Bibliometric Analysis of International Scientific Publications From the Philippines

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Abstract

This article presents a bibliometric analysis of international scientific publications from the Philippines for the period 1998-2002. A total of 1,625 bibliometric entries were extracted from the Science Citation Index representing ISI abstracted research journal articles that have at least one author with a Philippines country affiliation. Bulk of the analysis used a subset of 879 articles where the lead authors are from the Philippines. Patterns of authorship, collaboration, productivity and quality of international scientific publications across disciplines, institutional categories, and specific institutions were also extracted. Findings were clustered around three general theme patterns: collaboration is the norm, publications came from a disproportionate few, and low publication productivity and quality. Implications and recommendations of the theme patterns were discussed.

Key Words : international scientific publications; research productivity; bibliometric analysis

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Introduction

Knowledge is wealth and power. Perhaps this truism is aptly mirrored in observations indicating a link between scientific wealth (measured through scientific publications) of nations and their economy. Data from a ranking survey of the scientific research outputs from several countries (May, 1997) showed that the top seven countries were also the world's seven largest economies. It was further noted that the top five countries were also the ones who invested proportionately more in research and development compared to other countries. With the hegemony of an e-economy or knowledge economy, capacity for knowledge production (research) and utilization (technology) will be more than ever highly valued. In this regard, keeping tab of scientific contribution standings of nations and institutions through bibliometric tracking has been one of the worthy bases of inputs for strategic actions of institutions and nations.

In this article, a bibliometric analysis of ISI abstracted journal articles from the Philippines for the period 1998-2002 is presented. The analysis specifically aimed to extract patterns of authorship, collaboration, productivity and quality of international scientific publications across disciplines, institutional categories, and specific institutions. Findings are potentially relevant for benchmarking and policy implications at the institutional, sectoral, and national levels.

Methods

Bibliometrics, which is a research method commonly used in the library and information science was employed in this study. The method uses quantitative analysis to identify patterns of publication within a given field or body of literature.

Bibliometric Population

The study covered the entire bibliographic entries of international scientific research publications from the Philippines for the period 1998-2002. The publications were abstracted in the Science Citation Index of the Institute for Scientific Information (ISI). A total of 1,625 entries were included in the analysis.

Source of Biliographic Entries

The bibliographic entries were extracted from the Science Citation Index which is one of the databases of the ISI. Bibliometric and research productivity studies often use ISI databases because they are considered the most comprehensive in the world. It essentially covers the most important and influential researches conducted throughout the world (Testa, 1997). As of almost a decade ago, ISI databases covered over 16,000 international journals, books, proceedings in the sciences, arts, and humanities. It included about 15,000,000 papers published since 1945 and more than 200,000,000 references cited (Garfield et al., 1992). The ISI databases include the Science Citation Index, Social Science Citation Index, and Current Contents among others. Research that finds its way in the ISI database are generally considered adequately reviewed, reliable, significant, and accessible. It is for this reason that ISI databases have been used as the standard basis for considering scientific performance of individuals, institutions, and individuals.

Search Procedure

The Science Citation Index was accessed through the on-line version of ISI's Web of Science database. The keyword "Philippines" was entered in the authors' affiliation field of the database in order to retrieve all bibliographic entries for the period 1998-2002. The search was restricted to cover only journal articles. The necessary parameters were fed into the search window so that the database returned all the bibliographic fields that were used for the analysis. Relevant data from the various fields was then manually extracted for each of the entries.

Data of Interest

For each of the bibliographic entries, the following data were extracted: number of authors, citation counts, country of origin of the lead author, and institutional affiliation(s) of the Philippine-based author(s). The field (scientific discipline) classification of the article and the institutional category where the Philippine-based author came from were inferred. The field classification of each entry was determined by examining the journal title, the institutional affiliation of the authors, and the article title.

Results

With the search procedure described earlier, a total of 1,626 bibliographic entries were generated (see attachment 1 for an example of typical entry). It should be noted however that not all of these entries have Philippine-based lead authors. For as long as at least one of the authors have a Philippine institutional affiliation, even if they are not the lead author, the entry was included.

Table 1 reflects that the distribution of the publications across the five years of interest is more or less the same with an average of 325 articles per year. A small fraction (8.9%) of these 1,625 publications had a single author. Multiple authorships is the dominant practice.

(insert Table 1 around here)

Only 54% of all the entries could be fully credited as having the Philippines as the country affiliation of the lead author. Note that in international comparisons of scientific performance, lead authorship is often the basis of which country gets the credit in cases of multiple authorships. But just the same, the pattern indicates that collaboration with foreigners for doing research and publishing is extensive. As expected, lead collaborators come from developed countries with the USA and Japan leading the pack (See Table 2).

(insert Table 2 around here)

Analysis of Publications with Philippine Country Affiliation

In the succeeding analyses, the focus was only on the 879 publications where the lead authors have a Philippine country affiliation. The mean number of authors of these publications is 3.54 (SD=2.46). Similar to the larger sample, sole authorship (15.4%) is not the norm. It was typical to have 2-5 authors per article and at the extreme, one of the publications actually had 25 authors.

In terms of the field (scientific discipline) classification, almost half of the publications came from the area of agriculture (27.5%) and marine science (20.6%). The broad classification of Medicine, Biology, and Physics followed the distribution ranking. Smaller fractions (less than 5% each) of the distribution came from fields like Molecular Biology and Biotechnology, Chemistry, Geology, Mathematics, and many others (see Table 3).

(insert Table 3 around here)

International organizations and higher education institutions (HEIs) both public and private, accounted for almost 87% of the entire ISI publications with Philippine affiliation lead authors. Around 8% came from government institutions and the were from private institutions (See Table 4).

(insert Table 4 around here)

The ISI publications contribution of international organizations came almost entirely from only two organizations, the International Rice Research Institute (IRRI) in Los Banos and the Southeast Asian Fisheries Development Center (SEAFDEC) in Iloilo. IRRI topped the overall list in the country (27.2%), followed by the University of the Philippines (U.P.)-Diliman (17.3%), SEAFDEC comes in third (12.7%), and U.P. Los Banos was close with 12.5%. Other noteworthy public HEI contributors would be U.P. Manila and Mindanao State University. Private HEIs like De La Salle University and the University of Santo Tomas is within the top ten overall. See Table 5 for list of other institutions with ISI publication contributions for the period 1998-2002.

Government institution contributors came mostly from research units and medical facilities of the Department of Agriculture, Department of Health, and the Department of Science and Technology. Private institutions included companies, non-governmental organizations, and hospitals.

(insert Table 5 around here)

Quality of Publications

A widely used indicator of the quality of ISI publications is the citation counts (Garfield, 1992). The ISI databases have an indexing system that regularly updates the number of times each article has been cited by other ISI articles. The assumption is that when an article is cited, it can be a good indication of relevance and "quality." In the current analysis, we got the ratio of each article's citation count as of January 2003 and the number of years since the article was published. In effect, the citation count ratio reflects the average number of citations an article gets per year.

Results indicated that the mean citation counts of the 879 entries included in the analysis is 1.87 (SD=3.78) and the average citation ratio is 0.5 (SD=0.96). Unfortunately around half (51.9%)of the articles have not been cited at all as of January 2003. Only 21% of the articles have a citation ratio of at least 1.0. These were articles which have averaged at least 1 citation count per year since it was published. Depending on the scientific field, top caliber ISI papers averaged 5 to 12 citations per year. Articles with citation ratios of at least 1.0 were further analyzed by looking into the frequency distributions across field classification (See Table 6) and institutional category (Table 7).

Consistent with the pattern of productivity, better quality ISI publications came mostly from the fields of agriculture and marine science. Furthermore, most of these publications were produced by international organizations and a small number of HEIs.

(insert Table 6 around here)

(insert Table 7 around here)

Discussion

The findings reflect three general theme patterns: collaboration is a trend, research activities are highly skewed and disproportionately concentrated in a few institutions and international publication productivity and quality is way below benchmark standards. In this section, issues relating to each of the general theme patterns were discussed and accordingly some recommendations were presented.

Collaboration is a Trend

Collaboration in scientific publications has been a trend observed in most nations around the world (Galvez et al., 2000). It is in fact strategic for developing countries like the Philippines to collaborate with developed countries like US and Japan. At the individual level, collaboration may increase the chances of local scientists to have their work published in international journals. It could also be in some way a means of having direct (or indirect) access to local deficiencies like facilities, research equipment or instruments, technical expertise, or funding in general. In fact, the presence of well funded international organizations like the IRRI and SEAFDEC benefited us in many ways. Due to their proximity (IRRI with UP Los Banos, and SEAFDEC with UP Visayas), research collaborations between local and foreign scientists from these institutions have benefited both sides in many aspects – cross fertilization of technical expertise, access to facilities and equipment among others.

Continued collaborations with scientists in industrialized countries would be advantageous. However, it is recommended that foreign collaborations should be extended to countries where economic and social elements may have more significant parallelism to ours. For example, the data indicated that collaboration with China (see Table 2) was relatively minimal. Perhaps, collaboration with China could further enhance the strength in the area of

agriculture and marine science because this is one country that has also significant interests in these fields. In the case of our weak areas such as engineering and computer sciences, maybe increased collaborations with a country like India would be strategic.

Local collaborations should also be further enhanced. In particular, academe-industry tie-ups may serve to boost the capacities of both sides. The findings indicated that publications from private institutions are very few. A lot of the large industries stand to gain from technological development implications of research activities. However, it may not be aligned with their mission to maintain research personnel or scientists. Academe-industry tie ups will be beneficial in this regard. Facilities, equipment, and funding which HEIs lack could be provided by industries. The pool of scientists, which industry lacks could be provided by HEIs on the other hand. In the same manner, private medical institutions could partner with HEIs to complement their mostly practitioner medical doctors. This symbiotic relationship may serve to increase scientific outputs from the private institutions while at the same time address some structural and economic constraints to scientific productivity in the academe.

Publications Come From a Concentrated Few

Our data reflected that the international scientific publications of the country came from a disproportionately few institutions, within a select few sectors. Extending this further, previous empirical data showed that within these few institutions, a tiny fraction of individual scientists were producing most of the outputs (Valencia, 2004). For example, in the case of the more than 1,500 HEI's in the country, apparently the findings reflected that less than ten of these were significant contributors to international publication outputs. Most likely, economic realities have discouraged most HEIs to become research universities. It seems that market forces became the drive.

Given the national and institutional level economic constraints, the "concentrated few" pattern can be viewed as an opportunity. Perhaps, it might be more strategic to concentrate national R & D funds to these high performing institutions instead of spreading them too thinly considering the very meager national allocations. For example in the case of HEIs, making the University of the Philippines a national university and funneling it with substantial R&D funds would increase its capacity to become a world class research university. This is one way of concretizing the strategy of building on our strengths. Concentrating government funds on a few national universities has been found to be successful in the case of Singapore and Taiwan (Kao, 2004). In fact, some lead Australian research universities took it to the next level by adopting a strategy of extensive support to individual "star" scientists (Coll, 2004).

Low Scientific Publications Productivity and Quality

The findings indicated that the yearly averages of ISI publications from the Philippines for the period 1998-2002 are 325. To contextualize this figure, consider the data in Table 8 taken from a previous survey.

(insert Table 8 around here)

While our neighboring countries increased their ISI publication outputs dramatically, our improvements were way behind regional benchmarks even until 2002 as reflected in our findings. In terms of productivity, we could conclude that we are a far cry by international standards. Quality wise, as measured by citation counts and citation ratios, our findings seem to reflect the same pattern of being way below par.

International publication productivity and quality issues are definitely functions of numerous factors. Financial constraints which translate to lack of funding, facilities, incentives, and competent personnel are among the obvious reasons for the observed pattern. But also, many

have argued that one significant underlying factor for this issue is the lack of scientific publication culture even among the top research institutions in the country (Gonzalez, 1995; Lacanilao 1999). If this is indeed a major factor, then it may take a while and a lot of effort because culture is very difficult to change. But for the mean time, relevant recommendations would be to: increase the incentives for doing and publishing research at the national and institutional levels, encourage research collaborations internationally and domestically, intensify recruitment and training of scientists and engineers amidst the current lures of market demands like nursing, encourage and support programs that allow local students and professionals to be trained and educated abroad. At this point, our country is far from having substantial world class research and educational institutions and a critical mass of competent scientists and engineers in order for us not to rely heavily on foreign countries.

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Table 1

Philippine ISI publications for the period 1998-2002

Publication Year	**No. of Publications**	**%**
1998	288	17.7
1999	316	19.4
2000	365	22.4
2001	319	19.6
2002	337	20.8
TOTAL	**1,625**	**100.0**

Table 2

Percentage distribution (n=746):
Country affiliation of ISI publications with non-Philippine lead authors

Country Affiliation	**Frequency**	**% of publications**
USA	224	30.0
Japan	159	21.3
Germany	46	6.2
Australia	40	5.4
England	40	5.4
Canada	27	3.6
China	21	2.8
France	20	2.7
India	18	2.4
Netherlands	17	2.3
Switzerland	11	1.5
Spain	10	1.3
Denmark	9	1.2
Hongkong	9	1.2
Taiwan	8	1.1
Others*	87	
(less than 1% per country)		11.7
TOTAL	**746**	**100.0**

*Scotland Belgium South Korea Thailand Hong Kong Singapore Sweden Bangladesh Norway Israel Malaysia New Zealand Russia Bhutan Finland Ireland Italy Mexico Tanzania Argentina Colombia Costa Rica Gambia Ghana Indonesia Pakistan Peru Spain Sri Lanka Syria Tokyo UAE Zimbabwe

Table 3

Percentage distribution:
Field categories of ISI publications with Philippine lead authors

Field	**Frequency**	**%**
Agriculture	242	27.5
Marine	181	20.6
Medicine	99	11.3
Biology	92	10.5
Physics	78	8.9
Molecular Biology and Biotechnology	43	4.9
Chemistry	34	3.9
Geology	23	2.6
Mathematics	23	2.6
Engineering	17	1.9
Agricultural Engineering	11	1.3
Food Science	11	1.3
Animal Science	7	0.8
Vet Med	6	0.7
Computer Science	4	0.5
Forestry	3	0.3
Meteorology	3	0.3
Environmental Science	2	0.2
Total	**879.0**	**100.0**

Table 4

Percentage distribution:
ISI publications across types of institutions

Type of Institution	Number of ISI Publications	%
International Organization	379	43.1
HEI-Public	319	36.3
Government	72	8.2
HEI-Private	62	7.1
Private Institution	37	4.2
(not indicated)	10	1.1
Total	879	100

Table 5

Percentage distribution
of ISI publications (1998-2002) across institutions

Institution	Frequency	Percent
International Organizations		
International Rice Research Institute (IRRI)	239	27.2
Souteast Asian Fisheries Development Center (SEAFDEC)	112	12.7
Int'l Center for Living Aquatic Resoursec Management	15	1.7
Asian Development Bank	4	0.5
World Health Organization – Philippines	3	0.3
United Nations Development Program	2	0.2
International Center for Tropical Agriculture - Philippines	1	0.1
International Maritime Org	1	0.1
Japan International Cooperation Agency - Phil	1	0.1
HEIs		
University of the Philippines (UP) - Diliman	152	17.3
UP Los Banos	110	12.5
UP Manila	28	3.2
De La Salle University Manila	26	3
University of Sto. Tomas	17	1.9
Mindanao State University	8	0.9
Central Luzon State University	6	0.7
Siliman University	5	0.6
University of San Carlos	5	0.6
UP Visayas	5	0.6
Ateneo de Manila University	3	0.3
UP San Fernando	3	0.3
Benguet State University	2	0.2
Visayas State College of Agriculture	2	0.2
Angeles University	1	0.1
Cagayan State University	1	0.1
De La Salle University – Cavite	1	0.1
Don Bosco Tech College	1	0.1
Lyceum NW Univ, Dagupan	1	0.1
St. Louis University	1	0.1
University of Asia & the Pacific	1	0.1
University of St. La Salle – Bacolod	1	0.1
University Southern Mindanao	1	0.1
Government Institutions		
Philippine Rice Institute	16	1.8
Research Institute for Tropical Medicine	15	1.7
Mines & Geosciences Bureau	5	0.6
Philippine Children's Medical Center	4	0.5
Philippine Nuclear Research Institute	4	0.5
National Kidney & Transplant Institute	3	0.3
PHILVOCS	3	0.3

Bureau of Soils & Water Management	2	0.2
DOST-Food & Nutr. Res Inst	2	0.2
DOST-Ind Tech Dev Inst	2	0.2
Philippine Heart Center	2	0.2
PAGASA	2	0.2
Bureau of Fish & Aquatic Resources	1	0.1
Bureau of Agricultural & Fisheries Food Stand	1	0.1
Commission on Higher Education (CHED)	1	0.1
Coastal Management Center	1	0.1
Department of Agriculture	1	0.1
DOH-MCH	1	0.1
DOH-San Lazaro	1	0.1
Department of Science and Technology	1	0.1
East Avenue Medical Center	1	0.1
Jose R. Reyes Medical Center	1	0.1
National Museum	1	0.1
Phil Council Agriculture, Forestry & Natural Resources	1	0.1
Private Institution		
Tetra Tech EM Inc.	5	0.6
Makati Medical Center	4	0.5
St. Luke's Medical Center	4	0.5
Tropical Diseases Foundation (Makati Medical Center)	4	0.5
Haribon Foundation.	2	0.2
PNOC Energy Dev Corp	2	0.2
Central Visayan Institute - Bohol	1	0.1
Center for Chest Clinic	1	0.1
Famer Scientist Partnership for Development	1	0.1
Hideco Sugar Milling Co. Inc. (Leyte)	1	0.1
Holy Child Clinic (Pampanga)	1	0.1
Inspect Consultants Inst. Phil. Inc. (Olongapo)	1	0.1
Lepanto Consolidated Mining Company (Benguet)	1	0.1
Manila Doctors Hospital	1	0.1
PASAR Corp	1	0.1
Phil Agricultural & Resources Research Foundation Inc.	1	0.1
Philippine Eagle Foundation	1	0.1
Phillipine Geothermal Inc.	1	0.1
Research Center for Theoretical Physics (Bohol)	1	0.1
UERM Memorial Medical Ctr.	1	0.1
World Lab (Philippines)	1	0.1
(not indicated)	12	1.3
Total	879	100

Table 6

Percentage distribution
of ISI publications (with at least 1.0 citation ratio) across field classifications

Field	Frequency	Percent
Agriculture	66	35.7
Marine	31	16.8
Biology	18	9.7
Molecular Biology & Biotechnology	18	9.7
Physics	18	9.7
Medicine	17	9.2
Chemistry	6	3.2
Mathematics	4	2.2
Engineering	3	1.6
Geology	3	1.6
Veterinary Medicine	1	0.5
Total	185	100.0

Table 7

Percentage Distribution
Of ISI Publications (with at least 1.0 citation ratio) across types of institution

Type of Institution	No. of ISI Publications	%
International Organization	113	61.1
HEI-SU	39	21.1
Government	16	8.6
Private	11	5.9
HEI-Private	5	2.7
(not indicated)	1	0.5
Total	185	100.0

Table 8

Science and technology performance as indicated by the number of international journal Publications (Yearly Averages)

Country	Publications in 1981-1992	Publications in 1994-1995	Percent Increase
Taiwan	1728	5221	202
South Korea	1047	4255	301
Singapore	524	1270	142
Thailand	419	574	37
Malaysia	314	463	47
Indonesia	157	243	55
Philippines	209	224	7

Source: Lacanilao, 1999.

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