TRACK TO DEVELOPMENT

INCREASING THE RESEARCH CAPACITY AND PRODUCTIVITY OF THE PHILIPPINES

FULBRIGHT Philippines

UNIVERSITY of VIRGINIA
FRANK BATTEN SCHOOL of LEADERSHIP and PUBLIC POLICY

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~ THANK YOU ~

DISCLAIMER

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

EXECUTIVE SUMMARY

The Philippines only produces 4% of the STEM PhD graduates needed per year to reach the 380 research scientists and engineers UNESCO estimates required to be on track to industrialization (Vea, 2020). The first part of this applied policy project for Fulbright Philippines exposes three fundamental aspects that have created and perpetuated the shortage of STEM PhD graduates:

1. Insufficient research funding;
2. System wide institutional barriers;
3. And, the brain-drain.

The analysis proceeds with a *literature review* to find potential alternatives for Fulbright Philippines to address the shortage. The literature review identifies the following key takeaways:

- Visiting scholars have long-term impacts on individuals, institutions, and nations;
- Ample funding is a determinant of PhD degree completion;
- Restructuring PhD programs can substantially increase graduation rates.

Extensive research and interviews with experts led to four policy alternatives through which Fulbright Philippines can increase the number of STEM PhD graduates in the Philippines. Each of these alternatives are modeled with regards to the University of the Philippines – Diliman College of Science (UPD – CS). The first two alternatives are pilot programs Fulbright Philippines would implement in collaboration with UPD – CS. The last two are alternatives Fulbright Philippines would advocate for UPD – CS to implement. The alternatives are:

1. Visiting advisor PhD program;
2. 'Sandwich' PhD program with a University of California School;
3. Advocating to extend the retirement age to 70 for PhD advising;
4. Advocating to make PhD advising a tenure track requirement.

Each of the alternatives are analyzed through the following four **criteria**:

1. Costs – total cost of implementing each alternative;
2. Effectiveness – the number of STEM PhD graduates produced by each alternative;
3. Cost-Effectiveness – cost per PhD graduate produced by the alternative;
4. Political feasibility – the feasibility of each alternative at the national, institutional and organizational level.

After applying the criteria to alternatives, we **recommend the Fulbright Philippines implement a visiting advisor program with UPD – CS**. The visiting advisor program was the most cost-effective and politically feasible alternative. We recommend this program be piloted with an initial visiting advisor for a duration of three years.

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DEFINING THE PROBLEM

Introduction

The Philippines experienced remarkable progress between 1985 and 2018, as noted by the 66% decrease in poverty rates (World Bank, 2022). However, between 18-48% of the population remains impoverished, depending on how poverty is measured (Palatino, 2022). The Philippines has manifested their belief in higher education as a mechanism for reducing poverty and establishing long-term economic development through various congressional acts and national programs. However, the Philippines' poor research capacity and culture are barriers to its emergence from the developing world (Altbach, 1998).

Higher education systems worldwide face increasing pressures due to global competition (Ros & Oleksiyenko, 2018; Teichler & Cummings, 2015). The Philippines has focused primarily on expanding their higher education system, which is typical for developing countries (Singer & Benatar, 2001). However, systemic challenges like funding research, hiring researchers, and the complacent research culture in the higher education system bottleneck the Philippines' research capacity (Mendoza, 2022; Tan, 2022). Out of the array of challenges the Philippines higher education system faces, this policy analysis focuses on increasing the Philippines' research capacity by increasing the number of STEM PhD graduates. One study estimates that the current STEM PhD graduation rate needs to increase 24 times the current rate to achieve the development the Philippines desires (Vea, 2020).

The goal of this policy analysis is to identify cost-effective and practical alternatives for the Philippine-American Education Foundation (PAEF) to start increasing the number of STEM PhD graduates. The analysis begins by providing the political landscape and background of the Philippines higher education system and its challenges. Subsequently, the literature review provides empirical support to guide the identification of alternatives. This is followed by a description of the alternatives and evaluative criteria selected after extensive consultation with scholars and PAEF. Then all criteria are applied to each alternative to find the most practical approach for increasing STEM PhD graduation rates. The policy analysis concludes by weighing the trade-offs of each alternative to provide a recommendation and implementation strategy.

Political Landscape

In the aftermath of World War II, a laissez-faire higher education system emerged in the Philippines (Gonzalez, 1992). CHED was established in 1994 through the Congress of the Philippines to increase the quality of and accessibility for HEIs (*Higher Education Act of 1994 | Republic Act*, n.d.). A primary focus of CHED has been regulating and granting status to HEIs (Kheir, 2021). Scholars charge CHED for failing to have a state-directed expansion of higher education (Maca & Ortiga, 2019). CHED has openly expressed their policy stance as laissez-faire, but Maca & Ortiga argue CHED is simply allowing the proliferation of private HEIs to align foreign labor market demands to export human capital. However, CHED has taken a more hands-on role in steering the education system towards a quality transnational system with international recognition (Atienza, 2022; R.A. No. 11448 | Transnational Higher Education Act, 2019).

National Policy Strategy

The former administration put in place a long-term strategy called "AmBisyon Natin 2040", and it is supported by the current Marcos administration (Merez, 2022). The strategy aims to bring the Philippines to upper-middle income status by 2040 (AmBisyon Natin 2040, 2022). Education is one of the pillars for achieving this goal (Kheir, 2021). Consequently, Congress established the Quality Tertiary Education Act. This act provides students with **free tuition** at state universities and recognized local colleges and universities (*Republic Act No. 10931*, 2017).

Additionally, an emphasis has been placed on increasing the quality of education programs. The Philippines has put in place standards for graduate education, mandated outcomes-based education, and adopted the use of International Organization for Standardization (ISO) certifications (Chao & Symaco, 2021). The Philippines only has four institutions with international rankings (QS World University Rankings of Philippine HEIs, 2019). However, the Philippines envisions developing a system with better rankings, through transnational and joint-degree programs (Chao & Symaco, 2021). They ultimately hope to attract international faculty and students and develop a knowledge-based society to achieve "AmBisyon Natin 2040".

Background

The 'Brain Drain' and its Causes

The shortage of professors in the Philippines with a PhD blocks progress for achieving "AmBisyon Natin 2040". The shortage is not a recent phenomenon. Before 1992, the Philippines was already experiencing and had recognized the 'brain drain' (Gonzalez, 1992). The drain occurs at two levels. Internally, the brain drain is when trained researchers perform administrative roles in the government or in HEIs. Externally, the brain drain occurs due to human capital exports, one of the Philippines' largest exported products (Chao & Symaco, 2021; Gonzalez, 1992; Maca & Ortiga, 2019). The 'brain drain' explains much of the lack of professors with PhDs in HEIs, and this challenge is widely recognized.

After interviewing "Balik-Scientist" (a government program that aims to reverse the brain drain) Guillermo Mendoza, the following additional explanations of the brain drain emerged. First, students who study abroad for their PhD programs have little financial incentive to return to the Philippines. Those who return to become professors in the Philippines quickly find themselves frustrated with the lack of technical capacity at their institutions. Their institutions are not well equipped to provide them with the resources to conduct research. Furthermore, promotions and pay-level depend primarily on the courseload they have, rather than research productivity or PhD advising (Mendoza, 2022).

Institutional Barriers

There is no system-wide shortage of faculty at State Universities; the average faculty to student ratio is 1:31 (CHED Statistics, 2020). That is because about 40% of positions are filled with faculty with a master's degree, and 50% with a baccalaureate degree. Although there is opportunity for promotion with higher degree attainment, most would rather increase workload instead of signing up for a pay cut to get a PhD (Atienza, 2022; Mendoza, 2022). There is complacency among faculty, lack of opportunities for grants, and no clear incentives for conducting research (Mendoza, 2022).

Country Comparisons

The Philippines has the second largest number of higher education institutions and graduates from tertiary education among ASEAN countries. However, among the same countries, they spent the least on research and development (ASEAN, 2019), and spending

has remained low by international standards (UNESCO, 2021). Consequently, the Philippines has the lowest SCOPUS publications per capita and number of researchers per 1 million of the population compared to the same countries (C. Saloma, 2016b; UNESCO, 2014). A major limiting factor is that less than 1% of HEIs in the Philippines are suitable graduate training (Saloma, 2020). Additionally, only about 50% of those enrolled in PhD programs graduate (C. Saloma, 2016b).

Other countries also struggle with low rates of PhD holders amongst higher education faculty. South Africa has made deliberate efforts to increase these rates. South Africa experienced nearly a 100% increase in PhD holders among faculty (from 28% in 2010-54% in 2017) (Higher Education and Training Republic of South Africa, 2020). These improvements were twice the percentage increase the Philippines experienced, even though the Philippines had more PhD graduates during the same period (CHED Statistics, 2020).

Problem Statement

With only 15% of faculty holding a PhD in the Philippines' state universities and colleges (SUCs) (CHED Statistics, 2020), research output and researcher training persists lowest among ASEAN countries (Saloma, 2016a). In the Philippines, less than 1% of higher education institutions offer science, technology, engineering, and mathematics (STEM) PhD programs because they lack qualified Ph.D. faculty members to teach graduate courses and supervise Ph.D. students (Saloma, 2020). The United Nations Educational, Scientific and Cultural Organization (UNESCO) estimates that 380 research scientists and engineers per million of the population are required for a developing country to be on track towards industrialization; data from 2017 shows that **the Philippines only produces 4% of the needed STEM PhD graduates** to reach UNESCO's benchmark and chart the way for national economic development (Vea, 2020).

PHILIPPINE-AMERICAN EDUCATIONAL FOUNDATION

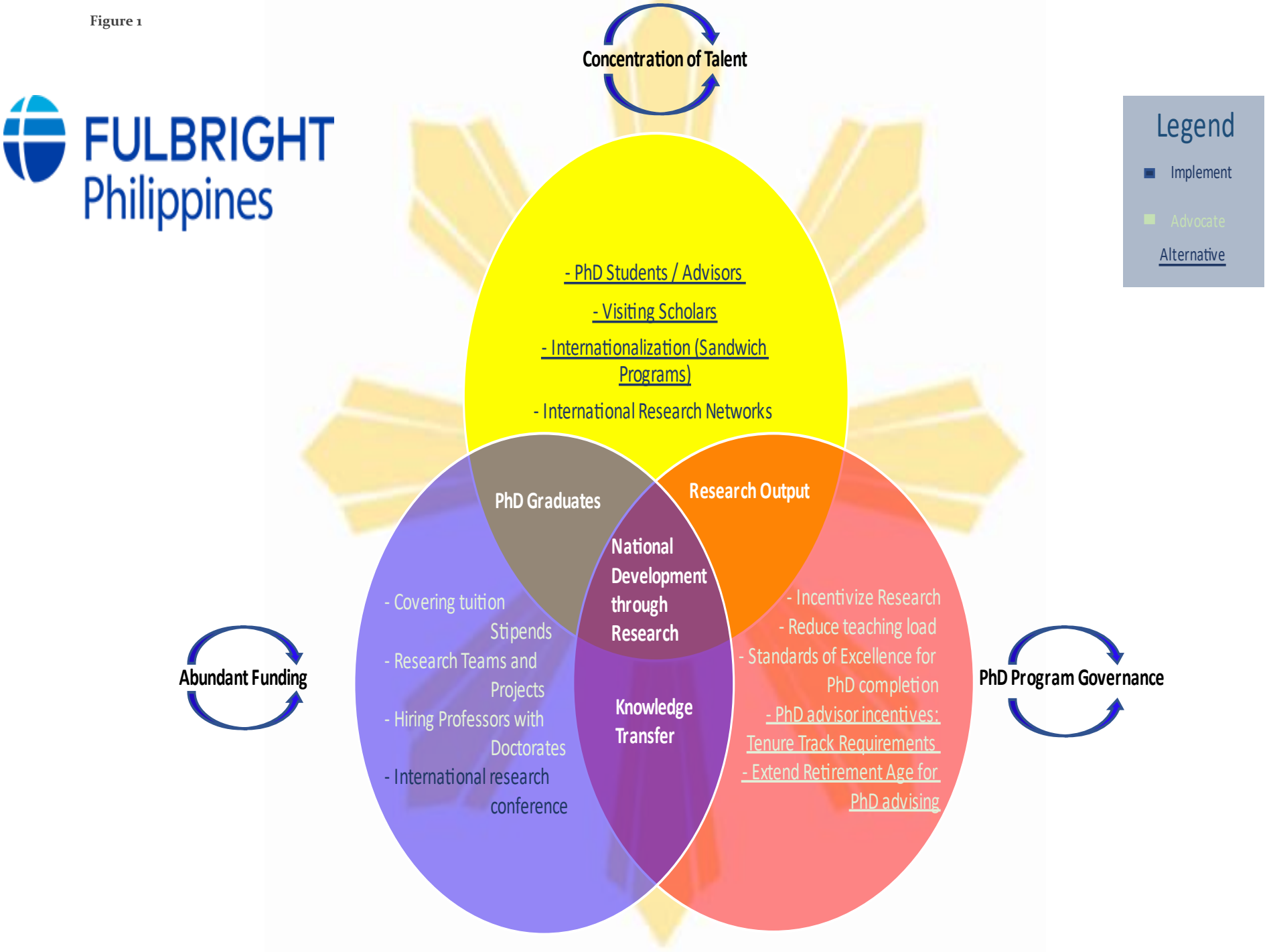
Profile & Ecosystem Map

The Philippine-American Educational Foundation (PAEF) is a binational organization charged with the administration of Fulbright scholarships and other educational exchanges. The organization's mission is to promote international education and empower minds to develop global and national leadership on pressing challenges. Each year, PAEF sends scholars to, and receives scholars from, the United States. Beyond implementing various international exchange programs, PAEF has power as an advocate. University leadership and CHED have direct relationships with PAEF. Thus, PAEF is engaged in improving research culture and capacity directly through implementation and advocacy.

PAEF has historically provided the Fulbright-CHED PhD scholarship for Filipinos to come to the U.S. for two years to pursue doctoral studies. Through this specific program, the Fulbright program has directly increased the number of STEM PhD graduates. There are a plethora of ways PAEF contributes to the research capacity of the Philippines, as will be demonstrated in Figure 1, an ecosystem map of PAEF.

Before reviewing the literature on potential solutions, it is helpful to look at Figure 1 below to clarify how the different solutions fit together and contribute to the main goal at the center of this analysis. The figure below illustrates the role PAEF plays and can play in the ecosystem of national development through research. In figure 1, the bulleted items represent the various contributions PAEF can make, separated by color to indicate the type of action. The anticipated outcomes are highlighted in the overlapping circles. The captions outside the circle describe the category of the circles.

Figure 1



Adapted from: Salmi, Jamil. "The Challenge of Establishing World -Class Universities," 2009.

LITERATURE REVIEW

Increasing Research Productivity and Capacity

Since PAEF's work centers on visiting scholars, this literature review naturally focuses on understanding the impact of visiting scholars. However, based on the advocacy role PAEF plays in the Philippines higher education system, this literature review seeks to understand how research funding can be allocated optimally, and what are demonstrated ways to increase the number of PhD graduates. In sum, the literature review is a synthesis of evidence that aims to identify potential courses of action for PAEF to improve the research capacity and culture in the Philippines and increase STEM PhD Graduates.

Impact of Visiting Scholars

Most of the research on visiting scholars is qualitative. Numerous studies have conducted surveys to understand the experiences of visiting scholars (McKeown, 2021; Miller & Blachford, 2012; Shimmi, 2014). A recent meta-analysis identified 406 articles on the topic; the review shows that visiting scholar experiences shape academic lives (Lally, 2022). The benefits of these programs have been coined as 'brain-circulation', the cross-country sharing of knowledge in our globalized world (Faulconbridge, 2007; Ros & Oleksiyenko, 2018). One scholar posits that visiting scholar programs were instrumental to reintegrate Germany into academia after World War II (Jöns, 2009). Germany benefited from the transnational knowledge network and became the top countries to co-author with U.S. scholars in the late 20th century. Moreover, the expanding field of global health has explored the effects of visiting scholars in more depth (Panosian & Coates, 2006). This is because the ideal place for global health research training is abroad (Crump et al., 2010; Heimburger et al., 2011). Visiting scholar programs have three primary impacts: scholarly training for the individual, service to the host country, and establishing the foundations for a career oriented in global health (Crump & Sugarman, 2008; Decamp, 2007; Haq et al., 2000). Lastly, another potential benefit of visiting scholars is sharing research ethics. Developing countries are often much more interested in expansion, which could be problematic for ethics (Singer & Benatar, 2001).

Although there is no shortage of research about visiting scholars, the studies generally lack estimates of effects (Rezhake et al., 2018). Research on global health studies has found more direct effects; for example, in Rezhake et al.'s impact evaluation of medical scholars' participation in the Fogarty and Fulbright, they find that participating as a visiting scholar increased their research publications and presentations and so did the international students partnered to work with them (2018). However, this field of study

may not be generalizable to other fields of study. Additionally, the research on global health has a limited scope, because sometimes it results in clinical care, not research (Decamp, 2007). Generally, these studies have focused on the impacts of individual visiting scholars. However, by doing so, we negate the intangible effects on those around the visiting scholar. More work should be done like this recent study that focuses on the ripple effects of researchers (Sattari et al., 2022). These researchers concluded that funding a researcher increases the number of publications of other faculty, postdocs, undergraduate students, research staff, and other staff. They argue this is because research is increasingly taking place in groups—all in the group benefit through association.

Number of PhD Graduates

Numerous studies aim to understand how financial considerations influence graduate school enrollment and completion (Belasco et al., 2014; Denecke et al., 2016; Ecton et al., 2021; English & Umbach, 2016; Saloma, 2016a). A recent study reports significant increases in applicants, black applicants, and black students enrolled when PhD programs offer free tuition and stipends (Ecton et al., 2021). This is important, given that scholars are typically an elite class (Altbach, 1998). Funding, among other factors, like age, cohort, field of study, and sex, are significant predictors of program completion (Groenvynck et al., 2013). Funding is the strongest predictor of graduate school completion, because it enables students to focus on research and lowers stress levels (Ehrenberg & Mavros, 1995; Seagram et al., 1998).

Compared to graduate school uptake, the literature on why PhD programs take so long to complete and there are such high attrition rates is thin. Furthermore, most studies focus on the role of an individual and neglect institutional factors. Geven and colleagues analyzed a set of reforms implemented by the European University Institute (EUI), an international graduate school *(2018)*. In 1990, EUI introduced several structural changes to account for the informal culture of their PhD programs. They reformed the culture by establishing guidelines, milestones, assessments, writing requirements, presentations, and encouraged closer student-advisor relationships. In 2001, despite the reforms, they found that attrition rates and time-to-completion were still too high. Thus, EUI introduced a second set of reforms. They found that three years of funding was inadequate, so they extended funding a fourth-year conditional upon expedited degree completion. Each intervention led to a marked improvement in PhD completion rate, 9

and 20 percentage points respectively. Other impact evaluations showed similar but more modest gains with comparable interventions in the U.S. *(Groen et al., 2005)*.

Generating Research Capacity and Infrastructure

Certainly, significant investments are required to improve research outputs and establish a well-rounded higher education system that drives national development (Altbach, 1998), but how to allocate funds remains an important question. Several Asian countries experienced transformative and sustainable growth through increased funding for research universities (Salmi, 2009). Korea invested nearly 3 billion USD between 1999-2012 to establish 10- globally competitive research universities (Byun et al., 2013). Similarly, Japan has invested substantial amounts to develop research capacity at universities and foster economic development and innovation. Japanese researchers conducted an evaluation of the impact of large financial investments on research output. They used a difference-in-differences approach to find the effects of funding on the number of scholarly articles produced and citations garnered. They find that the life sciences, information sciences, medical sciences, respectively, had the following statistically significant increases in publications, 4.67, 1.49, 3.44 (Ida & Fukuzawa, 2013). However, math and physics, mechanical engineering, social sciences, humanities, and chemistry did not have significant improvements. Beyond this, conducting research often requires adequate equipment, which is expensive (Altbach, 1998; Forrest & Spolarich, 2010). Practitioners and implementers in biomedical research have proposed the following guidelines for funding research: create a diverse portfolio, value team science, focus on steady progress, optimize lab size, and focus funding on researchers and research programs, not projects (Lorsch, 2015).

There is a vast amount of research regarding the benefits of funding research. Nevertheless, purchasing equipment and spurring research through funding alone will not secure the research culture necessary for continued and enduring academic excellence (Yang, 2009). Researchers have placed too much attention on direct outputs of research, because they are key indicators countries and ranking systems are interested in (Costello & Zumla, 2000). Focusing solely on outputs is a limited paradigm that misses the substantial benefits of funding research. Other benefits include the impact of participating in research for additional people who wouldn't without the additional

funding, the long-term collaborative networks created, and participating in scientific communities located in the heart of research production (Sattari et al., 2022).

Key Takeaways

Visiting scholar programs can have immediate and long-term returns to research output, direct benefits to society through service, and transnational knowledge networks (Costello & Zumla, 2000; Jöns, 2009). Thus, our first two alternatives, a visiting advisor and PhD sandwich program, focus on expanding or creating visiting scholar programs as fruitful avenue with immediate and long-term results. The process of increasing graduates from PhD programs is slow (ASSAf, 2010), especially since the current capacity to train PhD students is low (Saloma, 2016b). Nevertheless, a promising and potentially low cost approach to increasing the number of graduates is through institutional reforms (Geven et al., 2018; Groen et al., 2005). Hence, the final two alternatives focus on advocating for two institutional reforms to PhD programs recommended by a prominent scholar of the Philippines higher education system, Dr. Caesar Saloma (2020). Lastly, money does not produce research—individuals and groups produce research in facilities purchased with money (Sattari et al., 2022). However, a substantial increase in funding is imperative to enable research. There is opportunity for a large growth in research output through increased funding in the Philippines, much more than any developed countries (Altbach, 1998; Salmi, 2009). Funding will be a critical component for evaluating all the alternatives in the following sections.

EVALUATIVE CRITERIA & POLICY ALTERNATIVES

Evaluative Criteria

Costs

The Fulbright program operates on taxpayer dollars; therefore, resources are scarce and difficult to procure. The cost for each alternative is the sum of the costs for implementing the program. All costs associated with implementing the program are identified, added, and adjusted for inflation to find the total costs of each alternative.

Effectiveness

PAEF has the lofty charge of internationalizing the Philippines and American higher education systems. As a prime objective, they aim to develop scholars and leaders that address pressing national and global challenges. Thus, PAEF is focused on the holistic development of the individual they send, but also the impact they make on pressing challenges of either country. The measurement used to determine effectiveness will be the number of STEM PhD graduates produced by each alternative. The analysis will make projections about how many additional students will graduate because of each alternative.

Cost-effectiveness

This criterion will simplify comparative analysis among policy alternatives. It will provide decision-makers with a single number that encapsulates the cost and effectiveness of each alternative. Cost effectiveness will provide the cost per additional STEM PhD graduate produced.

Political feasibility

Currently, there is unparalleled political support for higher education initiatives in the Philippines. The Philippines is invested in higher education as a means for national economic development. Nevertheless, there has been a rise in anti-American sentiment in the Philippines. PAEF does not want to become a political target for advocacy efforts nor program implementation. In addition to determining the political feasibility at the national and organizational level, this criterion determines political feasibility with regards to all stakeholders. Each alternative will be ranked in terms of high-medium-low feasibility, with high being the best. Reports, bills, conferences, and other such resources will be used to assess the likelihood of approval for each alternative.

Alternatives

To arrive at more precise estimates, all the alternatives selected for this analysis pertain to collaboration with the University of the Philippines – Diliman (UPD), College of Science (CS). UPD – CS was selected for three reasons:

1. Availability of data;
2. They currently produce about 20% of the Philippines STEM PhD Graduates (Saloma, 2020; Vea, 2020);
3. Infrastructure and existing policies are conducive to success and feasibility.

For each of the alternatives below, we begin by providing a brief description of the logistics. The descriptions are followed by the motivation for the alternative. All alternatives are proposed as pilot programs set to run for a specified amount of time.

Fulbright Visiting Advisor Program at UPD – CS

The visiting advisor pilot program would be implemented by PAEF. PAEF would collaborate with CS to recruit one STEM PhD advisor from the U.S. who would initially come to the Philippines during their sabbatical. The visiting advisor would be brought to the Philippines at the onset of the program to meet and begin advising 3 STEM PhD students. The onset of this program aligns with the beginning of the third year for the 3 PhD students. The 3 participating students would be selected based on their academic performance, and through demonstrating strong learning and project management skills. The visiting advisor would meet with the three students over the course of the semester to identify dissertation research they can work on together remotely. At the conclusion of that first semester, the visiting advisor returns home and continues to work with the 3 students remotely for the remaining 5 semesters. The program concludes in the third year after the onset of the program with the visiting advisor participating in the dissertation defenses remotely.

This program, while very distinct, mirrors the balik scientist program administered by the Philippines Department of Science and Technology (DOST). The balik scientist program encourages experienced Filipino scientists living abroad to return to the Philippines and share their expertise. The program enables returning scholars to contribute to higher education institutions (HEIs) in whatever way they can. This is a key difference from the proposed alternative—scholars will be sent to the Philippines for the specific purpose of advising PhD students. Another key difference is the timeline of service. The balik scientist program allows program length to vary based on the preferences of the scientist. The visiting advisor program provides the numerous intangible benefits associated with visiting scholars (Faulconbridge, 2007; Lally, 2022; Ros & Oleksiyenko, 2018), and directly increases the capacity of CS to train STEM PhD students. This alternative also aims to reduce costs by leveraging technology.

Fulbright PhD 'Sandwich' Program Between UPD – CS and a University of California PhD Program

The Sandwich program would also be implemented by PAEF. PAEF would collaborate with CS and a PhD program in the University of California (UC) school system to establish a 'sandwich' PhD program. The 'sandwich' consists of the first two academic years undertaken at CS to complete core course work, and two years of dissertation research with advisors at a UC school. During the two years of coursework, students will apply to STEM PhD programs at a participating UC school. After receiving admission from the UC school, students will apply for the Fulbright fellowship. The top three students from the class will be selected based on academic performance and the research that would benefit the most by being conducted in the U.S. The three students receive all provisions needed for conducting their dissertation research at the UC school. Students will return to the Philippines at the end of their fourth year to defend their dissertation at CS. The program implementation period consists of the two years abroad.

This alternative is similar to the Fulbright-CHED PhD scholarship, the motivation is the same; beyond providing ample time for significant research experience, they offer PhD students the opportunity to develop skills, techniques, and experience under the mentorship of skilled researchers in the U.S. However, the current program draws from current PhD students, but the proposed program would admit three additional students since they are sent abroad for advising. The program also aims to streamline costs and reduce costs by partnering with UC schools. PAEF can take advantage of the connections established through the DOST program—Philippine California Advanced Research Institutes (PCARI). Above increasing the amount of STEM PhD graduates, participants will learn cutting edge research techniques and methods, develop broadened research networks, and learn best practices for conducting research and training researchers (Lally, 2022). Upon contractual and obligatory return to the Philippines, participants of the proposed program will return with a wealth of knowledge and ideas for innovative research and ways to optimize higher education institutions in the Philippines.

Advocating for Extending the Retirement Age to 70 for PhD Advising at UPD – CS (Saloma, 2020)

This is an alternative for PAEF to advocate for moving the current retirement age back to 70 for all professors at the CS. This pilot program proposes taking the first retiring cohort of professors and offering them the opportunity to extend their career for five more years. The extension would be solely for the purpose of advising graduate students. The professors would work a part-time rate to perform the needed advising. Throughout the five-years, temporary performance evaluations will be conducted to ensure the students and professors are on the path towards successful graduation. The program concludes with the retirement of the professor.

On June 30th, 2016, through Senate Bill Number 89, lawmakers in the Philippines enacted a policy mandating all Department of Education teachers retire at 60 instead of 65 (19th

Congress of the Republic, 2022). The idea behind the bill is out with the old, in with the new. They aim to revitalize the workforce and allow seniors to enjoy retirement. However, Republic Act 9500 provides the University of the Philippines national university system institutional autonomy (14th Congress of the Republic, 2008). Nevertheless, the national university system has a compulsory retirement age of 65, with optional retirement at 60 (UPD Faculty Manual, 2022). The reasoning behind this policy is like the former, but, in addition, there is a sentiment that these professors are earning too much for what they are producing. However, extending the obligatory retirement age to advise PhD students can enable the training of at least two full additional cohorts. Furthermore, if this pilot program proves successful, professors could work full-time as PhD advisors. This magnified focus on PhD advising can also lead to higher graduation rates by having more instructional support for students (Geven et al., 2018; Groen et al., 2005). Professors can make a substantial contribution to the number of STEM PhD graduates during the five years extended to their career.

Advocating PhD Advising as a Tenure-track Requirement at UPD – CS (Saloma, 2020)

This is another alternative for PAEF to advocate for institutional changes to increase graduation rates. To incentivize more graduate student training, this alternative proposes to make the successful training of 2 graduate students a requirement to receive tenure. This program would be piloted with a single cohort of new tenure track professors. It spans the 6 years these professors work towards tenure. To provide ample time for the increased advising hours, professors should be allowed to substitute away from teaching time. PAEF can advocate for this pilot program to initiate the institutional changes through the support of their board members at CHED and UPD.

The national universities have in their charter to be models of academic excellence. The national universities of the Philippines have institutional autonomy, and many provide graduate level training. One estimate reports that it is reasonable to expect each faculty member to graduate at least one student every three years; the same report then claims that at the rate of one student per 3 years, the College of Science at the University of the Philippines – Diliman (UPD) would triple its graduation output to about 40 per year (Saloma, 2020). However, professors in the Philippines are compensated more for teaching additional courses. This leads to the over-emphasis on teaching. Consequently, research, and, especially, PhD student mentoring, become perfunctory tasks. Increasing the emphasis on PhD advising at the start of a professor's career can establish a greater precedence for advising in the future. Furthermore, if successful, this model can be applied to other national universities or STEM PhD programs in the Philippines.

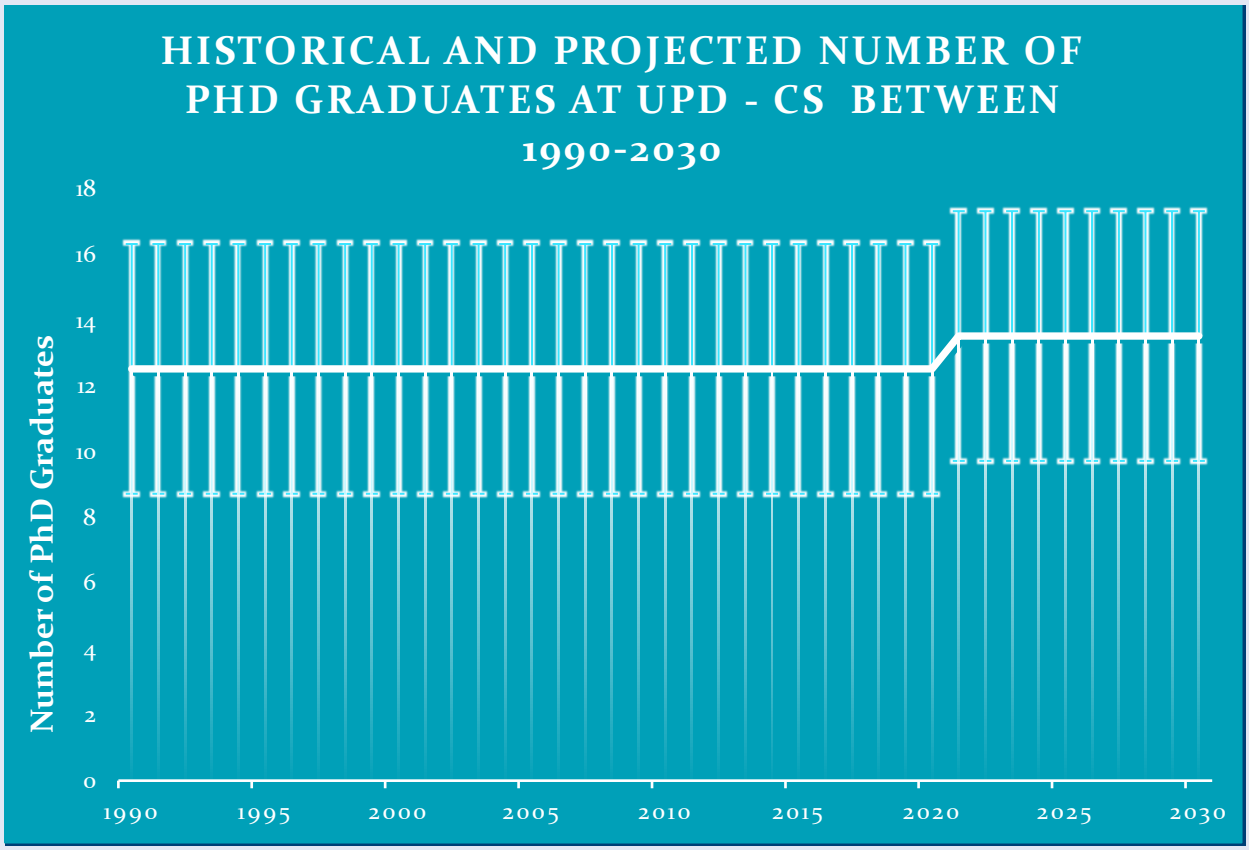
FINDINGS

Status Quo

The findings section of this report applies all the evaluative criteria to each alternative in turn. We begin by providing an estimate of what the STEM PhD graduation rate would be at CS in the absence of any policy alternative. This establishes a benchmark graduation rate.

Between 1990 and 2020, the College of Science (CS) at UPD has produced an average of 12.53 ± 3.80 PhD graduates per year (C. A. Saloma, 2020). However, between 2011-2018, there was an 9% increase in PhD holding faculty at CS (from 153 to 168). If we allow the average number of PhD graduates to increase at the same rate as faculty, we anticipate the CS will produce about 13.53 ± 3.80 PhD graduates per year in the coming years. Figure 2 below provides graphical representation; the visual provides the confidence interval for the historical and projected graduation rates. Based on limited access to data, we do not provide the exact amount of PhD graduates each year.

Figure 2



Fulbright Visiting Advisor Program at UPD – CS

Costs

The purpose of this alternative is to directly increase the number of PhD advisors at UPD CS by bringing faculty from the U.S.—visiting advisors—to advise PhD students in the Philippines. This proposed alternative is for a pilot program with one visiting advisor. Faculty applying for the fellowship must be in the planning stages of their sabbatical leave. Professors should plan to be on their sabbatical leave at the onset of the program; this will mitigate the financial burden placed of covering the professor's full salary. At the beginning of the program, the visiting advisor will spend a semester at UPD advising third year graduate students and helping them identify research projects they can work on together remotely. The costs of this program for the semester abroad includes housing, a faculty stipend, round-trip flight, dependent allowance and tuition, and a research and relocation allowance. The total estimated costs for the semester as a visiting advisor are $18,800 USD, see Appendix A, Table one for a breakdown of the costs. After the semester, the visiting advisor will return home and continue to meet with the graduate students 3 hours per week. The advisor will be paid $720 USD per week for their 3 hours of service. In the first year, the advisor will only provide their services for 16 weeks, which is equivalent to the spring semester. In the second academic year, the advisor will work 32 weeks, the equivalent of two semesters. After adding inflation adjusted costs of the third year we arrive at total costs for 5 semesters of remote advising and the semester abroad, which are: $79,203 USD. For a breakdown of total costs for remote advising, see Appendix A, Table 2. Lastly, PAEF should incorporate the implementation and administrative costs associated with establishing the pilot program and the time to ensure it would function well.

Effectiveness

At the end of the three years, we expect the advisor will successfully graduate 3 PhD students. While attrition rates in PhD programs span between 40-60%, the majority of those who dropout typically do in their second year (Wollast et al., 2018). Furthermore, all the students assigned to the visiting advisor will be selected from the top students in the cohort and whose research aligns with the visiting advisor. Additionally, PhD students in

the sciences tend to have higher graduation rates (Wollast et al., 2018). Therefore, there is a very high chance for the successful graduation of 3 students.

Cost-Effectiveness

The cost per PhD graduate in the visiting advisor program is $26,401 USD.

Political Feasibility

A primary concern for this alternative is the take-up rate among professors. It is difficult to gauge demand for this position, especially since professors must be on sabbatical during their first year. However, the pilot program will be implemented with one advisor, therefore, it should not be too challenging to obtain a highly qualified participant. The process of piloting the program will provide a good sample of demand for the position to estimate a feasible number of slots for expansion in the future. Another primary concern for administrators at CS is whether remote PhD advising will be effective. The COVID-19 pandemic has reduced some of the stigma associated with online programs. However, the PhD students will lack some professional and emotional development that comes from meeting directly with professors, but these challenges can be overcome with additional training to provide structure and avoid common remote advising challenges (Kumar & Johnson, 2019; Wisker et al., 2021). PhD students should be enthusiastic about having a visiting advisor for their supervisor, despite having to work together remotely. Lastly, although this program shares common elements with other Fulbright programs, it is novel in the sense that most of the work will be done in the US. Nevertheless, the program still works towards furthering the mission of the Fulbright program. None of the challenges with political feasibility, however, present significant barriers that would preclude a visiting advisor program. Thus, this alternative has a rank of high for political feasibility.

Fulbright PhD 'Sandwich' Program Between UPD – CS and a UC PhD Program

Costs

The PhD Students admitted to the sandwich program would complete their core coursework in the Philippines during the first two years of their program. The Fulbright program would cover costs associated with transportation, room and board, health insurance. The estimated average annual costs for fees and living costs for nonresidents at a UC school is $23,500 USD in year 1. Students will take the equivalent of 12 credits per academic year. The courses will be research, research seminar, exit seminar, and complete thesis. The Fulbright program will have to cover the average part time rate for a UC school, $7000 USD per year per student. This is the rate for international doctoral students with a nonresident supplemental tuition waiver ($5,850 USD), and to compensate for advising and enrollment costs ($1,150). The Fulbright program will also cover a roundtrip flight, the costs for the flights will be paid in the first year and after the second so we adjusted the second flight costs for inflation. At most, funding will be provided to support two academic years abroad. This pilot program is for 3 PhD students. The total costs were calculated by adding all the costs in year one to year two costs that were compounded at 4% to account for inflation. The estimated total costs for sending 3 PhD students abroad for 2 years: $217,700 USD. See Appendix A, Table 3 for calculation spreadsheet. Lastly, PAEF should incorporate the implementation and administrative costs associated with establishing the pilot program and the time to ensure it functions well.

Effectiveness

We expect all three PhD students admitted to this program will graduate. The students admitted to this program will be in their third year, which significantly reduces attrition rates. Additionally, these students will have other characteristics that research has shown contribute to successful graduation. Science and technology, funded, and prior grades in, PhD programs lead to high success rates (Wollast et al., 2018). Since there are very limited

slots for this program, there should be a large quantity of highly qualified candidates. All admitted students will have a high probability of completing their PhDs on time.

Cost-Effectiveness

The cost per PhD graduate from this project is $72,566 USD.

Political Feasibility

This alternative has high political feasibility because it parallels the traditional Fulbright programs. A separate Fulbright program, currently under review, the CHED-Fulbright PhD scholarship, gives opportunities for university lecturers to pursue PhDs in the US for two years. However, this alternative, the sandwich program, aims to enhance time in the US by having core coursework done beforehand allowing for greater concentration on research. What's more, this alternative has the potential to reduce costs and administrative burdens by establishing connections between a CS and the UC school system. Indeed, CHED has already established connections with the UC school system through Philippines-California Advanced Research Institutes (PCARI). Therefore, UC schools are likely going to be willing to participate in this program. However, there has to be a sufficient number of advisors at the UC schools to take on additional students. This will require substantial planning and coordination between the schools. A concern for UC schools may be a mismatch in curriculum between the two PhD programs that are sandwiched together. Curriculum can be aligned to resolve this issue, but a remaining challenge may be that of competence. Lastly, if the pilot program proves successful, there would have to be extensive planning in conjunction with the UC school system to manage the number of opportunities supplied. However, collaborations for the sandwich program could also expand to other universities that are willing to participate. Given that most of the anticipated barriers to feasibility are administrative issues that can be resolved, and the similarity with current Fulbright programs, the sandwich program has high political feasibility.

Advocating for Extending the Retirement Age to 70 for PhD Program Advising at UPD - CS

Costs

In 2020, about 81 (48.2%) of the 168 PhD holding faculty members in the UPD College of Science were 51 years or older (C. A. Saloma, 2020). Assuming a third of these 81 faculty members are split evenly into these three age brackets 51-55, 56-60, 61-65, we can say that about 27 faculty members are at the optional retirement age of 60 and approaching the mandatory retirement age of 65. Breaking this group of 27 faculty members down even further, we estimate a range of retiring professors to provide an interval for costs. The lower bound of the interval is 5 professors (about 19% of those between the ages of 61-65) retiring in the coming year. The upper bound estimate is 10 professors; in 2020, 12 CS faculty members retired (DIO, 2020). Certainly, there will be professors who are ready to retire and be done, but given the option to extend for advising, we assume about 60% of those at the age of 65 will choose to extend.[1] Costs are based on a part-time salary equivalent to 50% of a full-time salary of full professors since they will only perform the role of advisor. We adjusted salaries to increase by 4% each year to account for inflation. The pilot program is designed to operate for 5 years with one cohort of retiring professors. The lower bound estimate of the total costs of 3 retiring professors is about: $328,477.25 USD; see Appendix A Table 4 for calculation spreadsheet. The total costs for the upper bound estimate with 6 retiring professors is about: $656,954.50 USD, see Appendix A Table 5 for calculation spread sheet. The average of these two values is presented in the outcomes matrix and is equal to $492,715.88 USD.

In addition, to the costs of implementation, PAEF will undertake certain costs for advocating for this policy change. This will involve time at board meetings, establishing meetings with CHED, meeting and presenting to university administrators. PAEF should factor these costs into their decision-making process.

[1] A Fidelity poll in the U.S. found that 75% of faculty said they planned to retire after the age of 65 (Hicken, 2013); of those who planned to stay, 80% said they would do so for professional reasons. Therefore, we arrive at 60% because it is equal to 80% of the 75% that planned to retire after the age of 65.

Effectiveness

Under this part time work, we expect each professor can graduate about 3-5 students throughout the duration of the program. Professors will be spending the part-time that they work completely on advising. Therefore, we expect over the course of 5 years a professor will be able to work with 8 graduate students. The College of Science and other Scientific PhD programs have had a graduation rate of about 50% (Saloma, 2020). Thus, on average, we expect each professor to graduate about 4 students in about 5 years. Using the lower bound estimate from costing, 3 retiring professors that choose to extend, we estimate they will produce a total of 12 PhD graduates in six years. The upper bound estimate with 6 retiring professors, is 24 PhD graduates in 6 years. The average of these two estimates is 18 PhD graduates. See Appendix A, Table 6, for a breakdown of calculations.

Cost-Effectiveness

Using the average of the upper and lower bound costs and average number of expected PhD graduates, the cost per PhD graduate: $28,037.80 USD.

Political Feasibility

The UPD faculty manual, section 20.3 provides the conditions by which a professor can extend beyond the mandatory retirement age for PhD advising (2022). However, professors are only allowed to extend for one year. The manual makes it clear that extension beyond the retirement age should be done sparingly and for exigent service. Although the tenor at UPD is against such a lengthy extension, a recent bill to rescind the mandatory age was introduced in the House (Jaymalin, 2022). As a result, the Philippines' Department of Labor and Employment (DOLE) is planning to do a policy analysis to estimate effects. Despite the changing dialogue concerning the retirement age, this extending the retirement age to 70 has a rank of low for political feasibility because it is such a drastic policy change.

Advocating for PhD Advising as a Tenure-track Requirement at UPD - CS

Costs

Between 2015 and 2018, the College of Science (CS) at UPD increased by 15 PhD faculty members (C. A. Saloma, 2020). Dividing each year evenly, we estimate they would hire about 5 PhD holders a year. The UPD faculty manual states that new professors go up for tenure after six years. We estimate each professor can be incentivized to successfully graduate two PhD students during the six years (C. A. Saloma, 2020). The costs associated with this alternative are the additional time spent on advising which will substitute teaching time. First, to estimate the number of PhD students being advised in a year, we take the average number of PhD graduates from CS (12.53) and multiply it by 2 to account for the assumed graduation rate (50%). If each cohort has 25 PhD students, and it takes 5 years to graduate, then there are about 125 PhD students being taught at any given point. And, if each professor supervises 2 students, there are about 63 professors advising PhD students; this is equivalent to about 37.5% of the CS faculty are advising PhD students, this estimate of how many faculty members are advisors parallels the percentage found (36.4%) in an American study about how faculty use their time (Haider, 2017). With the estimated 63 professors graduating 12.53 students per year, each professor produces about 20% of a graduate per year (see Appendix A, Table 7, for a breakdown of how I arrived at this estimate). Therefore, in three years, a faculty member would produce about 60% of a PhD graduate at the going rate.

To incentivize faculty to produce 1 graduate every three years, faculty will have to increase the time they currently spend on advising by 67%. One estimate from the U.S. reports that faculty spend 1 hour and 19 minutes, on average, a week advising graduate students (Haider, 2017). Therefore, each professor would have to work about an additional .87 of an hour per week. Multiplying the weekly rate by 32 weeks in an academic year, each professor will have to forgo about 28 hours of teaching time. Another estimate from the US reports that professors spend 2.67 hours per week teaching a one credit course; in other terms, a one credit course per semester takes about 42.72 hours. In the six years a professor is teaching, they would need to teach 4 credits less than they would otherwise teach (see Appendix A, Table 8). To provide professors with the time they need for advising, they would teach 3 credits less during their second year and co-teach a class with another professor (equivalent to 1.5 credits) during their fourth year. Alternatively,

they could get a reduction of a 4 credit (class + lab) course reduction during their third year. Tuition per credit will cost $28.64 USD. On average, the faculty student ratio is 1 to 25 at state universities and colleges in the Philippines (CHED Statistics, 2020). Thus, reducing 3 credits in year two costs $2148 USD per Professor, after adjusting for inflation. In year 4, adjusting for inflation, the cost for 1.5 credits (25 students) is $1162 USD. Taking the sum of the costs per professor from years two and 4 and multiplying them by the 5 professors we arrive at the total costs of this alternative: $16,548 USD (see Appendix A, Table 9). Alternatively, the total costs for a 4-credit course in year 3, after adjusting for inflation, are: $14,893 USD (see Appendix A, Table 10). The average cost between these two estimates is: $15,836 USD. PAEF will also have to factor in advocating costs to implements this alternative.

Effectiveness

The five PhD advisors should work with about 4.5 more PhD students during their 6 years of tenure track. However, only half of those additional students would graduate within the 6-year period (2.25). Ultimately, if only 50% of PhD students graduate, then each professor would produce about one graduate above the status quo across the six-years. **The total estimated effectiveness of 5 professors is 5 PhD graduates.**

Cost-Effectiveness

The cost per PhD graduate is $3,167 USD.

Political Feasibility

The UPD faculty manual stipulates that if a department has more requirements for tenure track professors at lower ranks, the department must obtain approval from the College, Chancellor, President, and Board of Regents. To obtain approval from these gatekeepers, there will have to be substantial support from CS faculty and administrators. Since most of the burden of these changes will be placed on incoming faculty, there should not be much pushback from current faculty and administrators. Indeed, the biggest proponent of this policy change is a tenured professor at CS and a former chancellor of UPD. Although lobbying for policy changes is not one of PAEF's core competencies, they have the right resources and connections to effectively advocate for this change. Therefore, incentivizing PhD advising by making it a tenure track requirement ranks medium in terms of political feasibility.

Outcome Matrix

The alternatives vary in length of time which makes it difficult to compare the total cost and effectiveness of each program. To maximize comparability in the outcome matrix below, we provide the cost, effectiveness, and cost-effectiveness per year of the program (e.g., total cost of A divided by the number of years of alternative A). Costs are in USD, and effectiveness is the number of additional PhD grads per year.

Criteria	**Alternatives**			
Alternatives	Visiting Advisor	Sandwich PhD	Extend Retirement	Tenure Track
Cost	$26,400	$108,850	$98,543	$2,640
Effectiveness	1	1.5	3.6	0.83
Cost-Effectiveness	$26,400	$72,566	$27,373	$3,180
Political Feasibility	High	High	Low	Medium
Program Years	3	2	5	6

RECOMMENDATION

There is one standout policy alternative in terms of costs and cost effectiveness—making PhD advising a requirement for tenure. Costs for this alternative are substantially lower than any other. The second most appealing policy alternative is extending the retirement age to 70 for professors, because of the significant amount of PhD graduates that would be produced. However, to change the retirement age policy at UPD and tenure track requirements would require the full support of CS, the Chancellor, Board of Regents, and President. This would be a lengthy process with much uncertainty of success, even for just piloting these alternatives.

Based on the political infeasibility of the advocating alternatives, **we recommend the pilot visiting advisor program in conjunction with UPD – CS**. The visiting advisor program is the second-best alternative in terms of cost-effectiveness; it is a slightly more cost-effective approach than extending the retirement age. Yet, if the pilot program proves successful, and there is sufficient supply of visiting advisors, the program can be scaled up to be more effective than extending the retirement age. Additionally, as opposed to extending the retirement age, bringing PhD advisors from abroad can provide the intangible benefits associated with visiting scholars. Lastly, we recommend the visiting advisor pilot program because PAEF will have direct control over its implementation, and the program is more aligned with PAEF's current operations.

IMPLEMENTATION ANALYSIS

Next Steps

1. Determine supply of visiting advisors in the sciences:
    a. Analyze Fulbright data to find the number of applicants for similar programs.
    b. Connect with administrators of the Balik scientist program to understand what their supply pool looks like.
2. Meet with Dr. Giovanni A. Tapang, Dean of the College of Science:
    a. Garner support for collaborating on this pilot program.
3. Find a biology, chemistry, physics, math, or environmental science visiting advisor:
    a. Utilize current recruitment strategies to raise awareness about the fellowship.
    b. Create an application form and fellowship description webpage.
    c. Open the application period.
    d. Select candidate.
4. Advise CS about the discipline of the selected visiting advisor:
    a. Admit 3 additional PhD students to the cohort for that discipline.
    b. Students apply in their second years to work with the visiting advisor.
5. Coordinate arrival of the visiting between host institution, CS, and PAEF:
    a. Align visiting advisor's sabbatical period with first year of advising at CS.
    b. CS and advisor select 3 PhD students from top applicants.
    c. PAEF will secure flight, housing, for advisor make provisions for dependents.
6. First semester of advising:
    a. Initial reception and training with PAEF to establish program expectations
    b. Settle into UPD – CS, provide stipends.
    c. Meet PhD advisees and work with them part-time to identify research topics.
    d. Work on sabbatical research.
7. Return home for remote advising:
    a. After the first semester, advisor is expected to work remotely with advisees.
    b. Advise 3 students 3 hours per week.
    c. After each semester, students and advisor will complete check-in surveys.
8. Completion of Degrees:
    a. Mentors will participate in dissertation defense remotely.
    b. Visiting Advisors released from duties.
    c. Conduct exit surveys/ focus group with students and advisor.
9. Continue or conclude program:
    a. Synthesize feedback from participants and stakeholders.
    b. Estimate supply of visiting advisors.
    c. CS and PAEF jointly revise data and make program determinations.

Stakeholder Analysis

Visiting Advisor

A primary concern of implementation is finding a biology, chemistry, physics, math, or environmental science visiting advisor. It is difficult to estimate the supply of willing and capable professors; PAEF can use Fulbright data to get a baseline feel for potential supply. However, this is an imperative first step, because the entire program is contingent upon securing a visiting advisor. Since this program is piloted with a single advisor, there is a high chance of finding a candidate.

Another critical component for advising is time. The potential visiting advisors should be targeted and informed about the pilot program about 4 years before the start of advising. This is the safest approach for rolling out this pilot program, to avoid having 3 additional students without an advisor in the case where an advisor is not secured. Additionally, upfront it is uncertain from which discipline the advisor will be from. Thus, it is better to start by selecting the advisor and then admitting 3 additional students to the program that aligns with the advisor's discipline. However, this means a requirement for eligibility for this program is that professors must be in the planning stages of their sabbatical, which occurs no sooner than 3 years before the program takes place. After being selected, the professor can propose this opportunity for service and research to get approved for a sabbatical. Initially, the gap of three years between application and the commencement of the fellowship seems long and problematic, but it will also help the visiting advisor and their host institution prepare for their absence. Additionally, the advisor will have ample time to prepare all personal concerns for the temporary relocation.

PhD Students

Students are also of critical concern for securing the effectiveness of this program; especially since remote advising carries its own challenges. Early research about online mentoring found feelings of isolation based on low communication, difficulty in establishing trust, and technical challenges to be some of the challenges (Ensher et al., 2003). The same researchers and others conclude that using multiple activities and technologies to gain student trust, frequent communication, community building, helps overcome the transactional distance (Ensler, 2013; Headlam-Wells et al., 2005; Schichtel, 2010). Since advising is one of the most important factors for completing doctoral dissertations (Kumar & Johnson, 2019), training for remote advising should be provided to anticipate and overcome some of the challenges associated with online mentoring.

Students should also be selected based on their expression of certain competencies. We anticipate many students will apply to receive advising from the visiting advisor based on the potential for professional and educational development that cannot be provided locally. However, the nature of remote advising requires that students have demonstrated experience managing and directing their own learning (Kumar & Johnson, 2019). When

applying to work with the visiting advisor, students should demonstrate how they have, and plan to, manage their own learning with the support of the advisor. Demonstrated learning and research management, along with strong academic performance, should be the primary factors in selecting the students that will be most likely to succeed in with a remote advisor.

College of Science

The College of Science was selected as the collaborator of this project based to facilitate data analysis and comparison amongs the alternatives. However, CS has some of the best PhD programs in the sciences which means they should have some of the top PhD students in the Philippines. Nevertheless, if CS does not wish to engage in this join pilot program, PAEF should be able to identify another partner institution with relative ease. PAEF has an extensive network of higher education institutions they can partner with. Furthermore, it is reasonable to assume that most science PhD programs would like to increase the number of students they can take in, but are limited by their capacity to advise. Therefore, most programs would choose to enter this joint venture if presented with the opportunity.

Throughout the program, there will be several manageable administrative tasks for CS, or another institution, to perform. We do not anticipate challenges at these stages. However, at the conclusion of the pilot program, CS and PAEF should convene to discuss the feedback from advisors and students, determine the supply of applicants and their programs, and decide whether to expand or conclude the program. If they decide to expand, it would be based on a sufficient supply of advisors. With a sufficient supply of advisors, CS and PAEF may decide to increase the number of applicants in a certain PhD program, and then call for advisors for those specific disciplines. This would reduce the amount of time between application and advising. However, determining sufficient supply is critical to avoid not having an advisor for the additional students admitted. Lastly, again, based on the supply of advisors, PAEF may choose to expand this program to other colleges at UPD or other universities in the Philippines.

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APPENDIX A

Costs for Fulbright Visiting Advisor Program at UPD – CS

Table 1

Stipend for Semester Abroad						
Housing at UPD - 4 Months	Stipend	Round Trip Flight	Travel/Relocation Allowance	Research Allowance	Dependent benefit	Dependent tuition
$ 1,929.64	$ 11,520.00	$ 4,000.00	$ 305.00	$ 435.00	$ 610.00	$ 10,000.00

Total Costs Per Visiting Advisor's Semester
$ 28,799.64

Table 2

First Year Costs per Advisor						
Average Professor Salary	Hours Worked per Week	Work Weeks	Salary/Hours/Weeks= Hourly Wage(HW)	Consulting Fee = 3xHW	3 Hours of Consulting per Week	16 Weeks in Year 1 = Total cost per Advisor
$ 200,000.00	$ 50.00	$ 50.00	$ 80.00	$ 240.00	$ 720.00	$ 11,520.00

Costs in Year Two per Advisor Adjusted for Inflation						
Average Professor Salary	Hours Worked per Week	Work Weeks	Salary/Hours/Weeks= Hourly Wage(HW)	Consulting Fee = 3xHW	3 Hours of Consulting per Week	32 Weeks in Year 1 = Total cost per Advisor
$ 208,000.00	$ 50.00	$ 50.00	$ 83.20	$ 249.60	$ 748.80	$ 23,961.60

Costs in Year Three per Advisor Ajusted for Inflation						
Average Professor Salary	Hours Worked per Week	Work Weeks	Salary/Hours/Weeks= Hourly Wage(HW)	Consulting Fee = 3xHW	3 Hours of Consulting per Week	32 Weeks in Year 1 = Total cost per Advisor
$ 216,320.00	$ 50.00	$ 50.00	$ 86.53	$ 259.58	$ 778.75	$ 24,920.06

Total Costs for Remote Advising per Professor
$ 60,401.66

Costs for PhD 'Sandwich' Program between UPD – CS and a UC PhD Program

Table 3

Campus Fees	Books	Health Insurance	Housing/Meals
$ 1,600.00	$ 1,600.00	$ 5,472.00	$ 18,700.00

	Total Costs and Fees per year
Year 1	$ 27,372.00
Year 2	$ 28,466.88

Total 'Sandwich' Program Costs for Three Students Across Year 1

Tuition	Flight	Fees and Costs per student
$ 21,000.00	$ 3,600.00	$ 82,116.00

Year 1 Total Costs for 3 Students	**Total Costs (Year 1 +Year 2)**
$ 106,716.00	$ 217,700.64

Total 'Sandwich' Program Costs for Three Students Across Year 2

Tuition	Flight	Fees and Costs for 3 students
$ 21,840.00	$ 3,744.00	$ 85,400.64

Year 2 Total Costs for 3 Students
$ 110,984.64

Costs for Extending the Retirement Age to 70 for PhD Advising at UPD – CS

Table 4

Total Costs for Lower Bound					
Year	Retiring Professors	Take up	Extending Professors	Part-time Salary (Inflation Adj.)	Total
1	5	0.6	3	$ 1,091,694.00	$ 3,275,082.00
2	5	0.6	3	$ 1,135,361.76	$ 3,406,085.28
3	5	0.6	3	$ 1,180,776.23	$ 3,542,328.69
4	5	0.6	3	$ 1,228,007.28	$ 3,684,021.84
5	5	0.6	3	$ 1,328,212.67	$ 3,984,638.02
				Total Cost-Php	$ 17,892,155.83
				Total Cost-USD	$ 328,477.25

Table 5

Total Costs for Upper Bound					
Year	Retiring Professors	Take up	Extending Professors	Part-time Salary (Inflation Adj.)	Total
1	10	0.6	6	$ 1,091,694.00	$ 6,550,164.00
2	10	0.6	6	$ 1,135,361.76	$ 6,812,170.56
3	10	0.6	6	$ 1,180,776.23	$ 7,084,657.38
4	10	0.6	6	$ 1,228,007.28	$ 7,368,043.68
5	10	0.6	6	$ 1,328,212.67	$ 7,969,276.04
				Total Cost-Php	$ 35,784,311.66
				Total Cost-USD	$ 656,954.50

Effectiveness of Extending the Retirement Age to 70 for PhD Advising at UPD – CS

Table 6

Effectiveness of Extending the Retirement Age						
	Students per Professor	Expected graduates	Retiring Professors	Take up	Extending Professors	Total Graduates
Upper Bound	8	4	5	0.6	3	12
Lower Bound	8	4	10	0.6	6	24
					Average graduates	18

Costs for PhD advising as a Tenure Track Requirement at UPD – CS

Table 7

Number of Graduates per Professor per Year				
Grads per Year	Grad students per year	Years to Graduate	PhD students	Total of Faculty (2 per student)
12.53	25.06	5	125.3	62.65
			Grads per Professor per Year	0.2

Table 8

Calculating the Necessary Credit Reduction per Professor				
Current Advising Hours	Needed Weekly Hourly Increase (67%)	Additional Hours per Academic Year	Hours per 1 Credit course	Additional Hours per 6 Years
1.30	0.87	27.87	42.72	167.23
			Total Credits Removed	3.91

Table 9

Total Costs of Alternative for 5 Professors with 3 Credits in Year 2 and 1.5 Credits in Year 4				
1 Credit Year Two(USD) per Student	25 Students per Professor per Credit	3 credits in Year 2 per Professor	1 Credit Class in Year 4	Year 2 + Year 4
$ 28.64	$ 715.99	$ 2,147.97	$ 1,208.09	$ 3,356.06
			Total Costs for 5 Professors	$ 16,780.30

Table 10

Total Costs of Alternative with 4 Credits in Year 3 for 5 Professors		
1 Credit Year Two(USD) per Student	25 Students per Professor per Credit	4 credits in Year 3 per Professor
$ 28.64	$ 715.99	$ 2,978.52
	Total Costs for 5 Professors	$ 14,892.60