International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-1, November 2019

New Perspectives on the Associations between Research Performance and International Academic Networks in Science & Engineering Fields

Tutik Inayati

Abstract*: *International experience is seen as one factor of advancing networks for researchers, which would lead to heighten the researchers' performance. By searching through researchers' past academic publications and countries in which they pursued their higher education, the networks could be developed early and become fruitful to identify the performance of researchers. Quality of university is also questioned when it comes to the performance of researchers, which follows the debate of private and public universities' quality. Therefore, this study is intended to comprehend the association between three salient variables: type of university, availability of international co-authors, and pursuing higher education abroad. This study takes place in Indonesia, where top researchers whose performance is on the top 150 among all researchers and university lecturers are collected and analyzed. We collected top 150 researchers in Indonesia according to Indonesia's government official research index website and partake in searching their education and academic background. Using descriptive analysis and chi-square for test of independence, this study generates a new perspective about relationship of performance of researchers in Indonesia with their international experience. Thus, certain policy recommendation emphasizes in support for Indonesian researchers to undergo international experience in form of studying abroad or short research programs abroad.

Keywords* : *Research, Science index, international networks, Researchers' performance

I. INTRODUCTION

Performances of researchers or academic researchers are often connected to publications as the outputs of researches. Publications are also the indicators of one researcher's quality and productivity. Types of publications could be in many forms: academic journals, books, conference proceedings, articles, and others. However, academic journals are the most common type of publication among researchers. Being indifferent from the rest of the world, Indonesia also indicates the performances of its researchers by the number of publications produced by academics or researchers in institutions. Indonesia also becomes more aware of the type of academic journals in which researchers publish their research result. Certain indexing becomes more featured as high quality. As a result, the indexing of journals leads to business between conference committees, publishers, and universities. Even as a developing country, Indonesia generates many highly qualified scientists and researchers. Many of the output besides scientific publication is the patents. However, since patents are more contributed by Science, Technology, Engineering, and Math (STEM) fields, the research output in research fields beside STEM is Intellectual Property Rights (IPR). Consequently, many universities in Indonesia also obliged their academic researchers to generate IPR. According to Government's regulations, academicians in Indonesia have three primary obligations that will lead their academic status to professorship. Those obligations are teaching, research, and commitment to society. High impact journal manuscripts are perceived from how many other researchers cite their manuscripts; and it shows not only the number of citations indicates the quality of the journals [1] but also networks that a researcher has [2]. There is a discrepancy of available resources and support from the Government between public and private universities. Public universities tend to earn more support and good resource than private universities, thus affiliations, public or private universities, would be assumed to have close connection to have international joint research; hence increase the quality of the research. Having international co-authors in their academic publications could expand networks of researchers; hence, international experience is needed to broaden researchers' horizon. Engaging in joint research or studying abroad could be two of many ways to have international experience and having co-authors from different countries [3]. Having co-authors from other countries, especially more developed countries, could lead to knowledge transfer from countries that have more advanced circumstances. However, not all researchers in Indonesia have the opportunity join the international experience. Thus, this study provides empirical evidence whether international experience of researchers would be closely associated to their researchers' performances and increasing networks.

Revised Manuscript Received on November 30, 2019.
***** Correspondence Author
Tutik Inayati*, Entrepreneurship Department, BINUS Bandung School of Creative Technology, Bandung, Indonesia. Email: tutik.inayati@binus.edu

II. LITERATURE REVIEW

The debate between having an academic career in private or public universities could be whether public universities are better in research and publications compared to their counterparts, the private universities. In most countries, public universities triumphed because most supports are coming from the Government and more qualified faculties than in public universities; quality of universities itself also includes the standard of admitted students [4]. However, a research in USA showed that there is little contribution from State universities concerning innovations especially on generality of research products or patents [5]. Affirmed in [6], public universities generated less patents or any R&D outlets compared to private universities. Private universities are also seen as agents of change in high conflict countries such as Pakistan to evaluate higher education quality [7].

Having international co-authors in publications is often set as a proxy for a high-quality scientific publication, which would be seen quantitatively from the number of citations. A seminal research by [8] identified several parameters that would affect the quality of a publication. They used the number of citations as an indicator of the quality of publication aside from the co-publication with US researchers. Their research had indication of strong correlation occurred of co-publication with citations in some research fields. [9] studied the meaning of internationality in the sense of academic publications that it was an ambiguous result on the quality of publication itself, meaning that the quality of a publication would not be determined by how many international joint collaborations in research might occur.

However, several researches mentioned that there was no correlation between strength of co-authorship links and citations; but having international co-authorships might influence the high number of citations compared to domestic co-authorships [10]. This was also confirmed [11] in their research. They also statistically measured the relationship between correspondence authors, international co-authorship, and citation factors. They also emphasized the importance of having international collaboration in research networks. Meanwhile, research performance was previously seen to have no effect from having pursued higher education abroad [12] in three compared countries: South Korea, Malaysia, and Hong Kong. This implied that whether in other contexts it would be different.

Studying abroad is one procedure to have international experience. Here, students broaden their network with their supervisors and their colleagues. At the larger picture, to have people study abroad and return could create higher Foreign Direct Investments to the home country [13]. Another benefit of studying abroad is the different cultural experience that leads to creative process activities of a person that would lead to increased productivity. As explained by [14], new and creative ideas are prone to be generated by students who study abroad compared to students who do not study abroad. [15] stated there are three outcomes from international mobility programs: cultural, personal, and career. Therefore, aside from having different cultural perspectives and increasing creativity, even participating in short term mobility program could enhance careers and working productivity. On contrary, [3] explained that there is no correlation between how long people stayed abroad and the size of the networks they had.

Even though studying abroad could influence personal way of thinking, one study shows ethnic ties between people who study abroad are stronger. Therefore, it is also possible that while abroad they would build their own network and produce seminal research hence produce knowledge flow to become localized [16]; while according to [17] being ethnically alike leads to co-authorship in writing publication or partake in joint research, in the case of USA. However, their result was not in line [18] whose research output that similar ethnicity did not have significant relationship with the invention. This statement was also similar to a study by [19] who stated that when inventors from the same ethnicity worked together the quality of patents declined.

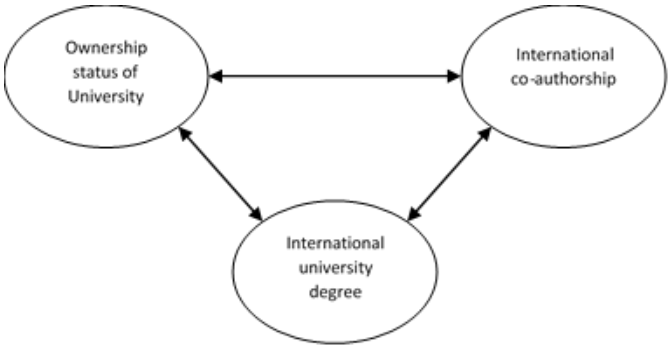

Fig 1. Conceptual framework

III. METHODOLOGY

Our subjects are top 150 researchers in Indonesia who are ranked by Indonesian Government based on their research output on the last week of August 2019. In this study, researchers are ranked based on their 3-year score, which indicates their publications. The score is based on five variables with different weights based on their difficulties to achieve; those are the number of articles indexed by Scopus (α), the number of publications aside from articles indexed by Scopus (β), The number of citations in Google Scholar (γ), The number of citations in Scopus (δ), and divided by statistical calculation on the highest score possible. Their score is counted as below:

$$S = \frac{\alpha * 40 + \beta * 15 + \gamma * 1 + \delta * 4}{\rho} \quad (1)$$

The score was provided by Indonesian Government through Sinta (Science and Technology Index) website (http://sinta2.ristekdikti.go.id). Consequently, we collected top 150 researchers who have the highest 3-year score in Sinta. Aside from the 3-year score, we also searched education background of our subjects and the availability of co-authors from abroad that are not available in Sinta website. We analyse data using statistics for describing data. Test of independence is also utilised to determine whether there is significant relationship between having international co-authors and studying abroad. As having international co-authorship, we searched each researcher's academic publication records to determine whether they had published international journals with fellow academics with different nationalities. If they had published at least one journal, then we classify them to have international co-authors.

International education experience variable sets whether researchers obtained university degree abroad. To acknowledge this, we searched their education background in Indonesian Government's Higher Education database online; if unavailable, we explored from other sources. Data is analyzed using chi-square test of independence, which initially have three hypotheses:

H1: There is an association between university ownership and international co-authorship

H2: There is an association between university ownership and international higher education

H3: There is an association between international co-authorship and international higher education

IV. RESULTS AND DISCUSSION

First most obvious results are the first rank researcher is a researcher working in a government-owned research institution in Indonesia. Twenty-nine of the top researchers are lecturers in private universities in Indonesia and 129 researchers are lecturers in public universities, the remaining one person belonged in research institution. In Indonesia, the image and quality of public university stand higher than private universities. So, more qualified and competent university lecturers belong to public universities and create discrepancy of university qualities. In Indonesia, it is commonly known that public universities become personal pride, for either students or lecturers. Public universities obtain more qualified people to conduct academic activities because their main support is Indonesian government. Lecturers' quality is not the only measurement of the university itself, many factors such as cooperation with other universities and industries, academic achievements and other factors also matter.

The second finding is that out of top 150 researchers, 127 of them have international co-authors in their research publication. Aside from qualification, the reason mainly is usually researchers obtain networks when they were studying abroad and within period of their work as researchers. However, this does not mean that every researcher who has international co-authors had pursued higher education abroad. Hence, it is worth to comprehend whether there is strong correlation between international education experience and network. In this study, network considers whether an Indonesian researcher has co-authors in his or her academic publication.

Scopus index publications become important indicator for researchers in Indonesia. These publications consist of journals, book chapter, and conference proceedings. On average, top 150 researchers in Indonesia had produced 46 scopus-indexed journals while they had produced 32 conference journals. However, the average number of book chapter is very small, only 2 book chapter per person. We could indicate the number would be much smaller for all researchers in Indonesia. Hence, book chapter publications could be further improved, because even the top researchers in Indonesia could produce no book chapter. Meanwhile, the minimum number of journals produced is 4 journals and maximum journal article produced is 688 by a person. Meanwhile, a researcher could produce no conference proceeding or 244 conference proceedings. Both are the minimum and maximum number of conference proceedings.

There are three independence tests that we discuss in this study, first is the relationship between affiliations and having international co-authors in publications. We categorized researchers' affiliation by public or private owned universities, since we already established earlier that public universities fill top university ranks.

Table I. Descriptive statistics

Descriptive Statistics

	N	Range	Min.	Max	Mean	Std. Deviation	Skewness	
						Statistic	Statistic	Std. Error
No. of Journals	150	684.0	4.0	688.0	46.513	60.5793	8.270	.198
Book chapter	150	34.0	.0	34.0	2.193	4.5682	3.981	.198
Conference	150	244.0	.0	244.0	32.973	37.7110	2.016	.198
Valid N (listwise)	150							

In total, there are 31 top ranked researchers who are in private-owned universities and remaining 119 researchers belong in public universities. Meanwhile, 127 researchers published their academic articles with international co-authors in them and remaining 23 researchers do not. According samples collected, the number of researchers who have a career in private universities and having international co-authors is 10 people, while 21 of private-owned universities researchers do not have international co-authors. As opposed to private-owned universities, public universities whose researchers have international co-authors is 106 people while remaining 113 of public universities researchers have no international co-authors.

Table II. Chi square independence test (affiliation and international co-authors)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.622[a]	1	.003		
Continuity Correction[b]	7.057	1	.008		
Likelihood Ratio	7.455	1	.006		
Fisher's Exact Test				.009	.006
N of Valid Cases	150				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.75.
b. Computed only for a 2x2 table

As we hypothesize that the variables are independent, table II conclude the result. From chi-square test of independence, we determine that affiliations of researchers and having international co-authors are not independent based on p-value 0.003 in Pearson chi-square test result since we set the significance level to be 0.005 or below. Therefore, there is high association between people belonging in private or public universities and whether they have international co-authors in their publications.

The second association analyzed is between affiliations and having international education background. The number of researchers who pursued higher education abroad is 95 people, while remaining 55 researchers did not. 16 researchers who did not study at universities abroad belong in private universities and 15 who studied at universities abroad belong in private universities. There are is a discrepancy between private universities and public universities because 80 researchers are in public universities and studied at universities abroad and 39 researchers did not study at universities abroad and belong to public universities.

Table III. Chi square independence test (affiliation and international higher education)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.759[a]	1	.053		
Continuity Correction[b]	2.991	1	.084		
Likelihood Ratio	3.655	1	.056		
Fisher's Exact Test				.062	.043
N of Valid Cases	150				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.37.
b. Computed only for a 2x2 table

Since we also set the significance level 0.05 for chi-square test of association, table III displays Pearson Chi-square p-value is 0.053, which is very close to the significance level. We take the conclusion to the exact number in statistical result. However, this could be future research reference about the association between affiliations and international higher education experience. In this study, we conclude that relationship of affiliation where a researcher is located, and his/her international higher education experience is independent.

The third and last analysis of this study is the association between having international co-authors in academic publications and having international higher education experience. According to our sample, only one researcher who had pursued higher education abroad but does not have international co-authors in academic publications researched. This could be the anomaly of our data, since all universities worldwide require students to publish academic journals with their supervisors' names attached in these publications. Meanwhile, the record number or researchers who had not studied at universities abroad yet has international co-authors is 33 people. This record indicates good networks built by our top researchers. Meanwhile, the number of researchers who had not studied abroad and have not had international co-authors so far is 22 people and remaining 94 researchers are the ones who had university degree abroad and had published academic writings with international co-authors.

Table IV. Chi square independence test (international co-authors and international higher education)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	40.701[a]	1	.000		
Continuity Correction[b]	37.756	1	.000		
Likelihood Ratio	43.406	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	150				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.43.
b. Computed only for a 2x2 table

In table IV, we determine the result of our hypothesis. P-value of Pearson chi-square is 0.000 with value of 40.701. This result indicates that we reject null hypothesis and imply that there is a very close association between having international co-authors and having university degree abroad. This would be the original value of our study that confirms that having academic network would have high association to publishing academic writings with international academicians.

V. CONCLUSIONS

Research performances are commonly measured by the publications and having networks with academicians from other countries to increase the quality of researches and specific knowledge. One way to broaden the knowledge and increase research quality is by having joint collaboration with other researchers. Another important issue is about affiliations of researchers. In Indonesia, most researchers who publish academic articles belong to one university; one of the issues faced is the quality of the university itself. Public universities, although not all of them, are considered having better academic quality than private-owned universities. Therefore, there are less resources and supports in private-owned universities compared to public universities. This quality is assumed to have connection with the research collaboration and universities abroad alumni to where they should make their career. This study has three main objectives. Those three main objectives are determining whether there is association between: researchers' affiliations and having international co-authors, researchers' affiliations and having international university degree, and having international co-authors and having international university degree. This study collected academic records of top 150 Indonesian researchers at the time of data collection. Data available is further analyzed using chi-square for each variable. There are three major findings in this study. First, compared to private-owned university, public universities have contributed almost six folds more on top researchers showing that most researchers recorded make careers in public universities. Second, our analysis shows that affiliations and having international co-authors are significantly connected but does not have association with international university degree. Third finding of this study is between having international co-authors and international university degree, there is a significantly association.

The implication for a country to increase its researchers' performance is to expand more networks in the form of joint research or any networks in academic organizations. Studying abroad may have strong correlation with having academic publication with fellow international academicians, but it does not have strong correlation with the affiliation where researchers finally stay, whether in public or private universities. Further research may to investigate deeper understanding about how the academic networks might be utilized to increase research performance, and whether there are alternative tools to measure research performances.

This study has several limitations. First, Indonesia, like other developing countries, does not account research activities as a priority due to many problems are considered more significant, such as poverty, unequal primary and secondary education. Nonetheless, Indonesia has begun to acknowledge that research activities could increase human resources quality and enhance the economic development through technology development. Second, this study includes top 150 researchers who have produced research outputs based on Indonesian government's requirements and prioritize Scopus-indexed publications first, then other types of publications. Another limitation is the association result between international co-authorship and having university degree abroad could be achieved by publishing international journal when they studied abroad. Hence, whether a researcher published journals after they graduate with international co-authors was not addressed. This is an interesting topic to cover for future research regarding international co-authorship after graduation.

REFERENCES

1. P. W. Beamish, "Publishing international (joint venture) research for impact," Asia Pacific J. Manag., vol. 23, no. 1, pp. 29–46, 2006.
2. B. Rienties and E. M. Nolan, "Understanding friendship and learning networks of international and host students using longitudinal Social Network Analysis," Int. J. Intercult. Relations, vol. 41, pp. 165–180, 2014.
3. W. Eduan, "Influence of study abroad factors on international research collaboration: evidence from higher education academics in sub-Saharan Africa," Stud. High. Educ., vol. 44, no. 4, pp. 774–785, Apr. 2019.
4. L. Romero and E. Del Rey, "Competition Between Public and Private Universities: Quality, Prices and Exams," Madrid, 04–64, 2004.
5. D. Hegde, "Public and private universities: Unequal sources of regional innovation?," Econ. Dev. Q., vol. 19, no. 4, pp. 373–386, Nov. 2005.
6. J. D. Adams and Z. Griliches, "Research Productivity in a System of Universities," Econ. Econom. Innov., pp. 105–140, 2000.
7. N. Halai, "Quality of private universities in Pakistan: An analysis of higher education commission rankings 2012," International Journal of Educational Management, vol. 27, no. 7. pp. 775–786, 2013.
8. U. Schmoch and T. Schubert, "Are international co-publications an indicator for quality of scientific research?," Scientometrics, vol. 74, no. 3, pp. 361–377, 2008.
9. G. Buela-Casal, P. Perakakis, M. Taylor, and P. Checa, "Measuring internationality: Reflections and perspectives on academic journals," Scientometrics, vol. 67, no. 1, pp. 45–65, 2006.
10. W. Glänzel and A. Schubert, "Double effort = Double impact? A critical view at international co-authorship in chemistry," Scientometrics, vol. 50, no. 2, pp. 199–214, 2001.
11. F. De Moya-Anegon, V. P. Guerrero-Bote, C. Lopez-Illescas, and H. F. Moed, "Statistical relationships between corresponding authorship, international co-authorship and citation impact of national research systems," J. Informetr., vol. 12, no. 4, pp. 1251–1262, Nov. 2018.
12. J. C. Shin, J. Jung, G. A. Postiglione, and N. Azman, "Research Productivity of Returnees from Study Abroad in Korea, Hong Kong, and Malaysia," Minerva, vol. 52, no. 4, pp. 467–487, Nov. 2014.
13. M. Beine, F. Docquier, and H. Rapoport, "Brain drain and human capital formation in developing countries: Winners and losers," Econ. J., vol. 118, no. 528, pp. 631–652, 2008.
14. C. S. Lee, D. J. Therriault, and T. Linderholm, "On the cognitive benefits of cultural experience: Exploring the relationship between studying abroad and creative thinking," Appl. Cogn. Psychol., vol. 26, no. 5, pp. 768–778, 2012.
15. A. Roy, A. Newman, T. Ellenberger, and A. Pyman, "Outcomes of international student mobility programs: a systematic review and agenda for future research," Stud. High. Educ., vol. 44, no. 9, pp. 1630–1644, 2018.
16. A. Agrawal, D. Kapur, and J. McHale, "How do spatial and social proximity influence knowledge flows? Evidence from patent data," J. Urban Econ., vol. 64, no. 2, pp. 258–269, 2008.
17. R. B. Freeman and W. Huang, "Collaborating with people like me: Ethnic coauthorship within the United States," J. Labor Econ., vol. 33, no. S1, pp. S289–S318, 2015.
18. S. Breschi, F. Lissoni, and E. Miguelez, "Foreign-origin inventors in the USA: Testing for diaspora and brain gain effects," J. Econ. Geogr., vol. 17, no. 5, pp. 1009–1038, 2017.
19. P. Almeida, A. Phene, and S. Li, "The Influence of Ethnic Community Knowledge on Indian Inventor Innovativeness," Organ. Sci., vol. 26, no. 1, pp. 198–217, Sep. 2014.
20. "SINTA - Science and Technology Index." [Online]. Available: http://sinta2.ristekdikti.go.id/. [Accessed: 11-Aug-2019].

AUTHORS PROFILE

Tutik Inayati is a university lecturer in Entrepreneurship Department in Bina Nusantara School of Creative Technology, Bandung. She graduated from Institut Teknologi Bandung from her bachelor to Doctoral degree. She received the opportunity to join double degree program between Institut Teknologi Bandung and Tokyo University of Science, Japan. She is mostly familiar with using System Dynamics as a tool in Systems Thinking as part of complex problem solving. Her research topic's interest is in brain drain, international migration, and technology policies; and lately, she is interested in MSMEs performances in Indonesia. She is also a member of Indonesia's Higher Education Lecturer Association.