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Malaysian Publication Productivity in the Field of Engineering using Scopus: A Bibliometric Study

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***Abstract*—This paper analyzed on publication from Scopus in engineering subject area by using the bibliometrics analysis in twenty years. Data of publication obtained from Scopus website by using the affiliation from Malaysia and the keyword search are engineering and chemical engineering. There are 6137 publications was obtained in the study. The top three types of documents are conference paper (4035), article (1999) and review (62). The four most productive countries are Malaysia (6137), United Kingdom (429), United States of America (199) and India (199). Many researchers publish their work in IEEE Region 10 Annual International Conference, Proceedings/TENCON, Proceedings of World Academy of Science, Engineering and Technology, and IEEE International Conference on Semiconductor Electronics, Proceedings. The most prolific authors were Majlis B.Y. (60), Seetharamu K.N. (49) and Mohamed A.(47) has published the most article in the field of engineering in Malaysia.**

Keywords —Bibliometrics, citation analysis, publications analysis, Scopus, Malaysia, engineering

I. INTRODUCTION

Library and information Sciences (LIS) consist of subfields which are informetrics, bibliometrics, scientometrics, cybermetrics and webometrics. Tague-Sutclife has define informetrics as "the study of the quantitative aspects of information in any form, not just records or bibliographies, and in any social group, not just scientists"[1]. Bibliometrics itself are part in the informetrics field of knowledge. Whereby informetrics consist of four subfield which is bibliometrics, scientometrics, cybermetrics, webometrics [1]. Bibliometrics is one of the older areas in library and information science and the terms bibliometrics itself was defined by Pritchard [2] as "The application of mathematical and statistical methods to books and other media of communication." Bibliometrics was used to replace the terms or name "statistical bibliography" which was used for the field of quantitative analysis of bibliographies [3]. It focuses on the material aspect by undertaking the counting of books, articles, publication, and citation which in general any statistical significant manifestation of recorded information, without any disciplinary bound [4]. Briefly, bibliometrics consist of three important laws which are Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence.

Malaysian Science and Technology Information Centre (MASTIC) had done several studies on bibliometrics in the field of Science and Technology (S&T) [9,10]. MASTIC is a division under the Ministry of Science, Technology and Innovation (MOSTI) which roles as a supports and provides basis of decision making,priority-setting ,planning and implementing the nations science and technology (S&T) policies. Secondly is by directing users to relevant information sources which either within its own extensive information holdings and elsewhere. Then it is also acts as a linking mechanism between three major players in Malaysian S&T system which first is to the policy makers and research providers, secondly to the researchers who make up the S&T infrastructure and lastly to the users and developers of research results[10].

Recent MASTIC study on bibliometrics was in 2003 and 2008 which has produce the report call Science and Technology Knowledge Productivity in Malaysia Bibliometrics Study 2003 & 2008. In MASTIC 2003, shows that only 12 paper had been published in the field of engineering [9], and the latest study by MASTIC 2008 shows that there are increasing number of publication in the engineering field which the subjects are civil engineering (681), electrical and electronic engineering (506), and lastly mechanical engineering (484) papers had been published and it was as a top subjects. Meanwhile for the bottom one was the advancement of knowledge engineering sciences (3) which produces only three papers [9]. Other study was done by Yin, shows that there are 848 publications has been published in by Malaysia in Chemical Engineering discipline and shows that it has Elsevier journal publication due to the popularity of ScienceDirect.com (owned by Elsevier). Furthermore Malaysian Chemical Engineering researcher focused more on catalysis and oil and gas engineering, and also environmental chemical engineering respectively [5].

Review focused on local literature illustrates that the several studies focused on the evaluation of journals of some specific disciplines, few studies about journals are repeated and the field of the engineering is remained a focus of the Malaysian' researchers. This is the first study in Malaysia that focusing on the field of engineering using bibliometris analysis at international and national level.

II. DATA COLLECTION

Data collection on publication from Scopus has been done within 2 months period of time in August 2011 until October 2011. These data had been collected only from Malaysia affiliation and only subject within the engineering field is taken (refer Figure 1). The period of publication data had been set to 20 years which is from 1991-2010. In total there were about 6137 publication data were collected. The keyword subjects that are being considered in the Scopus were "engineering and chemical engineering".

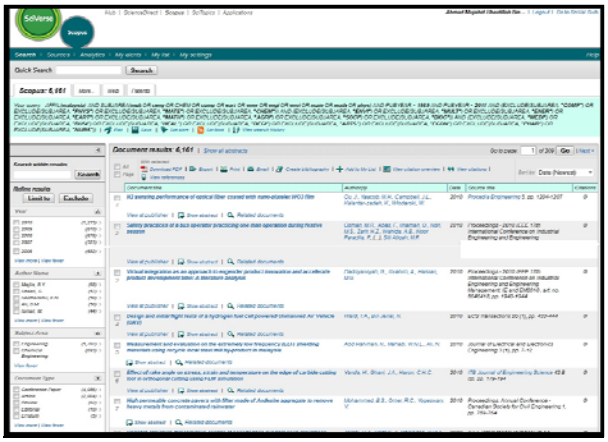

Fig 1: Screenshot of a search for Malaysian publication in the field of engineering in Scopus

In the publication data process firstly Scopus URL (Uniform Resource Locator) "www.scopus.com" was entered in the address field of internet browser. Then the process started after login in the system. Firstly, search tab was clicked which is in the upper left of the interface. Then "Malaysia" was typed in the field that being provided then affiliation was chosen in the document search tab. Limitation was set to in the Date Range area which is below the search field.

Twenty years' time frame was chosen by setting the published date from 1991 until 2010 and the year 2011 is being excluded since the data cannot be analyze correctly since it is being increasing as the time goes by. The end of period time 2010 is chosen for allowing some citation appears. At the document type area, all type was chosen and subject area is clicked and set to only engineering field by tick the physical science subject area since that area contains engineering field and the other check box was left not being tick.

During the first attempt 80716 documents was found in the system. Then filtering process started by excluding other subject area in the left tab. Subject other than engineering field related was ticked and exclude button was clicked to remove all the other subject except engineering field related. After that in the country field, only Malaysia affiliation was chosen and other country was excluded since this research was done for Malaysia.

Total 6137 number of article was found after all the filtering process done. Then in the document result field, all tick boxes was ticked and export process was chosen. These export process was done repeatedly until all 6137 number of article was downloaded. This is because only 2000 number of record can be view and downloaded at a time. There are two types of export file format is chosen which is in the *.csv(comma separated value) and in *.ris (Research Information System). Then All the data was edited and combined into one file which is in *.ris and *.csv file format. The *.csv file format data was analyzed further in the Microsoft Excel.

On the other hand, *.ris file format data was read by HistCite™ version 11.9.12 software to make it easier to be analysed and corrected. The corrected data was then exported into *.csv file format to be further analyzed in the Microsoft Excel. According to the Thomson Reuters website, HistCite™ is software that was developed by Dr.Eugene Garfield who is the founder of the Institute for Scientific Information and also the inventor of the Science citation index.

This software is one of the helpful software in the bibliometrics field research because of the function it has. Some of the function that HistCite™ are complete author or journal list with papers and citation ranks, complete list of countries, institutions and departments within institutions of origin of papers published and citation ranks [13]. After all the process of publication data process there are 6137 number of data were downloaded.

III. PUBLICATION ANALYSIS

Figure 2 shows that in year 1991-1995, 158 paper have been published, meanwhile the next five years which is in year 1996-2000 there are 545 paper published. It shows that the

research in engineering area increase about 3.45 times higher than the 5 years before. Then, in year 2001-2005 the paper published increase higher which is 1718 paper has been published which makes it 3.15 times higher than the five years before.

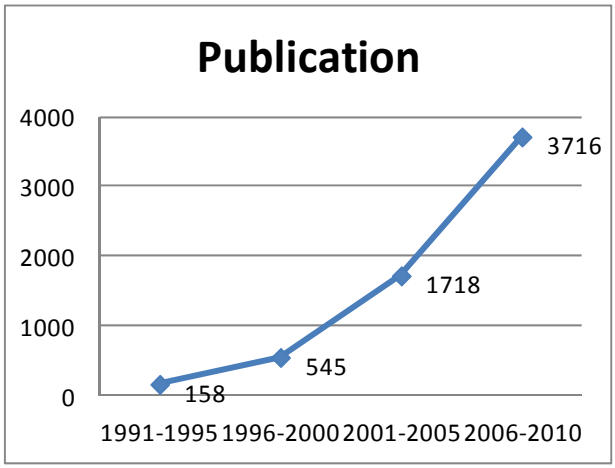

Fig 2: Publication in 5 years interval

Table I shows the number of paper publish based on Malaysian plan (RMK 8) and the rapid grow of the increasing paper is in RMK 8 which is the research is booming. This shows that the research in this field is getting increasing and more rapid growing.

Table I: Publication in 5 years interval

Year (5years) / RMK	Total Publication
1991-1995 (RMK6)	158
1996-2000 (RMK7)	545
2001-2005 (RMK8)	1718
2006-2010 (RMK9)	3716
Total	6137

The evidence of the researchers and the writers had shown great interest in doing the research in the engineering are the paper that had been published increases until 3176 papers in year 2006-2010. As we can see here in every 5 years interval, minimum number of paper published is not less than 3 times than the 5 years before. This reason might be there is the relationship between the published paper and the Malaysian Plan (RMK). The low publication in RMK 6 because Malaysia experiencing recession problems in the early RMK 5 and huge economic crisis in 1997-1998 which is during the RMK 6. Then in 1998, policy of selective capital controls has been implemented by the Malaysian government [7]. Therefore this will support the research process by the government and then the researcher will be published their work. Apart from that, the government has taken initiative by making a first time comprehensive approach in terms of size and management of research and development (R & D) as well as the total R & D activities, but it also has a strong foundation for policy development and management of science and technology (S & T) in the future [7]. The research grant incentive by government was launched in 1996, which helping the researcher to more focusing on research and development. In RMK 9 more paper published because the university in Malaysia strives to get their reputation high and to get the Research University status and APEX University.

A. Document Type

Table II shows type of document that had been published during 1991-2010. The most highly published article types are conference paper which each of them have 1999 and 4035 papers respectively. Similar result also found by Gu [8] which shows that conference paper was the most and primary channels that had been used by Malaysian researchers and authors.

Table II: Type of Document

Type of Document	Total Publication
Conference	4035
Journal	1999
Review	62
Others	61

B. Productive Country

Table III shows the top ten most productive countries which is the country of affiliation.

Table III: Most Productive Country

No.	Country	Total Publication
1	Malaysia	6137
2	United Kingdom	428
3	United States	199
4	India	199
5	Japan	165
6	Australia	145
7	Iran	74
8	Singapore	72
9	Indonesia	60
10	Germany	49

As we can see here Malaysia got the highest total number of publication which is 6137 articles, and it got the highest number of publication since the study conducted was on the Malaysian engineering field. The second highest was United Kingdom (428), and then followed by United States (199), India (199), Japan (165), Australia (145), Iran (74), Singapore (72), Indonesia (0), and lastly Germany (49). Publication that

comes from other country was because the collaboration between Malaysian and the author outside of Malaysia. A study by Malaysian Science and Technology Information Centre (MASTIC) (2008) in the field of S&T also produced a similar result.

C. Publication Channel

Table IV shows the most productive source or channels in set of total data 6137 of document. The table shows only top 10 source of journal which Malaysian researchers and writers in the field of engineering like to publish.

Table IV: The Top Publication Channel

No	Source	Count
1	IEEE Region 10 Annual International Conference, Proceedings/TENCON	322
2	Proceedings of World Academy of Science, Engineering and Technology	278
3	IEEE International Conference on Semiconductor Electronics, Proceedings, ICSE	205
4	Proceedings of the IEEE/CPMT International Electronics Manufacturing Technology (IEMT) Symposium	202
5	IFMBE Proceedings	145
6	2007 Asia-Pacific Conference on Applied Electromagnetics Proceedings, APACE2007	111
7	2008 International Conference on Electronic Design, ICED 2008	109
8	Advanced Materials Research	103
9	SCOReD2009 - Proceedings of 2009 IEEE Student Conference on Research and Development	99
10	Proceedings ICSE 2004 - 2004 IEEE International Conference on Semiconductor Electronics	98

The table shows us that most of the Malaysian engineers like to get their paper published by the conference proceedings channel. We can see that the most productive source of publication is IEEE Region 10 Annual International Conference, Proceedings/TENCON (322) article indexed in it. The second is Proceedings of World Academy of Science, Engineering and Technology (278) articles and followed by IEEE International Conference on Semiconductor Electronics, Proceedings, ICSE (205), Proceedings of the IEEE/CPMT International Electronics Manufacturing Technology (IEMT) Symposium (202), IFMBE Proceedings (145), 2007 Asia-Pacific Conference on Applied Electromagnetics Proceedings, APACE2007 (111), 2008 International Conference on Electronic Design, ICED 2008 (109), Advanced Materials Research (103), SCOReD2009 - Proceedings of 2009 IEEE Student Conference on Research and Development (99),and lastly for the top ten is Proceedings ICSE 2004 - 2004 IEEE International Conference on Semiconductor Electronics (98) articles. From the findings the entire top 10 publication source did not have any impact factor which is because Thompson Reuters does not calculate impact factor for any proceedings before 2010 titles thus makes all the proceeding journal are not issued with impact factors [11]. Thus there is none of the publication channel above have the impact factors in Journal Citation Report (JCR).

D. Productive authors

Table V shows the most productive authors. The first top author is Majlis B.Y (60) had published papers that indexed in the Scopus and he is from Universtiti Kebangsaan Malaysia (UKM). Secondly was Seetharamu (49) from Universiti Sains Malaysia (USM). The third was Mohamed A. (47) and Ismail M. (47) both from UKM, followed by Shaari S. (46) also from UKM, Othman M (44) from University Malaysia (UM), Ahmad I.(43) from Universiti Tenaga Nasional (UNITEN), Taib M.N (42) from Universiti Teknologi MARA (UiTM), Abdullah M.K (36) from Universiti Putra Malaysia (UPM) and lastly Ali B.M (35) from UPM, Hamzah M.K (34) from UiTM.

Table V: The most Productive Authors

No	Author	count
1	Majlis B.Y.	60
2	Seetharamu K.N.	49
3	Mohamed A.	47
4	Ismail M.	47
5	Shaari S.	46
6	Othman M.	44
7	Ahmad I.	43
8	Taib M.N.	42
9	Abdullah M.K.	36
10	Ali B.M.	35

E. Number of authors

Table VI shows that the authorship pattern in Malaysia about 7.27 percent from the paper being published from 1991-2010 was single author. The majority numbers of author per article were range from two to four per single article. Overall range numbers of authors per paper in Malaysia within the field of engineering are from one to thirty one authors. Two authors per paper were 25.33 percent from the published papers. Then three authors per paper were 30.75 percent and show 5.42 percent higher than two authors per paper. Meanwhile four authors were 20.17 percent, five authors 9.52 percent, six authors 4.14 percent. For seven, eight, nine, were 1.58 percent, 0.52 percent, 0.4 percent, but for ten, eleven, twelve, thirteen, fourteen and thirty one authors' per paper is 0.3 percent from the total publications. As we can see here the pattern of authorship are more to multiple authors which is the

percentage of authors within range of two to three authors are 76.26 percent. The past study of bibliometrics in other field also shows that the pattern of authorship now is more to multiple authors [14, 15, 16]. Thus we also can say that multiple authorship pattern shows that there are more collaboration occurs or happen between the researchers and authors.

Table VI: Number of author per paper

No .of Authors	Count
1	446
2	1555
3	1887
4	1238
5	584
6	254
7	97
8	32
9	25
>10	10
Total	**6137**

IV. CONCLUSION

Bibliometrics analysis of engineering in Malaysia from 1991-2010, shows that the trends of publications amongst the researchers from Malaysia like to publish their research papers and their findings in the proceeding and conference channel. The pattern of authorship in Malaysian now is more towards multiple authorships than single authorship due the demand on research to working in multi-disciplines. Malaysia does have collaboration in research from other developed country such as United Kingdom and United States. Malaysian publication in the field of engineering are increasing from year by year to and this is in order to follow the Malaysian Plan (RMK) and also from the Ministry of Science, Technology and Innovation (MOSTI).

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