

Report on the Contribution of Universities and Research Institutions in Scientific Development of Islamic Countries: The Case of Malaysia

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1. Introduction

The commitment of the Federal Government of Malaysia to enhance the capability of the country's higher education sector is the highest priority. This is proven by World Bank that shows since the year 2016, Malaysia is the world's fifth-largest country to allocate public funding for higher education. In the year 2017, Malaysia has remarkably allocated RM12.28 billion budget for higher education and an increase of 13.15% to RM13.89 billion for the year 2018.

Moreover, in line with the shift 7 of Malaysia Education Blueprint 2015-2025 (Higher Education) (MEB (HE)) innovation ecosystems, the research sector narratives have shifted from 'culturing research' to 'bring research that can directly benefit the community'. Since that, Malaysia Ministry of Higher Education has provided Research Priority Roadmap 2017 which focuses on:

- a. The Grand Challenge program, the UN Sustainable Development Goals (SDG), led by Malaysian Research Universities;
- b. Bringing translational research into focus, becoming more valuable and relevant for bottom billions; for example:-
 - i. Universiti Putra Malaysia (UPM) - implement rice research that has succeeded in increasing crop yield and rice quality.
 - ii. Universiti Sains Malaysia (USM)—implement research in membrane technology that is used to treat clean water during floods.
 - iii. Universiti Kebangsaan Malaysia (UKM)—implement research on Langkawi Geopark that helps to preserve and conserve flora and fauna.
 - iv. Universiti Malaysia Sarawak (UNIMAS)—implement Zika Virus detection research as used in conjunction with Olympic games in Brazil in 2016.
- c. Promoting talent among researchers involved in the field of SDG as well as the 4th industry revolution; and
- d. Positioning the investigation for global excellence in line with the 8th MEB (HE) shift.

Furthermore, Malaysia higher education seriously undertake research productivity as an integral part for nation building and improving social welfare. Out of the RM 5.58 billion invested by the Malaysia Federal Government for research purposes between years 2007 until 2015, Malaysia universities have managed to generate RM 7.17 billion which is a 28.5% Return on Investment Research (RoRI). The amount includes revenue from fundamental research (books, consultants, services) and commercial research (products, intellectual property). Malaysia Federal Government investment revenue has led to:-

- a. High volume of publications to enable Malaysia to lead Singapore and Thailand;
- b. High number of intellectual property and patent filed, and
- c. An increase of citations that allows our researchers to be recognized as the world's top 1%.

Consequently, the ranking of public and private Malaysian universities at the world level has also increased, partly due to the achievement in research outputs.

Source: (YB Dato' Seri Idris Jusoh, 2017/2018 - Amanat Menteri Pendidikan Tinggi)

Therefore, this report seeks to outline the detailed outputs of the performance of Malaysian Universities and Research Institutions, with the focus on scholarly publication particularly on the productivity, citations count, and research collaborations.

The data was retrieved from Web of Science (WOS) and SCOPUS databases supplied by Malaysia Citation Centre (MCC), a national agency that provides data and scholarly impact of Malaysian scholarly publications/journals. The time frame of the data includes publications published between 2014 and 2017. Publications covered all types of publication including articles, reviews and conference proceedings, chapter in book and research book. The scope of this report is the contribution of Universities and Research Institutions in Scientific Development of Islamic Countries with the focus on Malaysia Scholarly Publication.

2. Total Publications

The total publications of Malaysian Universities and Research Institutions (MURI) as gathered through SOPUS and WOS data from 2014 to 2017 is 133,638 publications. Figure 1 shows the top 10 of MURI which published most publications in SCOPUS. Based on the chart, University of Malaya leads with 18,342 publications for these four years. The following institutions are Universiti Teknologi Malaysia (14,845), Universiti Putra Malaysia (12,937) and Universiti Kebangsaan Malaysia (12,566). The percentage difference between University of Malaya and University Teknologi Malaysia was 19%. However, the subsequent percentage difference among other Malaysia Research Universities (MRUs) shows not much of gap. The average difference for MRUs publications is 4%-5%.

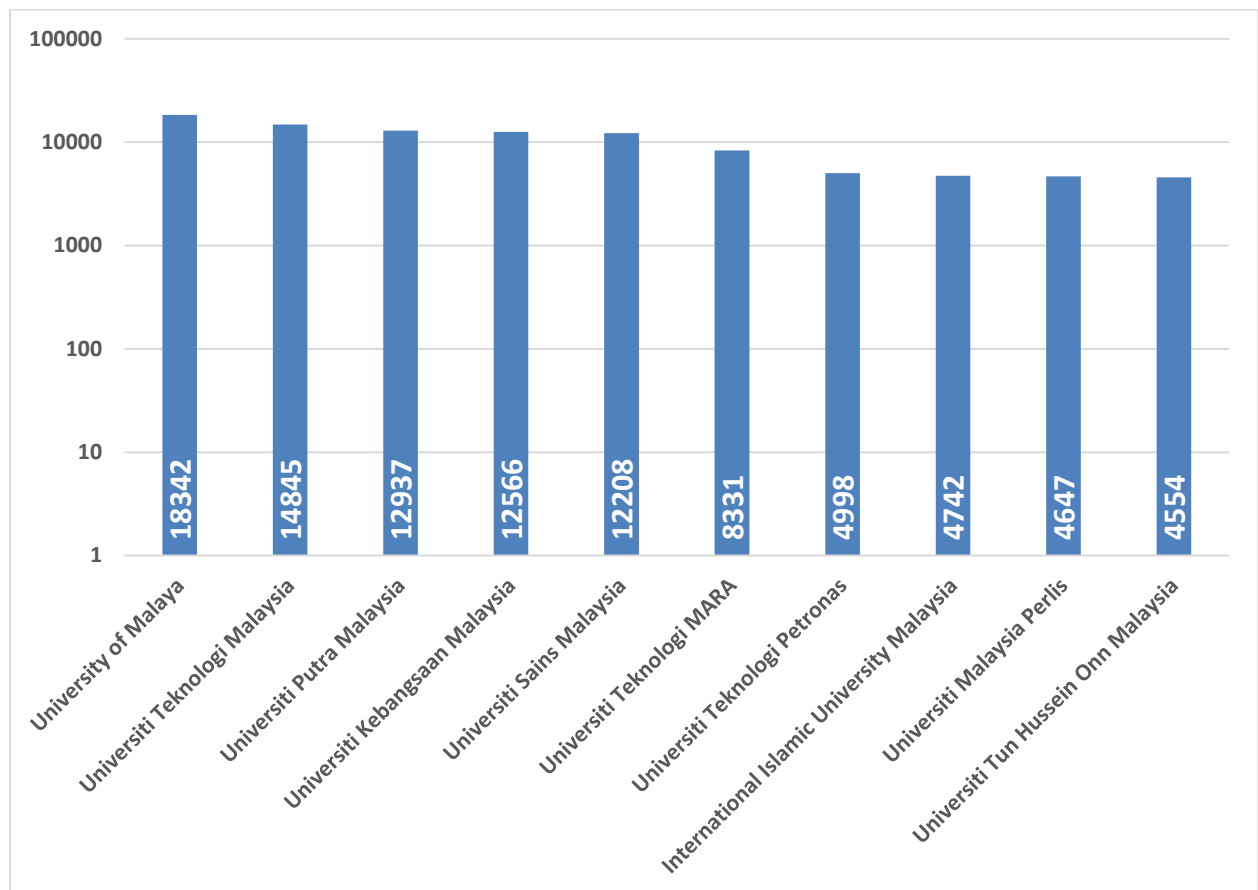


Figure 1 Total Publications by Institution in SCOPUS (Top 10)

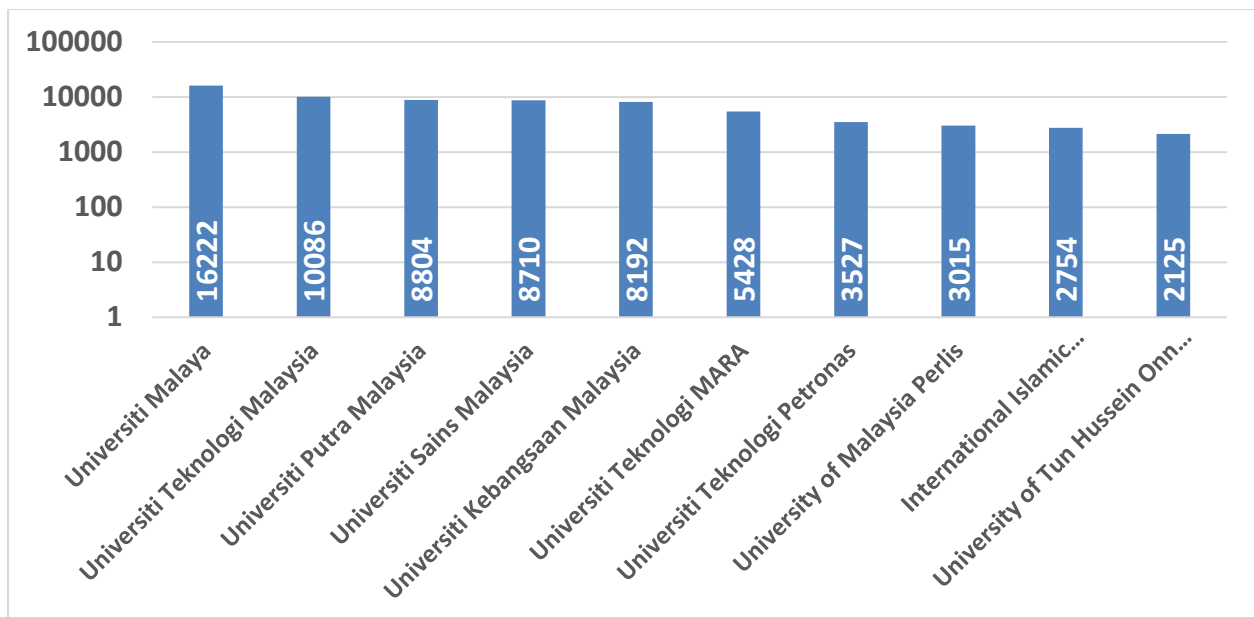


Figure 2 Total Publications by Institution in Web of Science (Top 10)

According to Figure 2, the listing of Top 10 institutions that published in WOS is not very much different than the one in SCOPUS. The dissimilarity however appears in the ranking for the MRUs, with Universiti Sains Malaysia ranked at number five (5) in SCOPUS but in WOS, it is ranked at number four (4). For the difference of gap in terms of the total publication percentage, in WOS, it is much higher than SCOPUS. Apparently, between University of Malaya and Universiti Teknologi Malaysia, the gap is 38%.

Both of the graphs above show that Universiti Teknologi Petronas is the only private universities listed in the Top 10 for SCOPUS and WOS.

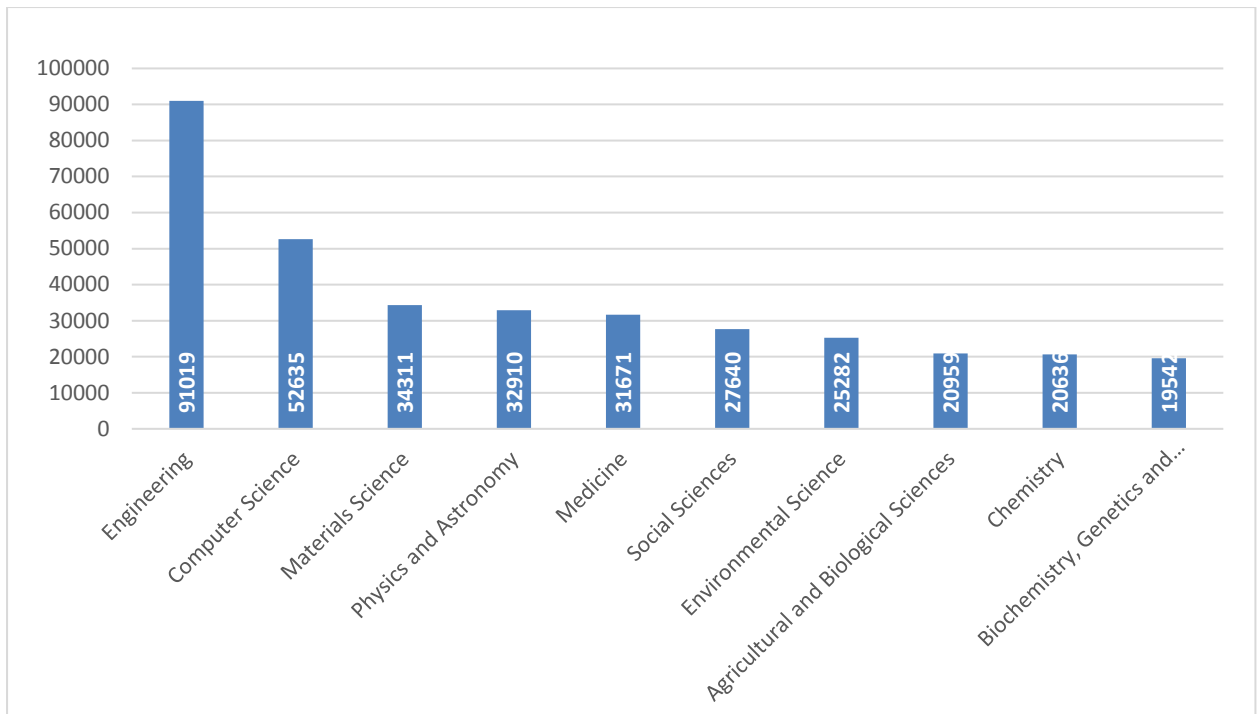


Figure 3 Total Publications by Subject Area in SCOPUS (Top 10)

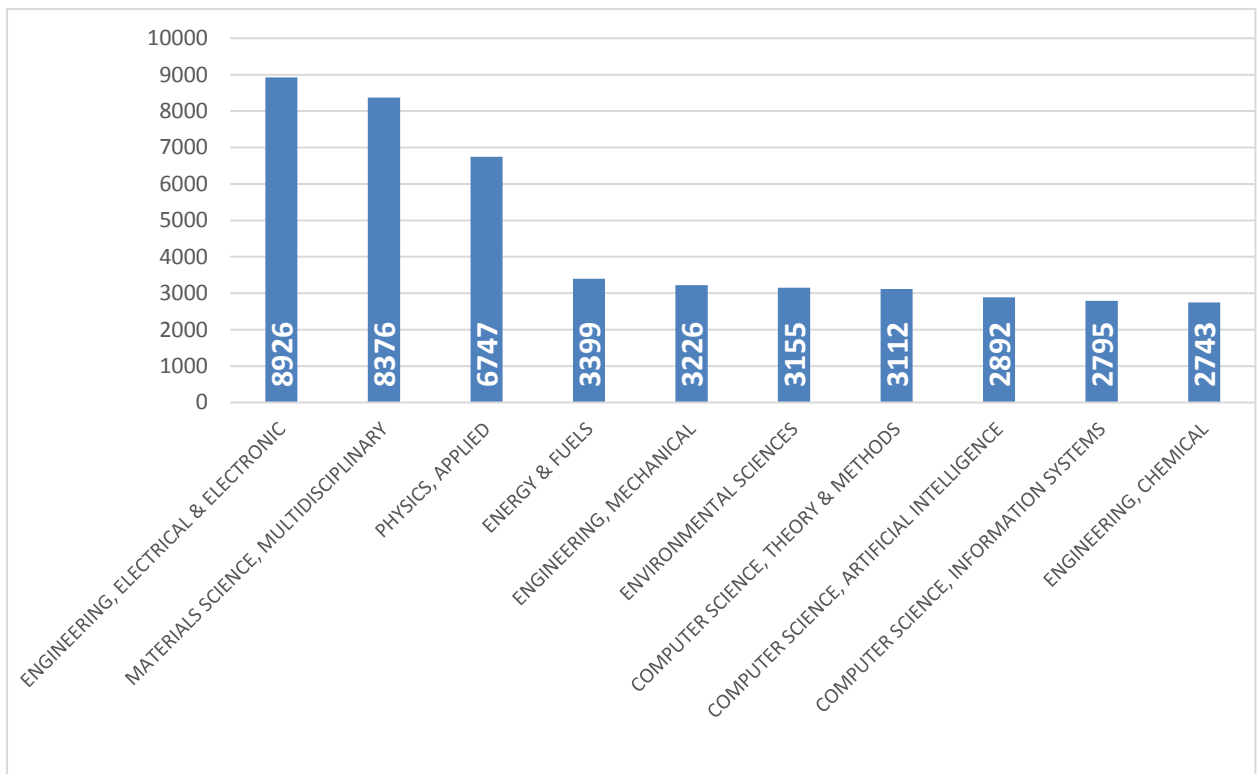


Figure 4 Total Publications by Subject Area in Web of Science (Top 10)

Figure 3 and 4 shows the subject of Engineering was dominated the publications in Malaysia for past four years. Computer Science was second place in SCOPUS after Engineering. According to Figure 4, WOS separated to specific sub-subject areas of Engineering. Certainly, Electrical & Electronic Engineering, Mechanical Engineering and Chemical Engineering were listed in Top 10 of total publications by subject area in WOS. In other words, Engineering was dominated in both SCOPUS and WOS. The gap between the first place and second place in SCOPUS was huge and it shows about 42%. Though, the gap among the subject areas in WOS was not much different among first of three subject areas.

Figure 5 shows the top 10 journal titles indexed in SCOPUS in terms of publication quantity whereby the top three journal titles are AIP Conference Proceedings (4281), Jurnal Teknologi (Sciences and Engineering) (3279) and ARPN Journal of Engineering and Applied Sciences (2158). The majority of journal titles are science, technology, and engineering subject areas. However, regardless of being the top most published journal publication, AIP Conference Proceedings does not make it to the most cited publication. Indeed, the highest citations are Renewable and Sustainable Energy Reviews (11972) and followed by Energy Conversion and Management (5194). In fact, these two journal titles are not in the Top 10 journal titles in SCOPUS as stated in Figure 5.

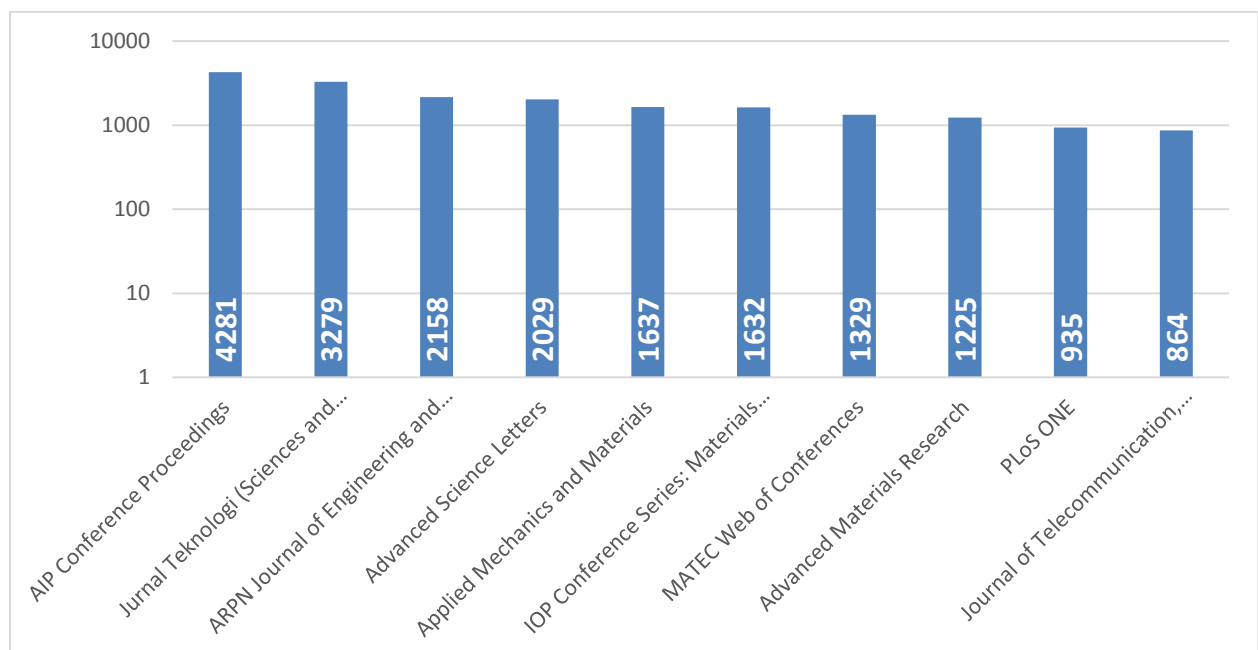


Figure 5 Total Publications by Journal Title in SCOPUS

3. Total Citations

Citation counts is a measure of the impact on a researcher’s work, meaning the higher citation count a particular article receives, the better contribution and impact it makes (Malaysian Citation Centre, 2016.)

The total number of citations received by Malaysian Universities and Research Institutions publications indexed in WOS from 2014 to 2017 is 268,926. It is far higher than the total number of publications produced within the same time range. Figure 6 highlights total publications and total citations received by Top Ten (10) Malaysian Universities and Research Institutions in 2014-2017. As expected, the research-designated public universities (UM, USM, UPM, UKM and UTM) lead in terms of total number of citations. Universiti Malaya receives the highest number of citations with a total of 78,919 citations, followed by Universiti Teknologi Malaysia (31,574), with a noticeable percentage difference of about 60%. The third and following ranks are Universiti Putra Malaysia (26,491), Universiti Sains Malaysia (25,553) and Universiti Kebangsaan Malaysia (24,644). This is followed by the only Foreign University with Malaysian Campus that made it to the list, Monash University Sunway (8,755), and the only Private University that has also managed to be in the list, Universiti Teknologi Petronas (5,986).

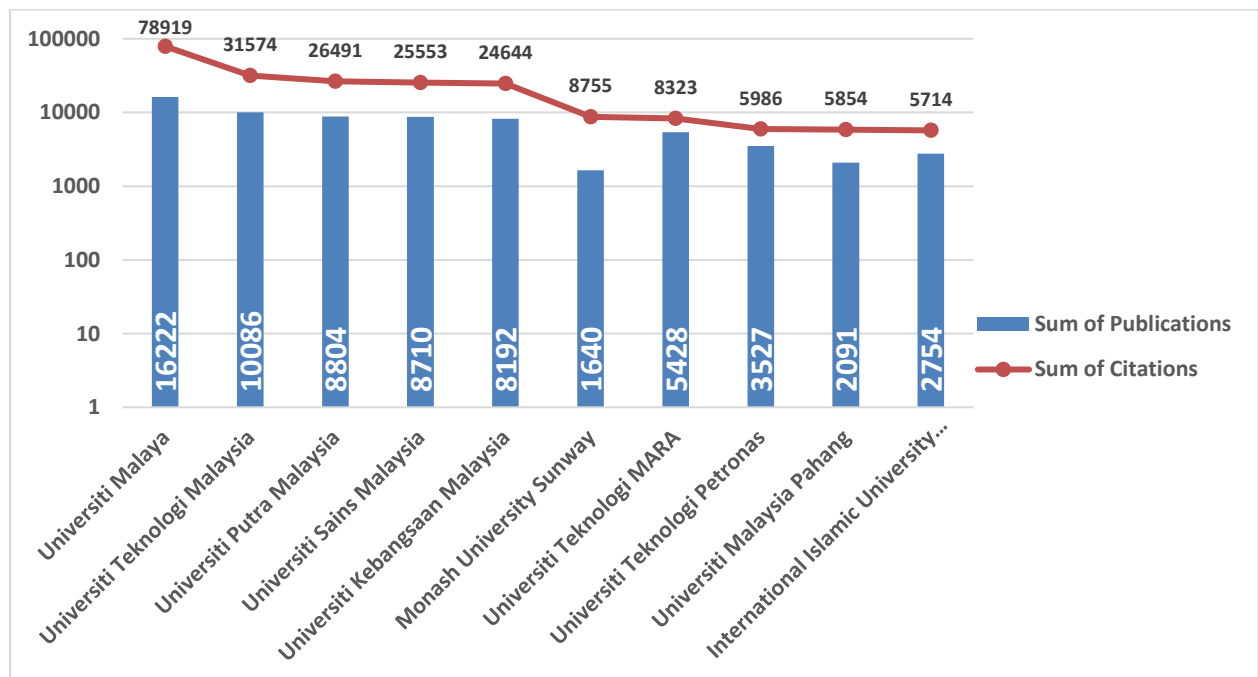


Figure 6 Total Citations by Institution in Web of Science (Top 10)

Figure 7 shows the total number of citations received by Malaysian Universities and Research Institutions publications indexed in SCOPUS from 2014 to 2017. With the total of 427,511 citations, it is far higher than the total number of publications produced within the same time range as compared to WOS with a gap of 33%. Data from SCOPUS proved that the research-designated public universities (UM, USM, UPM, UKM and UTM) still leads in total number of citations. Again, Universiti Malaya leads in terms of total citation (108,156), followed by Universiti Teknologi Malaysia (48,523), Universiti Putra Malaysia (41,843), Universiti Kebangsaan Malaysia (39,252) and Universiti Sains Malaysia (39,166). Universiti Teknologi Petronas is the leading Private University here and ranked at number seven (7) with (10,796) citations. It is also evident that there is a newly listed private university, Universiti Tunku Abdul Rahman (UTAR) that ranked in number eight (8) and received (10,678) citations. The figure also shows that Universiti Sains Malaysia drops at number five (5) in SCOPUS as compared to number four (4) in WOS.

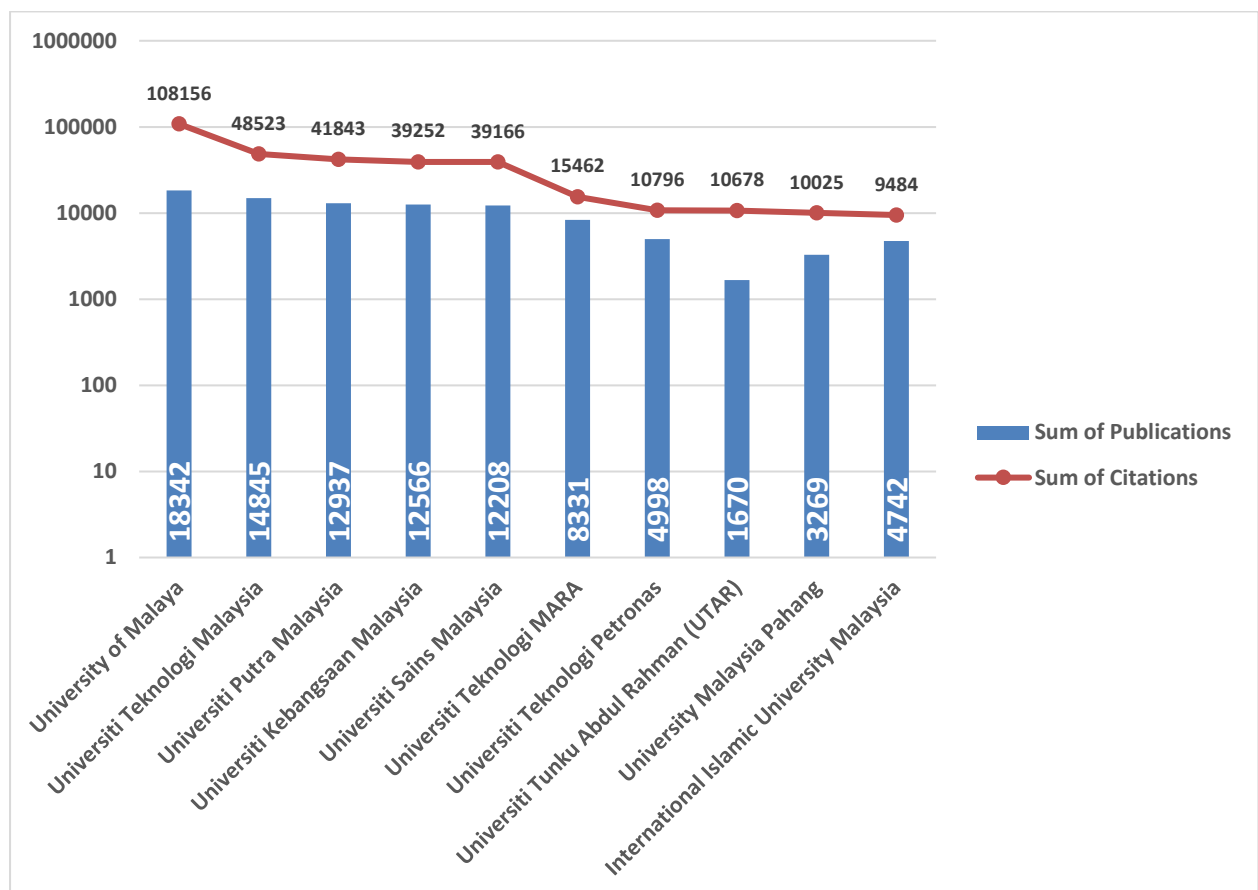


Figure 7 Total Citations by Institution in SCOPUS (Top 10)

Figure 8 ranks and shows total citations received by Top Ten (10) subject area in SCOPUS for the year 2014-2017 is 1,142,798. This total proved that SCOPUS received higher citation compared to WOS about 87%. About 20% of the subject that received highest citation (230,363) is Engineering field. The rank followed by Medicine (140,890), Material Science (137,558), Chemistry (111,459) and physics and Astronomy (110,931). Other subject area that received highest citations is Environmental Science ranked at number six (6) (107,677), followed by Biochemistry, Genetics and Molecular Biology (99,873), Computer Science (99,827), Agricultural and Biological Science (69,947). The figure also shows that only Social sciences only receive about 3% citations in SCOPUS.

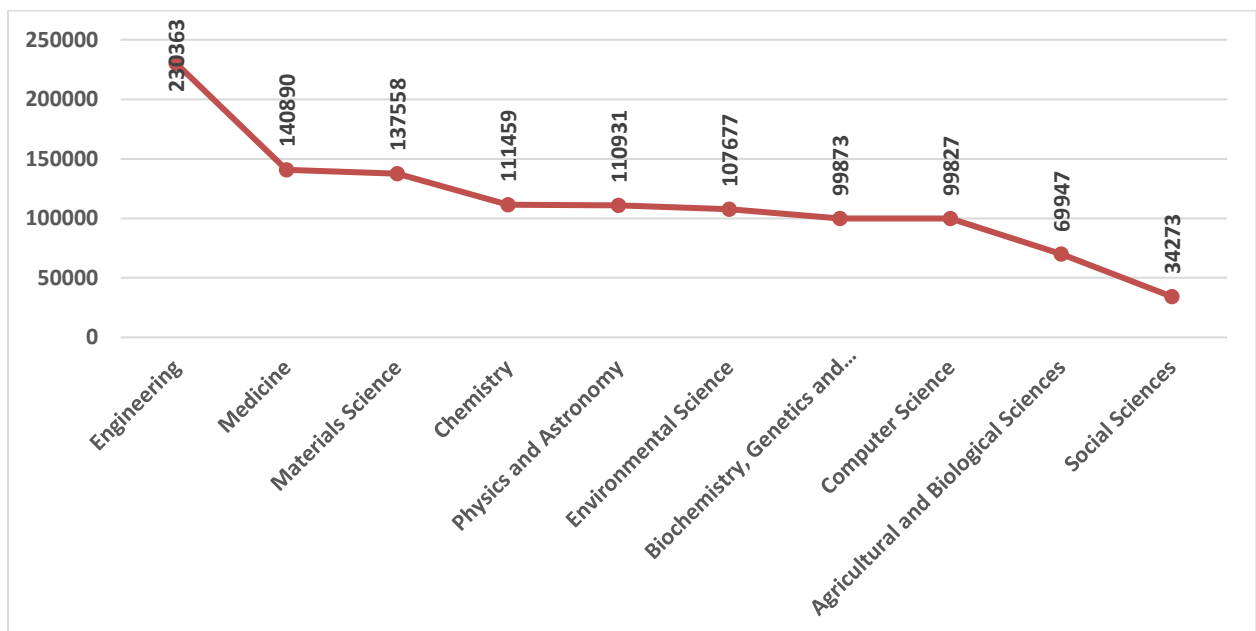


Figure 8 Total Citations by Subject Area in SCOPUS (Top 10)

Figure 9 shows the total citations received by Top Ten (10) subject areas in WOS for the year 2014-2017 which is 146,990. First in the rank is the subject area of Energy and Fuels (26,357), followed by Material Science, Multidisciplinary (20,173), Engineering, Chemical (15,980), Green & Sustainable Science & Technology (1,5065) and Environmental Sciences (13,256). Other subject areas that has also received high citations are Chemistry, Multidisciplinary (12,755), followed by Chemistry, Physical (12,220), Engineering, Electrical & Electronic (11,803), Thermodynamics (9,829) and the lowest number of citation received is in Physics, Applied (9,554).

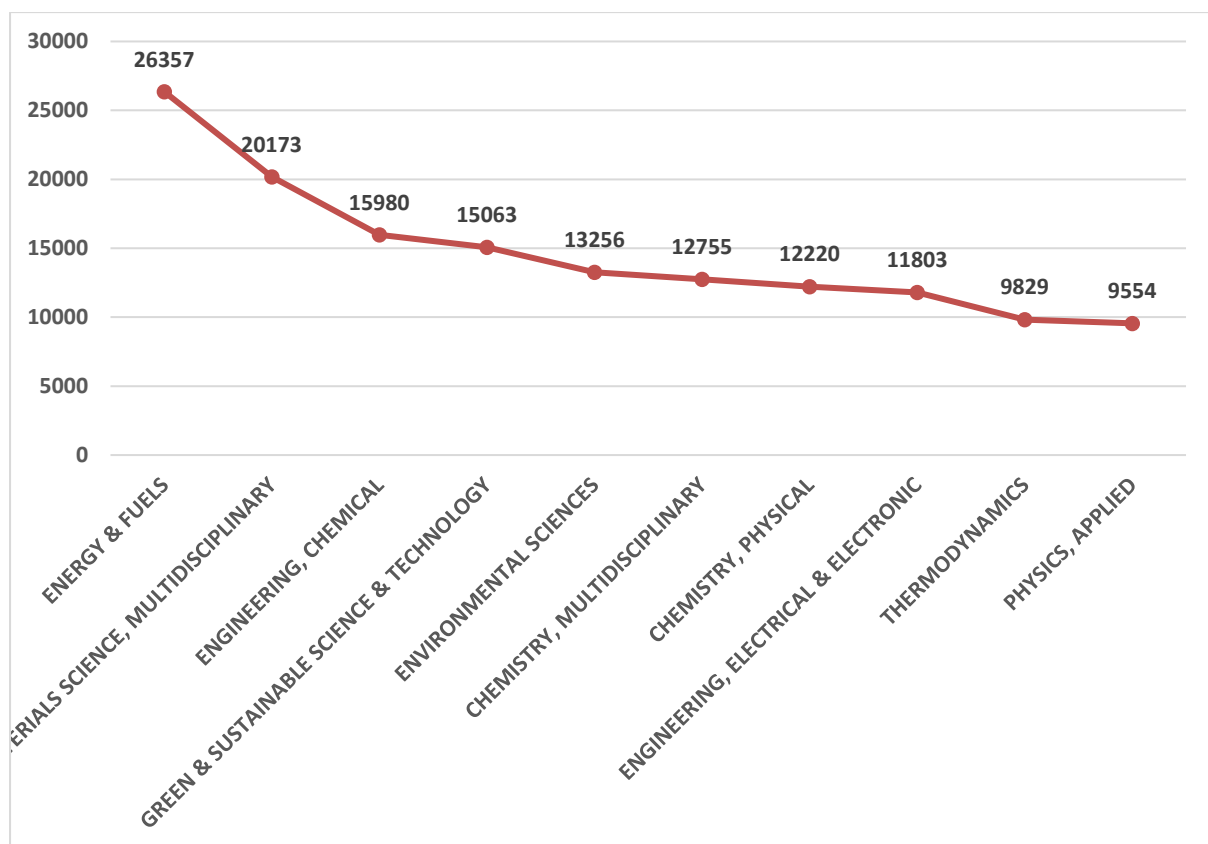


Figure 9 Total Citations by Subject Area in Web of Science (Top 10)

Figure 10 reveals the Top Ten (10) journals that received highest citations in SCOPUS. Journal of Renewable and Sustainable Energy Reviews received the highest citation (11,972), followed by Journal of Energy Conversion and Management (5,194), PLoS ONE (5,021), RSC Advances (4,506) and Journal of Cleaner Production (4,145). The rest of the journals are Journal of Materials and Design that was ranked at number six (6) (3,049), followed by European Physical Journal C (2,940), The Scientific World Journal (2,548), Jurnal Teknologi (Sciences and Technology) (2,482) and Journal of High Energy Physics received lowest citations (2,403). All of these journals are from science discipline.



Figure 10 Total Citations by Journal Title in SCOPUS

4. Total Publications by Country Collaboration

Research with international collaboration and publication is abounding in developed countries. Malaysian institutions have engaged with a total of 42,858 collaborations across 194 countries worldwide. This section of the report aims to examine the trend of international collaboration in scholarly publication from 2013 to 2017 particularly on the trend of collaborated countries in Malaysian context, as well as the patterns of citations received from countries' collaboration.

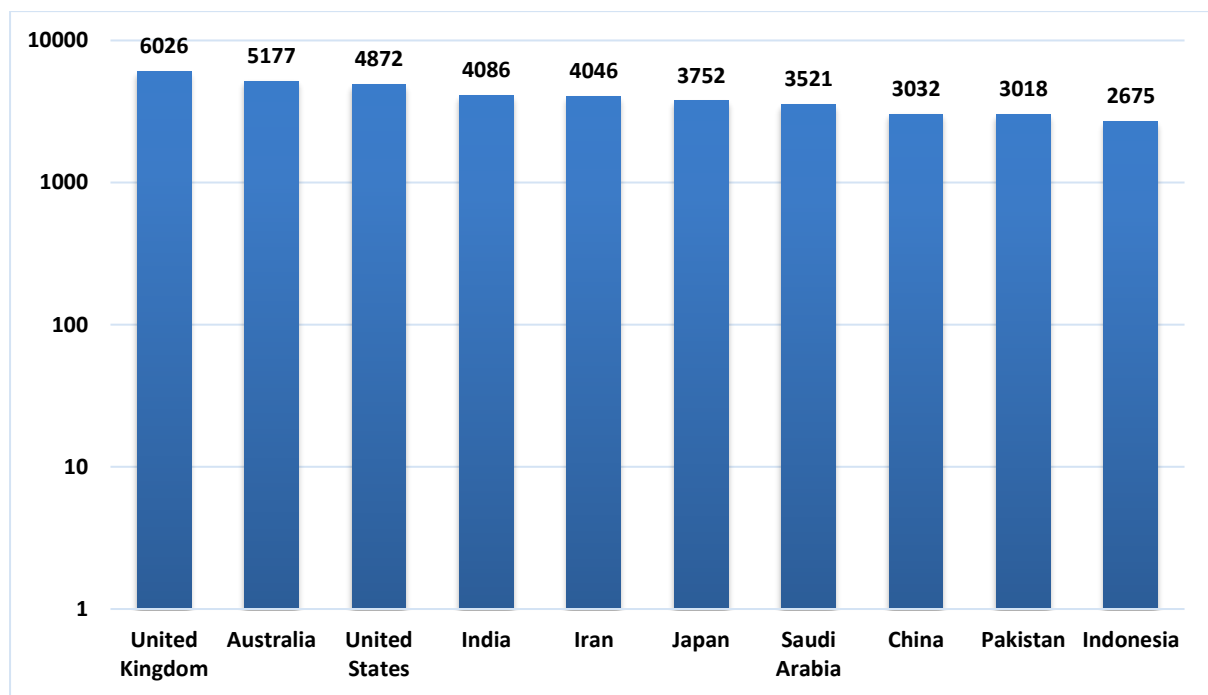


Figure 11 Total Publications by Country Collaboration

Figure 11 shows the top 10 co-authored publication of Malaysian Universities and Research Institutions with other countries. The topmost country in the rank is the United Kingdom (UK) (6026 papers) which shows this country's significant role in Malaysian research collaboration. The second and third most collaborated country is Australia (5177) and the United States (US) (4872), and then India (4086) and Iran (4046) that followed closely behind. Other collaborating countries as shown in the figure also have sizeable publications with Malaysian researchers.

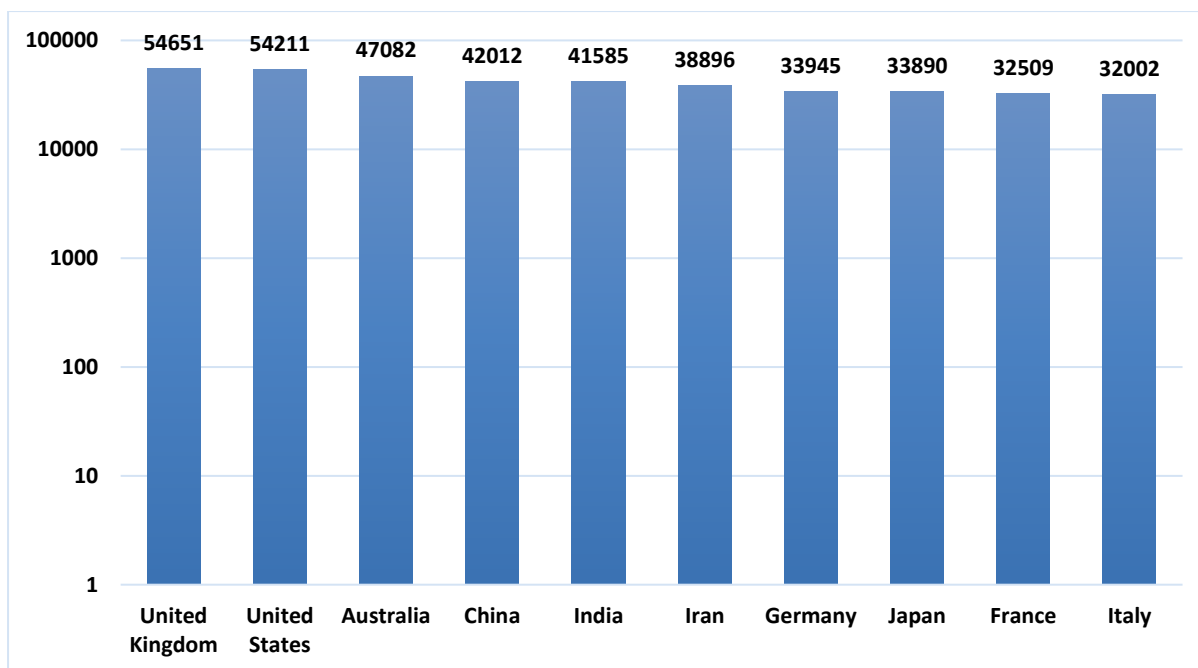


Figure 12 Total Citation by Collaboration Country in SCOPUS (Top 10)

The total number of citations received by Malaysian Institutions' international collaboration research as indexed in SCOPUS from 2014 to 2017 is 1,788,243. Based on Figure 12, among the top 10 collaborating countries with the highest citations, collaborations with the United Kingdom are the most highly cited (54,651), followed by the United States (54,211) and Australia (47,082). For the UK and the US, there is only a slight percentage difference (0.8%) between these top two countries with the highest citations. On the other hand, the percentage differences among other countries are around 10% - 20%.

With globalization in research, there is a flow of knowledge and information between scientists and researchers across the globe, and thus one would see more research collaborations and international co-authored publications. Furthermore, to strive for research excellence, there is a rapid demand for international cooperation in publishing for research related institutions (Low, Ng, Kabir, Koh & Sinnasamy, 2014).

5. Performance of Malaysian Journals

Among the initiatives of the Ministry of Higher Education (MOHE) Strategic Plan is to increase the quality of Malaysian journals so as to be competitive or at par with other international journals through indexation in indexing databases such as Web of Science and Scopus.

A selected number of journals are also indexed in MyCite which provides a comprehensive coverage of an online indexing database with a stringent selection criteria based on international standards.

Up to 2017, there are 475 journals compared to 353 journals in 2014 in the following disciplines: Arts and Humanities (A&H), Engineering and Technology (E&T), Medical and Health Sciences (MHS), Sciences (SC) and Social Sciences. These journals are listed in MyJournal which is an online database used to collect and index Malaysian journals.

Generally there are 4 categories of scholarly publishers. They are:

1. University Publishers with the highest number of journals.
2. Professional bodies or associations.
3. Government agencies.
4. Private organisations.

Title	Publisher	Database	Total Cites	Journal Impact Factor	5 Year Impact Factor	Immediacy Index	Cited HalfLife	Rank	Quartile	JIF Percentile	Category
Asia-Pacific Journal of Public Health	SAGE Publications Inc	SCIE & SSCI	1411	1.722	2.087	0.313	4.6	81/172 55/153	Q2 Q2	53.198 64.379	PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH (SCIE) PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH (SSCI)
Asian Myrmecology	Universiti Malaysia Sabah	SCIE	65	1.100	1.152	0.111	N/A	46/94	Q2	51.596	ENTOMOLOGY
Bulletin of the Malaysian Mathematical Sciences Society	Malaysian Mathematical Sciences Society, Universiti Sains Malaysia, Springer	SCIE	394	0.640	0.693	0.165	3.8	145/312	Q2	53.686	MATHEMATICS
Journal of Oil Palm Research	Malaysian Palm Oil Board	SCIE	302	0.544	0.624	0	7.6	104/124	Q4	16.532	FOOD SCIENCE & TECHNOLOGY
Journal of Rubber Research	Rubber Research Institute Malaysia	SCIE	162	0.125	0.268	0.056	>10.0	85/85	Q4	0.588	POLYMER SCIENCE
Journal of Tropical Forest Science	Forest Research Institute Malaysia	SCIE	503	0.612	0.677	0.164	7.5	48/66	Q3	28.03	FORESTRY
Malaysian Journal of Computer Science	University of Malaya	SCIE	65	0.476	0.420	0.050	N/A	122/130 96/105	Q4 Q4	6.538 9.048	COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE COMPUTER SCIENCE, THEORY & METHODS
Malaysian Journal of Library & Information Science	University of Malaya	SSCI	104	0.476	0.518	0.050	5.5	62/86	Q3	24.488	INFORMATION SCIENCE & LIBRARY SCIENCE
Malaysian Journal of Pathology	Academy of Medicine of Malaysia	SCIE	171	0.754	N/A	0.119	5.6	71/78	Q4	9.615	PATHOLOGY
Neurology Asia	ASEAN Neurological Association	SCIE	120	0.196	0.207	0.016	5.5	190/192	Q4	1.302	CLINICAL NEUROLOGY
Sains Malaysiana	Universiti Kebangsaan Malaysia	SCIE	574	0.350	0.468	0.036	3.8	47/63	Q3	26.19	MULTIDISCIPLINARY SCIENCES
Tropical Biomedicine	Malaysian Society of Parasitology and Tropical Medicine	SCIE	665	0.685	0.900	0.058	5.3	34/36 17/19	Q4 Q4	6.944 13.158	PARASITOLOGY TROPICAL MEDICINE
Al-Shajarah	International Islamic University Malaysia	AHCI									NOT AVAILABLE

AHCI – Arts & Humanities Citation Index®
 SCIE – Science Citation Index Expanded™
 SSCI – Social Sciences Citation Index®

Source: <http://cr.incites.thomsonreuters.com>

Figure 13 Total Number of Malaysian Journals Indexed in WOS and Their Respective Quartile in 2014

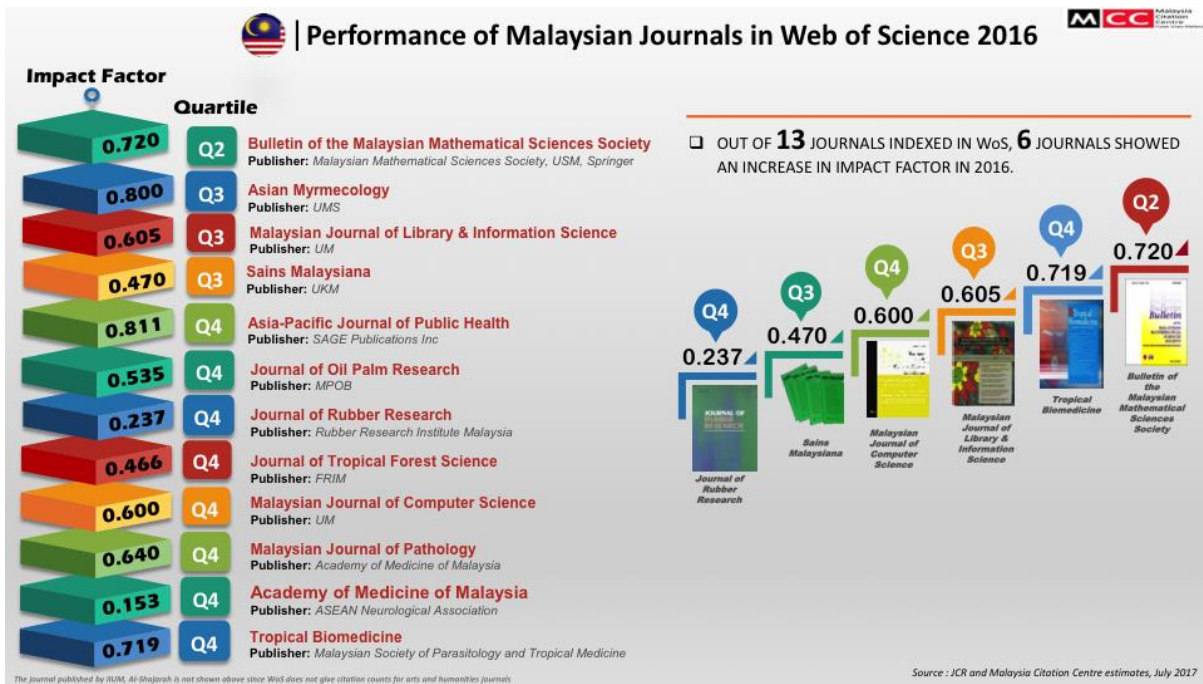


Figure 14 Total Number of Malaysian Journals Indexed in WOS and Their Respective Quartile in 2016

While Malaysian journals do have an international publishing standards, however, they lack impact as seen by the same number of journals indexed in WOS between 2014 and 2017, and also the relatively small of number of citations these articles received (Figure 13 and Figure 14). 50% of the journals showed a slight improvement in their impact factor. Therefore, Malaysian journals need to be more visible and discoverable to increase the journals' impact factor which is an indicative of the impact the journal has in it's respective field.

6. Conclusion

Research in science and technology is vital and indeed a critical key to progress towards a knowledge-based or an innovation-driven economy. Not only it promotes better understanding on different aspects of life, it has largely helped improves the standard of living by creating new knowledge and technological innovation. Today, there is a severe competition among countries to become the most competitive and knowledge-based economy in the world. For Malaysia to be able to catch up with and strive in this competitive world of knowledge economy, it needs to assure continuous progress and performance in its research activities.

Malaysia continues on its path in achieving developed nation status by 2020. While the government is committed to improving quality in the tertiary sector, recent budget cuts due to the fiscal deficit could hamper progress, especially in the development of research. Despite that, the country continues to develop its identity as an educational hub that has managed to attract growing numbers of inbound students.

This report presents an overview of the current developments in Malaysia, in the field of research and development (R&D) and science & technology (S&T). To be specific, the Scientific Publications of research and scientific development are taken into examination.

Academic research is one of the most important components of research activities conducted in this country. To a certain extent, the performance in academic research can be well reflected by the number of scientific articles published in indexed journals such as WOS and SCOPUS. In this regard, the commonly used indicators of the quantity and the growth of research output, i.e., articles, are applied to measure the research performance this country's targeted institutions. In fact, such bibliometric indicators have been widely used in national science and technology statistics publications to measure scientific capacity and linkages to world science, particularly in national and international rankings of universities. In South East Asia, Malaysian publication is the highest in this region which surpasses publications by Singapore and Thailand. The statistics exemplifies great efforts by the Malaysian government in investing in R&D besides the researchers' and institutions' progressive discoveries. Nevertheless, Malaysia still has some way to go to match Singapore's and Thailand's number of RSEs (Researcher, Scientist, and Engineer)

and Singapore's GERD (Gross Expenditure on Research and Development) (Rahman, 2016).

6.1 Malaysian publications/citations in SCOPUS and WOS

The total number of publications in SCOPUS gradually increases by 10.3% from 2014 to 2017, but in WOS, it slightly decreases by 21% within the same time range. One of the possible reasons is due to wider subject coverage in SCOPUS as compared to WOS. Out of the total of 1,142,798 citations received by the Top Ten subjects by Malaysian publications between 2014 and 2017 in SCOPUS, the highest three comes from Engineering (20%), Medicine (12.3%), and Material Science (12%). Meanwhile, in WOS, the total citations received by Top Ten (10) subject areas for the year 2014-2017 is 146,990, with Energy and Fuel (17.9%), Material Science (13.7%) and Chemical Engineering (10.8%) ranked as the three subject areas with the highest citation received. It also seems that between the two databases, there is an obvious gap between citations received. Low average of citations received in the fields of Arts, Humanities and Social Sciences is also evident. In overall, there is a decline of average citations per year across all fields of research.

6.2 Subject Area

Science disciplines journal dominated both WOS and SCOPUS. There is also a huge gap of total Malaysian journals indexed between WOS and SCOPUS. Out 542 journals published in Malaysia, only 12 (2%) journal titles were being indexed in WOS, and meanwhile, 80 (15%) journal titles were indexed in SCOPUS. This brought to a need for Malaysia to produce more quality journals to be indexed in both databases.

The research-designated public universities (UM, USM, UPM, UKM and UTM) lead in total publication output and the number of times cited. Universiti Malaya leads in terms of publication output (35.6% of total Top Ten institutions), followed by Universiti Teknologi Malaysia. The high contribution by the research universities may be attributed to the substantial allocation of grants by the government to enable and stimulate research activities. This may also be due to the endorsement by the Malaysian government to the recruitment of full time equivalent researchers both from Malaysia and from abroad to help accelerate research performance, which seems to bear fruit as shown in the increasing cumulative publication output from 2014 onwards. It is also evident that there is an increase in the number of publication output from private universities and colleges as well as foreign universities with Malaysian campuses such as Monash University Malaysia.

While Malaysia do produce international publishing standards journals, the impact it has is relatively small as seen by the number of citations received by articles in the

journals indexed in WOS and SCOPUS. This unfortunate event calls for Malaysian journals to be more visible and discoverable so that the journals' impact factor increases while at the same time establishes the journals' impact and prominence in their respective fields.

6.3 Total Publications

Throughout 2014 to 2017, the total number of the Top Ten subject areas for Malaysian publication in SCOPUS is 356,605. This is dominated by subject of Engineering (25%), followed by Computer Science (14.7%) and Materials Science (9.6%). Meanwhile in WOS, the total number of publication for the Top Ten subject areas is only 45,371 publications. Engineering (19.6%) remains dominating, followed by Material Science (18.5%) and Applied Physics (14.9%) as compared to other subjects.

6.4 Collaboration Country

In terms of international research collaboration, Malaysia has intensely collaborated more with the developed countries, as shown in the result with the United Kingdom, the United States and Australia as the top three countries being collaborated with in research publication. This also signifies the intensity of these countries' investment in research and development.

7. Acknowledgement

We are grateful to a number of parties that have contributed to the completion of this brief report - Malaysian Citation Centre for the full data provided, as well as the team from Perpustakaan Hamzah Sendut and Penerbit Universiti Sains Malaysia who had helped in the tabulation of the data, and the overall flow and content of the report. Without the help and team's spirit, it would have been quite impossible to produce this report in time.

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