Valuable Lessons from a Decade of ERDT and ASTHRDP Implementation

In an era wherein domestic economies are multiply interconnected and governments are becoming more protective of the intellectual properties of their enterprises and citizens, countries need their own cadre of R&D workers (researchers, scientists, and engineers). Their collective task is to constantly advance current scientific understanding of various natural phenomena and apply it successfully to develop more reliable techniques and tools for boosting labor productivity, and also for enhancing the quality of public services and life in general. To build and sustain a knowledge-based economy, a country needs a minimum of 380 full-time equivalent R&D workers per million inhabitants (FTEs) and an annual gross domestic expenditure for R&D (GERD) that is equivalent to at least 1% of GDP according to UNESCO.

The World Bank reports that there were 78.83 ± 5.18 and 187.66 FTEs in the Philippines during the period 2003–2011 and year 2013, respectively. The Department of Science and Technology (DOST) also mentioned in the 2019 Luzon Regional Scientific Meeting of the National Academy of Science and Technology (NAST) that the country’s GERD rose from 0.137 ± 0.015 % in 2002, 2003, and 2005 to 0.57 ± 0.061 % in the period 2016–2018. The figures reveal an upward trend made possible by increasing governmental support for R&D and growing enrollment in the higher education institutions (HEIs).

The 2018 national budget was 2.18 times bigger than that in 2006, with the corresponding allocations for the DOST and the state universities and colleges (SUCs) increasing 6.035 and 3.43 times, respectively. The sustained budget increases were made possible by a growing Philippine economy – from 2006 to 2016, the annual National Expenditure Programs that were prepared and submitted by Malacañang to Congress for approval were equivalent to 19.3 ± 1.32 % of GDP in the previous fiscal year. Between 2000 (77.992M) and 2017 (104.918M), the Philippine population grew at an average annual rate of 2% despite having a life expectancy (68.6 years) that is lower than the world average (70.8 years) in the period 2005–2010.

The Philippines (187.7 in 2013), after Indonesia (89.2 in 2009), has the lowest FTEs among the six major ASEAN economies (Singapore with 6,700 in 2014, Malaysia with 2,300 in 2015, Thailand with 1,200 in 2016, and Vietnam with 672.1 in 2015). The GERD of Singapore is the highest at 2.16% in 2014 – followed by those of Malaysia (1.3% in 2015), Thailand (0.78% in 2016), Vietnam (0.44% in 2015), the Philippines (0.14% in 2013), and Indonesia (0.08% in 2013). Four ASEAN countries have surpassed the UNESCO benchmark for FTEs, with two already spending above the 1% GDP threshold for GERD.

The Philippine government intends to invest more in human resource development with the stated aim of increasing the number R&D workers. During the 2019 NAST Visayas Regional Scientific Meeting, the DOST Science Education Institute (SEI) unveiled its plan to offer 1,927 Ph.D., 4,264 M.S., and 31,360 B.S. scholarship grants in the year 2020 – which are 51.7%, 17.4%, and 33.3% more than the corresponding numbers in 2018. From 2008 (Ph.D.: 302; M.S.: 956; B.S.: 10,294) to 2018, the number of Ph.D., M.S., and B.S. scholars that were supported by the DOST increased at an average yearly rate of 32.1%, 28%, and 12.9%, respectively. In addition to full tuition support, the Ph.D. (M.S.) scholarship grant in 2018 included a monthly stipend of Php 33K (Php 25K), a yearly book and transportation allowance of Php 30K (Php 30K), and a dissertation research grant of Php 100K (Php 50K). The grants are generous, allowing qualified B.S. graduates to pursue Science, Technology, Engineering, and Mathematics (STEM) Ph.D. and M.S. studies full-time for a period of three and two academic years, respectively. The graduate scholarships are administered through the Advanced Science and Technology Human Resource Development Program (ASTHRDP) and the Engineering Research and Development for Technology Program (ERDT).

Ph.D. and M.S. scholars, in particular, need a nurturing and enabling environment in order to complete their studies in due time. Failure to graduate will drive an erstwhile DOST-SEI scholar into financial indebtedness at a critical phase of his/her productive life. It will
also represent a negative return of an investment that involves the use of public funds. There is no doubt that all stakeholders genuinely desire for the unqualified success of each and every government scholar.

In AY 2017–2018, there were a total of 1,906 CHED-accredited HEIs – including 111 SUCs and 122 other public institutions that are financed by local government units. Close to half (46.46%) of undergraduates (2.882M) were enrolled in public HEIs where access to tertiary education is free, as provided for by the provisions of Republic Act 10931 that was signed into law by Philippine President Rodrigo Duterte in August 2017. Between AY 2003–2004 and AY 2015–2016, undergraduate enrollment grew by 69% to 4.105M, with those in public HEIs rising at a rate of 10% per annum. Presently, less than 1% of all HEIs could offer STEM Ph.D. programs due to the lack of qualified Ph.D. faculty members who can teach graduate courses and supervise the doctoral dissertation research of Ph.D. students.

The ASTHRDP and the ERDT were established by the DOST in 2007 in partnership with a number of HEIs that were selected due to their existing STEM Ph.D. degree programs. In the beginning, ten schools were identified to become members of ASTHRDP National Science Consortium: Ateneo de Manila University (ADMU), Central Luzon State University (CLSU), De La Salle University (DLSU), Mindanao State University – Iligan Institute of Technology (MSU-IIT), University of the Philippines (UP) Diliman, UP Los Baños, UP Manila, UP Visayas, University of Santo Tomas, and Visayas State University. The University of San Carlos (USC) in Cebu joined sometime later. On the other hand, eight were chosen to become ERDT partner schools: ADMU, CLSU, DLSU, MSU-IIT, Mapúa University, UP Diliman, UP Los Baños, and the USC. The number has not changed up to the present time. Five of ten original ASTHRDP and four out of eight ERDT member schools are located in the National Capital Region.

Based on figures recently made available by the DOST-SEI, the ASTHRDP awarded a total of 610 Ph.D. scholarships from 2008 to 2015 (eight-year period) and produced a total of 351 Ph.D. graduates from 2011 to 2018. The equivalent conversion rate over the eight-year period of reckoning is 57.5%. On the other hand, the ERDT granted a total of 268 Ph.D. scholarships from 2008 to 2015 and produced a total of 128 Ph.D. graduates within the period 2011–2018. The corresponding conversion rate is 47.8%. The figures indicate that barely two out of every four Ph.D. scholars were able to graduate, which is a matter of serious concern. The situation is akin to an academic course offering wherein only half of the class were able to pass.

The lack of competent and committed Ph.D. faculty supervisors is hampering the production of more Ph.D. graduates – not just in STEM but in other academic fields as well. In AY 2003–2004, Ph.D. degree holders comprised only 9.24 percent of all HEI faculty members. Fourteen years later, in AY 2017–2018, their number accounted for 14.07% as a result of an inconsequential yearly growth of 0.34%. The low number of available qualified Ph.D. faculty, coupled with the complexity and high cost of starting and operating a research laboratory, are preventing more HEIs – especially in other areas of the country – from offering tenable Ph.D. programs in STEM.

The College of Science (CS) and the College of Engineering (CoE) of UP Diliman produced 12.39 ± 3.73 and 5.39 ± 5.80 Ph.D. graduates per year, respectively from AY 1990–1991 to AY 2017–2018. To wit, a total of 154 and 73 full-time Ph.D. faculty members served the CS and CoE, respectively in the second semester of AY 2015–2016. Evidently, a majority of Ph.D. faculty members have not been guiding and directing Ph.D. candidates successfully. Note that if a Ph.D. faculty is able to train even just one Ph.D. student every three years, then CS would have about 50 Ph.D. graduates per year.

It is no different at the scale of UP Diliman, which produced 63.8 ± 16 Ph.D. graduates per year from AY 1990–1991 to AY 2014–2015 even though it employed hundreds of full-time Ph.D. faculty members in a given year – there were 498 in December 2015. For the 835 Ph.D. graduates tracked from AY 2003–2004 to the middle of AY 2015–2016, the average completion time is 7.8 ± 3.46 years post master’s degree. Doctorate degree programs regardless of specialization are designed for a three-year duration of study, and 66 were offered during AY 2017–2018. From Mid-Year Term 2015 to Second Semester of AY 2017–2018, UP Diliman yielded an average of 70 ± 12 doctorate graduates per academic year.

An enabling institutional intervention for eliciting more committed faculty members is to make successful mentoring of a Ph.D. student a minimum prerequisite in the recommendation for the grant of tenure – already a mutually-accepted practice at the National Institute of Physics (NIP) since the early 2000s. The NIP contributes 33% (4.11) of the total Ph.D. graduate output of CS, which is composed of ten constituent units including five national institutes.
The aforementioned prerequisite is difficult to impose fruitfully in an academic setting that is not nurturing. A newly-hired STEM (assistant) professor should be afforded sufficient time to prove himself or herself worthy of a permanent appointment. A sensible evaluation period is eight academic years for two reasons: (a) the most promising Ph.D. students are best recruited ahead of time \textit{i.e.}, during the time when they start to do their undergraduate thesis; and (b) building a new research laboratory takes considerable time and energy especially if it needs the acquisition and installation of sophisticated equipment and facilities. To ensure that a tenure track Ph.D. faculty is on the right road to becoming permanent, he/she must publish his/her research yearly together with his/her student as co-author.

A nurturing environment is unlikely to develop in a poorly-governed STEM department/institute and college. Their chief executive officers (deans, institute directors, and department chairpersons) must have definite term limits that are enforced strictly by the appointing powers in order to prevent the needless assignment of weary hold-overs and administratively-handicapped officers-in-charge, as well as the eventual rise of "irreplaceable" academic administrators. Unwarranted extensions undermine the culture of meritocracy, as well as loosen collegial adherence to hard-earned best practices that are so vital in a productive STEM institution. For the first time since its establishment in 1983, the NIP does not have a new director to succeed the incumbent whose second and final term expired on 31 May 2018. In the past, UP was able to exercise due diligence in searching for and appointing a new NIP chief executive officer in a timely manner.

Data-driven decision-making is indispensable in optimizing the allocation of valuable public resources. A closer examination of the World Bank figures for the Philippine FTEs reveal a striking average yearly increase of 19.71% from 2007 (78.83) to 2013 (187.66). Assuming data accuracy and a growth rate that is sustained in the five years that followed, the country would have 461.35 FTEs by 2018 – surpassing the oft-quoted UNESCO benchmark (380) in 2017 with 385.39 FTEs. The said projections could not be validated since the FTEs were not measured recently, but something crucial happened between 2011 (84.36) and 2013 that caused the FTE value to jump by 122%. Understanding what it was would be invaluable to stakeholders in the Philippine scientific enterprise system.

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