

14 Vigorously Advancing Science, Technology, and Innovation



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The Science, Technology, and Innovation (STI) sector has already been faced with issues that have prevented it from reaching its full potential even before the COVID-19 pandemic. Nonetheless, several reforms to drive the STI sector towards greater advancement were instituted, as a result of the increased collaboration of STI stakeholders. Among these are the Philippine Innovation Act, Philippine Startup Act, Philippine Space Act, and the *Balik Scientist Act*.

With the emergence of COVID-19, there is a need to advance STI that contributes to the attainment of a healthy and resilient Philippines. This will include the rollout of technologies that will help address the pandemic. Moreover, the procurement process of STI programs, projects, and activities (PPAs) will be reviewed and refined for timely implementation and greater impact. Various government support services for startups and micro, small, and medium enterprises (MSMEs) will also be ramped up to help them become more innovative and resilient in times of crisis. The establishment of the National Innovation Council (NIC), which is seen to guide the country towards long-term STI development, will also be fast-tracked.

Assessment and Challenges

Assessment. The linkages among the players in the STI ecosystem remain limited despite some significant strengthening of collaboration among the government, academe, and industry in the past year. Furthermore, the problem of slow commercialization of outputs of STI activities and its underutilization persist. This may be partly due to the absence of a vibrant intellectual property (IP) culture brought about by issues in IP ownership, lack of a legally-sanctioned payment mechanism for financial contributions and familiarity on

legal mechanisms, costly development of IPs, long processing time of IPs, among others. Other challenges include inadequate research and development (R&D) infrastructure, especially in the regions, and slow implementation of STI projects, due to procurement concerns and complex administrative requirements.

The country also continued to underinvest in R&D¹ and there is also low level of awareness on the results of R&D activities and the government's support

¹ Based on the latest available data from the Department of Science and Technology - Planning and Evaluation Service (DOST-PES) (as of January 2019), the Philippines' overall R&D expenditure slightly grew to 0.16 percent of Gross Domestic Product (GDP) in 2015 from 0.14 percent in 2013. However, this still reflects low R&D expenditure relative to the country's Association of Southeast Asian Nations (ASEAN) peers. This is also way below the 1 percent R&D spending share to GDP benchmark for developing countries recommended by the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

mechanisms to help firms become more innovative. Information dissemination campaigns, particularly on available technologies, remain inadequate and fragmented.² With these, many sectors still do not recognize, appreciate, and understand the use of technology and science-based information in their daily activities, which is exacerbated by the dwindling interest in science among the youth, inaccessible scientific information, and the lack of a conducive environment to develop an STI culture.

Based on the World Economic Forum (WEF) Readiness for the Future of Production Report 2018, the Philippines is not yet prepared to manage the Fourth Industrial Revolution (FIRE), as manifested in its weak performance across the drivers of production, which include technology and innovation, human capital, global trade and investment, institutional framework, sustainable resources, and demand environment, among others.³ For instance, the number of the country's researchers for every one million population declined to 200 in 2015 from 270 in 2013. This is also lower than the United Nations Educational, Scientific, and Cultural Organization (UNESCO) norm of 380 per million population and the East Asia and the Pacific average of 1,020 researchers per million population. In monitoring the performance of the STI ecosystem, the existing data on STI are still not enough to keep track and monitor the sector's progress and performance.

Challenges. The adverse spillovers of the prolonged pandemic to the economic sector could bring about a reduction of available resources for STI since the government will now be more focused on addressing the most immediate concerns. However, this is also the opportune time to further strengthen

and provide more resources to STI, as science-based methods and solutions will be needed more than ever in the new normal to curtail, mitigate, and respond to emerging challenges and potential catastrophes whether man-made or natural. The health sector, in particular, will be among the major gainers in this advancement of the sciences in the country.

There will be increased interest in using advances in biology and medical science in the new normal. Similar to the development of COVID-19 testing kits by local scientists, there will be greater efforts to find ways to manage pandemic situations via STI. Among these are means by which mass testing can be facilitated, including the design and manufacture of medical equipment that can aid in the treatment of patients, such as ventilators, among others. Moreover, the demand for health-related technologies (i.e., sanitation booths, contact-tracing applications, and other researches related to the treatment or response to the pandemic) is seen to increase. As companies, schools, and government agencies implement work from home arrangements, the use of digital technology will rise significantly. In addition, online business transactions and digital payments will increasingly become a necessity rather than convenience. All these need to be supported by a reliable digital infrastructure system with strong cybersecurity protection. In the production sector, there will be increased demand for automation and digitalization to supplement manual labor in the immediate term. Over the medium term, automated and digitalized processes may substitute for labor.

² Fatima Lourdes E. Del Prado and Maureen Ann D. Rosellon, "Technology and Knowledge Transfers in Production Networks: Case Study on Philippine Food Manufacturing Firms," Discussion Paper Series No. 2017-08, Philippine Institute for Development Studies (PIDS), March 2017.

³ As the study defined, "production" involves a broad spectrum of economic activities related to manufacturing products and goods. A full end-to-end appraisal of what it entails reveals the following sequence: Design-Source-Manufacture-Assemble-Distribute-Service-End of Use-Cycle. On the other hand, "readiness" is generally regarded as the ability to capitalize on future production opportunities, mitigate risks and challenges, and be resilient and agile in responding to unknown future shocks.

Targets

Table 14.1 shows the indicators and medium-term targets for each major outcome under this chapter. However, these indicators are limited only to those that have available data. The increase in STI application in agriculture, industry, services, and health sectors will be measured based on the increase in the expenditure and in the number of intellectual property products that have been registered and filed. In the same way, the investments in STI-based startups, enterprises, and spin-offs will be assessed based on the World Intellectual Property Organization (WIPO) - Investment Index percentile rank of the country and the number of technology business incubators (TBI) graduates and innovation hubs (e.g., TBIs, innovation centers, niche centers, etc.) established. The creative capacity for knowledge and technology

generation, acquisition, and adoption will be gauged based on the country's WIPO - Knowledge and Technology Outputs percentile rank of the country, R&D expenditure as a proportion of gross domestic product (GDP), number of researchers per million population, number of Science, Technology, Engineering, and Mathematics (STEM) enrollees and graduates in higher education institutes (HEIs), and the number of *Balik* Scientists engaged. Likewise, the strength of the open collaboration among actors in the STI ecosystem will be determined based on the WIPO University-Industry Collaboration percentile rank and the number of collaborations among the HEIs, industries, and the government.

Table 14.1 Updated Plan Targets to Vigorously Advance Science, Technology, and Innovation

INDICATOR	BASELINE VALUE (YEAR)	TARGETS			
		2020	2021	2022	END OF PLAN
Sector Outcome 1: Scale-up technology adoption					
Subsector Outcome: STI application in agriculture, industry, services, and health sectors increased					
Proportion of intellectual property products expenditures to GDP increased (%) ^{b/}	0.46 (2016) ^{a/}	Increasing	Increasing	Increasing	Increasing
Number of Filipino patents granted increased (incremental) ^{a/}	30 (2016)	38 ^{**}	30 ^{***}	38 ^{***}	38 ^{***}
Number of Filipino utility models registered increased (incremental) ^{a/}	552 (2016)	727 ^{**}	584 ^{***}	750 ^{***}	750 ^{***}
Number of Filipino industrial designs registered increased (incremental) ^{a/}	508 (2016)	627 ^{**}	494 ^{***}	622 ^{***}	622 ^{***}
Number of Filipino patents filed increased ^{b/}	245 (2016)	348 ^{**}	353 ^{***}	394 ^{***}	394 ^{***}
Number of Filipino utility models filed increased ^{b/}	1,100 (2016)	1,862 ^{**}	1,380 ^{***}	1,848 ^{***}	1,848 ^{***}
Number of Filipino industrial designs filed increased ^{b/}	959 (2016)	910 ^{**}	675 ^{***}	873 ^{***}	873 ^{***}
Number of Filipino patents filed under Patent Cooperation Treaty (PCT) increased ^{b/}	2 (2018)	3	3	4	4

INDICATOR	BASELINE VALUE (YEAR)	TARGETS			
		2020	2021	2022	END OF PLAN
Subsector Outcome: Investments in STI-based start-ups, enterprises, and spin-offs increased					
Global Innovation Index (GII) – Investment Index percentile rank improved ^{d/}	17 (2016)	22	24	25	25
Number of TBI graduates increased (i.e., enterprises and spin-offs) ^{a/}	41 (2016)	Increasing**	230***	270***	1,000***
Number of innovation hubs increased (e.g., TBIs, innovation centers, niche centers, etc.) ^{a/}	23 (2016)	63	108***	128***	128***
Sector Outcome 2: Accelerate Innovation					
Subsector Outcome: Creative capacity for knowledge and technology generation, acquisition, and adoption enhanced					
Overall Global Innovation Index (GII) rank improved ^{c/}	Top 58% (2016)	Top 38%**	Top 35%	Top 33%	Top 33%
GII-Knowledge and Technology Outputs percentile rank improved ^{d/}	66 (2016)	Top 33%	Top 33%	Top 33%	Top 33%
R&D expenditure as a proportion of GDP increased (in percent, incremental) ^{a/}	0.16 (2015)*	0.35	0.40	0.50	0.50
Number of researchers per million population increased (incremental) ^{a/}	200 (2015)*	290	295	300	300
Number of STEM enrollees in HEIs increased (in million, incremental) ^{a/}	1.29 (AY 2015-2016)	1.7	1.59	2.03	2.03
Number of STEM graduates in HEIs increased ^{a/}	183,000 (AY 2015-2016)	50,000	113,000	318,000	318,000
Number of <i>Balik</i> Scientists engaged increased (incremental) ^{a/}	25 (2016)	46**	101***	151***	151***
Subsector Outcome: Open collaboration among actors in the STI ecosystem strengthened					
GII University-Industry Collaboration percentile rank improved ^{d/}	52.5 (2016)	Top 49%	Top 49%	Top 49%	Top 49%
Number of collaborations between HEIs and industries increased (incremental) ^{a/}	70 (2014)	120	130	150	150
Number of collaborations between HEIs and government increased (National Government Agencies [NGA] and LGUs) (incremental) ^{a/}	300 (2015)	450	480	500	500
Number of STI-related international cooperations of HEIs increased (incremental) ^{a/}	40 (2015)	80	95***	100	100

^{a/} Original indicators set/approved in 2016 (<https://neda.gov.ph/pdp-results-matrices/2017-2022/>).

^{b/} Indicators set/approved before the pandemic (abridged version as of March 2020)

^{c/} New indicators set/approved after the March 2020 version.

^{d/} Original indicators set/approved in 2016 but with the terms corrected.

* Revision in baseline data.

**2020 original targets set/approved in 2016/prior to the pandemic retained.

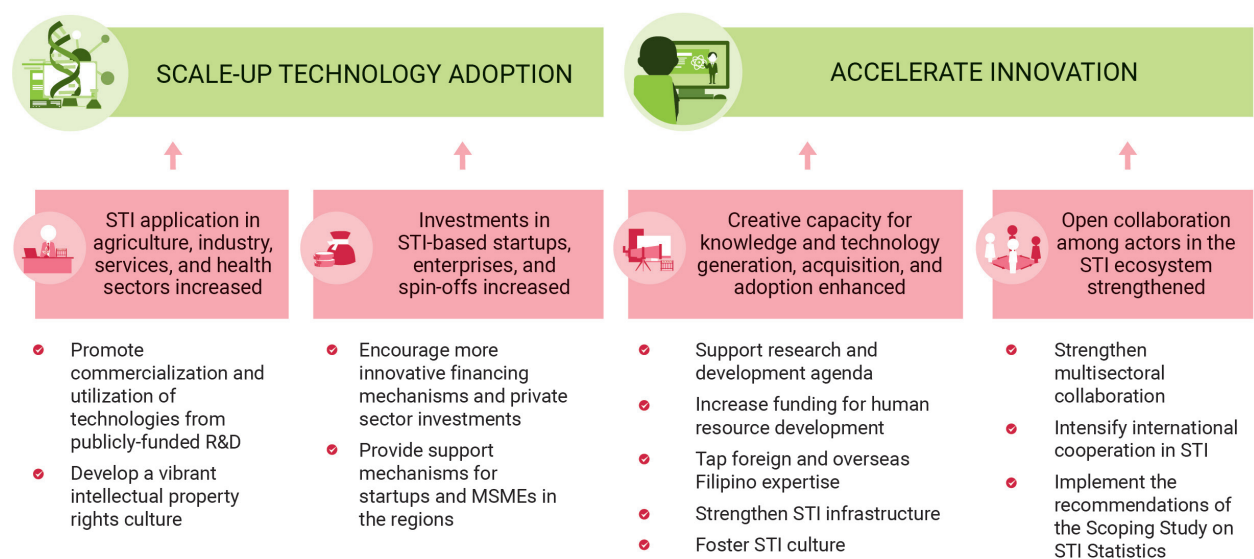
*** Revisions in targets for the remaining years of the Plan period.

Strategic Framework

Many of the strategies under this Chapter were refined to address the problems posed by the pandemic and also considered the existing and anticipated problems of the STI sector. As such, STI is deemed to contribute to the achievement of the overall Philippine Development Plan (PDP) goal of “Healthy and Resilient Philippines” by increasing the country’s growth potential. This will be done by scaling-up technology adoption and accelerating innovation to address the potential challenges ushered in by the new normal. To scale-

up technology adoption, STI application in the agriculture, industry, services, and health sectors, as well as investments in STI-based startups, enterprises and spin-offs, will be increased. These applications primarily cut across PDP Chapters 8, 9, and 10. To accelerate innovation, the creative capacity for knowledge and technology generation, acquisition, and adoption will be enhanced, and open collaboration among actors in the STI ecosystem will be strengthened.

Figure 14.1 Strategic Framework to Vigorously Advance Science, Technology, and Innovation



Strategies

Scaling-up technology adoption

Increasing STI application in agriculture, industry, services, and health sectors

Promote commercialization and utilization of technologies from publicly-funded R&D.

- ***Intensify the rollout of available technologies that can be used during pandemic, state of calamities, emergencies, and the transition to the new normal.*** The government will conduct an inventory for possible scale-up, promotion, and dissemination of available technologies (e.g., technologies for prolonged food shelf-life, possible alternative materials for personal protective equipment, e-vehicles, renewable energy technologies, digital technologies, information-sharing mobile applications and portals, information technology (IT) facilities, telemedicine technologies, COVID-19 tracking and monitoring technologies, contract tracing report system, and disease spread modeling technologies, among others). Shared service facilities and other existing STI support infrastructure will be utilized for mass production. Moreover, the government will incentivize, subsidize, and support researchers and research institutions that will engage in R&D related to development of test kits, medical equipment, vaccines (e.g., COVID-19 vaccine), medicine, and others.
- ***Utilize innovation hubs, business support mechanisms, state universities and colleges (SUCs), private HEIs, and LGUs to promote technologies and government support to innovation activities.*** The government will actively use innovation hubs, online

platforms, support mechanisms to businesses/entrepreneurs (e.g., *Negosyo Centers*), entrepreneurial organizations (e.g., Philippine Chamber of Commerce and Industry), SUCs and HEIs offering business/entrepreneurial courses, offices of LGUs (e.g., city/barangay halls issuing business permits/licenses), and others, as venues to introduce research outputs of the government and the academe that are ready for adoption, as well as the different support services of the government, to startups and MSMEs to help them become more innovative.

- ***Formulate public procurement guidelines for STI PPAs consistent with the Government Procurement Reform Act (GPPRA) (RA 9184).*** The NIC, in coordination with the Government Procurement Policy Board (GPPB), will review and identify problems in the current procurement process for STI PPAs and suggest solutions on how to resolve these constraints. This will entail the issuance of procurement guidelines consistent with RA 9184 that will ensure efficiency, transparency, timeliness, and relevance in the procurement process for STI PPAs (e.g., creation of special/separate procurement process for certain STI projects). This strategy will be prioritized and implemented with urgency, in light of the current pandemic and possible occurrences of disasters, epidemics, and other emergencies.
- ***Operationalize the Filipinnovation Portal.***⁴ The government will fast-track the establishment of the Filipinnovation portal which will serve as a repository of government and academic research and innovation outputs. These research outputs in the portal will be segregated by sector/areas (e.g., farming, fisheries, industrial applications, energy, services, health, construction, food

⁴ The preparation of the Innovation Portal is being supported by the Global Innovation Policy Accelerator. The Global Policy Accelerator program is funded through the United Kingdom government's Newton Fund and delivers executive development to national cohorts of senior policymakers from the main innovation institutions, while strengthening the implementation capabilities of their teams. (<https://www.nesta.org.uk/project/global-innovation-policy-accelerator/>)

production, digital technologies, and national security and defense, among others), for easier reference. The portal will also contain government programs and projects that can be availed to obtain support on innovation activities and scholarship programs. Access to the portal will be free for all Filipinos. Once operational, it will be aggressively promoted to the public and will be regularly monitored and updated, as needed. It will also be integrated and harmonized with the other existing innovation websites of the government such as the Startup Philippines website.

Alongside this, the government will launch an interactive communication strategy or platform where STI results, initiatives, and efforts are highlighted and communicated to Filipinos for their feedback.

- ***Increase public awareness on R&D activities.*** To become more effective in communicating and raising awareness on R&D, investments in promotions and communications will be increased. The government will maximize the use of information and communications technology (ICT)/online platforms in the conduct of technology transfer and commercialization programs, such as science fairs, exhibits, invention contests, and technology transfer days, among others, to help publicize and commercialize the existing technologies from the government, academe, and the industry. Technology promotions under these initiatives will be conducted by sector/area (e.g., agriculture, industry, services, farming, fisheries, industrial applications, energy, services, health, construction, food production, digital technologies, national security, and defense, among others). Face-to-face/physical technology transfer and commercialization programs will still be continued in accordance with appropriate social distancing measures.
- ***Ensure that the transfer or distribution of technologies as a public good will be on a non-exclusive and non-competitive basis.*** To ensure greater access to technologies generated

from publicly-funded R&D, the transfer or distribution of these technologies as a public good will be encouraged. These technologies will be transferred in a non-exclusive and non-competitive manner where no licensing fees, technology fees, and/or royalty will be charged or collected. The provision of free technologies to target users such as farmers, fisherfolk, and small-scale industries, among others intends to upgrade their processes and operations for improved productivity.

Develop a vibrant intellectual property rights culture.

- ***Expand the network of Innovation and Technology Support Offices (ITSOs) and enhance and develop its capacities to do online transactions.*** The Intellectual Property Office of the Philippines (IPOPHL) will continue to establish more ITSOs throughout the country and further enhance the capacities of existing ITSOs to guide innovators/inventors — from IP creation, protection, to commercialization, thus, improving patent applications' performance. In addition, the IPOPHL will capacitate the ITSOs to do their transactions/services online to assist clients (e.g. inventors) remotely.
- ***Streamline and rationalize administrative and registration procedures to remove several barriers to innovation.*** To encourage and improve innovation, the IPOPHL, in coordination with the NIC, will streamline and rationalize administrative and registration procedures. It will also undertake programs to assist MSMEs in the registration of patents, layout designs, registration of trademarks, and geographical indications and other marks of ownership, industrial designs, utility models, and deposit of copyrights. The IPOPHL will develop and provide the necessary IT infrastructure so that bulk of its services, processes, and procedures can be done online. Reforms on these initiatives will be reported to the NIC for effective monitoring and tracking of results. Under the new normal, e-commerce platforms are expected to be on the rise, thus, the

IPOPHL will also strengthen IP enforcement on virtual platforms.

- ***Increase public awareness of the National Intellectual Property Strategy (NIPS) and steer its adoption.*** The NIPS is the government's main action plan in creating a robust intellectual property regime, with strategies proposed for regulation, administration, and enforcement of IP. The envisioned IP system under the NIPS is seen to be more systematic, comprehensive, and effective in delivering reliable service for Philippine creators and innovators. Hence, the IPOPHL, in coordination with the NIC, will conduct various awareness campaigns/programs to promote the NIPS. Furthermore, the IP process (e.g., from application to commercialization) will also be made part of the curriculum in science and engineering courses to increase awareness and encourage participation.

Increasing investments in STI-based startups, enterprises, and spin-offs

Encourage more innovative financing mechanisms and private sector investments.

- ***Institutionalize the implementation of the Science for Change Program (S4CP).*** The government will institutionalize the implementation of the S4CP to advance the proliferation of demand-driven innovation activities that will respond to the demand of the users of technologies. The S4CP seeks to accelerate and expand STI programs in the country and will promote development and industrial competitiveness in the regions through the establishment of R&D centers under the Niche Centers in the Regions for R&D (NICER) program. The R&D Leadership (RDLead) program supports the NICER program through engaging Filipino experts to lead in strengthening research capabilities of HEIs and research and development institutions (RDIs). It is also expected to boost

academe-industry collaborations and industrial competitiveness through the Collaborative R&D to Leverage Philippine Economy (CRADLE) and Business Innovation through S&T (BIST) Programs. The Department of Science and Technology (DOST) recently launched the CRADLE Challenge 2020 inviting HEIs/RDIs to partner with Filipino private companies to formulate solutions that can aid our industries in overcoming the challenge of the new normal.⁵

- ***Establish and expand the funding mechanisms provided under the Philippine Innovation Act and the Innovative Startup Act.*** The government will invest in the growth and development of startup enterprises and partner with the private sector to ensure availability of financing for startups. The Startup Venture Fund and Startup Grant Fund under the Innovative Startup Act as well as the Innovation Fund, Innovation Development Credit and Financing, and Credit Quota under the Philippine Innovation Act will be operationalized towards ease of access by startups and MSMEs. The government will also require financial institutions to dedicate four percent of their available credit for startups and MSMEs, as promulgated under the Philippine Innovation Act. Thus, the formulation of guidelines on both legislation will be fast-tracked.

Provide support mechanisms for startups and MSMEs in the regions.

- ***Fast-track the implementation of the newly-enacted "Innovative Startup Act" (RA 11337).*** The Philippine Startup Development Program will be formulated to provide monetary and operational support to innovative and technology startups. The program will also provide capacity-building and exchange programs, as well as links to potential investors, collaborators, and customers in the Philippines and abroad. In addition, the MSME Innovation

⁵ The CRADLE Challenge has four thematic areas: (a) sustainable supply and logistics, (b) products for the new normal, (c) reinventing the workplace, and (d) services that transcend boundaries. The developed research outputs are aimed to advance the innovativeness and competitiveness of local Filipino companies and ultimately help jumpstart the Philippine economy.

Development Program will be mobilized to enable government agencies to work hand in hand with private organizations and academic institutions to provide technical and/or financial support programs for the development training of entrepreneurs. A regulatory sandbox⁶ approach will be used by the government for unimpeded roll out of startup technologies.

- ***Bolster government support to MSMEs and startups to enhance their innovation activities.***

This will be done through programs, such as the Small Enterprise Technology Upgrading Program (SETUP) 2.0, "OneExpert, OneLab", Shared Services Facilities, *Kapatid* Mentor Me, "One Town, One Product", and TBI 4.0. To advance innovation and facilitate efficient operation of MSMEs, the services of the Food Innovation Centers (FICs) will be upgraded from product prototyping or pilot-scale processing into toll processing. Pending the operationalization of the Filipinnovation portal, the Startup Philippines website will provide a centralized platform for news and information on government startup support programs and networking and learning opportunities, as well as a one-stop-shop for startup registration and support program applications.

- ***Continue reconfiguring the Department of Trade and Industry's (DTI) lineup of programs and projects available for startups and MSMEs in response to the COVID-19 pandemic.***

In response to the pandemic, the DTI will reconfigure its lineup of projects and programs to make it compatible to the minimum public health standards under the new normal. The establishment of Regional Inclusive Innovation Centers (RIICs) will be continued and replicated in other key areas around the

country (e.g., Batangas City [CALABARZON], Iloilo [Region 6], and Zamboanga [Region 9]). These programs include, but are not limited to, capacity-building activities for eligible and qualified startups or MSMEs affected by the pandemic, funding assistance/credit programs, and matching needs of MSMEs with startup solutions providers.

- ***Expand innovation/business support mechanisms to include online presence.*** Some services of the innovation hubs and TBIs, innovation centers, among others, will be conducted online (e.g., mentoring, training, and consultancy services), if applicable, to comply with social distancing measures. Furthermore, these innovation support mechanisms will also promote their services online to entice beneficiaries. Government agencies with existing online portals on business support mechanisms will be enhanced and strengthened.

The IPOPHL will also conduct training online through webinars such as the Learn, Be Empowered, Adopt, and Profit from IP (LEAP IP) Webinar Project and expand its online payment options for clients.

Accelerating innovation

Enhancing creative capacity for knowledge and technology generation, acquisition, and adoption

Support research and development agenda.

- ***Formulate the National Innovation Agenda Strategy Document (NIASD).*** The government, through the NIC, will craft the NIASD that will establish the country's vision and long-term goals for innovation, consistent with global and regional commitments and with *AmBisyon Natin 2040* and the PDP. This document will also provide a roadmap consisting of strategies and action plans for improving innovation governance (e.g., identifying and addressing the absorptive capacities of government agencies doing R&D).

⁶ A regulatory approach, typically summarized in writing and published, that allows live, time-bound testing of innovations under a regulator's oversight. Novel financial products, technologies, and business models can be tested under a set of rules, supervision requirements, and appropriate safeguards. A regulatory sandbox also creates a conducive and contained space where incumbents and challengers experiment with innovations at the edge or even outside of the existing regulatory framework. (UNSGSA, Briefing on Regulatory Sandboxes.)

The NIASD will contain innovation priority areas (e.g., food security, sustainable agriculture and natural resources, blue economy, education, vocational training, health, renewable energy, climate change and disaster resilience, resource efficiencies, traditional knowledge, traditional cultural expressions, genetic resources, infrastructure, governance, human capital, digital economy, transportation services, security and defense, and others as may be deemed relevant by the NIC), the strategies to be used to realize these priorities, and for which resources and budget will be provided.

In relation, the government will support the conduct of long-term STI foresight studies and development of evidenced-based planning framework to complement the NIASD, taking into consideration the whole STI ecosystem. Increasing capacities on planning tools such as foresight techniques will also be pursued.

- ***Establish relevance criteria and Research, Development, and Extension (RD&E) themes under the new normal.*** The government, guided by the country's innovation agenda and development goals, will develop RD&E themes. These themes will be adopted in the RD&E programs of concerned agencies which will ensure that a higher level of mission orientation in publicly-funded research is observed. A "relevance criteria" will also be applied by the agencies concerned, in the selection of RD&E programs or projects for funding. The relevance criteria will take into consideration the development thrusts and priorities of various regions in the country to ensure alignment (e.g., research areas needed to cope with the COVID-19 pandemic and the new normal). The government will likewise conduct an inventory of academic or educational and RD&E institutions, as well as their resources and capacities to undertake RD&E programs and projects. The inventory will serve as a reference when deciding the allocation of public funds for these purposes. The research areas under the Harmonized National Research and Development Agenda 2017-2022 will be

expanded and aligned with RD&E themes of the government. This will be complemented by sustained and aggressive capacity-building activities particularly for R&D institutions in the regions to spur regional R&D that addresses local concerns, expands opportunities for growth, and brings about significant changes in the regional STI landscape. Additional sources of funding for RD&E will also be identified (e.g., Department of Energy [DOE] unutilized fund and Malampaya).

- ***Conduct R&D studies on renewable energy technologies.*** The government will explore and conduct R&D studies on renewable energy technologies, including the viability of new technologies to expand the share of renewables in the energy supply mix to fuel the country's industrialization and urbanization, while simultaneously being mindful of its environmental responsibility. Moreover, the government will promote an innovation culture that supports new and emerging renewable technologies, as well as innovative business models in the renewable energy industry (see Chapter 19).
- ***Intensify the conduct of R&D through public-private partnership (PPP).*** The NIC will intensify the undertaking of PPP on R&D, including innovation, to encourage the private sector to deepen their R&D activities while at the same time accelerating the public sector's efforts. This will help the government tap more resources, avoid financial and procurement issues, and allow inflows of complementary private sector resources and expertise.
- ***Strengthen monitoring and evaluation system for all STI-related programs and projects.*** Monitoring and evaluation (M&E) mechanisms for RD&E, including impact assessment, will be enhanced to ensure the attainment of targeted outputs and intended outcomes as well as improve process performance. Adoption of the M&E Protocol prepared by the DOST for the STI community will also be encouraged.

- **Operationalize the Philippine Space Agency and implement the Philippine Space Development and Utilization Policy.** With the signing into law of the Philippine Space Act (RA 11363), the government has established the Philippine Space Agency and the Philippine Space Development and Utilization Policy to enable the country to reap the benefits of the development and use of space technologies (e.g., agribusiness, environmental conservation, national security and defense, telemedicine, infrastructure monitoring, urban planning, transportation and communication, and disaster management). This will also provide the Philippines a wider platform to contribute to regional efforts on hazard management and climate studies, space research and development, space industry capacity building, space education and awareness, and international cooperation.
- **Formulate a Human Resource Development (HRD) Plan for researchers in higher education.** This is to ensure that policies in HEIs especially in government-funded institutions provide incentives for research and mentoring. This will entail providing opportunities for aspiring researchers to get startup support, setting policies to make research rewarding (e.g., deloading, compensation, and peer recognition), and ensuring that research outputs are supported for patenting and commercialization within the institution. The plan will be inclusive, allowing small niche institutions to participate and develop their capability to ensure that research capacity is distributed not just in major urban centers of the country. In addition, the plan will also take into consideration the needs of the regions and ensure that research manpower is responsive to those needs.

Moreover, the national budget circular guidelines for promoting faculty members in SUCs and institutions supervised by the Technical Education and Skills Development Authority (TESDA) will be revisited regularly to ensure that those who are engaged in RD&E and innovation, under the Philippine Innovation Act, are given the proper recognition and commensurate points.

- **Accelerate efforts to prepare for the emerging Fourth Industrial Revolution (FIRe) landscape.** The government, through the NIC, will identify the priority frontier technologies⁷ that are relevant to the country's development setting and incorporate these in the RD&E themes that will be developed by the government. The NIC will also provide support (e.g., training programs to build new skills) to those that will be adversely affected (e.g., workers) by the emergence of the FIRe. Accelerating curriculum development related to FIRe and its approval by the Commission on Higher Education (CHED) will also be critical. The Department of Trade and Industry (DTI) - Competitiveness and Innovation Group will continue the implementation of its programs related to the absorption of industry 4.0 technologies and startup development.

Increase funding for HRD.

- **Expand the provision of scholarship programs.** The government will continue and expand the provision of scholarship programs such as the Expanded Specialized Science Secondary Education Scholarships, Expanded Undergraduate Science and Technology (S&T) Scholarships for Inclusive Development, and Expanded S&T Graduate (Masters/ Ph.D.) Scholarships, among others to further encourage students to pursue STI courses.

⁷ There is no universally-agreed definition for frontier technology. However, there is a recurring common feature across the different technological advances and that they all "have the potential to disrupt the status quo, alter the way people live and work, rearrange value pools, and lead to entirely new products and services." (UN-ESCAP, Frontier Technologies for Sustainable Development in Asia and the Pacific, 2018.). Some examples of frontier technologies are nanotechnology, artificial intelligence, internet-of- things, bioprinting, big data, blockchain, robotics, neurotechnology, synthetic biology, and others.

Moreover, the government will implement changes to the STEM curriculum⁸ and include life-long learning skills development to enable workers to respond to the requirements of the FIRE. This will be complemented by an intensive information drive to further increase the number of scholarship applicants. Government officials' leadership capacities for innovation will also be enhanced by conducting regular training programs/management seminars that will enable the government to lead relevant stakeholders (e.g., industries and academe) towards becoming innovative (*see Chapter 10*).

- **Expand the implementation of entrepreneurship-related courses to engineering and the other allied disciplines.** Technopreneurship courses (e.g., Technopreneurship 101) will be scaled up to expose undergraduate engineering students to the entrepreneurial mindset and the fundamentals of entrepreneurship. As such, it will be spread out to more HEIs throughout the country to increase their appreciation of STI and entrepreneurship, thereby increasing the utilization of technologies and innovation. Development of support programs will also be provided to ensure engineering graduates take on entrepreneurship as a career option.
- **Expand digital skills development programs for government employees and public school teachers.** The DICT, in support of the DepEd, the CHED, and the TESDA, will assist in the provision of teacher training opportunities related to digital literacy, cybersecurity, and other digital skills. The DICT will also contribute to the government's efforts towards digital transformation through the conduct of digital skills development programs for government employees and the deployment of Chief Information Officers (CIOs) to various government agencies. Government employees will be provided with professional training to effectively use digital tools and efficiently perform tasks even in alternative work setups. Government plans, policies, and processes

will also be advanced through the deployment of trained CIOs in government agencies, assigned to lead in the development of internal digital transformation strategies and business continuity plans (BCPs).

The Digital Workforce program of the DICT will also be launched as a capacity-building program to enable the broader use of digital technologies in critical sectors such as education, finance, health, agriculture, and logistics (*see Chapter 10*).

- **Pursue adult learning through online, distance, and/or blended learning.** This will involve the promotion of more open online courses (MOOCs) and flexible training arrangements through blended programs that will reduce face-to-face contact. Education agencies will also collaborate with the private sector and professional organizations to increase the number of online courses accredited for Continuing Professional Development. Curricular adjustments will be done to adapt to the new teaching-learning mode.

Strengthening formal and informal education on health, food, and well-being will also be pursued to equip Filipinos with the fundamental education and preparedness on sound practices in staying healthy and well.

- **Increase the number of HEIs offering quality programs in STI-aligned fields, especially in engineering and the sciences.** SUCs will invest in the enhancement of quality of program offerings and will explore offering engineering and science programs to increase the number of scientists and engineers. This can be achieved through sustained investments in facilities and faculty development coupled with proactive outreach to potential feeder high schools that could be assisted to provide students for the SUCs. STI HRD will get a boost from the free higher education provided through SUCs.

Tap foreign and overseas Filipino expertise.

⁸ CHED will lead the updating of the curriculum.

- **Support the liberalization of certain professions in the Regular Foreign Investment Negative List (RFINL).** The government will support and pursue initiatives to remove restrictions on the practice of professions by foreign experts (e.g., engineers) listed in the RFINL. Pending the amendments to the relevant national laws which restrict foreign professionals from entering the country, the government will consider crafting procedures and measures in granting of temporary permits (see Chapter 9).
- **Promote more participation of scientists in the Balik Scientist Program.** The government will aggressively promote the enhanced benefits and incentives under the *Balik Scientist Act* to encourage wider participation, particularly, in sectors and areas where expertise is lacking.
- **Promote startup visas and other benefits and incentives under the Innovative Startup Act (RA 11337).** The government will strategically market the country's startup ecosystem to experienced startup founders, investors, and other enablers.
- **Strengthen infrastructure for and regulation of digital transactions.** Given the increased demand for digital transactions (e.g., digital payments, online delivery, digital tax payments, and online financial services, among others), relevant digital infrastructure and regulatory oversight will be strengthened, including closer monitoring of cybersecurity plans. The implementation of DICT's National Broadband Program will be fast-tracked to provide the national ICT backbone to support government services delivery, including the use of digital transactions and the linking of digital transformation and research laboratories as part of the STI ecosystem.

Foster STI culture.

- **Harmonize/consolidate the communication advocacy of the government on STI.** Government will consolidate all its existing communication advocacy and campaigns and turn it into a comprehensive/harmonized advocacy plan to promote better public appreciation and understanding of STI. Privately-owned mass media networks will be incentivized to undertake mass education and promotion of science-responsive communities.

Strengthen STI infrastructure.

- **Establish STI facilities and innovation hubs.** The government will engage with the academe and industry to build more makerspace, innovation hubs, innovation centers, FabLabs, laboratory facilities, R&D centers, and prototyping facilities, as well as science and technology parks in strategic locations throughout the country to support the innovation and technology requirements of the MSMEs and startups. Moreover, the OneLab Network, a platform which integrates DOST analytical and testing laboratories and other laboratories in the Philippines and ASEAN countries, will be strengthened to provide easy access to testing and calibration services. The capabilities of existing and new STI facilities and innovation hubs to execute some of their services online will also be developed.
- **Aggressively promote to the public the importance and benefits of science in helping resolve national issues.** The government will use new and traditional media to inform the public of the benefits, importance, and potential of science to address various challenges and move the country forward. Public trust in science is important for science-based policy to succeed. Highly-technical data and information will be conveyed in a manner that can be easily understood by the public. In the case of the COVID-19 pandemic, the massive information campaign and institution of control measures have helped in the reduction of virus transmission. As an example, altering public behavior to lower virus transmission depends on how scientific data are imparted to the populace. "Flattening the curve" for ordinary citizens was unknown before the pandemic, but

through the communication efforts executed by doctors and scientists in several platforms, people were encouraged to remain indoors to minimize transmission. Misinformation about COVID-19 continually spread, leading to fear of the unknown. Scientific findings and projections on the virus, however frightening, shed light on how extensive it is. Scientists are being relied on to minimize fear, as such, accurate and effective communication by scientists will be used to reduce the anxiety of the populace.

- Better appreciation of STI by Filipinos could also be achieved by communicating tangible results. Several tools have been used to address the challenges caused by the crisis. For instance, the Baguio City LGU used a predictive analytics tool to understand the transmission of the virus in the locality and has contributed to the goal of containing the virus. A group of University of the Philippines (UP) researchers has correctly estimated the number of people to be affected by the virus should the government implement relaxed quarantine guidelines. The UP National Institute of Health (UP-NIH) has successfully developed test kits⁹ that helped expand the testing capacity of the country.

To help enhance the long-term capabilities of the country's workforce to generate new ideas for innovation and at the same time produce an agile workforce, creativity will be strongly nurtured as a vital skill of students at all levels and will also be integrated into all disciplines (e.g., science and engineering courses). The transformation of the DepEd's STEM Program to science, technology, engineering, arts, and math (STEAM) will serve as a starting point (see Chapter 7).

Strengthening open collaboration among actors in the STI ecosystem

Strengthen multisectoral collaboration.

- ***Establish and operationalize the NIC.*** In line with the Philippine Innovation Act (RA 11293),¹⁰ the government will establish the NIC, an inter-agency committee that will adopt a “whole-of-government approach” in steering the direction of STI development in the country. This will also identify and eliminate the areas of fragmentation/gaps in the governance framework of the STI sector leading to the lack of coherence in the policies, plans, and programs. Moreover, the NIC will strengthen and deepen interactions and partnerships among different actors from the public and private sector, academe, MSMEs, RDIs, and communities towards promoting inclusive growth and improving the quality of life through innovation.

Pending the creation of a secretariat and a unit of personnel that will help carry out the activities of the NIC, the NEDA will constitute an interim Secretariat through temporary detail of personnel from the NIC member agencies, pursuant to RA 11293.

Intensify international cooperation in STI.

- ***Encourage open science and collaboration to combat public health issues and emerging diseases such as COVID-19.*** International collaboration in scientific research and innovation has accelerated in the past months. The Philippines has taken advantage of this opportunity to improve the country's knowledge and scientific social capital. At the onset of the COVID-19 pandemic, scientific journals were made accessible to the public free of charge.

⁹ Talingdan, Maria Elena A., “DOST-NRCP Vice President Dr. Raul V. Destura, the Scientist behind the First Local COVID-19 Testing Kit,” NRCP Website, April 6, 2020.

¹⁰ The law establishes the NIC which will develop the country's innovation goals, priorities, and long-term national strategy. Said Council will also formulate a National Innovation Agenda and Strategy Document that establishes the country's vision and long-term goals for innovation and provides a roadmap and the strategies for improving innovation governance through clear-cut delineation and complementation of innovation efforts across agencies, deepening and accelerating innovation efforts, and integrating and fostering public-private partnerships, among others.

Several digital platforms have also provided opportunities for a more sustained STI international collaboration, as the pandemic pushed global scientific communication. These seem to be proving helpful for the advancement of the STI ecosystem in developing countries, such as the Philippines.

- **Intensify international STI collaboration.** The Philippines will continue to actively participate and figure more prominently in regional and international discussions on STI. As a member of a global scientific community, the Philippines will showcase Filipino ingenuity and innovations as possible solutions to common global problems and concerns. In addition, it will continue to explore new and emerging areas of scientific cooperation where the country and its partner governments and institutions may mutually benefit from (e.g., vaccine development, space and satellite technology, artificial intelligence, security and defense, etc.). The government will also intensify its efforts in improving the country's STI standing in the international community through information dissemination on potential STI partners in the Philippines, promoting international activities related to STI, and fostering exchanges on STI activities. Further, strategic partnerships will be built with other countries through activities such as joint R&D, exchange of scientists, building researchers' networks, joint seminars/workshops, technology transfer, and capacity-

building. Bilateral and multilateral partnerships will also be used to acquire new and existing foreign technologies (e.g., those that may be used to address the COVID-19 pandemic and adapt to the new normal).

Implement the recommendations of the Scoping Study on STI Statistics.

The results of the scoping study on STI statistics will feed into the work of and will be implemented by the Inter-Agency Committee (IAC) on STI Statistics. The IAC will aim to resolve the issues and concerns being encountered by various government agencies in producing STI statistics. The government will also identify indicators with available regional data to enable the concerned regional offices to effectively monitor their STI sector. This will allow the regions to provide their regional baselines, targets, and actual data on certain STI indicators.

The government will also require various stakeholders (e.g., SUCs) to submit data that will be recommended under the scoping study (e.g., R&D data) and encourage private corporations to participate voluntarily in sharing relevant data. These data will also serve as the country's inputs to various global indices. The Department of Budget and Management (DBM) and the DOST will work closely to develop the Unified Accounts Code Structure (UACS) for the R&D spending in the public sector. This will contribute significantly to the data collection and generation of the sector that will substantially aid the development planning cycle.

Legislative Agenda

Table 14.2 Legislative Agenda to Vigorously Advance Science, Technology, and Innovation

LEGISLATIVE AGENDA		RATIONALE	
STI application in agriculture, industry, services, and health sectors increased			
Amendments to the Intellectual Property (IP) Code		This seeks to strengthen the IPOPHL as the lead government agency in IP. It intends to improve its organizational structure to maintain and implement effective, efficient, economical, responsive, technology-driven, and sustainable services and programs; protect, enforce, and adjudicate; promote and steer creativity, innovation, development, utilization, and commercialization that would benefit MSMEs; enhance learning, advocacy; and support the enhancement of digital infrastructure and interconnectivity.	

LEGISLATIVE AGENDA	RATIONALE
<i>Investments in STI based startups, enterprises, and spin-offs increased</i>	
Science for Change (S4C) Act	This aims to expand various S&T programs of the DOST (e.g., R&D programs, technology business incubation, foreign scholarships) and prescribes the R&D areas to be considered under the S4C Program. The bill also seeks to require NGAs, LGUs, and SUCs to adopt publicly-funded and generated technologies whenever feasible and practicable.
<i>Creative capacity for knowledge and technology generation, acquisition, and adoption enhanced</i>	
Philippine Virology Science and Technology Institute	This will establish a research institute that will delve into the study of viruses. The country needs diagnostics to detect and limit the spread of existing viruses; vaccines to provide long-term protection; treatments to save lives in the shorter term; and social science to understand their behavioral and societal implications.
An Act Creating the Center for Disease Control and Prevention, Providing Mechanisms for Epidemic Control, and for Other Purposes	This proposed legislation aims to establish a center that will be the principal agency tasked with developing and applying communicable disease control and prevention initiatives. It will be responsible for controlling the introduction and spread of infectious diseases.
Comprehensive Philippine Atomic Regulation Act	This proposed measure aims to legislate an independent regulatory framework that will decide on issues affecting public health and safety, protection of the environment, and nuclear security and safeguards, that is beyond the reach of entities with self-motivated interests.
Strengthening the National Measurement Infrastructure System (NMIS), Amending RA 9236 also known as the National Metrology Act of 2003	This seeks to establish the National Metrology Institute under the DOST as well as provide capacity building programs through competency training to strengthen the local metrology authorities at the local level and foster a metrology culture that will instill a keen appreciation of the importance of metrology.
Provincial Science and Technology Office Act	This seeks to strengthen the existing Provincial Centers for Science and Technology (PSTC) under RA 6959 by converting them into an office so that the development and transfer of technologies in the rural areas can be vigorously pursued and implemented.
eHealth System and Services Act	This aims to establish, institutionalize, and regulate a coherent, coordinated, and collaborative National eHealth System, guided by a national policy and strategic framework.
Digital Philippines Act	This aims to adopt a whole-of-government approach in promoting digital innovation and transformation in business and government.
Philippine Defense Industry Development Act	This intends to provide the required policy environment for the development of a national defense industry through the strengthening and revitalizing of the self-reliant defense posture program, incentivizing in-country enterprises, rationalizing defense acquisition, and institutionalizing a functional office for defense technology research and industry development under the Department of National Defense (DND).