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JRMG
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FOREWORD

Let me extend my heartiest welcome to the first issue of the Journal of Research Management and Governance (JRMG). JRMG is beginning its journey in December 2018 with the University of Malaya – the premier research university in Malaysia – as its host.

In the past couple of decades, research efforts in Malaysia have intensified to a great extent. Research outputs in term of both quality and quality has been improving significantly. The number of research publications and patents has been on the rise. Other countries in the ASEAN region are also putting great efforts to improve their research performance.

Building and sustaining the momentum of research require an effective research ecosystem. Well trained professionals in research management and governance are a key element of such an ecosystem. The scope of research management and governance is wide. At the micro-level, it may involve managing individual research projects. At a bigger scale, research management is carried out at the institutional level, in a university or a research organization. At the macro-level, research management encompasses at national and international level efforts. Effective research management and governance or administration at different levels is vital to ensure the effective use of research funding and other resources, so as to achieve the intended outcome and impact.

In advanced countries, research management has, to a great extent, taken the shape of a profession on its own. It is recognized that professionals working in the area of research management are required to have unique blend of skills and experience in areas which can be grouped into: research-related, management- and communication-skills; and transferable skills. They may get involved in wide ranging activities such a science funding, project management, science communication, technology transfer, partnership and networking, outreach, lobbying, science policy, lab management, research support services, etc.

A few universities in advanced countries offer postgraduate degree and certificate programs in research management, administration or governance. Professional societies in different countries and regions are putting great efforts for research management professionals to excel. Some of these active societies include Association of Research Managers and Administrators, UK (ARMA); Australasian Research Management Society (ARMS); European Association of Research Managers and Administrators (EARMA); National Council of University Research Administrators (NCURA), USA; Research Manager and Administrator Network Japan (RMAN-J); Southern African Research & Innovation Management Association (SARIMA) and West African

Research and Innovation Management Association (WARIMA).

Research management, in this part of the world, is yet to emerge as a profession. In order to help research management profession to flourish in Malaysia and in this region, we need to start building a community of practice. The Journal of Research Management and Governance, the first of its kind in Malaysia and perhaps in the South East Asian region, intends to provide a platform for research management practitioners and administrators, and researchers to exchange knowledge, share their experience and views to order to achieve excellence in their professional pursuits. The journal publishes both scholarly research work and articles to share best practice and viewpoints. I take this opportunity to invite you and your colleagues to submit your contributions to JRMG in the following categories: 1. Full-length article, 2. Short communications, 3. Case Studies, 4. Opinions, 5. Book Review/Conference Report.

It is my hope that this journal will act as an effective scholarly platform for research management professionals in this region and beyond in the years to come.

A.S.M.A. Haseeb
Editor-in-Chief
University of Malaya

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PREFACE

It is my pleasure to welcome the inaugural issue of the Journal of Research Management and Governance (JRMG). University of Malaya as the premier university in Malaysia realizes the importance of research management and governance in supporting the whole research ecosystem. Research, as an integral part of academia has been progressing at an unprecedented rate in this part of the world with many institutions from emerging economies making their marks in global rankings. In the course of evolving into research-based institutions and coping with the flux of resources, information and research output, the need for professional management of research processes has become inevitable. The birth of JRMG is aimed as a platform for exchanging ideas and sharing strategies in the management and governance of research by those who are involved in research management, for the advancement of research in their respective organizations. Good practices of research management and governance significantly influence the various aspects of research including financial management, employment of appropriate talents, output management, and translation of research to the society. I would like to extend my gratitude to Prof. M.A. Haseeb and his team for their efforts in publishing JRMG. It is my greatest hope that JRMG will be recognised as a channel to connect research communities globally to communicate on matters pertaining to research processes be they issues or solutions.

Professor Dr. Shaliza Ibrahim
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DESCRIPTION

The Journal of Research Management & Governance (JRMG) (eISSN: 2637-1103) is an official journal of the University of Malaya. It is an international, peer-reviewed, open access journal with readership throughout the field of sciences and non-sciences. The JRMG was established to provide a platform for scholars, experts, researchers, practitioners, and students from various fields to come together under a common interest in the field covering all aspects related to management and administration of research in universities, research organizations and funding agencies including strategies and policies in research management and administration, development of research management professionals, management and storage of research output, impact and implication of research and the changing research environment at both national and international levels to publish original research, review papers, and other scholarly works that are freely accessible to the whole scientific community, locally and internationally.

AIMS AND SCOPES

The main objectives of this journal are to publish quality articles in research management and governance, and to discover and advance best practices in this area.

Articles published in JRMG cover all aspects related to management and governance of research in universities, research organizations, funding agencies and governments. This includes (but not limited to) research ecosystem, study and practice of research management profession, strategies and policies, research policy and ethics, changing research environment, quality and innovation in research administration and management, human resource management and development, full economic costing and research funding, knowledge transfer from research to application, data science and data curation as applied to research management, impact of research, developments within higher education environment and implications of major external influences on research management.

The Editors will consider papers for manuscripts based on novelty and contribution to the advancement of research management. JRMG publishes full-length articles, short communications, case studies, opinions and book review/conference report.

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RESEARCH ARTICLE

Water Research Productivity, Trends and Collaborations in Malaysia between 1964 to 2012

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ABSTRACT

The research in water cycle management is an important endeavour in any nation's environmental management practices. Bibliometric examination the breadth and scope of research is one way to study past research focus. This will allow establishment of prior research trends, output and performance in order to reorient future resources, improve research collaborations and research return of investment. In this study, publications that are available on online from Web of Science and SCOPUS were examined using bibliometric analysis to visualize past research focus, institutional and author collaborations, clusters of peer research networks, lead institutions associated with the water cycle management in Malaysia from 1964 to 2012. Results showed that 80% of publications were indexed in Scopus with 5277 unique authors from 814 institutions. Significant 'alpha researcher' phenomenon was detected where strong principal investigators do not collaborate with each other, often only linked with 'bridging' individual that adopt a 'middle man' strategy, connecting two 'alpha researchers' together. Although UM is historically the initiator of many water research since 1972, UPM, USM and UKM are the current research leaders. Research universities UPM, USM, UKM and UTM possess good internal collaboration while UM only interact with external collaborators, possibly due to the highly competitive nature among themselves. Analysis of research topics showed that water pollution has been a perennial research interest since the 1990s while the geological focus has been on the river and coastal areas with studies on lake and islands receiving the least attention. Future awarding of research resources should take into account these historical insights in order to improve research allocations and institutional collaborations.

Keywords: water research; bibliometric analysis; network analysis; data visualization

1. INTRODUCTION

Water is essential to human; either to human body needs itself (Sawka and Cheuvron, 2005) or as support for human activities (Gleick, 1996). Although it is estimated that roughly 71% of earth is covered by water, only less than one percent of the water is accessible to human and therefore suitable for human activities (consumption, agriculture, development, etc.) whereas 97% of the water is saline with

North and South Poles constitute around two percent (Eric et al., 2001). Fortunately, this portion of "usable" water (or freshwater) is constantly and naturally recycled, a process known as hydrological cycle. This cycle is heavily dependent on climate, sources (of the water being extracted from) and of course human intervention to the nature. Some natural hydrological cycle may take as low as two weeks; others may take years (Taikan Oki and Kanae, 2006). Without the optimization of water withdrawal and usage, we will face water scarcity, an event that has already taken place in certain regions due to geographical factors. Worse, it is estimated that water resources issue would be even more critical, with the current trends of drastic climate change and the increase of human population growth, water demands will have higher priority than the global warming by year 2025 (Vörösmarty et al., 2000).

Such importance prompted research in a wide range, applicable to water including water cycle management, climate change (with its effect towards water supply) and even biodiversity. Understanding the trends of such research not only provide us with the correlation of current issue of interest and amount of research being conducted to study them, but also as an indicator to evolution of research (e.g. basic sciences research compared to applied sciences research). One of the methods of studying such phenomena is the bibliometric analysis.

The term bibliometric was made famous by Alan Pritchard, who defined it as the use of statistical method to analyze information regarding books and media (Pritchard, 1965). It covers a wide range of analysis ranging from the basic; number of publications over certain period of years and quality of the research (derived from the number of citations) to more complex studies such as identifying the state of growth in scientific publication (Larivi`ere et al., 2008) and formulations of a collaborative index (Liao and Yen, 2012). In addition to providing alternative perspective, in terms of research trend of a topic of interest, bibliometric analysis provides direct measurement to authors' and institutions' performance in scientific community (research outputs). Most importantly, such results from bibliometric analysis enable funding agencies to justify the research budget well spent.

Bibliometric analysis has been applied to various research related to water. Hagendijk and Smeenk (1989) reported their case study on Dutch freshwater ecology back in 1989 and strongly suggested that bibliometric (among others) helps in understanding the intellectual continuity of researchers with relevance to science policy. Zhang et al. (2010) adopted bibliometric study on global wetland research with a detailed analysis on the keywords used; hence the temporal trends of the research. Research on drinking water was also mapped (Fu et al., 2013; Hu et al., 2010) using bibliometric approach in which regional contributions were presented and popular journals were identified.

Bibliometric studies in water research are often topics specific (Hu et al., 2010; Fu et al., 2013; Hagendijk and Smeenk, 1989; Zhang et al., 2010) or journals specific (Wang et al., 2010, 2011) whereas water research is actually a wide research area covering basic sciences and applied sciences with major topics such as water resources management, alternative energy (hydroelectric), wastewater treatment and others. A more general bibliometric study on water research could provide even more detailed information regarding research trends and focus. Unfortunately, bibliometric studies are very much data dependent; the bigger and the more accurate the dataset is, the better the results reflect. Efforts have been done by various parties in order to index as many publications as possible. Thomson Reuters's (formerly Institute for Scientific Information, ISI) collection of services (including the Journal Citation Reports, Web of Science, Web of Knowledge, etc.) and Elsevier's SCOPUS, are known to be two of the most extensive academic publications indexing services. Datasets used for bibliometric analysis were mostly mined from ISI (Gleick, 1996; Falagas et al., 2006; Nazim and Ahmad, 2008; Hu et al., 2010; Rajendram et al., 2006; Francisco Mun˜oz-Leiva et al., 2012; Zhang et al., 2010) while minority, were

from Scopus (Bajwa and Yaldram, 2013; Kumari, 2009). There is some literature which uses datasets from other established alternative sources as well, such as PubMed (Falagas et al., 2006; Vergidis et al., 2005) and Google Scholar (Sanni and Zainab, 2010).

Journals are normally ranked based on the number of publication and the number of citations within certain period of time. Although there are a number of different kinds of calculation to rank a journal, impact factor (Garfield, 1999) is arguably the most recognized which could be the reason majority of bibliometric studies were done on the ISI's datasets. For a more thorough representation, articles published in non ISI-indexed journals should also be considered during bibliometric studies. Although Archambault et al. (2009) indicated that bibliometric study is largely independent of databases, a study by Vieira and Gomes (2009) shows that Scopus, particularly, offered about around one third of additional publications (in addition to those available in ISI) with some of the highly cited publications included only in Scopus.

Data visualization techniques in bibliometric studies are often restricted to tables and simple xy/ scatter/bar/line charts with few attempts on other representations; such as global geographical mapping of the publications (Fu et al., 2013), strategic diagram (Francisco Mun˜oz-Leiva et al., 2012), network diagram (Rosas et al., 2011; Francisco Mun˜oz-Leiva et al., 2012) and radar plot (Vieira and Gomes, 2010). Although sometimes, simple representations are good enough, the shortcomings of simpler visualizations are the limited parameters that can be visualized at one time. Moreover, numbers might not be able to highlight trends and patterns in one glance. Human is able, however, to quickly distinguish colors and sizes. Of course, we need to strike a balance between the complexity of data visualization and the easy data interpretation.

In this paper, we attempt a bibliometric analysis on the water research conducted in Malaysia using the data mined from ISI and Scopus. In addition to the basic statistical aspects of the bibliometric analysis, such as citations distribution and publications growth, authors' and institutions' networks were also analysed.

2. METHODS

The dataset used for this study covered the data from ISI's Web of Knowledge (all databases) and SCOPUS. Publications indexed in Scopus were mined using predefined search terms (Table 1). They were then organized using OutWit Hub and Zotero and exported into RIS (Research Information Systems) format. Data was merged in EndNote reference management software with the removal of duplicate items.

Additional data were also mined according to the list of (Malaysian) institutions indexed by Scopus, mostly institutions of higher learning. Data in ISI was obtained by using all publications in the Water Resource category, filtered by Country=Malaysia.

The two datasets were combined and duplications were removed with priority (of retaining the publications) given to publications indexed by ISI. Further filtering of unrelated articles was done in addition to filling in missing information of the published articles (e.g. abstract, authors, affiliations, keywords, etc.). These are done semi-automatically using scripts developed in-house with the information mined from OutWit Hub and Zotero, after which, resulting in the final dataset for our bibliometric study. Institutions' name and authors' name were standardized to the best of our ability to improve the data consistency. Additional information was added to the final dataset, specifically, the publications' category and geographical sources (of the water used in the particular publication). Several

Python scripts were written to assist in the unique author identification (and aliases), unique institution identification, data generation for analysis and chart plotting, among others.

Table 1: List of controlled search terms used to retrieve datasets from Scopus

Eutrophication Flood	Flood
Storm water Groundwater	Groundwater
Hydrology Lake	Lake
Reservoir Pond	Pond
Well (thermal/spring) Rainfall	Rainfall
River Estuary	Estuary
Sea Coast	Rainfall
Offshore Wastewater	Wastewater
Water and health issue Water conservation	Water conservation
Water pollution Water quality	Water Quality
Water analysis Water resources	Water Resources
Water issue Water supply	Water Supply
Wetlands Water	Water

3. RESULTS AND DISCUSSION

3.1. Basic statistics

A total of 2516 publications were finalized for our bibliometric study, with 489 from ISI and 2027 from Scopus. The publications span from year 1964 to 2012. There are 5277 unique authors from 814 institutions. Unique authors were identified automatically based on the author's name and his/her known affiliations. Authors were formatted as Author's Name [Affiliation1; Affiliation2]. There are, however, some authors with unknown institutions (either untraceable or affiliated to a generic street address), denoted as NULL, which is 495, including unknown authors from unknown affiliations (NULL [NULL]). Unknown institutions are also classified as NULL.

Although the total publications are 2516, the results shown in the subsequent sections might be "more" than that, namely the total publications in accordance to authors or in accordance to institutions. The fact is that we do not include weightage when assigning the number of publications to the authors or the institutions. For example, if a publication were jointed written by author 1 from institution A and author 2 from institution B, author 1 and 2 will get the number of publications incremented by one, respectively, as with institution A and B.

The distribution of publications and citations among the authors follows the hyperbolic trend (Figure 1). Large percentage of authors occupied the lower boundary of the graph for both publications and citations, with more than 3500 authors published only once and more than 1800 authors with zero citations, in which, while considered "unhealthy" trends, do follow the trends of some of the research field (Vieira and Gomes, 2010). An ideal trend for both the plot would be an exponential curve; with majority of the authors having high number of publications or citations. Publication and citation trends for institutions (Figure 2) show similar pattern. Table 2 details the distribution quantitatively. Both authors and institutions publications distributions have serious lower extremes (positive skew); with a low third quartile value.

Table 2: Statistics on the authors', their respective institutions' publications and citations distributions. Generally, all distributions are positively skewed; the most positively skewed being the authors' publications distribution (Q1=Median=Q3). Majority of authors and institutions have the lowest possible publications (1) or citations (0)

		Q1	Median	Q3	Mean	Mode
Authors	Publications	1.00	1.00	1.00	1.71	1.00
	Citations	0.00	1.00	6.00	7.87	0.00
Institutions	Publications	1.00	1.00	2.00	4.77	1.00
	Citations	0.00	2.00	13.00	24.50	0.00

3.2. Authors analysis

Top 20 authors in accordance to number of publications are highlighted in Figure 3. The angle of each arc is proportional to the number of publications (of the authors) with the radius proportional to citations (of the authors). Figure 4 provides a slightly different perspective on top authors, in this case, sorted according to citations, with the arc angle representing the citations and the arc radius representing the number of publications. Comparing both Figure 3 and 4, there is a shift in the authors' ranking, concluding that a high number of publications does not always translate to high citations (and vice versa); with only four authors belong to both top 20's. Low citations with high publications number could be due to "networking"; relying on random citations from other authors, assuming the publications is not impactful enough (less visibility). However, authors with high number of publications have the tendency to be cited more (12 out 20 in Figure 3 have at least 100 citations). Some authors with high citations have a small number of publications (half of 20 in Figure 4 have less than five publications). These authors could be research officers, support staffs or postgraduates, rather than fulltime researchers which make sense since they would have not published as frequent. As far as publication sustainability is concerned, authors with frequent publications are generally preferred (at least with a high publications rate, the random probability of being cited is higher, as shown in Figure 6). Figure 6 shows that authors with more than six publications will definitely be cited although there are authors who published only once with high citations. Examples of these publications include review articles and publications with broad coverage (e.g. polycyclic aromatic hydrocarbons in rivers and estuaries in Malaysia). These kinds of publications often receive frequent citations due to the extensive information on the particular topic of research.

For a closer look at individual author's performance, we have come up with a "character's attributes" chart which illustrates the strength and weakness of that particular author (Figure 5). Each attribute has been normalized (with the maximum value of the respective attribute). Aziz, H.A. seems to be the most "balanced" authors in terms of all the attributes. Mokhtar, M. has the most number of collaborators but "owns" (being a corresponding author) only a small number of them in which he/she is likely to be the co-researcher in most of the publications. Yap, C.K., on the other hand, has the highest number of publications and the highest number of "ownerships". This could probably mean that he/she is the project leader (in the particular publications) and often receives funding for research (good credibility/track records). He/she, however, has a slightly weaker citations attribute. Being the most active author, Ismail, A., though has a reasonably good number of publications, does not have good citations and ownership attributes, hence being active does not guarantee the positive effects on the author's performance.

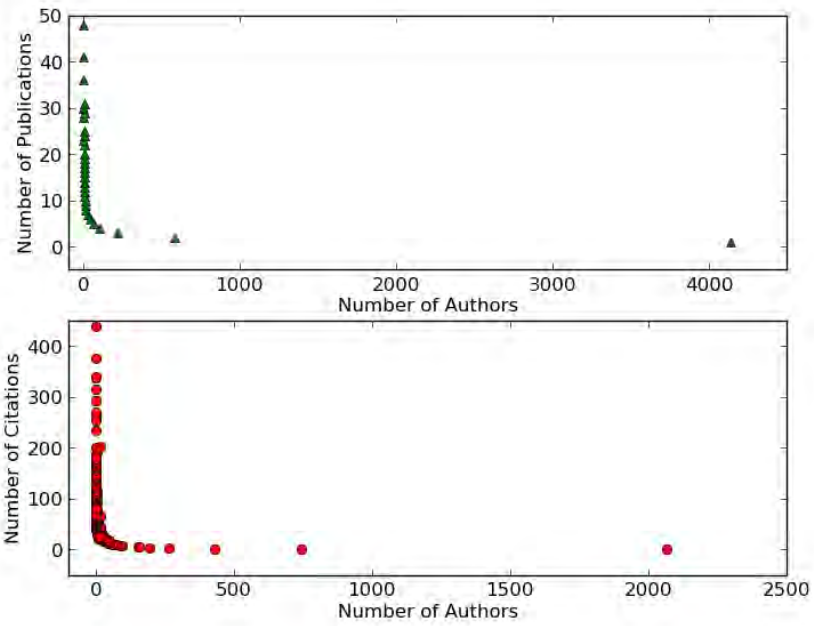


Figure 1: Publications (top) and citations (bottom) distribution for authors. More than 3500 authors published only once (top) and more than 1800 authors have zero citation (bottom). A relatively small number of authors occupy the bottom lower range in term of number of publications (top) and citations (bottom)

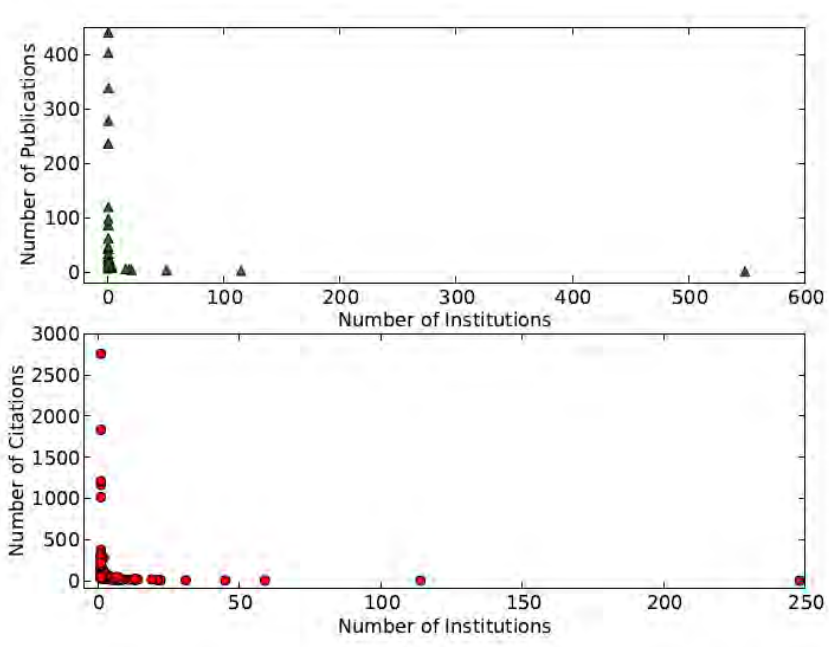


Figure 2: Publications (top) and citations (bottom) distribution for institutions. Around 550 institutions published only once (top) and slightly less than 250 institutions have zero citation (bottom). A relatively small number of institutions occupy the bottom lower range in term of number of publications (top) and citations (bottom)

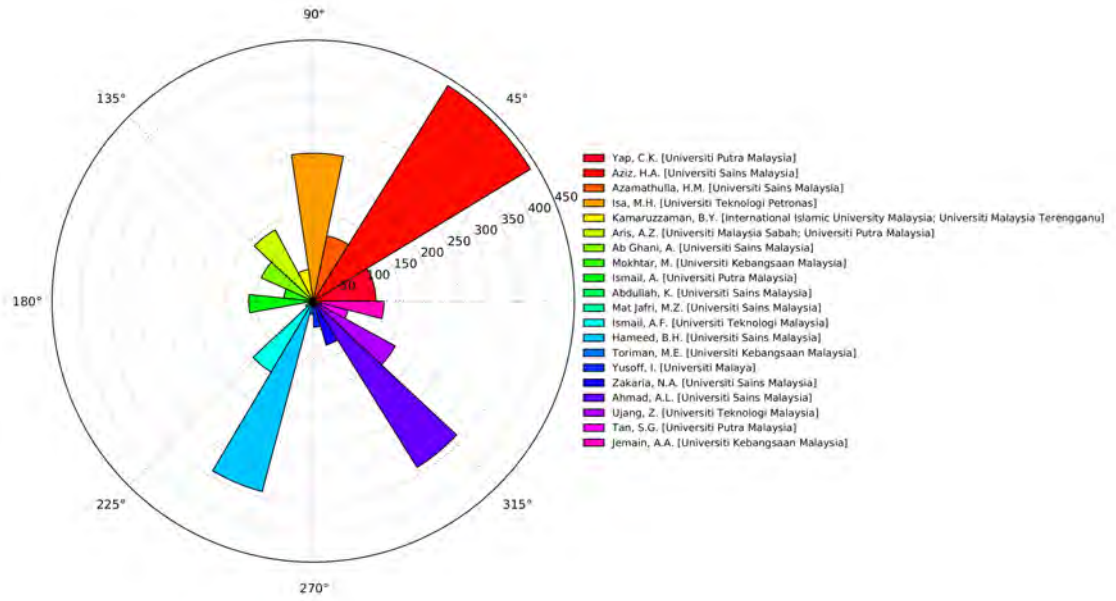


Figure 3: Top 20 authors sorted by number of publications; arc angle ∝ number of publications and arc radius=number of citations

3.3. Institutional Analysis

Top institutions' performance, sorted by the number of publications is shown in Figure 7 (with Figure 8 as close-up). All of the institutions' names are abbreviated (Table 3). Only one of the top 20 institutions is a non-Malaysian institution (Kyoto University). Since the datasets are about water research in Malaysia, hence it is only logical that most of the top institutions are based in Malaysia. Generally, the number of authors is directly proportional to the number of publications (an almost linear plot in Figure 7 and 8), with few exceptions (clearly shown in Figure 8). Citations trend, on the other hand, is less dependent on both parameters. USM, being the institution with the second highest number of publications, tops the citations (Figure 4 shows that six authors with highest citations are in fact from USM). This situation is even more apparent in the dotted area in Figure 7 (see Figure 8 for close-up). FRIM possessed better citations count than most of the institutions in Figure 8 except for UMS and UTP.

Table 3: List of abbreviations used for institutions

Abbreviation	Full Name
UPM	Universiti Putra Malaysia
USM	Universiti Sains Malaysia
UKM	Universiti Kebangsaan Malaysia
UTM	Universiti Teknologi Malaysia
UM	Universiti Malaya
UiTM	Universiti Teknologi MARA
IIUM	International Islamic University Malaysia
UMT	Universiti Malaysia Terengganu
UTP	Universiti Teknologi Petronas
UMS	Universiti Malaysia Sabah
UNIMAS	Universiti Malaysia Sarawak
MNA	Malaysia Nuclear Agency
UMP	Universiti Malaysia Pahang
FRIM	Forest Research Institute Malaysia
UTHM	Universiti Tun Hussein Onn Malaysia
UniMAP	Universiti Malaysia Perlis
Kyoto U	Kyoto University
UTAR	Universiti Tunku Abdul Rahman
MMU	Multimedia University
UniTEN	Universiti Tenaga Nasional
DID	Department of Irrigation & Drainage Malaysia

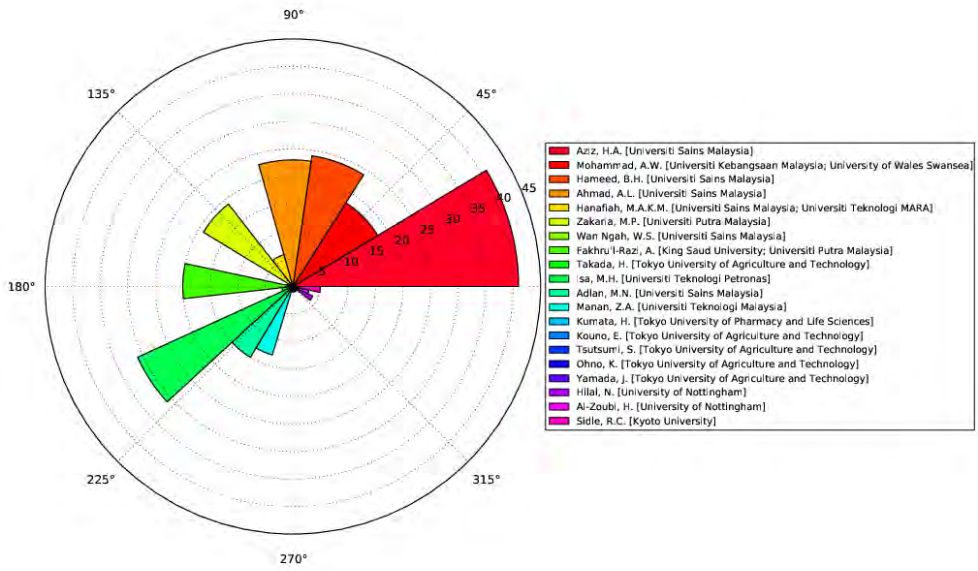


Figure 4: Top 20 authors sorted by number of citations; arc angle ∝ number of citations and arc radius=number of publications

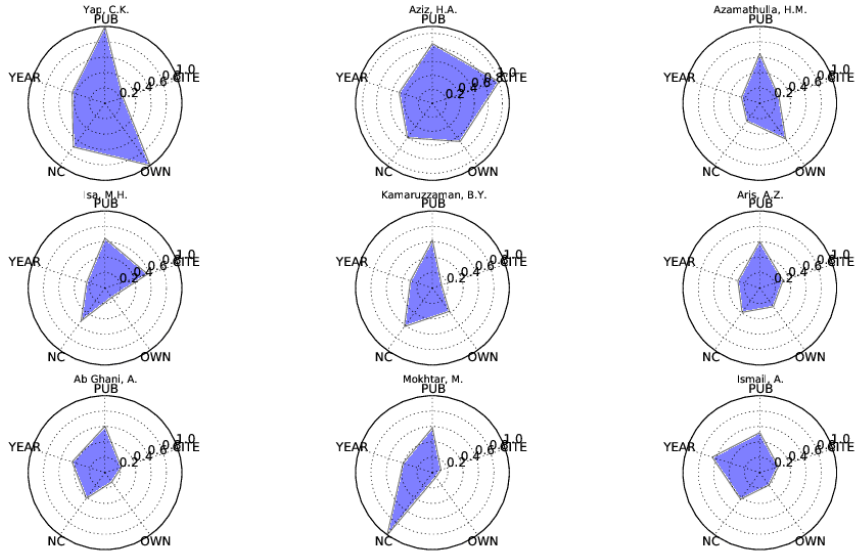


Figure 5: Performance chart of the top nine authors sorted by number of publications; PUB=number of publications, CITE=number of citations, OWN=number as corresponding author, NC=number of collaborators (authors) and YEAR=number of year active (at least one publication)

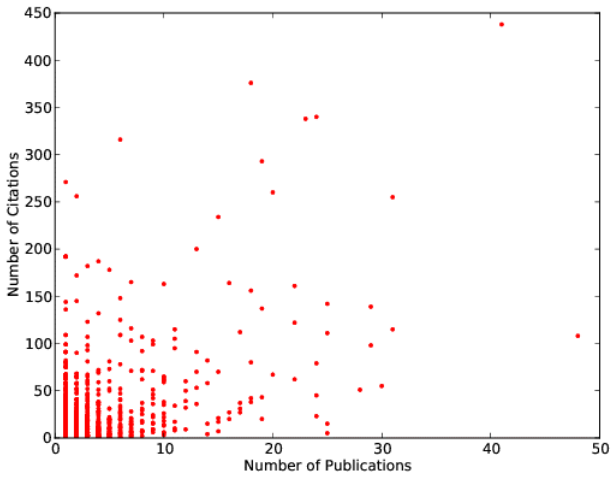


Figure 6: Authors' citations-publications distribution

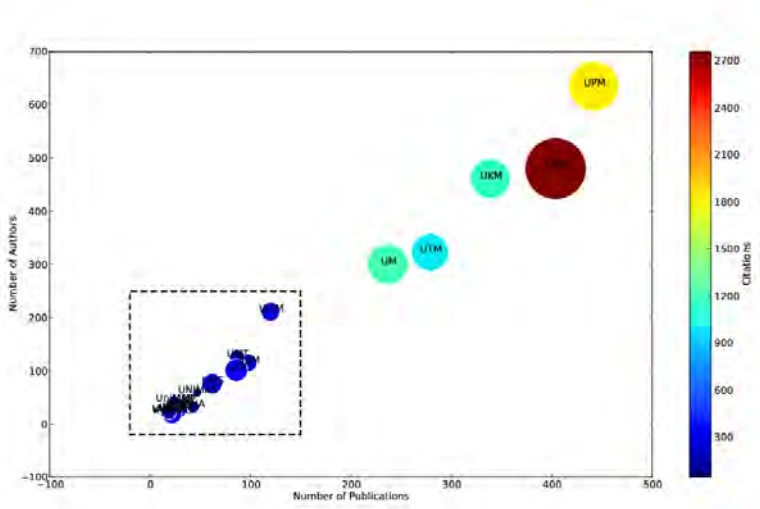


Figure 7: Top 20 institutions' trend on number of authors, number of publications and citations, sorted by the number of publications. The dotted area is enlarged as Figure 8. The size of the bubbles is ∝ the number of citations (also highlighted as cool-warm color scheme). A clear split exists between two groups of institutions; those with more than 200 publications and those without

The top five institutions in Figure 7 are classified as research universities (RUs) in Malaysia, which have more research capacities in terms of number of researchers, equipment and budgets. The ranking could also be driven by funding received; unfortunately, we do not have sufficient data to prove that hypothesis. These RUs can be seen clearly leading the pack, with the nearest non-RU institution, IIUM is approximately 100 publications behind.

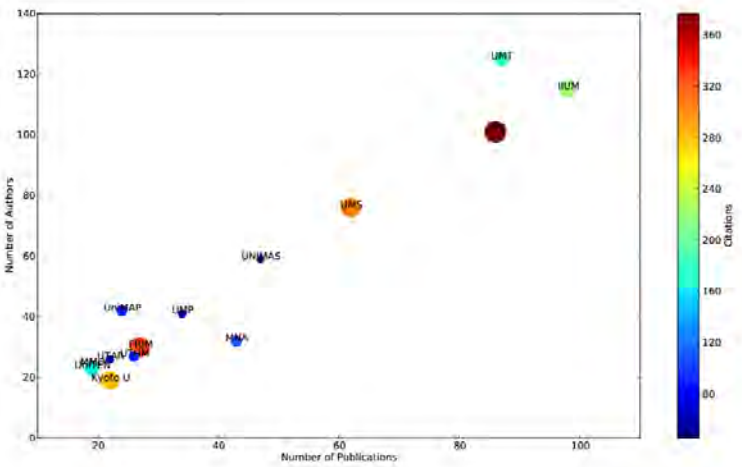


Figure 8: Close-up of the dotted area in Figure 7. While generally, the number of publications still correlates well with the number of authors, there are exceptions, such as UMT and UMP

Ranking could also be affected by the shift in the institutions' research focus. UTM, a traditionally technology-based institution is able to be ranked at number four in water research in Malaysia despite the fact that water research is a very diverse area of research. Famous for its law studies, IIUM is also gaining traction in water research in Malaysia. Non-public/private institutions can be seen populating the lower rank (Figure 8), such as MMU and UNITEN but not UTP. Although funding to these private institutions from the government is limited, research in UTP is partly collaborated with PETRONAS (an oil and gas company closely related to UTP), which actually does a lot of research regarding offshore and drilling with some of them related to water research in Malaysia. A rather surprise institution in the top 20 is the Malaysian Nuclear Agency (MNA). Though the main focus of MNA is nuclear research, a lot of projects involving heavy metals can be considered as water research related.

The yearly publications trend can be observed in Figure 9. UKM and UM can be seen as the pioneer in water research in Malaysia (as far as top 20 institutions with highest publications are concerned) with publications as early as 1972. They were joined by UTM, USM and UPM in year 1984-85. The rest of the institutions started to contribute to publications either in late 90s or early 2000s. The nature of starting involvement (year) of the institutions could be because of the establishment of the institutions (RUs are established earlier than the rest). As for the publication's growth, the top eight institutions generally recorded a yearly increment (denoted by the cool-warm color scheme in Figure 9).

Generally, as the number of new authors increases, the number of publications increases, following an exponential trend (Figure 10). However, the increase of number in new authors is more than the increase in publications; with the gap becoming obvious since year 2000. The increase in this gap could lead to a worry sign that too many authors are sharing the same publications. While some of the researches are indeed in a large scale, which more than five authors are significantly involved in, publications authorship should be limited to those who contribute considerably (authorship ethics). Pressure from the institutions and individual performance index/assessment (for salary increment/ promotion) could be two of the reasons this trend is happening.

The top 20 institutions can be ranked similarly using the attributes radar plot (Figure 11). There is not much surprise here as the RUs have better attributes compared to the rest. UPM has the most "maximum" attributes with only citations being bested by USM. We do not see any significant or unique

trend for institutions unlike the authors' attributes radar plots. Figure 11, however, shows that there is a huge gap between the RUs and the rest.

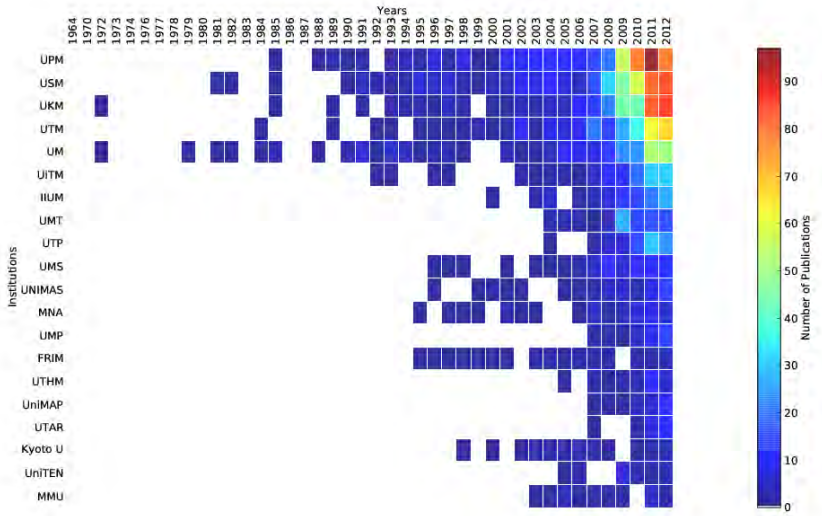


Figure 9: Yearly publications recorded for top 20 institutions; with white=no publications. All institutions seem to be constantly publish something about water research in Malaysia once they have started their first with the publication-less gap ranging from one to four years (from 1990 onwards)

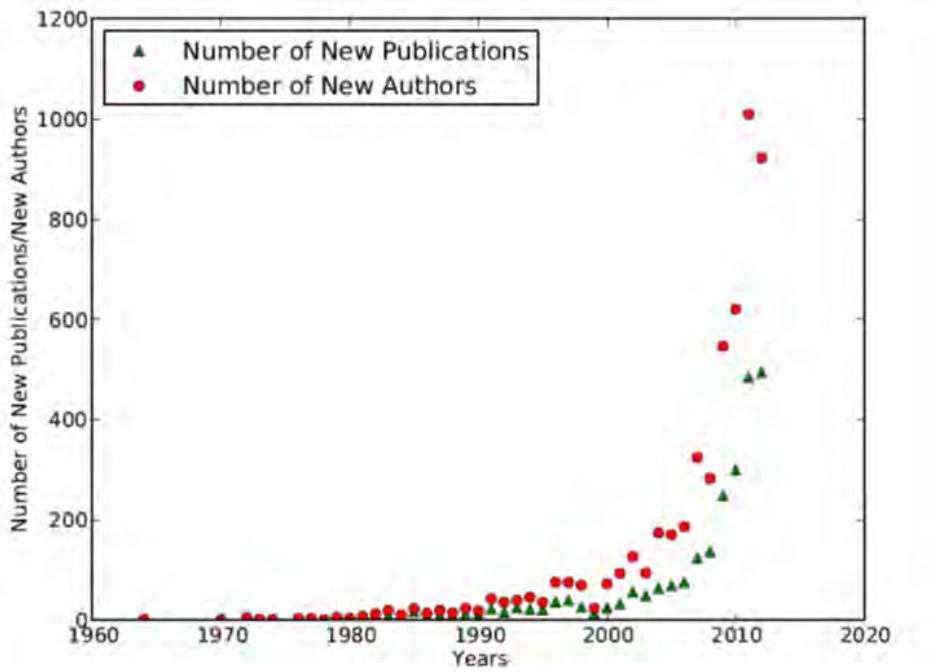


Figure 10: New authors and new publications by years

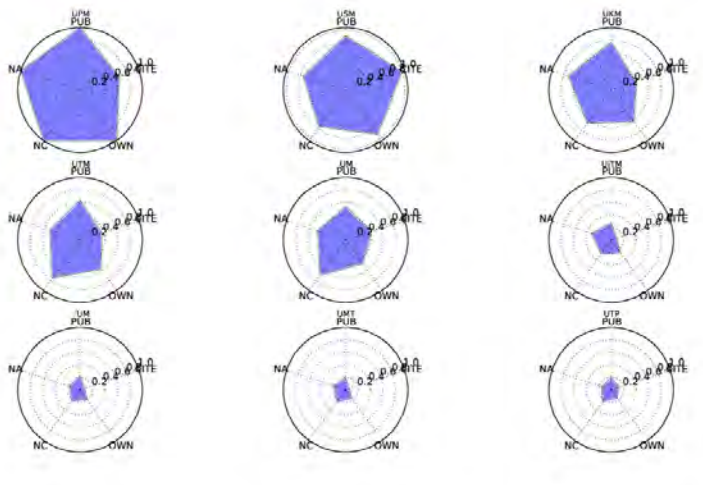


Figure 11: Performance chart of the top nine institutions sorted by number of publications; PUB=number of publications, CITE=number of citations, OWN=number as corresponding institution, NC=number of collaborators (institutions) and NA=number of authors

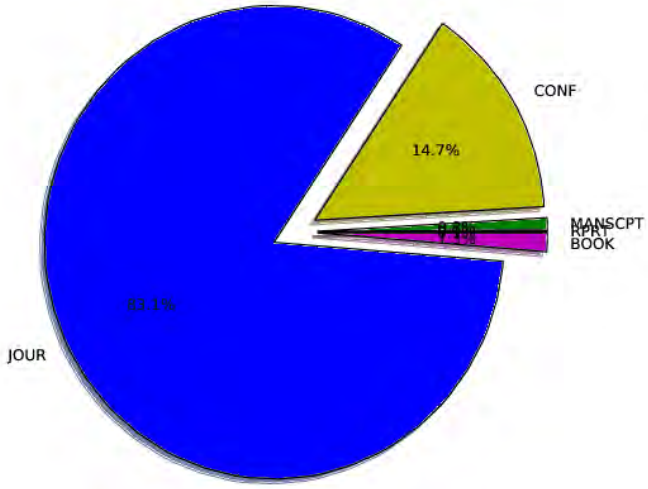


Figure 12: Distribution of publication types. Majority (83.1%) of the articles are JOUR followed by CONF at 14.7% with the rest scored less than 2% each

Five types of publications can be identified from the datasets, namely book (BOOK), report (RPRT), conference (CONF), manuscript (MANSCPT) and journal (JOUR), with journal dominating at 83.1%, followed by conference at 14.7% (Figure 12).

Publications increase yearly with journal articles being the major contribution each year, which itself, is increasing as well (Figure 13). Conference articles are enjoying the increment, too, but at a slower pace. The publications are then categorized into seven categories, detailed out in Table 4, and ranked (fractional ranking) yearly as in Figure 14. Pollution is often ranked highest across year 1964–2012, being the preferred area of research. Pollution is getting more attention by the year because of nature degradation as a result of human activities. Energy and drainage categories are evidently the "coldest" area of research across the years. In our dataset, energy category often involves hydropower

(in Malaysia) and in order to conduct research, access to the dam is required which is fairly restricted. Drainage category, on the other hand, focuses on agriculture (according to our dataset); and it is only a small subset of drainage-based research. This can actually be expanded to drainage in terms of cityscapes, for example. With the annual recurring flood in Malaysia, drainage ought to be given a better attention.

We then took a look at the institutions' and authors' expertise for each category via simple ranking based on number of publications found in the respective categories (Table 5 and 6). Although there are only six unique institutions dominating the top three for each category, we can conclude that UKM is generally expert in water management and climate change types of studies whereas UPM excels in pollution, biodiversity and drainage types of researches. UTP surprisingly overtook RUs in energy category mainly because of its affiliation with PETRONAS.

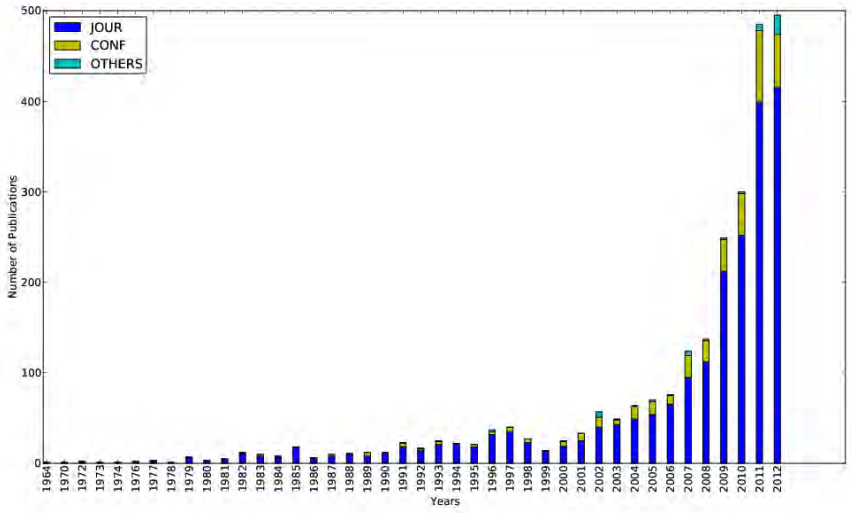


Figure 13: Yearly distribution of publication types. All publications types are generally increasing with JOUR at a faster pace compared to CONF

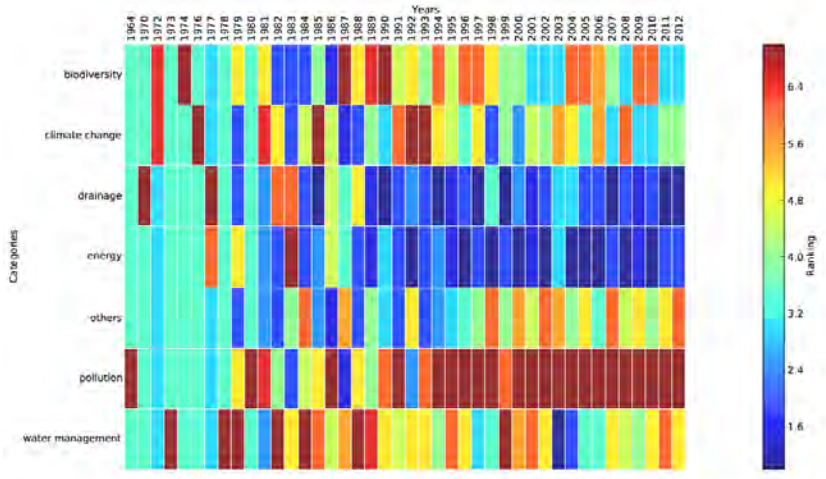


Figure 14: Yearly ranking of categories. Pollution is the "hottest" topic whereas energy and drainage are two of the lowest ranked categories

Table 5: Institutions' expertise based on categories in Table 4

Categories	Institutions		
	1st	2nd	3rd
Water management	UKM	UPM	UTM
Climate change	UKM	UTM	USM
Pollution	UPM	USM	UKM
Biodiversity	UPM	UKM	USM
Drainage	UPM	UM	USM
Energy	UTP	UKM	UPM
Others	USM	UTM	UPM

Aris, A.Z. [UMS; UPM] is the only author that appeared twice as one of the top three in two categories: water management and biodiversity (Table 6). Comparing Table 5 and 6, we can identify authors with significant contribution to their institutions. For example, Mokhtar, M. [UKM] being the only author from UKM (Table 6) out of top three in water management could be the one that contribute significantly in water management that cause UKM to rank first in water management (Table 5). Only two categories do not tally in both tables: biodiversity and energy; however, this is subjected to argument that there is more than one author who scores similar rankings as the top three in Table 6. Arshad, A. [UPM] is ranked similar to Aris, A.Z. [UMS; UPM] and Ahmad, Z. [MNA; UKM]; meaning UPM actually has two authors instead of one in the top three. In energy, there are five authors with similar scores, which include the three in Table 6, plus one from UTP and one from UKM.

We did further articles analysis based on the source of water mentioned or used in the publications. The publications were classified based on the keywords (Table 7, with some regular expressions), title and abstract, with manual intervention if more than one water sources mentioned.

The result showed that four major geological categories captured the most attention, namely RIVER, COAST, WASTE and RAIN (Figure 15). Two least geological categories are LAKE and ISLAND. Around 14.3% of the publications did not mention the water sources used in the research.

Most publications categorized as LAKE are those involving large lakes as a result of dam constructions such as Kenyir, Chini and Titiwangsa. This correlates well with the result in Figure 12 (in which energy category research is one of the least published about). With RIVER as the top geological category, we can assume that it is because of the direct effect to human, especially when it comes to water consumption. COAST geological category could be attributed to the geographical nature of Malaysia which is surrounded by sea. Some of the publications in COAST also mention hydrocarbon or crude oils. WASTE focuses mainly on industrial by-products such as palm oil (agriculture) and dye (textile) wastewater. Membrane is also frequently mentioned in WASTE publications as a treatment method. Malaysia's climate (heavy rains and frequent floods) is obviously the reason RAIN category is one of the four top geological categories. A lot of publications in UNDEFINED geological category are either laboratory works (with generic water source) or policies and social sciences researches.

Table 6: Authors' expertise based on categories in Table 4. Note that there is more than one author with similar scores in the top three in categories with *

Categories	Authors		
	1st	2nd	3rd
Water management	Mokhtar, M. [UKM]	Manan, Z.A [UTM]	Aris, A.Z [UMS; UPM]
Climate change	Jemain, A.A [UKM]	Deni,S.M [UITM]	Toriman, M.E [UKM]
Pollution	Yap, C.K [UPM]	Aziz, H.A. [USM]	Ismail, A. [UPM]
Biodiversity	Kamaruzzaman, B.Y. [IIUM, UMT]	Aris, A.Z [UMS; UPM]	Ahmad, Z. [MAN;UKM]
Drainage	Lee, T.S. [UPM]	Amin, M.S.M [UPM]	Rowshon, M.K. [UPM]
Energy	Choy, F.K. [TNB]	Cheong, B. [Schlumberger]	Daungkaw, S. [Schlumberger]
Others	Azamathulla, H.M [USM]	Marghany, M. [UTM]	Ismail, A.F. [UTM]

Table 7: Geological Classification

Classification	Words used for classifying
RIVER	stream, river, fresh (||-)water, potable, ground(||-)water, sg(.||), sungai, drinking
RAIN	rain, rain(||-)fall, storm(||-)water, run(||-) off, catchment,
LAKE	reservoir, lake, hydroelectric, tasik, dam
COAST	beach, sea, tsunami, estuary(y||ies), coast, strait, sea(||-)water, off(||-)shore, kuala
ISLAND	island, pulau
WASTE	water(||-)water, effluent, contaminated, polluted, leachate, sludge

Yearly trends (Figure 16) show that COAST, RIVER and WASTE are getting more attention in research in recent years compared to the rest of geological classification. In fact, during 1988–1993, COAST was ranked first. ISLAND mostly remained the "coldest" geological classification (although ranked first in 1978 since it was the only paper in 1978) whereas LAKE was ranked first twice: in 1973 and 1983. WASTE was not exactly the "hottest" research area until year 1999 onwards. This could be due to the industrial demands. With the availability of membrane treatment of waste water for the past ten years or so (Atkinson, 2006), research on membrane and waste water treatment is getting more attention.

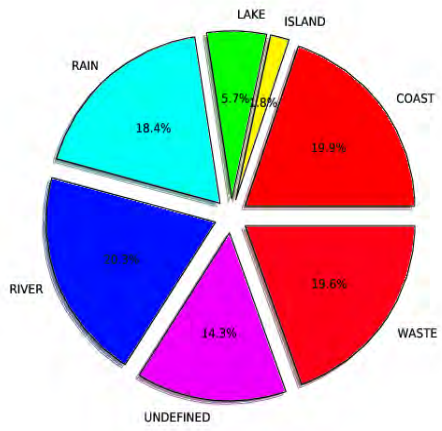


Figure 15: Distribution of publications based on geological classification (Table 7)

3.4. Authors' Collaboration Network Analysis

Gephi network visualization software (Bastian et al., 2009) was used to visualize and analyze our datasets in terms of authors networking and institutional networking. All the networks are undirected. There are 5277 authors (nodes) with 12227 interactions (edges) in our authors' network with 161 non-interacting authors and 514 authors who only interact once. The overview of the network is shown in Figure 17. Nodes' size is proportional to the nodes' degree and all the nodes are coloured according to "communities" detected via modularity analysis. The largest sub-network consists of 2465 nodes with 7397 interactions (Figure 18). We can now see a little bit more clearly on the communities. Only three out of top 50 authors, sorted by number of publications are not in the largest sub-network whereas all top 50 authors sorted by number of collaborators are in the largest sub-network. We then filtered the largest sub-network to observe any common 1st level "neighbours", with exception to Aziz–Isa. Aziz, H.A. [USM] and Azamathulla, H.M. [USM] do not share any collaborator although they are from the same institutions. (Figure 19). Only Aziz, H.A. [USM] (2nd) collaborates with Isa, M.H. [UTP] (4th) for 22 times directly. The other authors seemed to have their own "exclusive" collaborators and are not connected either directly or through any common 1st level "neighbours", with exception to Aziz–Isa.

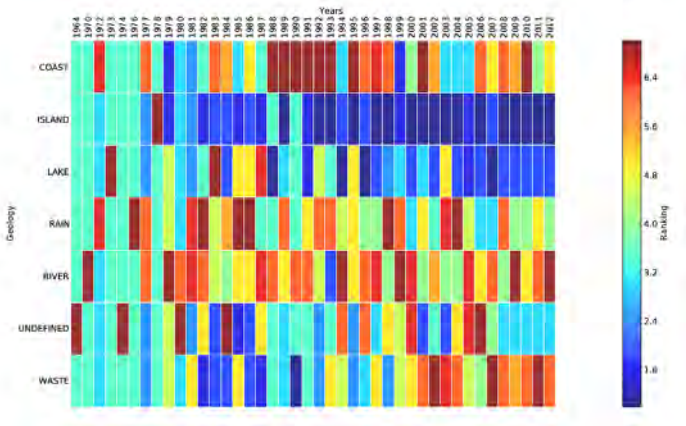


Figure 16: Yearly distribution of publications based on geological classifications. RIVER and WASTE are often ranked higher than the rest while ISLAND and LAKE are two of the least popular areas of research in terms of geological classification

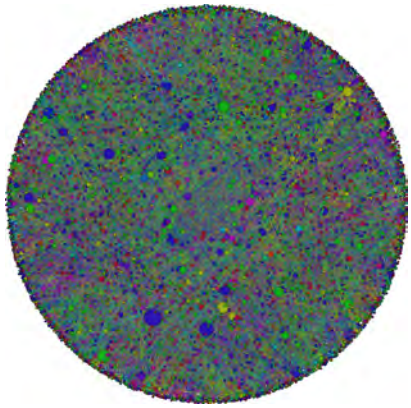


Figure 17: Overall authors' collaboration network via ARF layout. Color represents groups/ communities detected by Gephi and nodes' size is proportional to the node's degree

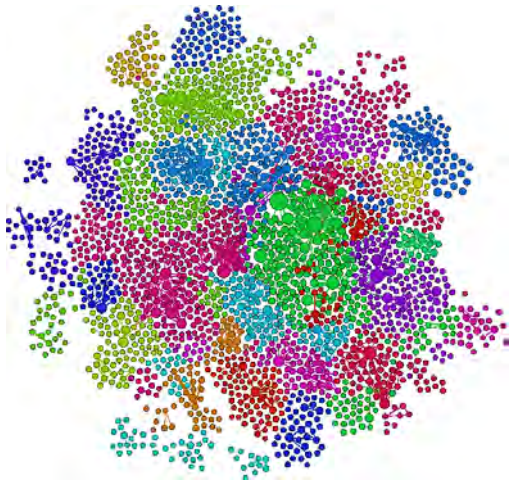


Figure 18: The largest authors' collaboration sub-network via OpenOrd lay- out. Colour represents groups/communities detected by Gephi and nodes' size is proportional to the node's degree

If we look at the network generated by the top five authors sorted by the number of collaborators, Mokhtar, M. [UKM] collaborates with Toriman, M.E. [UKM] ten times directly. Kamaruzzaman, B.Y. [IIUM; UMT] (5th) remains "isolated" from the other top four authors. Yusop, Z. [UTM] acts as the "middle-man" between Ujang, Z. [UTM] and Toriman, M.E. [UKM] whereas more than one common node connects between Yap, C.K. [UPM] and Mokhtar, M. [UKM], and, between Yap, C.K. [UPM] and Toriman, M.E. [UKM], notably Surif, S. [UKM]. Yusop, Z. and Surif, S. could be adopting the "middle-men" strategy to increase their publications. However, considering they both connect between high-degree nodes, they could play a bigger role in bringing big players together (e.g. Yap and Mokhtar or Ujang and Toriman), thus resulting in even bigger and more solid network. In fact, in the centrality analysis of the network, Yusop has the highest betweenness centrality score, which makes him/her the critical personnel in collaboration across different communities. Authors with high betweenness centrality normally have high inter-institutional collaborators/inter-institutions ratio (Table 8) but in the case of Mokhtar and Ujang, they rank relatively low even though they have high intra collaborators.

Another important observation is the eigenvector centrality of the network. Eigenvector centrality often gives a picture of the leader of highly connected communities (Figure 21). Authors such as

Mokhtar and Toriman are connected to several other high-profile authors in the cluster and thus, they are considered two of the most influential authors in their communities.

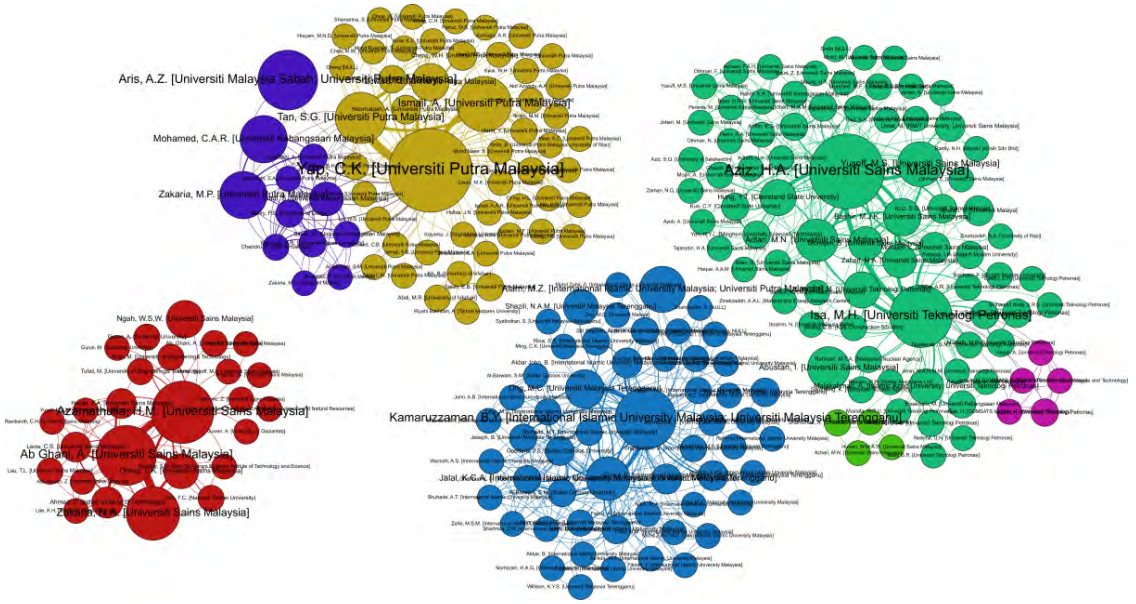


Figure 19: Top five authors' collaboration sub-network sorted by number of publications. Colour represents groups/communities detected by Gephi and nodes' size is proportional to the node's number of publications

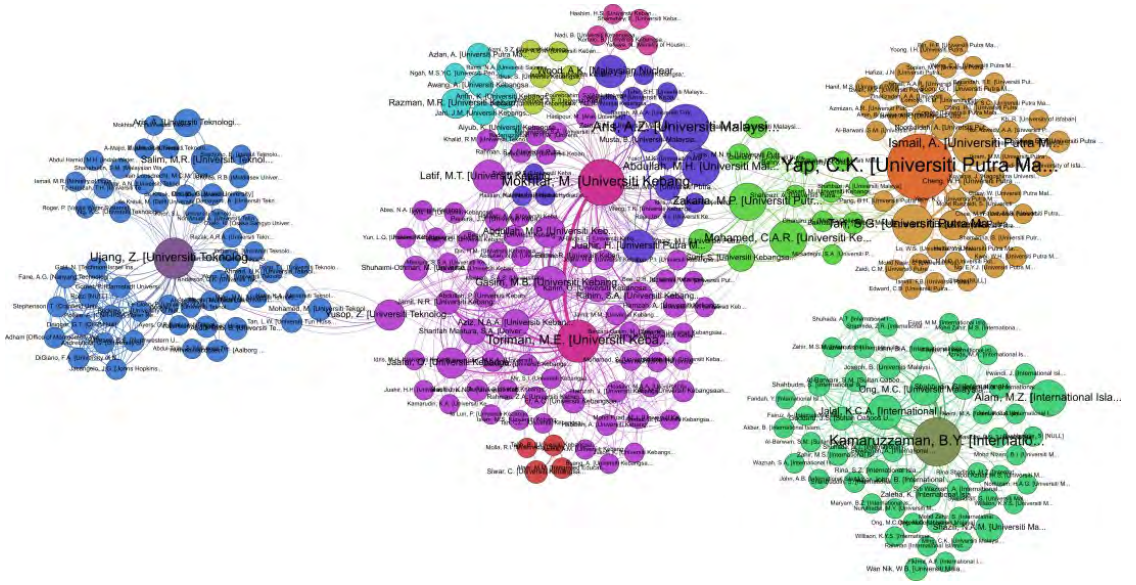


Figure 20: Top five authors' collaboration sub-network sorted by number of collaborators. Colour represents groups/communities detected by Gephi and nodes' size is proportional to the node's number of publications

Since most of the members in the cluster are from UKM, we can conclude that both authors are the leaders among UKM community. Table 9 lists the top five authors with highest eigenvector centrality in the overall network and in general, they have a large number of intra institutional collaborators

compared to inter institutional collaborators. Considering Mokhtar and Juahir both have a top five ranking of betweenness centrality and eigenvector centrality, both of them enjoy working among their local colleagues as well as having the ability to collaborate with those outside of their local communities. They would serve as the best example of striking a balance intra and inter partnership.

Surprisingly, Yap, who has the most number of publications and number of collaborators, does not appear in any top five centralities. It could be that, his network, although has the highest degree (connections), he does not connect to other nodes (Figure 22) often, especially with nodes from other communities, whereas Mokhtar's community network is denser compared to Yap's (Figure 22).

We also take a look at the authors' network in top institutions (Figure 23). These networks only map the connections between authors in the particular institution. Relevant nodes and edges were extracted and communities were detected by Gephi before being exported to visualization by Circos (Krzywinski et al., 2009). The interactions between communities decreased as we move from Figure 23a to 23f although the number of communities is roughly similar. UPM, USM, UKM and UTM could be considered having good intra collaboration among their respective communities with at least 10% of the communities is interacting among each other. The interactions among communities are driven by the community size and community strength (number of publications) with interactions dominating the right portion of the graph. In the case of UM, although it has 51 local communities, the size of each community is small compared to the rest of the RUs. Surprisingly, the largest local community in UM, U63, does not interact outside of itself. A possible explanation to this could be the fact that researchers in UM are highly competitive among each other and only collaborate with members in the same community. Similar trend is observed in UITM; however, the situation is slightly different from UM. UITM is actually a network of universities with branches in almost every state in Malaysia and in our analysis, we group all branches together under UITM. The lack of interactions among UITM local communities is simply because the researchers (although affiliated to UITM) are based in different branches of UITM. For IIUM and UMT, interactions exist among communities with high publications number and low publications number although the interactions are still very much community size dependent.

Table 9: Top five authors with the highest eigenvector centrality. Rank is based on eigenvector centrality score, Intra=number of intra institution collaborators, Inter=number of inter institutions collaborators and Inter Inst=number of unique inter institutions

Rank	Author	Intra	Inter	Inter Inst
1	Mokhtar, M. [UKM]	59	28	11
2	Toriman, M.E. [UKM]	64	6	3
3	Aziz, N.A.A. [UKM]	40	3	2
4	Gasim, M.B. [UKM]	36	8	4
4	Juahir, H. [UPM]	20	32	12

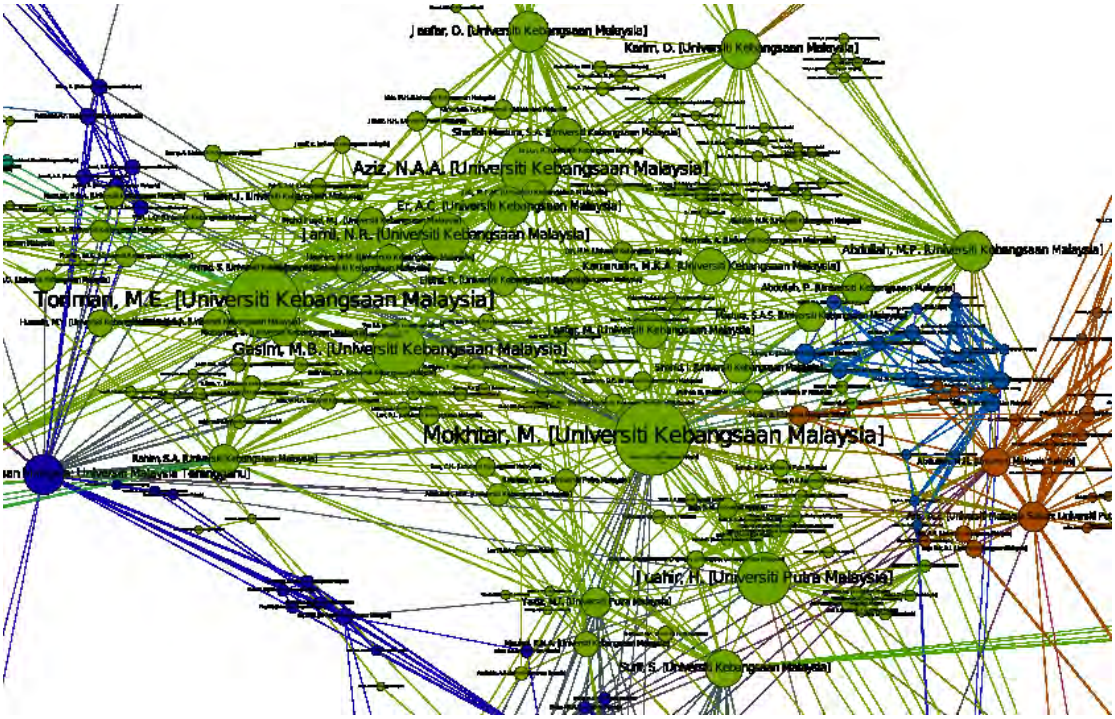


Figure 21: A highly connected clusters in authors' collaboration network showing authors with high eigenvector centrality (which is proportional to node size)

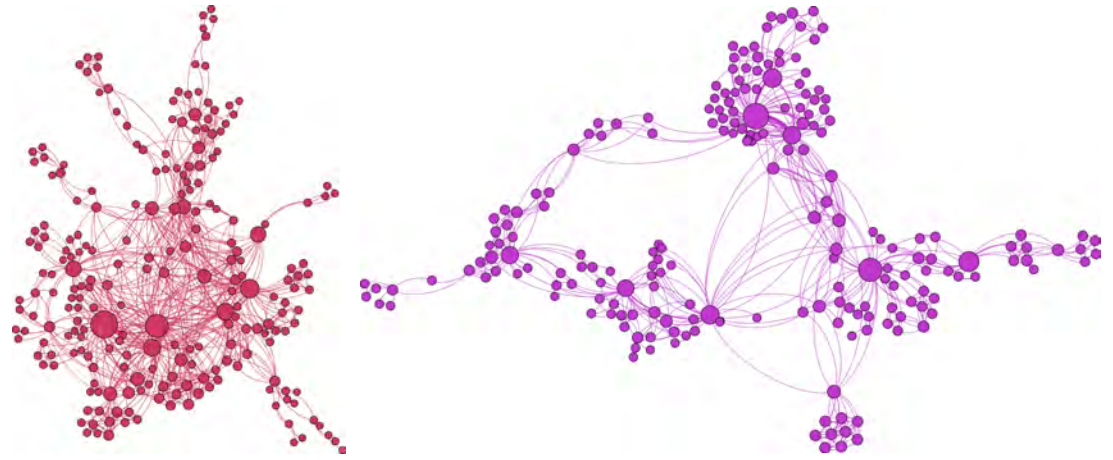
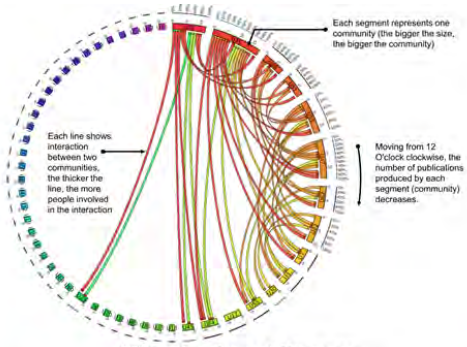
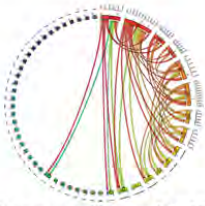


Figure 22: Comparison of two communities with different connections density with Mokhtar's community network in red (left) versus Yap's community network (right)

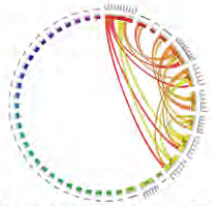
Last but not least, we observed the collaboration network among the top 20 authors (Figure 24 and Table 10). Five out of the top 20 authors do not interact among the top 20 authors; namely Kamaruzzaman (A5), Ismail (A10), Yusoff (A16), Jemain (A18) and Ujang (A20). The majority of the top 20 authors only collaborate with authors from the same institutions (true to the top 20 authors) and only four interact with authors from different institutions. The results showed that there is no significant inter institutional collaborations among top authors.



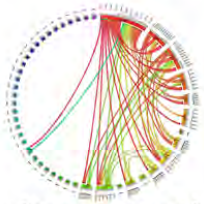
(*) Explanation of Diagram



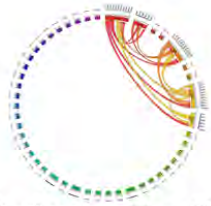
(a) UPM (50 communities with 15 interacting communities)



(b) USM (42 local communities with 9 interacting communities)



(c) UKM (45 local communities with 13 interacting communities)

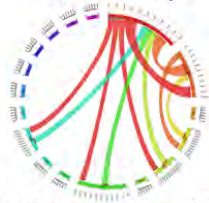


(d) UTM (46 local communities with 5 interacting communities)

(e) UM (51 communities with 6 interacting communities)

(f) UITM (49 local communities with 3 interacting communities)

(g) IIUM (17 local communities with 5 interacting communities)



(h) UMT (17 local communities with 6 interacting communities)

Figure 23 (*, a-h): Comparison of network of top institutional (local) communities. Outermost ring denotes each community detected by Gephi and only inter links (connections to different communities) are shown. Communities without any interactions (i.e. communities with only one member) are discarded. The ring segments are sorted by the cumulative number of publications (starting from 12 O'clock) and the ring size is ∝ community size

Figure 24: Top 20 author's collaboration network

Table 10: Top 20 authors with the corresponding code as in Figure 24

Code	Author
A1	Yap, C.K. [UPM]
A2	Aziz, H.A. [USM]
A3	Azamathulla, H.M. [USM]
A4	Isa, M.H. [UTP]
A5	Kamaruzzaman, B.Y. [IIUM; UMT]
A6	Ab Ghani, A. [USM]
A7	Aris, A.Z. [UMS; UPM]
A8	Mokhtar, M. [UKM]
A9	Abdullah, K. [USM]
A10	Ismail, A.F. [UTM]
A11	Mat Jafri, M.Z. [USM]
A12	Ismail, A. [UPM]
A13	Toriman, M.E. [UKM]
A14	Zakaria, N.A. [USM]
A15	Hameed, B.H. [USM]
A16	Yusoff, I. [UM]
A17	Ahmad, A.L. [USM]
A18	Jemain, A.A. [UKM]
A19	Tan, S.G. [UPM]
A20	Ujang, Z. [UTM]

3.5. Institutions' Collaboration Network Analysis

The overall institutional collaboration network is shown in Figure 25 with a total of 813 nodes (excluding NULL) and 1668 edges. The top five institutions (all RUs) scored the top betweenness centrality (highly connected to multiple communities) and eigenvector centrality (highly connected in a highly connected sub network). For the top ten institutions, UPM, UKM and UMS are grouped in the same community (detected by Gephi), USM and UTP are in another community, and, UTM–UITM and IIUM–UMT are in separate communities, respectively. Figure 27 shows the interactions among the top 20 institutions. Overall, the interactions are very much diverse but not all institutions in the top 20 collaborate with each other. The most diverse collaborations would be UKM (I3) and UTM (I4), with only no collaborations in two out of top 20 institutions. The least diverse RU would be UM (I5), which only interact with 13 out of the top 20 institutions. FRIM (I14) is the overall least diverse institutions with interactions only with four out of top 20 institutions. The highest frequency of collaboration is between UPM (I1) and UKM (I3) which is 39 times, followed by IIUM–UMT (27 times).

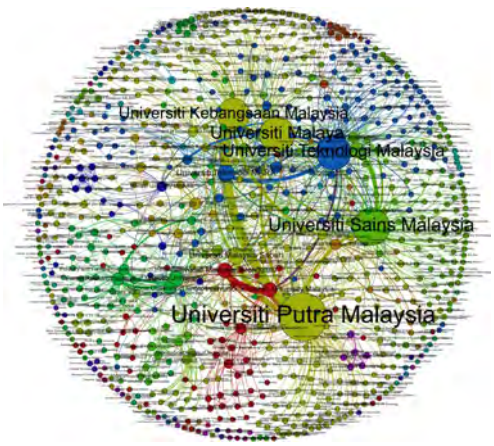


Figure 25: Institutional collaboration network

The institutional network can also be observed in terms of Malaysian and non-Malaysian institutions. There are 168 Malaysian institutions and 646 foreign institutions from our dataset. Table 12 shows the Malaysian-foreign institutional collaborators for the top 20 institutions

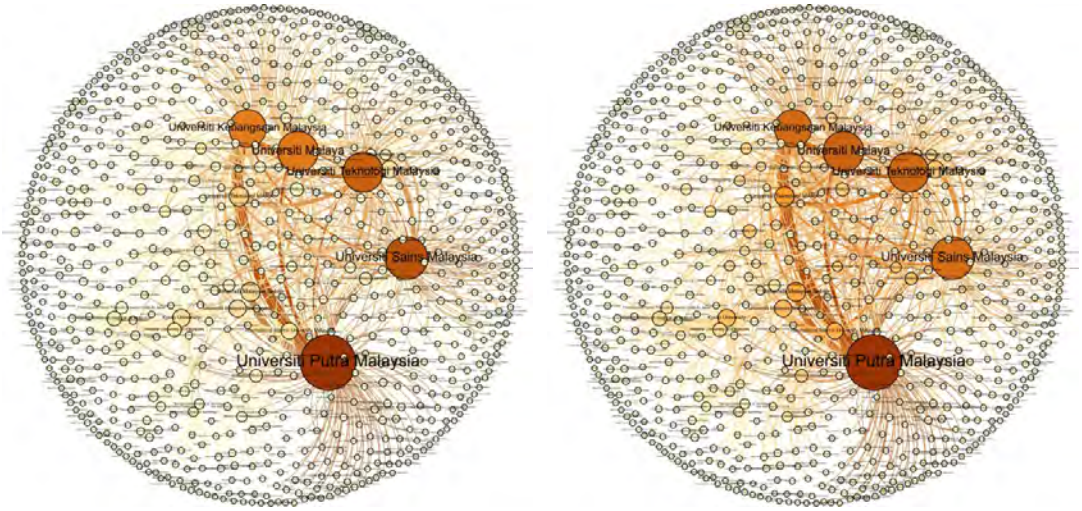


Figure 26: Institutional network with nodes (left) coloured by betweenness centrality (right) coloured by eigenvector centrality

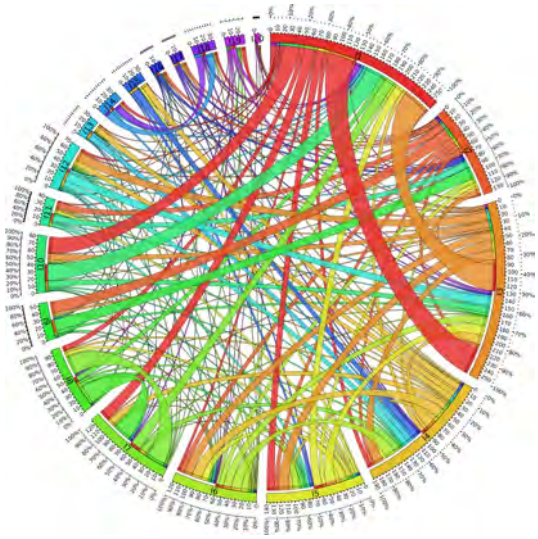


Figure 27: Top 20 Institutional collaboration network

RUs generally have more foreign collaborators than local ones, although UKM's ratio of FOR/MAL is relatively lower. IIUM, although it has smaller foreign collaborators, it manages to be one of the top ten institutions. The lack of foreign collaborators could be due to the institutions' reputation (in our case, reputation in water research). The established institutions (especially the RUs) have significant foreign collaborators compared to others. FRIM has a higher number of foreign collaborators compared to local collaborators since it is the de-facto guardian of Malaysian forest (foreign institutions will definitely need a "local" contact especially when the research is done in Malaysian forest). This could also mean that the foreign researchers are more interested in water research in Malaysian forest compared to local researchers. Kyoto University surprisingly has more foreign collaborators than Malaysian collaborators although the dataset is on water research in Malaysia.

Table 11: Top 20 institutions with the corresponding code as in Figure 24

Code	Institution
I1	Universiti Putra Malaysia
I2	Universiti Sains Malaysia
I3	Universiti Kebangsaan Malaysia
I4	Universiti Teknologi Malaysia
I5	Universiti Malaya
I6	Universiti Teknologi MARA
I7	International Islamic University Malaysia
I8	Universiti Malaysia Terengganu
I9	Universiti Teknologi Petronas
I10	Universiti Malaysia Sabah
I11	Universiti Malaysia Sarawak
I12	Malaysian Nuclear Agency
I13	Universiti Malaysia Pahang
I14	Forest Research Institute of Malaysia
I15	Universiti Tun Hussein Onn Malaysia
I16	Universiti Malaysia Perlis
I17	Universiti Tunku Abdul Rahman
I18	Kyoto University
I19	Universiti Tenaga Nasional
I20	Multimedia University

Table 12: Top 20 institutions with the number of Malaysian (MAL) and foreign (FOR) institutions (collaborators)

Institutions	FOR	MAL
Universiti Putra Malaysia	111	41
Universiti Sains Malaysia	88	25
Universiti Kebangsaan Malaysia	57	40
Universiti Teknologi Malaysia	70	35
Universiti Malaya	73	33
Universiti Teknologi MARA	22	20
International Islamic University Malaysia	12	21
Universiti Malaysia Terengganu	21	14
Universiti Teknologi Petronas	25	10
Universiti Malaysia Sabah	25	16
Universiti Malaysia Sarawak	7	13
Malaysian Nuclear Agency	4	12
Universiti Malaysia Pahang	14	9
Forest Research Institute of Malaysia	23	4
Universiti Tun Hussein Onn Malaysia	12	4
Universiti Malaysia Perlis	7	9
Universiti Tunku Abdul Rahman	12	5
Kyoto University	24	12
Multimedia University	3	6
Universiti Tenaga Nasional	1	6

4. CONCLUSIONS

In this study, historical analysis of indexed publications on water research was able to provide credible insights into past research focus, mapped collaborations, define research clusters, and identify leading institutions in Malaysia. The 814 institutions showed wide breadth of collaborations with UM being the historical lead in the research area. Significant research personas were also identified, showing research clusters created by 'alpha researchers'. Water pollution was highly focused as a research area, probably due to the pressing need and immediate impact of the applied research findings to the governance of the environment and society. The research bias on rivers and coastal areas could be due similar reasons, with accessibility to research sites being an added research incentive. Distribution of research resources should account for this research precedence in order to create a more effective and equitable research allocations. Dominant researchers identified from the publication strength present a challenge to the research community by creating research caucuses that might impeded research progress by creating personality bias or institutional research silos. Institutional diversity and transdisciplinary nature of researchers is paramount in ensuring breadth and depth of the research reach. Governing stakeholders would need to take into account all these factors when safeguarding a nation's continuous research momentum.

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RESEARCH ARTICLE

Initializing multi-stakeholder engagement in the context of Marine Protected Area management and capacity-building programmes: A Tun Mustapha Park case study

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ABSTRACT

As global trends in Marine Protected Area (MPA) management shift towards participatory co-governance, the importance of effective stakeholder engagement in its implementation stages warrant greater emphasis. This case study highlights key lessons learned from the employment of a mixture of focus group discussions (FGDs), interviews and reconnaissance surveys in a preliminary study-site visit to Tun Mustapha Park (TMP), Sabah, Malaysia, where our research team is undertaking a 4-year research and capacity-building project. We found that trust building, understanding the local culture and politics, and recognition of complex stakeholder dynamics were key elements to successful engagement, while identifying key decision-makers for follow-ups were crucial for on-going engagement. This paper presents insights into the types of information collected by our team, which would be useful among conservation practitioners who will be conducting similar engagement work in the future.

Keywords: multi-stakeholder engagement; marine protected areas; capacity-building; marine management; co-governance

1. INTRODUCTION

As coastal populations grow exponentially, there is a burgeoning need to reconcile socio-economic demands and biodiversity protection goals (Klein et al., 2008; Mills et al., 2016). Marine Protected Areas (MPAs) have been used globally as a management tool for conservation of marine ecosystems and biodiversity; yet neglecting certain interests within its social landscape can lead to stakeholder conflicts and non-compliance (Fernandez, 2007). In response, governments and marine park managers are increasingly adopting more socially inclusive forms of governance as opposed to highly institutional ones as a hopeful solution. The recent shift to a more inclusive governance approach, known as 'co-governance', is also a result of its positive track record in fostering cooperation between local communities and MPA planners – a much desired social situation for effective MPA management where human and financial resources for enforcement are typically scarce (Evans, Cherett, & Pemsl, 2011).

In Malaysia, the governance of MPAs have historically been top-down and is often compounded by management complexities and power overlaps (Islam et al., 2017). For instance, the establishment of marine parks fall under both the jurisdictions of the Sabah Wildlife Department and the Department of Marine Park Malaysia; yet the former reports to the State government and the latter works under the Federal government. Malaysian MPAs have also traditionally been designated as 'no-take', namely all forms of resource extractions are strictly prohibited, consequently changing the economic landscape for local communities who depend directly on its marine resources for food and a primary source of income (Islam et al., 2017). In recent years, however, the global recognition of artisanal communities' rights, coupled with advancements in spatial planning technology have promoted more inclusive forms of governance (Cinner & Aswani 2007; Klein, Steinback, Watts, Scholz, & Possingham, 2010). In Sabah, government agencies and non-governmental organizations (NGOs) have also sought to develop MPA frameworks which incorporate community consultations to ensure locations for biodiversity preservation are unanimously agreed upon while the freedom to fish in other locations are prescribed to varying degrees (Jumin et al., 2017; Sabah Parks, 2017).

The Tun Mustapha Park (TMP), off the north coast of the state of Sabah, covers an area of 8988km^2 and was established in May 2016 as the first multiple-use marine park in Malaysia following a 13-year participatory and consultative process facilitated by WWF-Malaysia and Sabah Parks (Langenheim, 2016; WWF-Malaysia, 2017). As the largest MPA in Malaysia which supports an abundance of marine life and ethnically diverse communities, TMP is collaboratively managed by multiple stakeholders based on the concept of co-governance involving community participation at all stages of implementation (Sabah Parks, 2017; WWF-Malaysia, 2017). While a multitude of past case-studies have discussed methods to stakeholder engagement in MPA spatial planning processes (Pomeroy & Douvere, 2008; Ritchie & Ellis, 2010; Gopnik et al., 2012), few have assessed stakeholder engagement during implementation stages where capacity-building, recognised as a cornerstone for active participation of stakeholders and knowledge-sharing (Cuthill & Fien, 2005), is a central focus.

Blue Communities is a 4-year programme funded by the UK Government's Global Challenges Research Fund (GCRF) to support the ongoing implementation and management of marine ecosystems across four case-study sites in Southeast Asia: Malaysia, Indonesia, Philippines and Vietnam. The core objective of the programme is to develop interdisciplinary research capabilities, which in turn would encourage knowledge exchange and collaboration with local stakeholders to enhance the existing management plans for MPA. As a country partner to Blue Communities, the University of Malaya have sought to work with stakeholders in TMP to provide support in achieving the management's mission for biodiversity protection, sustainable development, and poverty alleviation (Sabah Parks, 2017).

Here we discuss our techniques used to initiate engagement with stakeholders during our first site visit to TMP in March 2018. The objectives of this paper are to provide insights into the types of information gathered through engagement methods, discuss associated challenges, and present lessons learned.

2. STAKEHOLDER ENGAGEMENT METHODS

2.1. Objective Setting

To initiate engagement with stakeholders, we designed a site visit to TMP which aimed to (i) introduce the project to TMP stakeholders, (ii) identify knowledge gaps and issues related to marine spatial planning in the marine park, (iii) set key progress milestones for monitoring and evaluation among team members, and (iv) conduct reconnaissance surveys at various islands located within the TMP boundary. Engagement approaches included a stakeholder meeting with focus group discussions, open-ended interviews and reconnaissance surveys.

2.2. Focus Group Discussions (FGDs)

We invited a range of representatives from government, NGOs, the local community and private sector to a stakeholder meeting in the state capital of Sabah, Kota Kinabalu. The invitation list included all key decision-makers, influential societies and known community groups. Consequently, 27 stakeholder groups attended the 1-day meeting hosted by the University of Malaya.

The meeting was divided into four sessions: (1) What is the current state of TMP and the major ecosystem services provided? (2) Future aspirations for a sustainable TMP and how do we get there? (3) Challenges and issues to reach aspirations, and (4) Stakeholder analysis. To stimulate discussions with varied opinions and perspectives, participants were divided into four groups, each of which consisted of representatives from each sector – government, NGO, tour operators and local community, facilitated by one of our team members. Participants were briefed on the objectives of the meeting, the voluntary nature of their participation and their right to leave at any time without reason. Written informed consent was obtained from each participant.

The topic for each session was introduced to the participants and they were free to discuss the topics within the assigned groups based on their experiences and knowledge. Tools such as sticky notes and maps were used to encourage discussion within the groups. In Session 1, participants at each table drew a mind map on flipchart paper and used sticky notes to link the ecosystem services and associated threats. In session 2, the participants wrote statements on their future aspirations for TMP on flipchart paper. In session 3, the participants discussed challenges and potential solutions related to society, economy, environment, health, governance and technology in TMP; the resulting points of discussion were written on sticky notes and placed on a map of TMP. Finally, in session 4, participants collectively drew influence-importance matrices on flipchart paper. After each session, a plenary session was held where the results of the discussion were presented by representative of each group. When the stakeholder meeting was over, participants were handed feedback and evaluation forms, and team members ran a post-mortem analysis to collate the information resulted from the meeting.

2.3. Interviews

Following the stakeholder meeting, team members travelled to the largest and most populated island in TMP, Banggi Island, to conduct informal interviews with local groups (i.e. youth club, fisher association, health group, and a privately-run homestay) to understand the socio-economic situation in the island.

Interviews were carried in an informal fashion with open-ended questions, where interviewees took the lead in the conversation allowing team members to note their interests and sentiments without interruption. Questions were framed to gain insights into an organisation's activities, which stakeholders they worked closely with, trends they observed, and personal aspirations for the marine park.

2.4. Reconnaissance Surveys

The team also conducted reconnaissance surveys at several locations including beaches, villages, a copra processing farm, mangrove forest, and *bagang* (a traditional wooden structure with a large net used to catch anchovies at the seaside) (Mohd Ariff & Mohammad Raduan, 2008). Observations were made on infrastructure conditions, lifestyle (i.e. nomadic, types of fisheries they involved in), general health of ecosystems, cleanliness, water supply, and demographic factors (i.e. religion, ethnicity).

3. LESSONS LEARNED AND RECOMMENDATIONS

3.1. Mutual Trust among Stakeholders

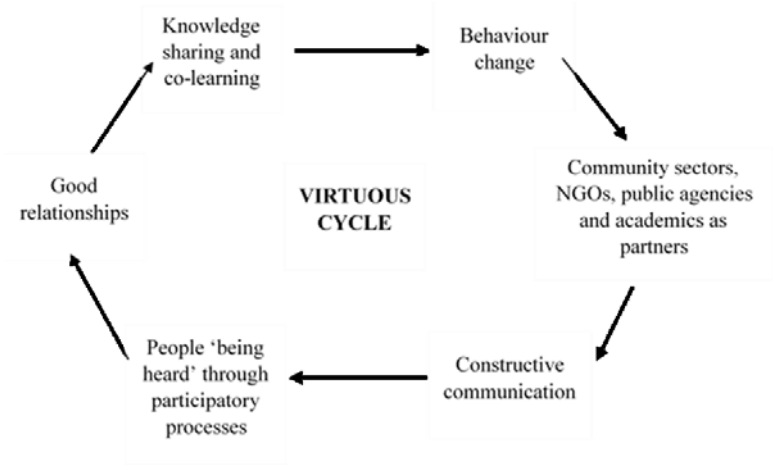

Figure 1: Virtuous cycle of contact brought about by capacity-building and collaborative partnerships amongst stakeholders as adapted from Cuthill & Fien (2005)

Results of the engagement methods employed over the course of the site visit provided a range of lessons for our team. Firstly, our team learned that utilising the right tools to encourage equal participation was key to creating a neutral environment for open sharing among stakeholders. For example, at FGD groups where more prominent or dominant personalities were present, the wealth of information recorded tended to be from a single person's point of view, whereas other present participants were observed to be relatively passive or quiet. Dominance can also cause a diversion from intended topics of discussion (Wong, 2008) and our team found the use of tools such as sticky notes helpful in steering the direction of conversation, minimising dominance, and encouraging participation from less vocal participants. Such constructive communication is an important step in having all voices heard and to reinforce the 'virtuous cycle of contact' which further promotes cooperation (Figure 1) (Cuthill & Fien, 2005).

Our team also learned that a prerequisite for effective ongoing engagement was mutual trust among stakeholders. In complex socio-ecological systems such as MPAs, understanding the local communities' concerns, priorities and needs are a pivotal step to building this trust (Jones & Wells, 2007). We found that carrying out informal, open-ended interviews at their homes or work spaces

provided a safe-space for open sharing sessions which helped the team understand specific community resource needs while fostering a mutual sense of trust and respect. For example, one respondent described the challenges in meeting the steep reporting requirements of funding bodies when seeking support for alternative livelihoods projects such as woven handicrafts.

3.2. Understanding Stakeholder Dynamics

The FGDs helped us understand stakeholder dynamics and perspectives on conservation and management of TMP to further inform engagement strategies. This understanding of complex stakeholder dynamics, often captured through either consensus or disagreement in opinions, is also consistently a key finding from FGDs across a wealth of global conservation literature (Ochieng et al. 2017). For example, we interpreted the management to strongly prioritise community interests in their work through their expression of understanding towards the inequitable effects of weak enforcement of zoning plans on artisanal fishers' access to fishing grounds. We also noted conflicting opinions on the level of inclusivity in zoning plans reflecting the ongoing bargain between stakeholder groups. Such divergences in opinions have also proved characteristic of communities with varying levels of administrative diversity and development as shown in a study on a small-scale marine reserve in Indonesia (Crawford, Kasmidi, Korompis, & Pollnac, 2006).

3.3. Type of Information Gathered

The various engagement methods employed returned various types of information. The FGDs provided a snapshot of concerns and priorities of TMP stakeholders including the need for family planning, the frequency of illegal fish bombing, the marginalization of minority groups, need for proper waste management, land development plans, and access to healthcare and clean water. Through interviews, we were able to capture the finer details of livelihoods of the community including fishermen income, the distance travelled to closest markets, the level of competition between and among commercial and artisanal fishers, other forms of side income, and perceived threats to their welfare. Finally, the reconnaissance surveys resulted in many important observations including set-ups of rainwater harvesting set-up, water wells located near burial sites, shortage in power and water supply, unmanaged garbage along village proximate beaches, and lack in basic infrastructure. While reconnaissance surveys often produce biased results as they are usually conducted along accessible routes as opposed to at random, they are useful in giving a quick general understanding of the area and important background information for future work on-site (Hurst & Allen, 2007).

3.4. Failure and Recommendations

In summary, lessons learned from the TMP site visit include the importance of developing mutual trust among primary stakeholders, understanding of local cultural and political context, and recognising complex stakeholder dynamics – all of which are factors found to contribute significantly to successful MPAs worldwide including in the United States and the Caribbean (Pomeroy & Douvere 2008; Dalton, Forrester, & Pollnac, 2010). Our team was unable to meet the third objective of our site-visit to TMP which was to set key progress milestones for monitoring and evaluation. We found that targeted milestones were difficult to determine as feasibility in addressing specific issues such as alternative livelihood development in TMP required further assessments into barriers to implementation, community buy-in, and sustainability of recommended interventions. Therefore, the third objective may have been premature here and hence we suggest that objectives for initial engagement should be

focused on building trust between researchers and stakeholders, facilitating reflection from stakeholders, and identifying shared goals. Although the engagement techniques used during our team's first engagement with the stakeholders were successful in achieving most of our objectives, there was relatively little face-to-face interaction with individual stakeholder groups. We would recommend that stakeholder meetings and FGDs are strongly complemented with ongoing interaction and courtesy visits to foster trust and maintain positive relationships. In addition to engaging with key influential actors, community engagement should be continuously pursued especially when project goals are community-centric. Our failure to have a fair representation from the local community at our FGDs is likely due to lack of engagement with them prior to the stakeholder meeting. We recommend future researchers to hold a town hall-esque session with the local community as early into the project as possible to introduce its objectives and contribution to encourage their participation in futures activities (Jones & Wells, 2007). We also highlight consideration for power homogeneity in FGDs as we found that imbalanced power dynamics (i.e. presence of authority and seniority) may have led to dominance in discussions and biased results (Wong, 2008). This case-study will be relevant to MPA conservation practitioners who are looking to engage in complex governance systems where there are multiple levels of management and numerous stakeholders, particularly where participatory methods and social inclusivity are key considerations in its design.

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OPINION

Realizing Research Impact and the Experience of a Malaysian University

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ABSTRACT

This paper touches on a range of aspects that affect the realization of research impact. Malaysia has invested significantly in research and we have world class researchers who have proven themselves with high impact publications. However, there is still a lack of clear connection when it comes to relating research output to resources. This paper recommends proper initial research planning involving multi-sectorial stakeholders, and identification of impact and impact pathways in conceptualizing research projects. Strong institutional support in the form of professional research managers to assist researchers in research processes is important to ensure that the research activities are run smoothly and monitored well. Initiatives to enhance researchers networking, mobility and competency through relevant training programmes will encourage our academics to expand their horizon and generate new ideas for research. Considering the amount of investment that has been made and the conducive environment that we have at universities, it may seem that we are not fully capturing or extracting all the results and products of our research endeavour. It is thus highly desired that Malaysia should have sound database and data management system to capture all the work that has been done and make the information accessible to research managers as well as researchers to do strategic analyses.

Keywords: research impact; research development; assessment tool

1. INTRODUCTION

Research and development in Malaysia can be traced back to the mid and early 1900s, with the founding of research institutes. Research institutes were established for specific niche areas -- the Rubber Research Institute (RRI), the Institute of Medical Research (IMR), Forest Research Institute Malaysia (FRIM), Malaysian Palm Oil Board (MPOB), and the Malaysian Agricultural Research and Development Institute (MARDI), to name a few. Naturally, the outcome from these research institutes has to do with the advancement of the respective commodities or economic sectors that each of them addresses.

Universities were first established primarily to provide tertiary education i.e. teaching and learning, and to produce the workforce for a growing nation. Universities have also contributed significantly in research, with the increase in expertise in various academic disciplines. Universities enjoy the advantage of having a continuous flux of students and graduates, which perpetuate the academic momentum and energy, as well as expanding the network of stakeholders. Research continues to thrive under this

vibrant environment with our academics engaging in cutting-edge and high impact research projects. This in turn, keeps the knowledge and skills taught to our students relevant and alive. Research inevitably, is an integral part of academia.

As one of the fastest growing economies in Southeast Asia, Malaysia has nearly achieved its aspiration to be the education hub for the region, and in the last decade it has progressed steadily towards becoming a world class player in research with multi-fold increase in the output, even surpassing China and Korea in the rate of growth of indexed publications.

The bulk of research funds for public institutions come from the government, but through the expansion of research network and collaborations, more funds are now coming from the private sector and international agencies. In line with this development, our researchers are becoming more receptive to the need to deliver beyond the academic output that is to also be thinking of the socio-economic impact, from the time of conceiving their research ideas.

2. IMPACT OF UNIVERSITIES' RESEARCH

Evaluating the impact of university research in Malaysia puts into consideration a broad range of parameters, from the immediate academic output in the form of journal papers and talents, to more direct outcome with stakeholders with the uptake of products or services by industries and communities.

It is fair to say that universities are the keepers of fundamental research, which is essential in discovering new knowledge. University researchers, supported by an ecosystem comprising teams of experts, library resources, physical infrastructure and special facilities, have a conducive setting to conduct experiment-based, curiosity-driven fundamental research which generates new ideas that can be published.

Publishing research results in academic journals marks the climax of an academic research and is the professional way to disseminate findings. Academic journals are ranked in terms of their impact, prestige and influence. Papers in indexed journals are accessible by the research community all over the world, and a measure of the impact is the number of citations received in the published literature. The h -index gives an indication of the productivity and citation impact of a researcher.

As paper citations increase through cross-referencing of papers, the researchers and institutions with which they are affiliated become better-known. This potentially opens opportunities for networking and collaborations among researchers, which augurs well for the respective institutions' as well as the country's reputations. The number of citations per researcher is used as a criterion in world university rankings.

Apart from publishing papers, a good number of academic researchers are inclined towards solving real life issues. This results in a range of outcomes from policy papers that could influence government policies to innovations that can be commercialized and translated to society.

In justifying the investment of public funds for research and development, universities have been under greater pressure to have a more pragmatic approach in research, with emphasis on social good. At the same time, prestigious private and international grants including Toyota Foundation, Sumitomo, and Global Challenge Research Fund (UK) are all looking at impact to society. In Malaysia, the quadruple helix model has been put forward to ensure input from the government, industries, academia and society in creating an open innovation system with multi-sectorial collaborations. The availability of suitable funding has attracted our researchers to embark in community-centred projects and become better at adapting to carrying out research with direct benefits to the people.

Applied research produce inventions, technologies, designs, or works of art which are protected as intellectual properties in the form of patents, trademarks and copyrights. Marketable research outputs generate interests from potential investors who may provide funds to co-develop products or technologies for a full-scale application if the economic advantage is clear. A challenge faced by academics to take their research products to the next level for commercialization is in getting the right match for a business partner. Academics are generally not equipped to market their products, plus their time is better spent concentrating on their research and teaching duties.

Opportunities are made available through pre-commercialization grants, accelerator programmes on developing business model canvasses and pitching to investors, start-up funds, and entrepreneurial programmes, such as those provided by the Malaysian Global Innovation and Creativity Centre (MaGIC), CRADLE Sdn Bhd, and PlatCOM Ventrues Sdn Bhd. However, institutional support is still essential for researchers to progress to the next level with their innovations. Technology transfer offices (TTOs) act as conduits to promote research products. Skill and experienced professional innovation managers at TTOs can effectively bridge the gap between academia and the commercial world, which otherwise remains a major hurdle for uptake by the corporate sector.

The Ministry of Education had twice commissioned impact studies on Research Universities – for the first five years and for the second five years period to mark one decade of RUs. The study looked at Talent Development, Research Prominence, Wealth Creation and Bridging the Grand Challenge. Details on these studies can be obtained from the final report.

3. ASSESSMENT TOOL

The Malaysian Research Assessment (MyRA) instrument was developed in-house by the then Ministry of Higher Education, with the establishment of Research Universities in 2006. MyRA criteria are: Quantity and Quality of Researchers, Quantity and Quality of Research, Postgraduates, Innovation, Professional Services and Gifts, Networking and Linkages, and Support Facilities including accreditation of our laboratories.

The parameters which are being assessed include number of journal and conference papers, citations, h-index, patents, copyright, trademarks, and income generated from commercialization of research products, as well as licensing and spin-offs. Number of graduates (talents), amount of funding, number of projects and principal investigators are also counted, as they reflect the strength and capacity of the university in conducting research and obtaining research funds. Awards and recognition received by academics are included as achievement as it shows the leadership strength of the institution.

Since it started about ten years ago, there are now two versions of MyRA. The main difference between the two versions is the benchmarks. Research Universities are subjected to the second version of MyRA which is more output-focused, whereas the newer / younger universities use the first version which still has emphasis on input.

MyRA puts high weightage on publications and citations, thus stressing the importance of academic prominence. With the advent of more community-based projects, we are searching for the best method to measure qualitative outcomes. A rubric method with star rating is currently used to evaluate the impact of community-based projects in terms of the extent of effect on the community, how transformational and sustainable.

MyRA audits are conducted every year, and the evaluations are done as a post-award monitoring exercise to assess the achievement of the research project and the return on investment. We are now beginning to emphasize the importance of identifying potential impact of a study from the time the

research proposal is developed or when ideas are conceived. Researchers are required to explain the potential outcome and impact of their work in the proposals. We may see a move towards qualitative assessment of impact that we are seeing in the UK and other countries. It may start by modelling after the UK Research Evaluation Framework (REF), but with adjustments to suit what is best for Malaysia, and eventually there might be a version specially catered for Malaysian research assessment.

Another instrument used for Malaysian institutions is the SETARA rating which is more on teaching and learning (education), but takes into account the quality of research since this has direct influence on education.

While still measuring input to research in terms of student numbers, grant quantum and researchers' qualification, and looking at traditional research output, we are mindful about the importance of societal or external impact as practiced in the UK. The MyRA instrument undergoes regular reviews to incorporate changes as we evolve. In assessing Malaysian institutions we should acknowledge the various categories of universities with different levels of maturity.

4. UNIVERSITY OF MALAYA'S JOURNEY AND EXPERIENCE

Among the earliest publications by UM academics from 1960s include a paper entitled Contemporary Urbanisation in Malaysia published in Asian Survey by the late Professor Hamzah Sendut, and a letter on Subdivisions of Estates in Malaya (1951-1960) published in Malayan Economic Review by none other than Royal Professor Ungku Abdul Aziz. These articles, published in Web of Science-indexed journals and addressing pertinent socio-economic issues of the time, would have met the deliverables criteria for research today. UM's first patent was granted in 1980 for the PVC hand pump invented by the research team of Professor Goh Sing Yau through an international fund. The pump had benefitted communities in 11 countries including Africa.

Research at UM from the early days was driven by the passion and dedication of our academics who truly enjoyed their work and believed in the importance of their contribution. Government funding that started coming in the 1980s provided further support and motivation for our research work to grow from strength to strength. The Intensification of Research in Priority Areas (IRPA) programme was introduced in 1988 to strengthen the system of research and development financing under the provisions of the then Ministry of Science, Technology and Environment (MOSTE). Research funding continued over the next decades with the Ministry of Education introducing its Scheme Research Programmes, as well as other ministries and agencies having their respective R&D allocations. In 2006 when UM was accorded Research University (RU) status along with three other universities, we received annual block grants to support research intensification expected of RUs.

UM's research evolved from individual projects to programmes incorporating wider disciplines, focusing on common themes or issues to solve, and researchers were able to find their footing or hone their expertise in their respective areas of interest. In 2010, UM leadership imposed the requirement to publish in ISI-cited journals as part of the annual appraisal for all academics, who again rose to the challenge to overcome any psychological barriers and delivered their KPIs. Then the High Impact Research (HIR) progamme was introduced, specifically with the aim of getting high impact publications in top tier journals. Analyses have shown that the HIR did contribute significantly towards increasing the numbers of high impact publications, which are now garnering high citation counts and partly contributing to putting UM among the top ranked universities in the world.

In realizing the need to stress on trans-disciplinary research for a more holistic approach in problem solving, UM created Flagship projects, followed by Grand Challenge research programmes. Yet

faster and more tangible external impacts were realized through Community Engagement projects managed by UM Community and Sustainability Centre (UMCares), prototype grants by UM Centre for Innovation and Commercialization (UMCIC) and Living Lab project by the then Sustainability Science research cluster. At the national level, there was the Knowledge Transfer Programme (KTP). Through these initiatives, the impacts on society were more evident and encouraging but sustaining the benefits may be an area that needs further support.

UM researchers in recent years have seen tremendous success in securing international research grants -- 400% increase both in terms of numbers of projects and grant quantum over the last three to four years. Factors that could have contributed to this increase are that researchers are forced to apply for international grants due to limited internal and local funds, researchers are more confident having seen their work published in high impact journals and getting good citation counts, and they are gaining more contact or linkage with potential international collaborators. However, one important strategy was to create a unit with a dedicated research manager solely to look for calls for international grants, the requirements and giving one-on-one assistance in completing and submitting the applications. Impact in international partnerships clearly shows much higher citations for publications compared to papers with no international collaboration.

In 2015, UM became a collaborative partner for BPKI, JPT to implement a project on enhancing Malaysian Research Management and Governance funded by the Newton Ungku Omar Fund. Four key areas are full economic costing for research, data curation and repository, research impact, and professional research managers. We have had the opportunity to learn more about REF in the UK.

UM would like to ensure that the research momentum is sustained so as to further enhance interdisciplinary research as this is important not only to optimize resources but also to provide integrated solutions to problems. It is also desirable for us to balance applied and fundamental research because it is vital for new discoveries to be supported by sound theory and fundamentals.

5. CONCLUSIONS

Realizing research impact requires both top-down and bottom-up approaches that are well aligned and complementary to each other. Research directions should not only be in line with the organisation's strategies, vision and mission, the national agenda, and universal trends, but should also take into account current research strengths and emerging areas. While maintaining high impact publications as testament to the quality of work carried out, we need to show significant external or societal impact. For government funders, what is probably more important is to clearly relate an output to the resource in order make better judgement for future planning.

Areas to facilitate in enhancing research impact are as follows:-

- stakeholders involvement in conceiving ideas for research
- identification of impact and impact pathways in proposal writing
- institutional support to administer research management processes
- researchers competency in keeping up with rapid changes
- comprehensive database to track progress and analyse performance

We need to be more adept with engaging stakeholders from all sectors of the economy even before the conception of a research topic and identifying impact and impact pathway during the planning stage. If a system is put in place for stakeholders' engagement and establishing impact pathway, monitoring impact and determining the returns on investment will be more straight-forward. The current practice of tracing back "how it all began" for a particular research outcome, is often

cumbersome because it could mean going back many years of work and going through different sources of funding at different stages of the research.

Research can benefit much from a conducive ecosystem that ensures good support services and facilities. While our researchers spend time keeping up with new subject areas and technologies, as well as looking for grants, they need the assistance of professional research managers who are dedicated in seeing to the smooth-running of all research processes from proposal writing, budgeting, and submission to procurement and expenditure, progress monitoring, project closure and reporting of impact.

The U21 Ranking of National Higher Education Systems 2018, evaluating research performances of 50 countries has put Malaysia at number 26 for Overall Rank, 33 for Connectivity, 15 for Environment and 12 for Resources but a poor rank of 42 for Output. U21 Output is measured in terms of quality of publications, PhD graduates, employability and throughputs relative to the researchers. Despite our numbers of PhD graduates increasing, there is probably a need to have a bigger plan and strategy for the country's readiness to employ PhD graduates at suitable levels in industries and means to sustain funding for the publication of high impact papers. At the university level, we can heighten connectivity through stakeholders' engagement and global partnership in research. Increasing international collaborations also requires very focused effort and adopting practices compatible with those of our potential partners.

Supporting researchers' mobility and interactions with stakeholders is relevant in enhancing their outlook, perspectives and competency. Hence, initiatives geared towards this effort would certainly be beneficial to our researchers.

Finally, we are in dire need of a comprehensive database that is accessible to researchers and research managers. A data management system for data on research, as well as research data sets, needs to be established as this will provide means for strategic analyses and facilitate the formulation of research ideas and direction.

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OPINION

Philanthropic Fund Raising for Higher Education

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ABSTRACT

With the recent trend towards mass higher education, funding for higher education has become an important issue around the globe. Many governments do not seem to be able to afford it. Economic crisis from time to time makes the situation even worse. Fundraising by universities from alternative sources is increasingly being discussed. This article intends to give an introduction to philanthropic fundraising for higher education and research. Early history of fundraising for higher education and fundraising scenarios in the US, UK and EU are presented. Different models of university fundraising is outlined. Some thoughts on the potential of university fundraising in the Malaysian context are presented towards the end.

Keywords: philanthropic fundraising; fundraising models; higher education; fundraising history; Malaysian scenario

1. INTRODUCTION

An increasing fraction of the population across the globe is receiving university education nowadays. Traditionally, in majority of the countries, higher education has been mainly funded by the government. However, with the recent trend towards mass higher education, many governments are finding it increasingly difficult to fully fund university education. Over the years, higher education sector has been the victim of budget cuts in times of financial crisis. This has put universities in a vulnerable situation.

There has been an increasing expectation worldwide that universities should raise funds from alternative sources. Public universities in Malaysia have also been asked to raise funds on their own to meet a part of their expenditure. This has become an important issue for higher education leaders in the country. This article intends to give an introduction to fundraising for higher education and research. Early history of fundraising is presented in the next section which is followed by fundraising scenarios in the US, UK and EU. A summary of the different models of university fundraising is then provided. Following this, some thoughts on Malaysian scenario are briefly discussed.

2. EARLY HISTORY OF GIVING TO THE CAUSE OF HIGHER EDUCATION

The history of fundraising for higher education probably dates back as early as 387 BC when Plato established the Academy in Athens. The Academy was established through contributions, which included land endowment, by Plato himself, and Cimon, an Athenian statesman and military leader. The endowment generated income to sustain the Academy which operated for the next nine hundred years

(Cook & Lasher, 1996). Another example of philanthropic funding for higher education is associated with the University of Al-Qarawiyyin, which is in Fez, Morocco. The university is considered to be the oldest continually operating first degree-awarding educational institution in the world (University of Al-Quaraouiyine; UNESCO). The donation from Fatima al-Fihri, the daughter of a wealthy merchant Mohammed al-Fihri, made it possible to establish this higher education institution in 859. In more recent time, the history of giving to the cause of higher education is associated with the Harvard College (established in 1636), which eventually grew into the Harvard University. A young clergyman, John Harvard, donated half of his estate and his personal library to the college. His monetary contribution allowed the college to send a delegation to England in 1643 to gain additional financial support for the college (Harvard University). Here is an excerpt from what can probably be considered as the first fundraising brochure for higher education (The Economist, 2015):

"After God had carried us safe to New England, and we had builded our houses, provide necessaries for our livelihood, reared convenient places for God's worship and settled Civil Government, one of the next things we longed for and looked for was to advance learning and perpetuate it to posterity."

Philanthropic fundraising for the cause of higher education continues to gain more and more importance. It has been proven to be very successful in the USA. Universities in other parts of the world are also exploring fundraising as a means to gain financial sustainability. Fundraising scenario in a few country/region is briefly presented in the next section.

3. UNIVERSITY FUNDRAISING IN DIFFERENT COUNTRIES

3.1. The USA

In the US, fundraising for higher education has a deep-rooted base since its beginning with the establishment of the Harvard College as mentioned above. Fundraising is considered to be a part of the culture in the US where government role is desired to be limited. Citizens are habituated to support these institutions (Times Higher Education, 2009). Giving to the cause of higher education can be related to a bigger culture of philanthropy in the US. In 2016, the total of philanthropic giving in the US amounted to USD 390 billion (The Giving Institute, 2017) which is 2.11% of the US GDP. Religious organizations received the highest, USD 119 billion (32%) from philanthropy. The higher education sector raised USD 41 billion in 2016. Out of this amount, USD 17.45 billion (42.50%) came from alumni and non-alumni individuals, while different foundations donated USD 12.45 billion. Corporations' donations to higher education amounted to USD 6.60 billion (Council for Aid to Education, 2016). A bulk of the philanthropic grants given to the US higher education sector is attracted by the top few universities, for example, Harvard, Stanford etc. The top 1% of US universities raised 27% of all donations to higher education.

Fundraising, as a profession, is quite well established in the US. Universities offer academic courses and degree programmes to train professionals specialized in fundraising (Erwin, 2011). Fundraising emerged as an academic sub-discipline there. Graduate level research is carried out on fundraising for higher education (Satterwhite, 2004; Caboni, 2010; Walcott, 2015; Garland, 2013; Proper, 2011; Carver, 2014).

A lot of efforts go into developing the profession of fundraising. A few of the famous professional organizations in this area include the Council for Advancement and Support of Education (CASE) and Council for Aid to Education (CAE). CASE is a large organization and has established itself beyond the shore of the US. It has 3670 member universities, colleges and schools in 82 countries (Advancement and Support of Education). It is the largest of its kind in the world with its offices in London, Washington

DC and Singapore. CASE provides professional support service and training, administers award for outstanding practice, publishes books, provides tools and engages in advocacy.

In the US universities, fundraising is considered to be a critical management function, similar to that in a non-profit organization (Erwin, 2011). University presidents in the US generally play the central role in fundraising. In fact, fund raising effectiveness is very often considered as an important factor in the selection of presidents and as an indicator of their success. Presidents provide the administrative leadership and mainly focus on big donors. He/she is, of course, supported by team efforts of all, including fundraising officers, administrators and faculty members (Satterwhite, 2004; Cook, 1994).

3.2. The UK

The UK used to have the tradition of voluntary support for higher education in the early period (Proper, 2009). But in the twentieth century, higher education in the UK has mainly been supported by the government. In recent years, however, declining support from the government has forced the universities to resort to fundraising efforts. The higher education sector in the UK has been putting serious efforts on fundraising for only a decade or so. This is in contrast with the US which has an unbroken history of fundraising for centuries. The quantum of fund raised in the UK for higher education is obviously lower compared with that in the US. Oxford and Cambridge Universities are the largest recipients of funds with each receiving between £200m - £250m per year (Thomas, 2016).

Fund raising does not happen automatically. Universities have to put considerable efforts, invest adequately and hire well trained human resources for raising funds. In the UK, a survey shows that universities spent £55 million on fundraising in 2006-07, and each university employed an average of ten staff to do the job (Times Higher Education, 2009). One of the main challenges that the UK universities currently face in fundraising is a serious lack of qualified fundraising professionals. It is estimated that the need for fundraising staff will double or even triple by 2020 (Gallagher, 2014). The UK universities have been increasingly looking to recruit fundraising professionals from the US and Canada, which have a more mature fundraising sector.

3.3. The EU

The EU as well is paying attention to fundraising for higher education in recent time (European Commission, 2006; European Commission, 2008; European Commission, 2011; Pérez-Esparrells, & Torre, 2012). In the past, fundraising was not taken seriously by universities in the EU countries as they were traditionally supported by the respective governments. Citizens normally have expectation of high public spending for education and research, as they pay higher taxes. In general, philanthropic giving in the EU countries is also lower compared with that in the US. But the EU nowadays recognizes that universities should engage in fundraising rather than depending solely on the government. The EU is asking member governments to play their roles in terms of improving the public policy and in developing the culture of giving. The EU is also urging the universities to develop the culture of asking (European Commission, 2011; Pérez-Esparrells, & Torre, 2012). Some of the main difficulties of fundraising in Europe include lack of philanthropic spirit, tax incentives, and institutional fundraising infrastructure (Mora & Nugent, 1998). The EU came up with a set of ten recommendations to facilitate fundraising by universities (European Commission, 2008):

1. Universities should include fundraising from philanthropy as part of their overall strategy.
2. Build up internal fundraising competences within universities.

3. Review the qualifications required of university leadership to include fundraising skills and make fundraising one of their core responsibilities.
4. Review management and accounting practices at universities.
5. Take advantage of increased university autonomy.
6. Explore possibilities for the creation of university foundations.
7. Introduce a system of 'matching funds' by government for donations raised from private donors.
8. Review fiscal rules to make them more inviting to university research fundraising.
9. Claim the 'right of philanthropic transfer' within the EU.
10. Promote a culture of giving and create a culture of asking.

These recommendations take into account the fact that fundraising for higher education is not something that universities can tackle alone. Both governments and policy makers have important roles to play.

4. FUNDRAISING MODELS

There are different ways a university can raise funds. University fundraising efforts have been categorized into four major models (European Commission, 2008):
1) Alumni Model, 2) Major Gift Model, 3) Foundation Research Model, and 4) Multi-Mode Model.

The Alumni Model is characterized by a continuous collection of small donation by the alumni relationship office of a university. Such an office is also called an institutional advancement office or a development office. Interactions with potential donors are usually structured but informal, and include mass mailings of standard letters, e-mails etc. In the Major Gift Mode, universities attract donations from wealthy individuals. Such donations are larger than those targeted by other models and their use is usually specified by the donors. University leadership including the president plays the main role in connecting and creating personal relationship with these wealthy individuals. In the Foundation Model, individual researchers apply for research grants to different public and private funding bodies for research. The main actors in this model are individual researchers. In the Multi-Mode Model, more than one models are combined to raise fund.

It may be noted in this connection that Waqf, a pious endowment in the Islamic tradition, can be an effective mechanism to raise funds for higher education (Mahamood & Rahman, 2015; Koç, 2012). The use of Waqf in higher education is quite well established in Turkey, where 75 out of a total of 195 universities are substantially funded through Waqf (Razak et al., 2016). A couple of universities in Indonesia are also fully funded through Waqf. Some universities in Malaysia established their Waqf funds and so far raised a small amount of money (Razak et al., 2016). This avenue deserves to be further explored on a wider scale.

5. MALAYSIAN SCENARIO

Different public universities in Malaysia are currently generating some funds on their own. But the amount raised is meagre at present. University authorities are struggling with raising a substantial amount to make them financially sustainable in the long run.

In order to analyse the potential of fundraising for higher education in Malaysia, let us assume that the amount raised for higher education is correlated with the giving tendency of the citizens of a nation. The Charities Aid Foundation has developed the World Giving Index which measures the propensity of the population of a country to give charity (Charities Aid Foundation, 2016). The World Giving Index is

measured by the average of the following three factors: 1) percentage of population giving money to charities, 2) percentage of the population who have volunteered for an organisation in the previous month, and 3) percentage of the population who have helped a stranger in the previous month. The sum of these three quantities divided by three gives the World Giving Index. According to the Global Giving Index, Malaysia's position is 22nd out of a total 140 countries surveyed (Charities Aid Foundation, 2016). This can be considered as encouraging. Detailed data on the giving habits of Malaysians are not available though. Limited number of studies shows that 71.8% of Malaysians would like to contribute to religious causes, while 23.9% would like to donate to education (Rohayati et al., 2016; Bustamy et al., 2002).

One can do a back-of-the-envelope calculation regarding how much money can possibly be raised for higher education in Malaysia. As mentioned earlier, charity in the US accounts for 2.11% of GDP. In the EU, it varies from country to country: the range can be between 0.1 - 0.8% of GDP. The average in EU is 0.2% of GDP for nine countries (Observatoire de la Fondation de France / CERPhi, 2015). In the absence of any such data for Malaysia, let us assume that philanthropic giving in Malaysia is in the lower side of the EU range and is approximately 0.1-0.5% of GDP. Assuming that 15% of this amount can be attracted to the cause of higher education, universities in Malaysia have the potential to raise between RM186 to 932 million every year (calculated based on the GDP of 2017). This is just an indicative amount and by no means accurate. Research needs to be carried out to make more accurate estimates.

The above amount may not be very large compared with the operating budget of twenty public universities, which is RM6.72 billion in 2018. The amount turns out to be between about 3-14% of the operating budget. Even to raise this amount, it will be important at this stage to create an effective ecosystem for fundraising for higher education in the country. Facilitation by the government, civil society and other stakeholders can go a long way in promoting the culture of giving to the cause of higher education. Universities themselves need to create the internal infrastructure, engage in capacity building, invest and employ trained professionals to help with fundraising.

6. CONCLUSION

Recent trend towards mass higher education is making it increasingly difficult for governments to fully fund university education. As a result, fundraising by universities has become an important issue in many parts of the world. Fundraising for higher education is quite mature in the US, which has an unbroken tradition for centuries. The success of university fundraising in the US is thought to be related to the greater culture of philanthropy and the desire for limited role of government. The UK universities, in recent decades, are working seriously on fundraising as government support for higher education is dwindling. The UK universities are mainly adapting the US fundraising model. The EU is also encouraging the governments and universities in member countries to develop fundraising for higher education and research. There are four major models of university fundraising: Alumni Model, 2) Major Gift Model, 3) Foundation Research Model, and 4) Multi-Mode Model. In addition, Waqf, a pious donation in the Islamic tradition, has been found to be successful in some Islamic countries, e.g. Turkey. Universities in Malaysia have reasonable potential to raise funds. To be successful, universities need to create internal infrastructure, engage in capacity building, invest and employ trained professionals. However, the success will not depend only on universities. It will require the development of a culture of giving to the cause of higher education where government, policy makers, civil society and other stakeholders have big roles to play.

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