when administrative requirements, including complex procedures, hinder the timely purchase of research equipment or consumables, thereby reducing research productivity and slowing commercialization (STRIDE 2014). Such inefficiencies disincentivize researchers and require urgent appropriate reforms.

REGIONAL INCLUSIVE INNOVATION CENTERS TO BRIDGE THE GAPS AND BUILD CONNECTED CREATIVE COMMUNITIES

To address the weak innovation performance of the Philippines, connecting and integrating the elements and stakeholders of our innovation and entrepreneurship ecosystem would be crucial. Our vision is to close this gap by linking the stakeholders together through the creation of Regional Inclusive Innovation Centers or (RIICs) in different parts of the country (Figure 10).

These RIICs are envisioned as being at the core of Philippine economic transformation and serving as the linchpin of productive collaborations between and among industries, universities, government agencies, LGUs, start-ups, MSME's, R&D laboratories, S&T parks, incubators, fab labs, investors, among many other local players. Moreover, the centers serve as platforms for DTI's i3S, which aims at growing innovative and globally competitive manufacturing, agriculture, and services, while strengthening their linkages into domestic and global value chains.

In the end, the RIICs will constitute a network of creative communities in various regions of the country, propelled by innovative and entrepreneurial Filipinos, who are driven by their desire to do things better, provide solutions, make better products, and address market demands. They will be nurtured by the collaboration of government, industry, and education/academia through policies, programs, and projects that continuously develop human capital; ensure access to funding and other sources of financing; and provide the needed support mechanisms and services for commercialization. All of these activities, interactions, and partnerships will be fostered in an environment in which institutions, infrastructure, IP rights system, culture, and customers enable more and better innovation and entrepreneurship throughout the country.

STRATEGIES AND RECOMMENDATIONS

In order to achieve the overall vision of creating an inclusive innovation and entrepreneurship

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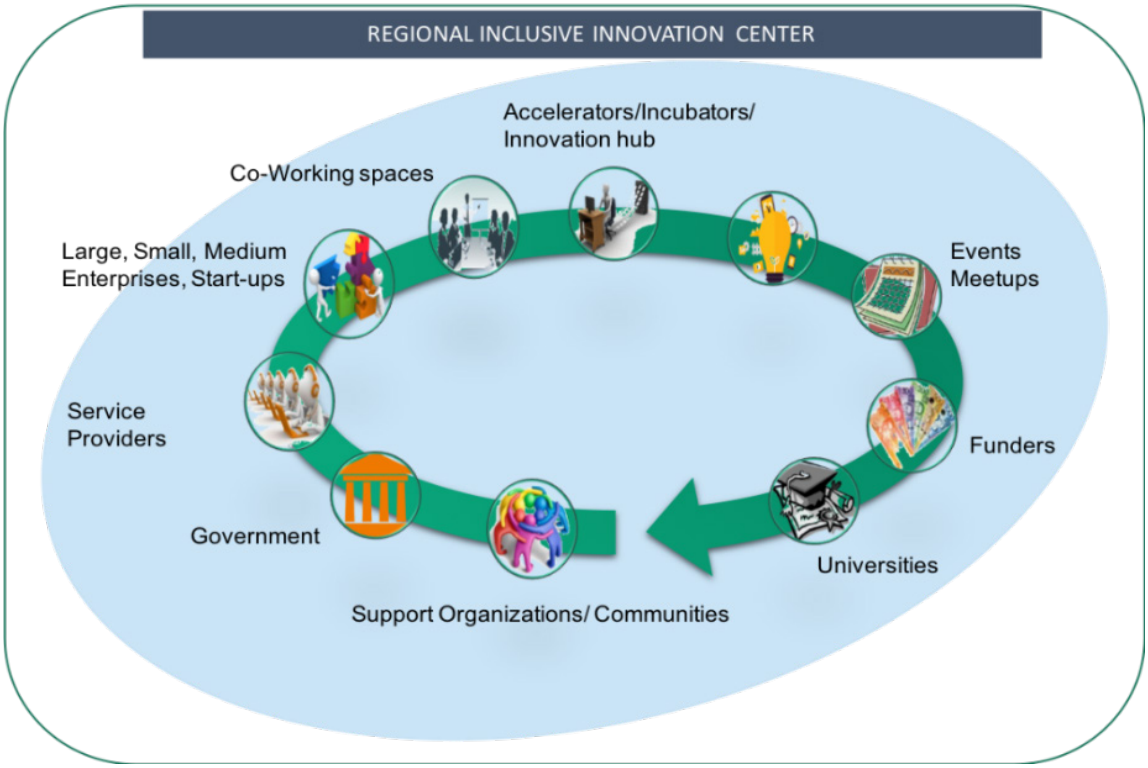

Figure 10. Regional Inclusive Innovation Center (RIIC).

ecosystem, the following government-led strategies and recommendations are proposed vis-à-vis the key elements of the ecosystem: 1) Development of Human Capital Towards Innovation and Entrepreneurship; 2) Strong Government-Academe-Industry Linkages; 3) An Enabling Program and Policy Environment to Accelerate Innovation; 4) An Entrepreneurship Culture and Support Programs for MSMEs; 5) Creation of Funding & Finance Programs to Incentivize Innovation; and 6) Growth and Development of Industry Clusters. The more specific recommendations are discussed below:

1. *Development of Human Capital Towards Innovation and Entrepreneurship*

Human capital is the engine of innovation and entrepreneurship. It fuels knowledge production, spurs revisions to innovations, catalyzes incremental innovations, identifies and develops new enterprises and business opportunities, facilitates technology adoption, and leads the diffusion or transfer of knowledge to another generation of skilled workers which then accrues to enhanced human and social capital.

The success of this inclusive innovation-entrepreneurship dynamic is anchored on the composition and agility of human capital— the set of skills, competencies, and attributes that reflect both technical competence and the so-called 'generic skills' such as problem solving, creativity, teamwork, and communication skills, learning to learn, motivation, discipline, self-confidence, self-awareness, networking, and capacity to embrace change.

The role of "Philippine education," then, in developing a culture of innovation and entrepreneurship will have to start in the formative years, from pre-Kindergarten to 12th Grade and seamlessly progressing to tertiary and higher education. The government's three education agencies, i.e., DepEd, Technical Education and Skills Development Authority (TESDA), and CHED will need to design integrative programs and curricula

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that can effectively produce Filipino lifelong learners who possess the knowledge, competencies, values, and attitudes needed for them to succeed in the world of work, develop innovative solutions to key societal issues, or transform these innovations into economic goods. In this regard, the following initiatives are recommended:

- Use DepEd's review of the K-12 curriculum as a window of opportunity to reconfigure the building blocks to innovation and entrepreneurship, including greater attention to Science, Technology, Engineering, Agro-Fisheries, and Mathematics (STEAM) education in basic education;
- TESDA may support local MSMEs, startups, and industries of specific regions through dynamic and customized technical-vocational (techvoc) programs that can produce the human capital needed in these local enterprises;
- TESDA may offer or accredit private providers that offer re-skilling and upskilling courses (e.g., coding, data analytics, leadership, entrepreneurship, risk taking, teamwork, etc.) to produce knowledge workers/professionals in the new knowledge economy; and
- CHED may support the reconfiguration of performance metrics of teaching, research and extension excellence to include faculty immersion in industry, inviting industry leaders as guest university lecturers and resource persons; it could also promote inclusion of market-driven research and university-industry research collaboration.

2. *Strong Government-Academe-Industry Linkages*

The triple helix of government, academe, and industry collaboration serves the pursuit of knowledge production and designing solutions (innovation), as well as value-creation and commercialization (entrepreneurship). Two key areas of action have been identified to optimize this collaboration: 1) curricular development, re-engineering and reforms in the undergraduate and post-graduate curricula and 2) research and extension engagements with industry. To create a culture of dialogue between academe and industry, the following teaching and learning programs and activities are recommended:

- Organize student-faculty visits and dialogue with local entrepreneurs or leaders of industry;
- Engage local entrepreneurs or leaders of industry as guest lecturers in classes or as conference speakers;
- Strengthen student internship programs that serve as platforms to provide students with industry-relevant knowledge and competencies;
- Use local success stories on innovation and technopreneurship as real-life examples;
- Hold in-service trainings and seminars on innovation and entrepreneurship for faculty;
- Establish university programs that encourage cross-pollination of courses to prepare students for the collaborative and multi-perspective nature of innovation and entrepreneurship;
- Include technopreneurship in all programs and coursework;
- Initiate curricular reforms to address job mismatch and cater the needs of the emerging industries in the regions;
- Use Design Thinking modules through electives that introduce technology-based modules;
- Conduct campus information caravans to promote innovation and entrepreneurship among university administrators, staff, faculty, students, parents, and alumni; and
- Actively participate in the activities in the proposed RIICs.

Research collaboration between academe and industry is another important area that can advance innovation and entrepreneurship through the following mechanisms:

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- Craft new metrics of performance excellence that recognize and reward faculty research engagement with industry and the inclusion of entrepreneurship and community engagements as new metrics of extension;
- Establish university research groups and centers that cater to the needs of the local community and industry;
- Introduce faculty-researchers to the value of solutions-driven and market-driven research as well as the process of business development, customer discovery and customer development;
- Train faculty-researchers on the methods of market studies, market segmentation, and analyses;
- Establish pathways for university publications and patents to be translated into industry solutions or to pass on university researches to industry for implementation;
- Include innovation and entrepreneurship in the existing R&D consortia of universities;
- Encourage faculty-researchers to be actively engaged in the Regional Filipinnovation and Entrepreneurship Hubs as resource persons;
- Establish and fund university office, technoparks, hubs, or centers focusing on entrepreneurship, innovation, and technology and business incubation; and
- Establish common Fabrication Labs/Hubs that are based on local industry needs.

3. *Enabling Program and Policy Environment to Accelerate Innovation*

The Philippines has made significant strides in creating the program and policy environment that is conducive to innovation particularly in the areas of technology transfer and commercialization and support for start-ups.

- Strengthen our young IP system to facilitate the commercialization process;
- Support the passage of the proposed Philippine Innovation Act[2] and Innovative Startups Act[3] as these will be significant milestones in the country's efforts to boost innovation and entrepreneurship;
- Strengthen the implementation of the Technology Transfer Act;
- Capacitate SUCs/Higher Education Institutions (HEIs) to establish pathways for university publications and patents to be translated into industry solutions or to pass on university researches to industry for adoption;
- Provide support and assistance to facilitate the process of IP filing and management; and
- Simplify and reduce the cost of IP filing.

4. *An Entrepreneurship Culture and Support Programs for Startups, Micro, Small, and Medium Enterprises (MSMEs)*

The Philippines must place greater emphasis on creating a culture of entrepreneurship through the following:

- Strengthen and expand one-stop-shops for MSMEs that provide services including but not limited to certification, licensing, capability training, production, and marketing of products/services. Services can be expanded to provide financial consulting, and linkage with financial institutions and hubs that can provide creative and design services and transform their knowledge into successful products and services;

[2] Senate Bill no. 1355, or the Philippine Innovation Act, aims to generate and scale up action in all levels and areas of education, training, research and development towards promoting innovation and internationalization activities of MSMEs as driver of sustainable and inclusive growth (Source: https://www.senate.gov.ph/lisdata/2544021952!.pdf).

[3] Senate Bill no. 1532, or the Innovative Startup Act, seeks to support innovative startups through financial subsidies like tax breaks and grants, easier business registration procedures, and technical assistance and training programs (Source: https://www.senate.gov.ph/lisdata/2639522697!.pdf).

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- Foster greater cooperation among actors in the MSME support network (i.e., incubators, accelerators, small business development centers, and export assistance centers) by deepening and strengthening their involvement and engagement with stakeholders, including industry experts;
- Establish regional startup offices or hubs that can serve as a platform for MSMEs to connect and network with industry experts as well as function as business incubator for the stakeholders in the regions;
- Build and/or strengthen MSME partnerships with industry and academe for mentorship programs for innovation and technology-related training programs and activities;
- Provide incentives to MSMEs that innovate and undertake R&D initiatives;
- Create an investment environment that encourages more private sector participation to include angel investors, venture capital and crowd fund-sourcing;
- Strengthen programs that provide financing to commercially-viable projects to bridge the gap between commercialization and R&D.

Central as well to developing an entrepreneurship culture is the pivotal role of education. There ought to be synergistic programs and activities at the basic, tertiary, and higher education levels to support appreciation of entrepreneurship, acquisition of entrepreneurial and 21st century/lifelong learning skills and promotion of venture creation as a career opportunity.

5. *Creation of Funding & Finance Programs to Incentivize Innovation*

It is critical for innovators and entrepreneurs to have adequate financial resources as they move forward in commercializing their ideas and products. These will include public funding (such as grants, microcredit, tax incentives) and private sources of finance (such as equity financing, venture capital). The appropriate form of funding/financing for a particular stage of innovative/entrepreneurial activity (seed, startup, early-stage, expansion) should be made accessible and interventions in order to make these available must be carried out.

- Increase GERD until it reaches the UNESCO benchmark of 1% of GDP;
- Formulate incentives for innovation and R&D;
- Review requirements and procedures for availing of government funds for R&D in order to ease access by MSMEs and researchers; and
- Provide information on finding sources of financing, qualifying for these, and sustaining capital flow.

6. *Growth and Development of Industry Clusters*

The Regional Inclusive Innovation Centers (RIICs) are expected to drive and support the growth of industry clusters. Industry clusters combine the strengths of entities into a collective, helping spur development and accelerate economic growth. Clusters provide benefits such as maximization of capacity as they share R&D, hard and soft infrastructure and human resources. They also attract expertise and local suppliers; ensure the top export products while sustaining revenues; attract new investments and encourage local expansion and creation of start-ups; promote horizontal collaboration and strategic partnerships and enhance productivity as firms get specialized inputs, skills, unique information, knowledge and technology.

Table 3 provides potential clusters of priority industries in regions across the country. The success of each of the clusters is heavily dependent on the shared or common infrastructure, including physical and human resources, and other key players such as local government units, investors, financial institutions, suppliers of services, and universities, among many others.

The more specific industry cluster activities are given in Figures 11a and 11b. In electronics, for instance, upgrading would need more investments in R&D, advanced products and technologies, auto electronics, aerospace electronics, batteries, and

Transactions NAST PHL 40 No. 2 (2018)
doi.org/10.57043/transnastphl.2018.1086

consumer electronics. In automotive, the direction is towards the manufacture of advance driver assistance system or ADAS parts and components, engineering services outsourcing, automatic transmission, sensors, motors including metal casting, forging, and machining products, electric motor powertrains, batteries, and E-vehicles.

WAY FORWARD: ROADMAP IMPLEMENTATION

The Memorandum of Understanding (MoU) signed between the DTI and DOST in June 2017 will be expanded to include NEDA, DepEd, CHED, DA, and DICT, as part of the whole-of- government approach in building the ecosystem. The goal is to revive and reconstitute the Filipinnovation Council,

Table 3: Potential Industries by Region.

Region	**Priority Industries**
NCR	IT-BPM, E-commerce
CAR	coffee, processed vegetables, aerospace, electronics, tourism
Region 1	coffee, cacao, processed fruits, processed meat, tourism
Region 2	processed fruits, processed meat, coffee, furniture, cacao, agribusiness
Region 3	bamboo, furniture, aerospace, processed meat, shipbuilding
Region 4A	auto and auto parts, electronics, petrochemical, IT-BPM, chemicals, aerospace
Region 4B	seaweed, tablea, rubber, coco coir, tourism
Region 5	metal casting, coco coir, health care, agribusiness
Region 6	processed meat, processed shrimp, tourism
Region 7	seaweed/carrageenan, dried mangoes, furniture, IT-BPM, shipbuilding, tourism
Region 8	processed meat, copper, processed marine, processed fruits, natural health, agri-business
Region 9	rubber & rubber products, coconut & coconut products, fish & fish products, mango & mango products, seaweed & seaweed products
Region 10	rubber, bamboo, cacao, coco coir, coffee, agribusiness, tourism
Region 11	processed meat, seaweed/carrageenan, cacao/ tablea, agribusiness, tourism
Region 12	rubber, palm oil, processed fish/aquamarine, tourism, agribusiness
Region 13	processed marine, palm oil, rubber, agribusiness
ARMM	coffee, rubber, cacao, palm oil, agribusiness

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doi.org/10.57043/transnastphl.2018.1086

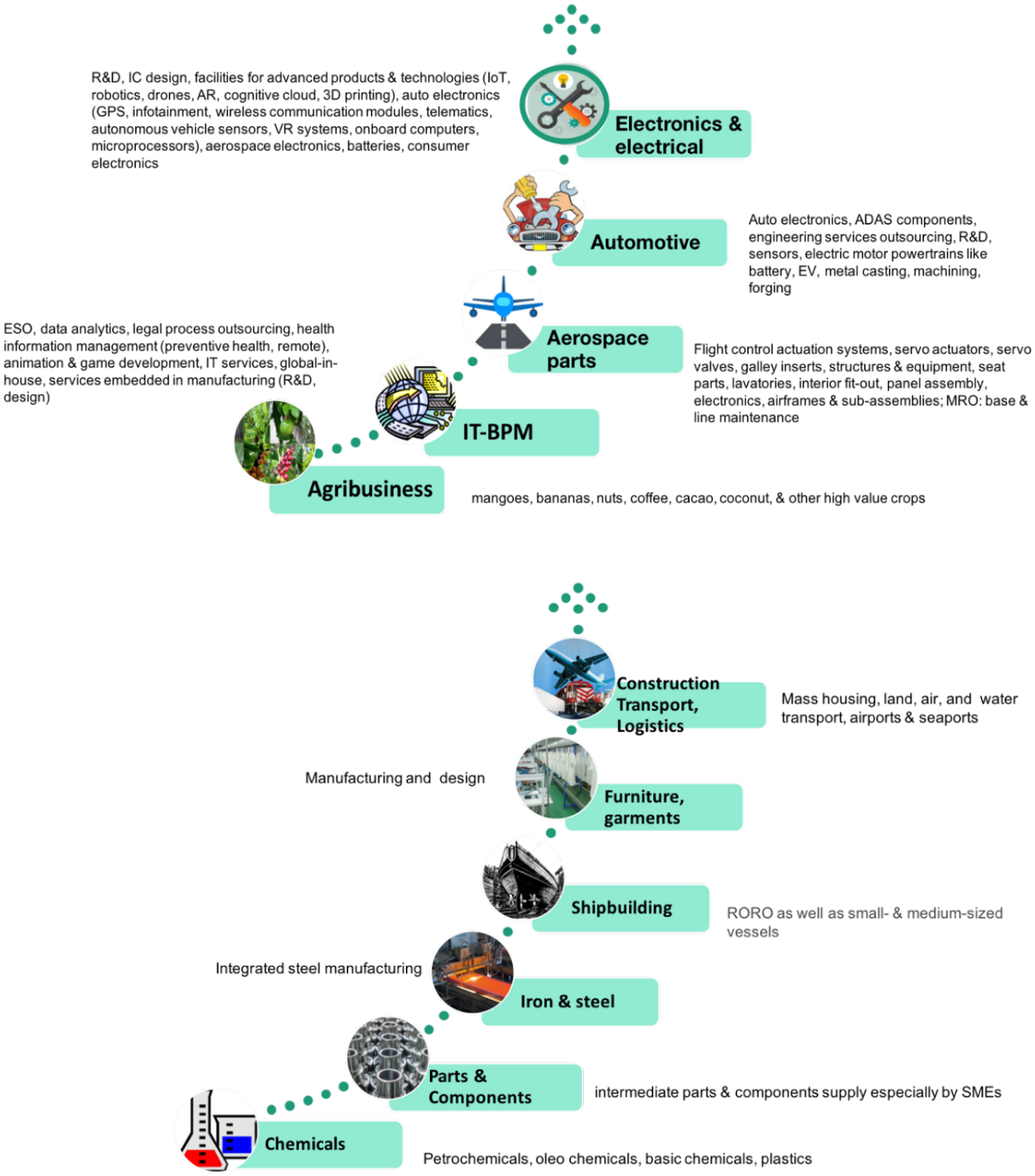

Figure 11. Upgrading Trajectories and Industry Clusters (a) From agribusiness to electronics and electrical; (b) from chemicals to constructions, transport, and logistics.

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doi.org/10.57043/transnastphl.2018.1086

to be composed of concerned national government agencies and representatives from industry and education/academia, which will serve as the central coordinating mechanism on innovation and entrepreneurship policies, strategies, and programs/projects in the country.

Together, the member-agencies of the Council will coordinate their innovation and entrepreneurship-related policies, strategies, and programs/projects in order to avoid duplication, harmonize strategies, and maximize resources. Towards this end, a central data portal containing information on major government-funded research projects will be developed. Table 4 summarizes the strategies and identifies the assignments and responsibilities of the different stakeholders in implementing the Roadmap.

The ultimate goal of the Inclusive Filipinnovation and Entrepreneurship Roadmap is to activate innovation and entrepreneurship as the main levers to reduce if not completely eliminate poverty in the country. Conceivably, by institutionalizing the right policy framework and implementing innovation-centered strategies and programs, domestic firms and industries can address the challenges and take advantage of market opportunities arising from Industry 4.0 technologies and serve as an engine for sustainable growth, job creation, and poverty reduction.

Table 4: Major Tasks and Responsibilities in Implementing the Innovation Roadmap.

Elements	**Who will be responsible**	**Recommendations/Strategies**
Development of Human Capital Towards Innovation and Entrepreneurship	DepEd, TESDA, and CHED	• Promote STEAM across all levels • Curricular development and reforms across all levels • Infuse 21st century skills sets across all levels • Build local champions, advocates, influencers and leaders of innovation and entrepreneurship
Strong Government-Academe-Industry-Linkages	NEDA, DOST, DTI, DA, CHED, DICT, DILG, LGUs, universities & colleges, large enterprises/start-ups/MSMEs	• Strengthen current government initiatives • Knowledge-centers based in SUCs/HEIs • Faculty industry immersion incentives • Encourage market-driven research in universities • Research database • Establish SUCs/HEIs as centers for excellence in innovation and entrepreneurship • Strengthening of Regional Development Councils - S&T & Innovation
An Enabling Program and Policy Environment to Accelerate Innovation	NEDA, DOST, DTI, DA, IPOPHIL, CHED, DILG, DBM, SUCs/HEIs	• Key innovation-related policies, legislation, & their alignment • Inter-government convergence • Agile policy infrastructure within SUCs/HEIs • Funding scheme/mechanism bill for R&D projects • IP system promotion and utilization
An Entrepreneurship Culture and Support Programs for Micro, Small, and Medium Enterprises (MSMEs)	DTI, DOST, DA, DILG	• Entrepreneurial culture • One-stop-shop for MSMEs • MSMEs and startup capacity building programs • Regional startup offices

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Creation of Funding & Finance Programs to Incentivize Innovation	DBM, DOF	• Specialized and efficient funding schemes • Increase in R&D allocation • Information dissemination
An Enabling Environment to Support the Growth and Development of Industry Clusters	DTI, DA, NEDA, DILG/ LGUs	• Products/services online inventory • Regional Innovation Centers Creation • Convergence between government-industry-academe • Incubation hubs and concrete quality standards

ACKNOWLEDGMENT

The author is grateful to the following for the research support provided in crafting the Inclusive Filipinnovation and Entrepreneurship Roadmap: Dr. Francis Quimba, Dr. Kris Francisco, Dr. Napoleon Juanillo, Jr., Dr. Richard Abendan, Mr. Richard Umali, and the Department of Trade and Industry - Bureau of Trade and Industrial Policy Research staff.

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