Philippine Journal of Science
148 (1): vii-ix, March 2019
ISSN 0031 - 7683

EDITORIAL

Brain Drain and Inbreeding in the Training of Future Filipino Scientists

Brain drain is normally associated with educated or professional people from one country, economic sector, or field leaving for another—usually for better pay or living conditions. This social phenomenon, if left unbridled, produces a profound socio-economic impact that does not bode well for a society that should value hard work and merit over personal connections in determining the positional fitness of its leaders and executives—especially those who serve in the public sector.

It has been found that European countries that are weak at controlling corruption also have relatively low brain drain index scores based on 2009 and 2010 data[1]. Corruption is defined as the abuse of public authority for private interest, resulting in a biased allocation of public resources. Control pertains to the capacity of a society to restrict authorities from distributing public goods and resources in order to advance their own personal interest. Countries that are perceived to be highly corrupt also spend low on scientific R&D as a percentage of national GDP, while lagging behind in global innovation performance. Scandinavian countries are the least corrupt and the most innovative. They are the most successful at generating human capital and at retaining their most skilled workers. The study indicates that an effective means of mitigating unwanted human capital flight is to control demonstrably the level of corruption instead of enacting more laws that further restrict the free flow of goods and services across national borders. The introduction of additional regulations tends to worsen the perception of corruption in a society where the rule of law is unstable.

In terms of magnitude, the Philippines (1.11M high-skill immigrants) and India (1.035M) were the leading suppliers of 'brains' in the year 2000 while the United Kingdom (1.479M) and Germany (0.945M) topped the list among the developed countries[2]. The study defined high-skill immigrant as a foreign-born individual, aged 25 or more, and holding an academic or professional degree beyond high school. It concluded that globalization aided by the brain drain has made human capital more scarce in places that most needed it while making it more abundant where it is already plentiful, consequentially widening the gap in national incomes. On the other hand, the study also pointed out the positive role played by the Indian diaspora in developing the thriving IT sector of their motherland.

The Philippine Statistical Authority revealed that in 2017, there were 2.339M overseas Filipino workers (female: 53.66%)—with 20.7% and 9.5% of them hailing from the CALABARZON area and the National Capital Region, respectively. More than seventy percent (72.8%) of the OFWs were of ages from 25 to 44 years old. Those who were hired as managers (1.2%), professionals (8.7%), and technicians (5.9%) accounted for 15.8% of the total, respectively. According to the *Bangko Sentral ng Pilipinas*, the total overseas Filipino remittance amounted to USD 32.2B in 2018—representing an increase of 3% relative to that of the previous year. The amount is equivalent to 9.7% of the 2018 GDP, which grew by 6.2% year-to-year. The Department of Tourism reported that 7.13M foreign tourists visited in 2018, representing a year-to-year increase of 7.7%. As a matter of perspective, Thailand (population: 69.183M) had 38.28M foreign tourists in 2018, which is 8.3% higher than the number in 2017. In 2016, the Financial Times estimated that on average, a foreign tourist would contribute USD 1,430 to the local economy. Overseas remittance and the tourism industry are the top foreign exchange earners for the Philippines (2018 population: 106.5M)—well ahead of foreign direct investments (USD 8.7B in 2017). Arguably, the tourism industry offers a more benign means of earning foreign exchange and its potential has remained largely untapped—using Thailand as a benchmark.

The Philippine scientific enterprise system has been dealing with a persistent threat that undermines its long-term capacity to produce additional Ph.D. graduates in Science, Technology, Engineering, Agriculture, and Mathematics (STEAM). It concerns with the limited capability of the system to entice more talented young Filipinos to proceed to Ph.D. work right after completing a STEAM undergraduate degree and to improve their chance of succeeding to graduate in due time. According

to the Commission on Higher Education (CHED), more than a hundred twenty thousand college students (123,286 or 17.4% of all college graduates) were awarded STEAM degrees in AY 2017–2018. The number is 3.58% higher than that produced in AY 2014–2015.

There is no data available from CHED, but it has been estimated that the number of STEAM Ph.D. graduates produced by higher education institutions (HEIs) is only about a hundred per academic year[3]. In contrast, an average of 1,486 new lawyers (2000–2017) and 1,917 new accountants (2000–2018) are granted permission each year to practice law and accountancy work. The meager production rate is mainly due to the limited number of HEIs—less than one percent of the 1,906 HEIs in AY 2017–2018—that is capable of offering tenable Ph.D. programs in STEAM. Qualified personnel are not readily available to teach graduate courses and to supervise the dissertation research of Ph.D. candidates. In addition, the establishment of a new research laboratory is a technically complex and expensive task.

During AY 2017–2018, only 14.07% of HEI faculty members had Ph.D. degrees in all academic disciplines, including those that belong to the Arts and Humanities as well as the Social Sciences—a severe handicap of the higher education system given that only Ph.D. faculty members are qualified to train doctoral students. The percentage is higher than that (12.54%) in AY 2014–2015 but the gain (1.53%) is lower than the corresponding increase (3.58%) in the number of STEAM college graduates produced during the same period. From AY 2004–2005 to AY 2017–2018, the overall increase in the Ph.D. faculty complement is only 4.97% (0.36% per year), which does not speak well of the efficacy of the government programs instituted to address the Ph.D. shortage. The data indicate that the Philippines could not rely on foreign universities to provide its HEIs with more Ph.D.'s.

To thrive and prosper, Ph.D. programs need a steady stream of smart, motivated, creative, hardworking, and skillful students. Having Ph.D.'s with established research track records in the faculty roster would be for naught if they do not have the right students to work with and to mentor. The ensuing collaboration between supervisors and their advisees would steadily improve the quality of the Ph.D. program in a department.

Products of undergraduate STEAM programs may also be deterred from proceeding to graduate school due to the lack of a Ph.D. program that matches their undergraduate interest and skill set. For example, the National Institute of Physics in UP Diliman has produced a total of 594 (annual average: 31.26) BS in Applied Physics (59.76%) and BS in Physics graduates from AY 1999–2000 to AY 2017–2018 (19 years)[4]. However, the NIP has only graduated 289 MS (average: 16.06) and 74 Ph.D. students (average: 4.11) between AY 2001–2002 and AY 2017–2018.

Even though it produces more graduates in Applied Physics, the NIP does not have a corresponding MS/Ph.D. program in Applied Physics, and those who wish to continue graduate studies in Physics have no other path but to enter into the MS/Ph.D. in Physics program where the core courses are designed in line with the BS in Physics curriculum. Affected students have to retool and take prerequisite undergraduate courses that were not part of their BS in Applied Physics curriculum. It means a heavier graduate workload and a different mindset for them. The creation of an MS/Ph.D. in Applied Physics program is long overdue in this country—the BS in Applied Physics program of NIP was first introduced more than thirty years ago.

To complicate matters, mentoring is voluntary and not all Ph.D. faculty members accept Ph.D. students as dissertation advisees. For example, the College of Science (CS) in UP Diliman is served by about 150 Ph.D. faculty members, yet it produces less than twenty Ph.D. graduates per year. From AY 1990–1991 to AY 2014–2015, the CS yielded an average of 12.56 Ph.D. graduates. Note that if every Ph.D. faculty contributes even just one graduate in every five years, then CS will increase its annual Ph.D. production to thirty (30).

A legitimate concern regarding the training of doctoral students is 'inbreeding.' Simply stated, inbreeding is the production of Ph.D. graduates whose dissertation research topics are retailed within a narrow range and would appear serialized when taken together as a whole. These graduates also tend to inherit the undesirable habits of their supervisors, including questionable research practices and age-old personal conflicts and grudges. Inbreeding is an argument that is peddled by some to explain why a balky doctoral program is not a bad thing after all. Undoubtedly, it is an anathema to institutions and individuals who are directly engaged in establishing a culture of science in society.

Inbreeding is not addressed by avoiding the supervision of Ph.D. students, but rather by actively recruiting and mentoring them properly. Successful mentors are those who guide their students to become independent scientists after graduation. During their brief period of collaboration,

the student will learn firsthand from his or her dissertation supervisor about the best research practices that have been developed and refined through time. In a sense, the dissertation research topic that a student is asked to investigate is secondary to his being able to develop the right attitude and to acquire the tools that are considered timeless and universal in scientific inquiry.

To fast-track their chance of becoming productive independent scientists, it is advisable that new Ph.D. graduates are sent to do postdoctoral work in another research laboratory. Concerned agencies of government (*e.g.*, CHED, Department of Science and Technology, *etc.*) should offer well-crafted postdoctoral fellowship programs that would enable these young researchers to work in the best research laboratories in the world.

Brain drain and inbreeding weaken the capacity of the Philippine scientific enterprise system to continue improving in terms of researcher density and spectrum of research areas that its scientists are capable of engaging in productively. The good news is that these challenges are not insurmountable and can be overcome if their nature is understood more accurately by our science policy makers and government leaders.

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