Taking a leap of faith: How young scholars from four ASEAN countries forge ahead for successful research careers

POLYTECHNIQUE MONTRÉAL

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The transformation of Research in the South: policies and outcomes
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BACKGROUND

- Follow up to the Global State of Young Scientists (GloSYS) 2013 pilot study (PI: Beaudry)
- Project funded by the National Science Technology and Innovation Policy Office (STI) of Thailand
- Project led by
  - Prof Futao Huang (Hiroshima University, Japan
  - Dr. Orakanoke Phanraksa (National Science and Technology Development Agency, NSTDA, Thailand)
  - Prof Catherine Beaudry (Polytechnique Montreal, Canada)
- For the Global Young Academy (GYA), Germany
- One year project: 2015

Global Young Academy
The voice of young scientists around the world

Goal: analyse the situation of young researchers and scientists in selected ASEAN countries in the context of multiple challenges in the higher education sector in Asia

GOAL OF THE ARTICLE

- Compare four Asian countries
  - Indonesia
  - Malaysia
  - Singapore
  - Thailand
- In regards to the factors that impact
  - Scientific outputs
  - Technological outcomes
  - Commercialization
  - Outreach activities
- From the literature, we know very little from the developing world…

AGE – THE EVIDENCE

- Some say that scientists **do their best work while young**
  - Einstein, Newton and Gauss are obvious examples
  - Younger scientists are more creative (Simonton, 1984 & 1997) and productive
  - The young benefit from having a fresher look at some of the old problems (Kuhn, 1962)
- Others argue that **knowledge matures with age**
  - Plank, Braun and Cram were in their 40s when they formulated their theories
  - Younger scientists are NOT more creative and productive
  - The old Mertonian argument suggests that as scientists rise in the hierarchy, they increase their productivity and impact

IN FAVOUR OF YOUNG SCIENTISTS

- **Younger** scientists are generally **more productive**
  - Gieryn, 1981 – X-Ray and Radio Astronomy
  - Horner, Rushton and Vernon, 1986 – psychology (peaks around 40)
  - Over, 1988 - psychology
- **Significant contributions** (Lehman, 1953) and extraordinary contributions (Zuckerman and Merton 1973; Zuckerman, 1977; Simonton, 1997) of researchers are generally made **before their 40th birthday**
  - Stern, 1978 – mathematics

IN FAVOUR OF OLDER SCIENTISTS

- **Mid-career and older** scientists are **more productive** and have **more impact** (Cole, 1979; Kyvik and Olsen, 2008)
  - But highly productive scientists remain productive, but those who produce little, publish even less later on (Allison and Steward, 1974)
  - But no difference is found around 2000 (Wray, 2003 and 2004)
- **Older scientists are higher up in the hierarchy** (Cole and Cole, 1973), obtain more funding, and hence more graduate students → productivity and impact increases

- Hence the good do no necessarily all die young..

IN FAVOUR OF BOTH

- Gingras et al. (2008) show that
  - Older professors are more productive
  - Younger scientists have more impact (citations)
- Over (1988)
  - Older authors are not more likely to produce high impact publications than younger authors
- **But very little evidence from developing countries and BRICS**

- **H1** (Age): Older young scientists are more productive in terms of research output

GENDER – THE EVIDENCE

- Women on average **publish fewer papers** than their male colleagues (Aksnes et al., 2011; Fox, 2005; (political science) Hesli and Lee, 2011; Nakhaie, 2002; Prpić 2002; Xie and Shauman, 1998 and 2003; Zuckerman, 1991)
- Women **focus more on research quality** than research quantity (Sonnert and Holton, 1995)
- Women are generally **underrepresented** in academia (Neumark and Gardecki, 1998; Xie and Shauman, 2003)
- **Diminution in the gender differences** as the population of female scientists increases (Abramo et al., 2009a; Xie and Shauman, 1998)
- No gender effect found for biochemists (Long, 1992)
- **H2** (Gender): Female researchers are less prolific in terms of scientific output

PUBLIC FUNDING – THE EVIDENCE

- Partha and David (1994), Kleinman and Vallas (2001) argue that institutions and social norms of open science are functionally maximizing the long term growth of scientific knowledge
  - But are not powerful to be socially optimum in terms of producing economic rents and commercial outputs from the existing stock of scientific knowledge
- Pavitt (2000 and 2001) refer to the importance of public support for scientific infrastructure development and highlight its role in the effectiveness of public grants in the US
- Salter and Martin (2001) suggest two distinct forms of justification for granting body to award financial support
  - Lack of instruments and laboratory tools for conducting research
  - Need for hiring new researchers/students or making/expanding of scientific network

PRIVATE FUNDING

- In terms of private funding, Balconi and Laboranti (2006) argue that in applied fields, there are two stages for the establishment of a new technology
  - First, the discovery of new avenues for potential commercial activities
  - Second, the realisation of these possibilities by developing new industrial products via answering to the specific research question
- Geuna and Nesta (2003) claim that increased industrial funding will force researchers to
  - Shift to more applied research
  - Neglecting their normative responsibilities for knowledge development

PUBLIC VS PRIVATE FUNDING

- Entrepreneurial university (Etzkovitz, 2003) starts with entrepreneurial academics and possibly with academic inventors (→patents)
  - Concern that universities may concentrate more on 'private' research rather than science as a public good (Dasgupta and David, 1987, 1994)
  - Trade-off between publishing and patenting (Azoulay et al, 2006; Breschi et al., 2007; Owen-Smith and Powell, 2003; Stephan et al., 2007; Thursby and Thursby, 2002) ?
  - Anti-commons argument (Heller and Eisenberg, 1998; Murray and Stern, 2007)
- Geuna (2001) argues that the fading role of public funding can result in
  - Over-use of resources
  - Focus on short-term research endeavor
  - Conflict in incentive structures
  - "Exacerbation of the impact of cumulative and self-reinforcement phenomena present in the process of scientific production" (pp. 626)

FUNDING HYPOTHESES

- **H3** (Funding): Researchers with a higher proportion of funding from
  - (a) public national organizations
  - will also generate more scientific output
- while researchers with a higher proportion of funding from
  - (b) private organizations or
  - (c) philanthropic organizations
  - will generate more technological output

COLLABORATION – THE EVIDENCE

- Positive effect on scientific production of more central scientists in more cliquish networks (Beaudry and Allaoui, 2012)
- Not detrimental to the quality of publications (Godin and Gingras, 2000)
- Interdisciplinary fields are more conducive to collaboration (Abramo et al., 2009)
- Probability of collaboration of two scientists increases with the number of their common collaborators (Newman, 2001)

COLLABORATION – NETWORKING

- Networking (Godin and Gingras, 2000; Chwe, 2000; Hicks, 1995; Johnes, 1988; Melin,1996; Azoulay et al., 2007; Abramo et al., 2009; Ynalvez and Shrum, 2011; Newman, 2001a, b; Beaudry and Allaoui, 2012; Cowan and Jonard, 2003&2004; Cowan and Jonard, 2003; Newman, 2004; Katz, 1994)

- **H4** (Collaboration): Researchers who collaborate will also generate more research output

METHODOLOGY (I/II)

- Based on a questionnaire (tested in 2013 for Thailand amongst other countries)
  - Corrections were made and questions were added
  - But the core of the questionnaire remains relatively unchanged
  - The questionnaire was re-tested on a restricted sample in order to validate the changes and the new questions in the four countries of interest
- Four countries were initially targeted:
  - Indonesia
  - Malaysia
  - Singapore
  - Thailand

METHODOLOGY (II/II)

- Team members and colleagues contacted the main research institutions, both public and private
  - Access to email lists of young researchers
- Questionnaire sent to all these young researchers, with a reminder two weeks later
- The questionnaire was launched in two phases
  - 218 responses in April-June 2015
  - 534 responses in July-September 2015 (significant respondent fatigue problem → only 325 valid responses)
  - Tests to compare the two samples showed no significant differences between the two groups for the main variables of interest

DATA

- Out of the 557 responses deemed valid, 543 remained once observations for which key variables were missing were removed
- Our sample is therefore composed of
  - 68 researchers currently working in Indonesia
  - 189 researchers in Malaysia
  - 45 in Singapore, 255 in Thailand
  - 25 in developed countries
  - 13 in the rest of the world

  - 273 men and 270 women
    - Serious overestimation of the number of female doctoral holders
  - Age ~36

DATA

- 62.3% of men (53.3% of women) are in a relationship
- Men have on average 0.78 children and women 0.72

- 68% of Malaysian researchers are in a relationship and have 1.07 children while 39% of Thailand researchers are in a relationship and have 0.28 children
  - Thailand researchers are 1.6 years older (36.7) than their Malaysian colleagues

REGRESSION RESULTS

ln(nbArtChapConf+1)	(Art-1)	(Art-2)	(Art-3)	(Art-4)	(Art-5)	(Art-6)	(Art-7)
dFemale	-0.0386	0.0787	0.4415		-0.0566	-0.0481	-0.0324
PhDAge	-0.0036	-0.0035	-0.0040	-0.0029	-0.1506 **	0.1613 *	-0.4452 **
ln(*nbChildren*+1)	**0.2501*** **	**0.3848*** **	**0.2502*** **	**0.2561*** **	**0.2292*** **	**0.2391*** **	**0.2512*** **
dIndonesia	0.3049	0.3003	0.3037	0.2883	0.3353	0.3127	0.2341
dMalaysia	**0.6688*** **	**0.6862*** **	**0.6670*** **	**0.6511*** **	**0.6983*** **	**0.6782*** **	**0.6247*** **
dSingapore	-0.2372	-0.2395	-0.2351	-0.2596	-0.1953	-0.2772	-0.3285
dThailand	-0.0810	-0.0705	-0.0811	-0.0933	-0.0685	-0.0920	-0.1396
dOther	0.4450	0.4680	0.4563	0.4483	0.4683	0.4471	0.4491
1/(*propHoursTeach*+1)	**-0.8918***	**-0.8682***	**-0.9143***	**-0.9080***	**-1.8547*** **	**-0.9640***	**-0.8696***
1/(*propHoursResearch*+1)	-0.0618	-0.0238	0.2378	-0.0753	0.0941	0.9436	0.0238
1/(*propHoursCons*+1)	0.1304	0.1170	0.1603	0.1200	0.2351	0.0893	0.1565
1/(*propHoursFund*+1)	-0.5100	-0.4511	-0.5360	-0.4742	-0.3456	-0.6276	-3.0631 **
PropSelfHousework	0.0009	0.0013	0.0008	0.0009	0.0015	0.0011	0.0010
1/(*FundNational*+1)	-0.1309	-0.1219	-0.1345	-0.1322	-0.1000	-0.1215	-0.1004
1/(*FundPrivate*+1)	**-0.2249***	**-0.2102***	**-0.2160***	**-0.2271***	**-0.2100***	**-0.2120***	**-0.2295***
1/(*FundPhil*+1)	-0.0669	-0.0617	-0.0595	-0.0584	-0.1264	-0.0684	-0.0645
1/(*FundInt*+1)	**-0.4286*** **	**-0.4345*** **	**-0.4336*** **	**-0.4389*** **	**-0.4384*** **	**-0.4184*** **	**-0.4146*** **
dMobility	0.0182	0.0019	0.0224		0.0423	0.0496	0.0503
CollForeign	0.0543	0.0540	0.0537	0.0523	0.0546	0.0509	0.0522
CollNational	**0.1717*** **	**0.1736*** **	**0.1765*** **	**0.1749*** **	**0.1714*** **	**0.1789*** **	**0.1749*** **
***dFemale* x ln(*nbChildren*)**		**-0.2684***					
dFemale x 1/(*PropHoursResearch*+1)			-0.6622				
MobileMen				-0.0636			
NonMobileWomen				-0.1423			
MobileWomen				-0.0533			
***PhDAge* x 1/(*PropHoursTeach*+1)**					**0.1951** **		
***PhDAge* x 1/(*PropHoursResearch*+1)**						**-0.2140***	
***PhDAge* x 1/(*PropHoursFund*+1)**							**0.4639** **
Number of observations	338	338	338	338	338	338	338

ln(nbArtChapConf+1)	(Art-8)	(Art-9)	(Art-10)	(Art-11)	(Art-12)	(Art-13)	(Art-14)
dFemale	-0.0377	-0.0394	-0.0418	-0.2806**	-0.0188	-0.0408	
PhDAge	-0.0035	-0.0038	-0.0038	-0.0152	0.0362	-0.0034	-0.0036
dChildren						**0.2723***	
ln(*nbChildren*+1)	**0.2506***	**0.2523***	**0.2545***	**0.2367***	**0.2498***		
dIndonesia	0.3057	0.3251	0.2882	0.3125	0.3084	0.3181	0.3219
dMalaysia	**0.6682***	**0.6598***	**0.6412***	**0.6929***	**0.6908***	**0.6841***	**0.6970***
dSingapore	-0.2428	-0.2239	-0.2530	-0.2201	-0.1876	-0.2218	-0.2215
dThailand	-0.0828	-0.0555	-0.1016	-0.0960	-0.0894	-0.0743	-0.0628
dOther	0.4408	0.4674	0.4025	0.4377	0.4619	0.4534	0.4751
1/(*propHoursTeach*+1)	**-0.8895***	**-0.8997***	**-0.8940***	**-0.9542***	**-0.9504***	**-0.9010***	**-0.8632***
1/(*propHoursResearch*+1)	0.1974	-0.0167	-0.0813	0.0337	-0.0085	-0.0862	-0.0674
1/(*propHoursCons*+1)	0.1227	0.1159	0.0975	0.2128	0.1440	0.1333	0.1453
1/(*propHoursFund*+1)	-0.5362	**-5.0942****	-4.1358	-0.4823	-0.4973	-0.4650	-0.4336
PropSelfHousework	0.0010	0.0011	0.0009	0.0011	0.0011	0.0010	0.0012
1/(*FundNational*+1)	-0.1297	-0.1413	-0.1288	-0.1123	-0.1309	-0.1244	-0.1159
1/(*FundPrivate*+1)	**-0.2256***	**-0.2508****	**-0.2291***	**-0.2271***	**-0.2288***	**-0.2282***	**-0.2227***
1/(*FundPhil*+1)	-0.0681	-0.0924	-0.0536	-0.0938	-0.0894	-0.0497	-0.0466
1/(*FundInt*+1)	**-0.4333***	**-0.4120***	**-0.4130***	**-0.4223***	**-0.4477***	**-0.4509***	**-0.4502***
dMobility	0.0188	0.0212	0.0148	0.0598	0.0369	0.0040	-0.0061
CollForeign	0.1324	**-1.6375****	0.0554	0.0543	**0.1507***	0.0623	0.0642
CollNational	**0.1703***	**0.1723***	**-0.7713**	**0.1736***	**0.1469**	**0.1651***	**0.1632***
CollForeign x 1/(*PropHoursResearch*+1)	-0.1111						
***CollForeign* x 1/(*PropHoursFund*+1)**		**1.7453****					
CollNational x 1/(*PropHoursFund*+1)			0.9636				
dFemale* x *PhDAge				**0.0483****			
PhDAge* x *CollForeign					**-0.0254****		
Men_with_children							**0.3535***
ChildlessWomen							0.0209
Women_with_children							**0.2261***

DISCUSSSION

- No gender difference in noted on the number of articles, chapters and conference presentations
- When we interact gender with the number of years since PhD graduation (PhDAge)
  - being female has a negative effect on research output
  - but having graduated for a longer period slightly offsets this negative impact
  - without completely cancelling the impact
  - → the overall impact is negative for women

DISCUSSION

- Having children is generally associated with greater productivity (both counting the number of children, or simply accounting the fact of having children)
  - Women with a greater number of children are however less productive than men with an equal number of children
- If a researcher receives a higher proportion of funds from international sources however,
  - He is also likely to be more prolific
- A higher proportion of private funding has a similar impact

CONCLUSION

- Neither PhDAge, nor Age, were ever significant
  - H1 (older young scientists are more prolific) is not validated which is not surprising considering the fact that our sample is composed mainly of young scientists
- H2 (female researchers are less prolific) is rejected once we account for a variety of factors that influence scientific production
  - Women who have more children are less productive than their male counterpart
  - Having children is however associated with a degree of maturity that we do not successfully capture with either Age or PhDAge

CONCLUSION

- Our funding variables only highlight the importance of private funding and of international funding for research output
  - Hypotheses H3a (scientific output) and H3b-H3c (technological output) are all rejected
- H4 is always supported
  - Hence validating the close relationship between collaboration and research output of any kind

FUTURE WORK

- Take into account country discrepancies
  - Thailand has 30% of researchers in Research institutions
  - Malaysia has 95% of its surveyed researchers in universities and higher education institutions
  - Improve the response rate in Indonesia and Singapore?
- Explore creativity and innovation personality traits
- Match questionnaire-based information with full bibliometrics analysis
  - Use information from the corresponding author email address

THANK YOU!

Any questions?

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GLOSYS-ASEAN PROJECT

- Funding provided by the National Science Technology and Innovation Policy Office (STI)
- Principal Investigator : Prof Futao Huang (Hiroshima University, Japan)
- Co-Principal Investigators
  - Prof. Catherine Beaudry (Polytechique Montreal, Canada)
  - Dr. Orakanoke Phanraksa (National Science and Technology Development Agency, NSTDA, Thailand)
- Co-ordination of the research activities:
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  - Pattranooj Saengchantr
  - Dr. Johannes Geffers (GYA, Germany)
- Research working group members (GYA members):
  - Dr. Karen Lorimer, Glasgow Caledonian University, Scotland
  - Dr. Martin Dominik, University of St Andrews, Scotland
  - Dr. Mitsunobu Kano, Okayama University, Japan
  - Dr. Shoji Komai, Nara Institute of Science and Technology, Japan15
  - Dr. Hsin-Chou Yang, Academia Sinica, Taiwan

GLOSYS-ASEAN REGIONAL SUB-PROJECTS

- Indonesia
  - Dr. Vanny Narita, National Innovation Council of the Republic of Indonesia
- Malaysia
  - Young Scientists Network – Academy of Sciences Malaysia (the National Young Academy of Malaysia), namely
  - Prof Dr Ramesh Subramaniam - University of Malaya (GYA member)
  - Dr. Normi Mohd Yahaya - Universiti Putra Malaysia (GYA and YSN-ASM member)
  - Prof Dr. Basyaruddin Abdul Rahman - Universiti Putra Malaysia (GYA alumni and YSN-ASM Chair)
  - Assoc Prof Dr Abhimanyu Veerakumarasivam - Perdana University (YSN-ASM Vice Chair)
  - Dr. Zainovia Lockman - Universiti Sains Malaysia (YSN-ASM International Networking Working Group Chair)
  - Prof. Dr. Cheong Sok Ching - Cancer Research Initiatives Foundation (YSN-ASM Research Leadership Working Group Chair)
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