How young scholars in four ASEAN countries forged successful research careers

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1 Context

Becoming fully established as a member of the academic profession and attaining a permanent position is a career goal for many young scientists. Closely intertwined in the career development of young scholars is their early career performance, which will pave the way for their future successes. This study reports on the second phase of The Global State of Young Scientists (GloSYS), which was launched by the Global Young Academy (GYA) in 2013. This second phase investigated the career paths of young scientists and researchers in four research systems in Southeast Asia (Indonesia, Malaysia, Singapore, and Thailand). The study examined the different conditions and obstacles, including : career development in an era of increasing competition and expectations ; how national support mechanisms influence productivity and success ; and young scientists' perceptions of their situation and their personal motivation to pursue an academic career. The existing literature focuses only on the challenges and opportunities of young scientists in select countries and largely neglects the research systems of developing and emerging nations.

This study examined the disparities and the differences in opportunities hazards that academic careers hold in these countries. Also reviewed were the concerns of young scholars about their career paths within their national contexts. The study examined country disparities in science, and within this context considered factors such as age and gender. This study reflects on the increasingly mobile and international careers of young scientists, who are working in a profession where knowledge is produced in a globally competitive context but also in environments strongly shaped by local and national institutions. A number of ideas are proposed that consider the contemporary,

global challenges and opportunities that young scientists face when pursuing career advancement in different parts of the world.

2 Empirical Approach and Main Findings

Several factors influence research performance, which ultimately contributes to building a research career. A number of these factors are socio-demographic (e.g., age and gender) others are related to the choices made by the researchers (e.g., collaboration and funding).

Age — Views on the relationship between aging and research productivity fall into two groups. The first group generally advocates that younger researchers are more productive and more likely to be cited than their older colleagues. The second group argues that it is not younger researchers but mid-career and older researchers who produce the most research and have a greater scientific impact. Both theories have some merit and there is evidence that the effect of age varies between different disciplines. With this in mind, our first hypothesis was : H1 (Age) : Older young scientists are more productive in terms of research output.

Gender — A vast literature highlights the poor research performance of women in relation to men. On average, women publish fewer papers than their male colleagues ; women seem to be less productive in the first decade of their career, but are more productive after ; articles authored by women receive fewer citations than those of their male colleagues ; and a smaller proportion of women benefit from research funds. A number of explanations for these discrepancies have been put forward : women with young children are less mobile, have fewer networking opportunities and collaborate less than men ; research funding, access to graduate and postdoctoral students are biased against women ; women devote more time to teaching and administrative duties than men ; and women specialize less than men. Our second hypothesis was : H2 (Gender) : Female researchers are less prolific in terms of scientific output.

Funding — Public funding of university research has a positive effect on scientific production and can be perceived as a signal of quality, not only of the funded researchers, but of their university. Universities and departments that have been awarded public grants have larger teams and attract more government funding. This enables researchers to build research infrastructure, hire new researchers or students, or to establish and expand scientific networks. Some studies have found that industrial research and development (R&D) contracts and funding from private sources have an impact if they represent a small proportion of total funding. In addition, it has been suggested that philanthropic funding from not-for-profit (NFP) organizations can have a positive impact on scientific production. Our third hypothesis was : H3 (Funding) : Researchers with a higher proportion of funding from (a) public national organizations will also generate more scientific output ; whereas, researchers with a higher proportion of funding from (b) private organizations or (c) philanthropic organizations will generate more technological output.

Collaboration — Networking and collaborating both benefit scientific production. Collaboration is also a powerful means to raise funds, and consequently, scientific

collaboration and research funding are intertwined. The fact that most papers are now written in collaboration may contribute to reducing gender differences. Collaboration should have a positive impact on research production, but because women work in smaller or more localized teams their research may be less numerous. Our fourth hypothesis was : H4 (Collaboration) : Researchers who collaborate will also generate more research output.

Mobility — The mobility of academic staff is an important aspect of the internationalization of research systems. Mobility is generally associated with positive effects for the institution and for mobile individuals. Mobile researchers generally have a larger international network ; perform better than their non-mobile peers ; publish and are cited more often ; and have better access to funding. Our last hypothesis was : H5 (Mobility) : Researchers who have spent some time abroad, for study, research, or work-related purposes, will be more prolific.

Data — Data were collected using an email questionnaire sent to young researchers in the main research institutions, both public and private, in Indonesia, Malaysia, Singapore, and Thailand as well as some researchers working in other parts of the world. Our sample included 68 researchers currently working in Indonesia, 189 in Malaysia, 45 in Singapore, 255 in Thailand, 25 in developed countries, and 13 in the rest of the world. Our analysis compared the sample means of each country or region and of each gender.

The study examined the motivation to enter a research career and the satisfaction of such a career choice. Regarding motivation, relatively few differences were noted between countries. Of the 12 characteristics reviewed, flexibility of working hours, research itself, training the next generation, and applying knowledge to improve society were more important for Malaysian researchers compared with their Thai colleagues. In contrast, more Thai researchers than Malaysians chose academia or research because no other job was available. Singapore researchers stood out for ranking the lowest on all the motivation factors. When comparing genders, men gave more importance to research ; whereas, women gave more importance to job security. The only other notable difference was that women tended to choose a career in research less often than men because no other job was available.

Although job security was a distinguishing factor for women as a motivation to enter a career in research, it did not discriminate between men and women as a satisfaction factor. Job security was one of the most important satisfaction factors for Thai researchers compared with their Malaysian colleagues. In contrast, Malaysian researchers favoured income and working hours. One satisfaction factor ranked in the top two for most Asian countries : the flexibility of working hours. Not surprisingly, we found that men appeared more prolific in terms of research outputs than their female colleagues (hence supporting what is generally acknowledged in the literature), but the difference between the two genders was not significant. The poor performance of Singapore was rather surprising and was probably due to the poor response rate to our survey.

There were some differences in access to research funding between the countries. In Malaysia, the highest proportion of the funding came from local and national sources, when compared with Thailand and the other Asian countries. In Thailand, the importance of private and philanthropic research funding was significantly higher than in Malaysia. With the exception of private funding, favoured by men, no significant difference was noted in terms of the proportion of funding from different sources.

Individuals who devoted more time to research were more likely to produce more scientific output. Research was the most time-consuming task, and on average, researchers devoted more than 20 hours per week to research. Women devoted more time to teaching and administration, and slightly more to research than men. In contrast, men spent more time in consulting and fund-raising activities.

Research collaboration, reflected by the number of co-authors per article, has increasingly become the norm. Both men and women collaborated with colleagues in their own organization and sometimes with colleagues from their own country but in other disciplines. Men collaborated slightly more than women with foreign colleagues and with private companies. Malaysian researchers surveyed collaborated "rarely" to "sometimes" with researchers from other countries ; whereas, in Thailand, the frequency was closer to "rarely." To account for various types of collaboration on research output, we considered three factors : collaboration with researchers from other countries ; from other disciplines, fields, or gender ; and from their own university or country. No gender differences were noted, and the same higher values for collaboration were observed for both Malaysia and Thailand.

Model — Four potential dependent variables were identified : traditional research output measured by the number of articles, book chapters, and conference presentations ; the number of pending and granted patents ; the number of commercialization related outputs ; and the number of outreach activities. Regression analysis identified the significance factors contributing to higher research output. As anticipated from the descriptive statistics, gender did not influence productivity. When interacted with the number of years since PhD graduation, being female had a negative effect on research output, although having graduated for a longer period slightly offset this negative impact. Having children was associated with greater productivity. Women with a greater number of children were, however, less productive than men with an equal number of children. Compared with childless men, both men and women with children were more prolific, but the effect was less pronounced for women.

The analysis also implied that a greater proportion of time spent teaching (in comparison with the other tasks) had a positive effect on research output. Being older decreased this effect without completely offsetting it. There was a negative impact of fundraising activities on research output. As researchers aged, spending more time performing research activities was associated with increased research output.

Researchers who received a higher proportion of funds from international sources were likely to be more prolific. Moreover, a higher proportion of private funding had a similar impact. Nonetheless, higher frequency of collaboration at the national level was positively associated with greater scientific output, but not foreign collaboration. The

frequency of foreign collaboration only became significant when interacted with the inverse of the proportion of working hours devoted to fundraising. As the proportion of working hours spent fundraising increased to its maximum value, spending more time fundraising increased scientific output as the frequency of foreign collaboration increased.

In terms of technological production in the form of patents, devoting more hours to teaching, having a greater proportion of funding from international sources, and collaborating more often with compatriots all had a positive impact. Being a woman had no particular impact, but being a woman and devoting more time to research had a negative impact on the number of patents generated. Compared with non-mobile men, mobile men produced fewer patents, and non-mobile women produce even fewer patents. An interesting result of our regressions relates to the moderating effect of the proportion of hours devoted to research on the relationship between the number of patents and the frequency of foreign collaboration. Although time devoted to research had a positive impact amplified by foreign collaboration, as more time was spent on research there was a negative impact of more foreign collaboration.

Technological output was expected to be very closely related to commercialization output as the two variables were highly correlated. By and large, this was generally observed. There was no impact from having children on technological output ; however, when it was time to commercialize these technological outputs, more "maturity" as measured by men with children had a positive impact ; whereas, being a woman with children had a strong negative impact. Finally, in terms of outreach activities, women with children were less active than their male counterparts. Although patenting might have been construed as being part of scientific output, or at least applied science output, when it came to spending more time and effort to commercialize and to perform outreach activities, the time devoted to family and children left very little margin for women. It appears that women simply do not have the time or interest for these activities.

3 Main messages for policy and practice

We set out to examine five hypotheses impacting research production. Hypothesis H1, that age increased productivity was only partially supported. We compared real age with PhD age and chose the latter as yielding better and more robust results. Only when interacted with gender and with the proportion of hours dedicated to various tasks, was PhD age significant.

The second hypothesis (H2) that female researchers are less prolific was only significant when a moderating variable was used (i.e., PhD age, the number of children ; the proportion of hours devoted to research, foreign collaboration, mobility). As such, H2 was rejected. Consistent existing research, women who had more children were less productive than their male counterparts. Our results showed that men with children were more productive (followed by women with children). Furthermore, female scientists who collaborated with foreign partners did not reduce their technological output (patents) and outreach activities as much as men did when they collaborated with foreign colleagues.

Our funding variables highlighted the importance of private funding and of international funding for research output. Hypothesis H3(a) that national funding would be more important for productivity was rejected, as private and international funding mattered more for classic research output. Surprisingly, private funding had no impact on technological output, commercialization, and outreach activities. Therefore, hypotheses H3(b) and H3(c) could not be validated. For all four categories of output, international funding had a strong positive relationship with scientific output. Thus, the importance of national funding in the literature may not be appropriate for developing countries.

The only hypothesis that was wholeheartedly supported was H4, which validated the close relationship between collaboration and research output. A higher frequency of collaboration was clearly associated with higher research productivity. Because of the importance of international funding, foreign collaboration was included in the regressions. The impact of foreign collaboration did not impact research productivity on its own but required moderating effects from other indicators (e.g., the number of hours devoted to research or to fundraising, PhD age, or gender). This points to the need for a more complex framework to fully capture the influence of such indicators.

The last hypothesis (H5) on mobility was not significant on its own. There was, however, an interesting interaction between gender and mobility. Compared to non-mobile men, mobile men produced fewer articles ; whereas, mobile women did not fare any worse, but non-mobile women produced even less. Mobility would appear to be beneficial to women, but not to men. The fifth hypothesis was therefore only partially supported.

This research was based on a single survey on the perception of researchers about their career and research outputs. As such, it had a number of limitations. First, out of the 750 responses, only 338 are usable for the regression analysis. The questionnaire was too long and the results suffered from respondent fatigue. This will have to be remedied in future similar studies. Second, because of the poor response rate in Indonesia and Singapore, the results were not representative of these two countries. Third, the survey was entirely anonymous and as a consequence, we could not verify the true output of these researchers using bibliometric tools, but more importantly, the survey cannot be used to further study these researchers to see whether their perceptions had an impact on their future career.

In terms of policy, it is clear that foreign funding plays an important role in increasing research productivity in the countries examined. Foreign collaboration and mobility were also positive factors but the complex relationships merit further research. These foreign relations are important and may compensate for deficiencies in the local science system.