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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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Editor's Remarks

Dear Readers,

It is our distinct pleasure to welcome you to the latest issue of the Journal of Research Management and Governance (JRMG). As we navigate an increasingly challenging research landscape, the importance of effective research management has never been more apparent.

In recent years, we have witnessed significant shifts in how research is conducted, funded, and disseminated. The rise of interdisciplinary collaboration, the push for open science, and the growing emphasis on societal impact have all contributed to a transformation in research management practices. As practitioners and scholars in this field, we should continually adapt and innovate to support the advancement of knowledge while ensuring responsible and efficient use of resources.

In this issue, we present a diverse range of articles that explore critical challenges and emerging trends in research management:

(a) Setting the Benchmark: A Comparative Analysis of Research Performance Indicators between Leading World Research Universities and Top-Ranked Research Universities in Malaysia: This article provides the comparison on the research performance and research preferences of leading world universities with those of highly ranked Malaysian universities. The analysis of the research performance offers insights for refining the research focus of Malaysian universities and strengthening international and corporate partnerships as well as unique regional research areas.

(b) Framework to Humanise Research Support in Academic Institutions: The ever-evolving landscape of research management is a fundamentally human endeavour that encompasses individuals and institutions. Our authors propose a new framework based on which, universities can create a research ecosystem that balances global goals with local relevance, resulting in a collaborative working model that is more strategic.

(c) Reshaping Research Ecosystems: Recommendations for Equitable Recognition of Non-STEM Research in Higher Institution Management: In recent years, there is an increasing call for more holistic approach to evaluating academic contributions, recognising the value of diverse disciplines and the limitations of purely quantitative assessments. This article highlights the importance of widening the concept of research impact, including qualitative evaluations, and embracing interdisciplinary approaches. It also discusses the impact of university rankings and the incorporation of SDGs in reframing the value of non-STEM disciplines.

(c) **Empowering Research Ecosystems: Profiles and Bibliometrics Analysis of Research Officers at Universiti Malaya:** The future trajectory of Universiti Malaya (UM) as a prominent regional research institution in Malaysia is intricately intertwined with the expertise and contributions of its research workforce, including the Research Officers (ROs). This article provides an overview of their general roles in empowering UM's research and innovation landscape, and uses bibliometric analysis of data from the Scopus database to examine their scholarly output produced between 2018 and 2022. The findings show that the ROs consistently contribute to scholarly output and the important role of ROs in a Malaysian research university.

We are honoured to feature both empirical studies and theoretical frameworks in this issue that contribute to the growing body of knowledge in research management. As we move forward, JRMG remains committed to serving as a platform for sharing insights, best practices, and critical analyses that advance our understanding of effective research management. We encourage submissions that challenge existing paradigms and propose innovative solutions to the complex problems facing our research community.

We would like to express our appreciation to the authors for their valuable contributions and the reviewers whose thoughtful feedback has helped enhance the quality of the published work. We hope that the articles in this issue will encourage new ideas and inspire meaningful discussion among our readers. We look forward to your continued engagement with JRMG.

Thank you.
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RESEARCH ARTICLE

Setting the Benchmark: A Comparative Analysis of Research Performance Indicators between Leading World Research Universities and Top-Ranked Research Universities in Malaysia

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ABSTRACT

The National Higher Education Strategic Plan 2007-2020 and the Malaysia Education Blueprint (Higher Education) 2015-2025 aim to strengthen research and innovation in Malaysian universities, positioning them as world-class institutions. As a result of these national initiatives, six Malaysian universities have been ranked among the top 500 in the Times Higher Education (THE) World University Rankings 2024. This paper examines the institutional research performance of the top-ranked Malaysian universities in comparison to the leading world universities. Ten top-ranked world and Malaysian universities were identified based on the Times Higher Education World University Rankings 2024. Bibliometric indicators from Elsevier's SciVal were used to compare research performance among these universities from 2018 to 2023. The results indicate that the leading world universities outperform the top-ranked Malaysian universities in areas such as scholarly output, citation counts, and research impact measured by citations and publication in top journal percentiles. They are pioneers in their respective subject areas, with citations of their publications being twice the world average. Malaysian universities are active in international co-authorship but show lower impact, reflecting a growing yet developing academic influence compared to leading world universities. The publication landscape of the world's leading universities is dominated by the subject areas of Medicine, and Physics and Astronomy. Malaysian universities demonstrate a broader range of subject area preferences, with a strong emphasis on Engineering. By benchmarking against the world's leading institutions, Malaysian universities can identify areas for research improvements to enhance their world rankings.

Keywords: Bibliometric Analysis, Research Preferences, Research Universities, Scholarly Output, World University Rankings

1. Introduction

A university is an institution of higher education for creating, preserving, and disseminating knowledge. The concept of a research university is not a recent development as it originated among German universities during the early nineteenth century, as well as was established in the United States after the conclusion of the Civil War (Atkinson & Blanpied, 2008). A research university differs from a traditional university due to its primary emphasis on advanced research. Such a university allocates a significant amount of its resources to postgraduate studies, research, and innovation activities. The impact of research universities on the economy and society can be measured by metrics such as the advancement of a nation's industrial development, attainment of Nobel Prizes, increase in international student enrolment, and enhancement of global standing.

The mandate of globalization requires Malaysian universities to adapt to the new global landscape. Therefore, four public universities were designated as research universities in 2006, with a primary focus on research innovation and commercialization. The aim of this initiative was to have two Malaysian universities ranked among the top 100 world universities (Sheriff & Abdullah, 2017). Two national initiatives were formulated to transform higher education in Malaysia: the National Higher Education Strategic Plan 2007-2020, and the Malaysia Education Blueprint (Higher Education) 2015-2025. The transformation aims to achieve national success by developing a knowledge-based economy and cultivating quality human capital characterized by knowledge, skills, innovation, and competitiveness. To date, there are a total of five research universities in Malaysia, namely Universiti Malaya, Universiti Putra Malaysia, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, and Universiti Teknologi Malaysia. These universities are expected to serve as models of research excellence for other Malaysian universities, which are categorized as focused or comprehensive universities. To date, a total of 26 Malaysian universities are ranked in the Times Higher Education (THE) World University Rankings (Times Higher Education: World University Ranking 2024, 2024).

There are several reputable global methodologies that assess research-intensive universities according to their primary objectives. One such evaluation is the World University Rankings by the Times Higher Education (THE), while other prominent rankings for higher education institutions include the Academic Ranking of World Universities (ARWU) and the QS World University Rankings. All three ranking systems have explicit evaluation criteria that are specifically designed for research universities. THE evaluates the university's performance through five areas: i) teaching (the learning environment), ii) research environment (volume, income, and reputation), iii) research quality, iv) international outlook (staff, students, and research), and v) industry (knowledge transfer) (Times Higher Education: World University Ranking 2024, 2024). Based on these criteria, research universities are distinguished by the quantity of publications and the breadth of subject areas. A university is required to publish a minimum of 150 diverse publications annually, with no single subject area accounting for more than 80% of the publications.

ARWU, also known as the Shanghai ranking, was originally compiled by the Shanghai Jiao Tong University, emphasizing Nobel laureates, ground-breaking publications, and highly cited researchers. QS World University Rankings uses various metrics to measure university performance, including academic and employer reputation, faculty/student ratio, citations per faculty, international faculty and student

ratio, international research network, employment outcomes, and sustainability (QS World University Rankings 2023). To be ranked, an institution is required to fulfil three eligibility criteria that include reputation threshold, research threshold (no less than 100 Scopus-index publications in the last five years), and size.

In Malaysia, the Malaysian Research Assessment (MyRA) is a research performance metric used to measure the university's research and development performance. Seven criteria were used to measure inputs, outputs, outcomes, and the impact of the universities' research and development and commercialization activities. Universities are rated based on their annual performance and awarded rating stars accordingly. Research universities must achieve a 6-star rating to maintain their status.

As research is a fundamental criterion in university ranking, it is imperative to understand the impact of research on the overall academic reputation and global competitiveness of a university. Thus, the aim of this paper is to compare the research performance and research preferences of leading world universities with those of highly ranked Malaysian universities. The research questions of this study are as follows:

Q1) What are the key research performance differences between leading world universities and top-ranked Malaysian universities?

Q2) Do research preferences differ between leading world and top-ranked Malaysian universities?

2. Methodology

The Times Higher Education (THE) World University Rankings 2024 was used to determine the ten top-ranked world and Malaysian universities. Bibliometric data from Elsevier's SciVal from the period of 2018 to 2023, was used to analyze and compare the research performance of these universities across various criteria.

2.1 World University Rankings

The Times Higher Education (THE) World University Rankings 2024 was used to determine the 10 top-ranked universities in the world. The THE World University Rankings is a globally recognized ranking system that evaluates research-intensive universities. A new methodology (WUR3.0) has been expanded from 13 to include 18 calibrated performance indicators. These indicators evaluate a university's performance across five areas: teaching (29.5%), research environment (29%), research quality (30%), international outlook (7.5%), and industry (4%). The two areas relevant to this study are research environment and research quality.

The research environment considers a university's reputation for research excellence (18%), research income (5.5%), and research productivity (5.5%). A university's research excellence reputation is determined by an annual academic reputation survey completed by peers. Research income is adjusted based on the number of academic staff members and purchasing power parity (PPP). This indicator is normalized to accommodate each university's subject profile and to acknowledge that bigger research grants were awarded to science research than social science, arts, and humanities research. Research productivity was measured using the number of academic publications in Elsevier's Scopus-index

journals, scaled for institutional size, and normalized by the subject.

The indicators for research quality examine the contribution of a university in sharing and transferring knowledge through published work. This evaluation consists of four indicators: citation impact (15%), research strength (5%), research excellence (5%), and research influence (5%). The citation impact captures a university's research influence by capturing the average number of citations received by published work. The data includes all indexed publications indexed between 2018 and 2022, along with citations to these publications made from 2018 to 2023. The data are normalized to account for differences in citation volume across various subject areas. This prevents institutions from gaining an unfair advantage in research subjects with traditionally high citation counts. The research strength is measured by the 75th percentile of the field-weighted citation impact (FWCI). FWCI measures the number of citations received by a publication compared to the average or expected citation received by similar publications over three years. A FWCI value greater than 1 indicates higher-than-average citations for similar publications worldwide, while a value of 1 indicates average impact. Research excellence measures the number of publications in the top 10 percentiles normalized by year, subject, and staff numbers. Research influences measure the citation count and the importance of citing papers, considering that different disciplines have different citation patterns.

2.2 SciVal

Elsevier's Scopus is recognized as a reliable bibliographic database for scholarly work. SciVal, launched in 2014, is a research performance assessment tool from Elsevier that enables the analysis of Scopus datasets (Elsevier, 2024). It was used to extract the research performance of each university. Data were downloaded with an updated date of 1 May 2024. Publication data were extracted from 2018 to 2023, following the WUR methodology, which uses citations within a six-year window.

Bibliometric indicators extracted from SciVal are as follows:

a. Scholarly output: Total scholarly production by a university from 2018 to 2023. All types of indexed documents are accepted, including articles, conference proceedings, reviews, books, book chapters, etc.
b. Citation count: Number of times the set of publications from 2018 to 2023 have been cited
c. Citations per publication: Total number of citations divided by the total number of publications
d. Field-weighted citation impact: Number of citations received by a publication compared to the expected citation received by similar publications
e. Outputs in the top 10% citation percentiles
f. Publications in the top 10% of journal percentiles
g. International collaboration: Percentage of publications that involve at least two authors from institutions located in more than one country
h. Academic-corporate collaboration: Percentage of publications that involve authors with academic and corporate affiliations.

2.3 Research Preferences

All scholarly output published on Scopus was categorised using the All Science Journal Classification (ASJC) codes based on its subject area as shown in Table 1.

Table 1: Broad subject area classification by Scopus.

No	Subject Area	Subject Area Classifications
1	Physical Sciences	Chemical Engineering Chemistry Computer Science Earth and Planetary Sciences Energy Engineering Environmental Science Material Science Mathematics Physics and Astronomy Multidisciplinary
2	Health Sciences	Medicine Nursing Veterinary Dentistry Health Professions Multidisciplinary
3	Social Sciences	Arts and Humanities Business, Management and Accounting Decision Sciences Economics, Econometrics and Finance Psychology Social Sciences Multidisciplinary
4	Life Sciences	Agricultural and Biological Sciences Biochemistry, Genetics and Molecular Biology Immunology and Microbiology Neuroscience Pharmacology, Toxicology and Pharmaceutics Multidisciplinary

3. Results and Discussion

The THE World University Rankings 2024 included a total of 1904 universities in the latest assessment (THE, 2024). The top 10 in global and Malaysian research universities were determined based on THE World University Rankings 2024.

The United Kingdom and the United States dominate the top 10 research universities in the world, with seven American and three British universities (see Table 2). These universities are well-known for their excellence in education, research, and innovation. Based on the research environment score, the top five universities are the University of Cambridge (100), the University of Oxford (100), Harvard University (99.9), the University of California, Berkeley (98.8), and Tsinghua University (98.1) from China (ranked 12th overall) (data not shown). In THE 2024 rankings, Tsinghua University was ranked first among the top Asian universities. The top five universities with the highest research quality scores are Massachusetts

Institute of Technology (99.7), Stanford University (99.6), Harvard University (99.4), University of California, Berkeley (99.0), and University of Oxford (99.0) (see Table 3).

Table 2: THE World University Rankings 2024: Top 10 universities in the world.

Times Higher Education (THE) World University Rankings 2024: Top 10		
1	University of Oxford	United Kingdom
2	Stanford University	United States
3	Massachusetts Institute of Technology	United States
4	Harvard University	United States
5	University of Cambridge	United Kingdom
6	Princeton University	United States
7	California Institute of Technology	United States
8	Imperial College London	United Kingdom
9	University of California, Berkeley	United States
10	Yale University	United States

Table 3: Top 10 universities in the world ranked according to their overall score, research environment, and research quality.

No.	Name of University	Scores		
		Overall	Research Environment	Research Quality
1	University of Oxford	98.5	100.0	99.0
2	Stanford University	98.0	97.8	99.6
3	Massachusetts Institute of Technology	97.9	96.2	99.7
4	Harvard University	97.8	99.9	99.4
5	University of Cambridge	97.5	100.0	98.0
6	Princeton University	96.9	97.9	98.8
7	California Institute of Technology	96.5	98.0	95.9
8	Imperial College London	95.1	95.5	98.6
9	University of California, Berkeley	94.6	98.8	99.0
10	Yale University	94.2	94.9	97.7

The recent THE World University Rankings reveal that all five Malaysian research universities, Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Universiti Teknologi Malaysia, and Universiti Putra Malaysia are ranked in the top 10 universities in the country. It is worth noting that Sunway University is the only private university that made it into the top 10 universities in the ranking, with the other 9 being public universities (see Table 4). The top 5 Malaysian universities ranked by research quality are Universiti Teknologi Petronas (77.7), Universiti Malaya (72.6), Sunway University (71.7), Universiti Utara Malaysia (69.7), and Universiti Malaysia Pahang Al-Sultan Abdullah (67.5) (see Table 5). Malaysian universities generally have a lower research environment score (>40). The top 5 Malaysian universities with the best research environment are Universiti Teknologi Petronas (37.8), Universiti Malaya (35.4), Universiti Putra Malaysia (30.5), Universiti Teknologi Malaysia (29.3), and

Universiti Kebangsaan Malaysia (27.8).

In comparison to the near-perfect overall, research environment, and research quality scores of the leading world universities, the top Malaysian universities received significantly lower scores. This highlights a significant gap in research excellence and capability. The disparity underscores that leading world universities have greater resources, including advanced infrastructure, funding, and intellectual assets, compared to Malaysian universities.

Table 4: THE World University Rankings 2024: Top 10 Malaysian universities.

No.	Name of Institution	THE World University Rankings 2024
1	Universiti Malaya	251-300
2	Universiti Teknologi Petronas	301-350
3	Universiti Kebangsaan Malaysia	401-500
4	Universiti Sains Malaysia	401-500
5	Universiti Teknologi Malaysia	401-500
6	Universiti Utara Malaysia	401-500
7	Universiti Putra Malaysia	501-600
8	Universiti Malaysia Pahang Al-Sultan Abdullah	601-800
9	Universiti Pendidikan Sultan Idris	601-800
10	Sunway University	601-800

Table 5: Top 10 Malaysian universities ranked according to their overall score, research environment, and research quality.

No.	Name of University	Scores		
		Overall	Research Environment	Research Quality
1	Universiti Malaya	53.1 – 55.8	35.4	72.6
2	Universiti Teknologi Petronas	51.1 – 53.0	37.8	77.7
3	Universiti Kebangsaan Malaysia	45.4 – 49.0	27.8	58.7
4	Universiti Sains Malaysia	45.4 – 49.0	27.8	60.0
5	Universiti Teknologi Malaysia	45.4 – 49.0	29.3	65.0
6	Universiti Utara Malaysia	45.4 – 49.0	27.6	69.7
7	Universiti Putra Malaysia	41.9 – 45.3	30.5	51.2
8	Universiti Malaysia Pahang Al-Sultan Abdullah	37.0 – 41.8	19.0	67.5
9	Universiti Pendidikan Sultan Idris	37.0 – 41.8	25.2	38.8
10	Sunway University	37.0 – 41.8	14.6	71.7

Publication performance is vital for international university rankings such as the THE World University Rankings. Scholarly publications, including journal articles, conference proceedings, books, book chapters, editorials, letters, notes, errata, and short surveys, play a vital role in evaluating the quality and impact of research. In this study, the research performance of universities was analysed using SciVal. Harvard University produced the highest number of scholarly outputs (186,885) from 2018 until 2023, followed by the University of Oxford (107,406) and Stanford University (100,898) (see Table 6). Harvard University also received the highest total number of citations (4,551,927), which is attributed to its

scholarly outputs, surpassing all other universities. In relation to scholarly publications, the number of citations per publication reflects the impact of the research. The Massachusetts Institute of Technology had the highest average citations per publication, with an average of 29.5, and the highest FWCI of 2.40. The top 10 universities in the world generally have an FWCI higher than 2.0. An FWCI higher than 2.0 indicates that the publication will be cited twice more than the world average for similar publications. The Massachusetts Institute of Technology has the highest percentage of publications (54.2%) in the top 10% journal percentiles and the highest percentage of outputs (25.4%) in the top 10% citation percentiles among the top 10 universities in the world. Imperial College London had the highest level of international collaboration, with 64.9% of its publications involving international partners. On the other hand, the Massachusetts Institute of Technology recorded the highest percentage (10.3%) of academic-corporate collaboration. In general, the top 10 universities in the world all demonstrated high levels of scholarly productivity, citations per publication, publication in the top 10% of journal percentiles, and strong international collaboration.

Among the top-ranked universities in Malaysia, Universiti Sains Malaysia has the highest number of scholarly outputs (28,107), followed by Universiti Malaya (27,844) and Universiti Kebangsaan Malaysia (26,215) (see Table 7). It is worth noting that there is a significant disparity in the total number of scholarly outputs among the top 10 Malaysian universities, with Universiti Pendidikan Sultan Idris having the lowest number of scholarly outputs at 3,250. The five research universities have more publications than other universities. According to the number of scholarly publications, the top three Malaysian universities, in terms of the highest total number of citations, are Universiti Malaya (441,835), Universiti Kebangsaan Malaysia (333,754), and Universiti Sains Malaysia (325,032). Universiti Malaya (15.9) achieved the highest number of citations per publication, followed by Sunway University (14.3). It is essential to highlight that Sunway University has the highest FWCI (1.74) among the top 10 Malaysian universities. Generally, the top ten Malaysian universities have a minimum FWCI of 1.05, equivalent to the average world citation for a similar publication. Sunway University stands out regarding outputs in the top 10% citation percentiles and publications in the top 10% journal percentiles. Sunway University has the highest number of top-cited (19.8%) and top-ranked (23.0%) publications among the top 10 Malaysian universities.

A recent study identified three factors that influence the citation and impact of research. These factors include paper-related factors (e.g., paper quality, work novelty, and field characteristics), journal-related factors (e.g., the impact factor, journal scope, and the form of publication), and author-related factors (e.g., number of authors, international and national collaborations, gender, age, and race) (Tahamtan et al., 2016). It is important to note that citation indicators are useful in measuring the impact of a study in academia. However, studies that reach practitioners may not be cited in scholarly work but are still valuable and can have an impact in industry. It has been observed that university rankings are strongly correlated with research impact. A higher level of research impact is associated with a higher university ranking (Lancho-Barrantes & Cantu-Ortiz, 2021). Sunway University (69.3%), Universiti Teknologi Petronas (60.7%), and Universiti Malaya (58.7%) are the top three universities in Malaysia that have been actively collaborating with international institutions. These universities have been performing exceptionally well in terms of international collaboration and are on par with the world's leading universities. The proportion of international research collaborations has increased from 4.7% in 1980 to

25.7% in 2021 (Aksnes & Sivertsen, 2023). This has stemmed from the increasing complexity of interdisciplinary scientific research, more funding opportunities, and greater mobility among researchers (Larivière et al., 2015). International collaborations tend to lead to a greater research impact, resulting in higher citation rates than domestic collaborations. It is worth noting that publications with international collaboration are likely to be cited twice as often as single-country publications. On the other hand, the global trend of academic-corporate collaboration has also shown an increasing trend. The different forms of collaboration include research partnerships, equipment and facility sharing, and commercialization acceleration. By leveraging shared experience and resources, collaboration between academia and corporations can lead to industry-specific problem-solving, validation of work, financial benefits, and promotion of innovation (Esangbedo et al., 2024; Evan et al., 2023). Among the Malaysian universities, Universiti Teknologi Petronas (5.0%) achieved the highest percentage of academic-corporate collaboration, followed by Universiti Malaya (2.5%) (see Table 6).

The analysis of research publication preferences indicates that both leading world and top-ranked Malaysian universities show a strong preference for science and engineering. Analysis of publications by subject area of the top 10 universities in the world shows that either Medicine or Physics and Astronomy is the top subject area of excellence across all top 10 universities (see Table 8). Oxford University, Stanford University, Harvard University, Yale University, and Imperial College London are known for their advancements in the field of Medicine, while Massachusetts Institute of Technology, Princeton University, California Institute of Technology, and University of California, Berkeley stand out for their strong research focus in Physics and Astronomy. Other prominent research areas for publications among the top 10 universities in the include Biochemistry, Genetics, and Molecular Biology, Engineering, Computer Science, Earth and Planetary Sciences, and Social Sciences (see Table 9). These leading universities are world leaders in their respective research areas, setting the standard for other institutions to follow.

In contrast, Malaysian universities show a broader range of subject preferences, including Medicine, Engineering, Computer Science, Agricultural and Biological Sciences, Physics and Astronomy, and Social Sciences (see Table 10). The findings reveal that Malaysian universities place a strong emphasis on Engineering, with five universities excelling in this subject area: Universiti Teknologi Petronas, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia, Universiti Teknologi Malaysia, and Universiti Malaysia Pahang Al-Sultan Abdullah (see Table 11). This finding is consistent with a study conducted by Mohd Sarjidan and Md Kasim (2023), which indicated that Malaysian universities have the highest number of publications in the field of Engineering. Each university has a different top subject area preference. For example, Universiti Putra Malaysia leads in Agricultural and Biological Sciences, while Universiti Malaya excels in Medicine, and Universiti Pendidikan Sultan Idris stands out for Social Sciences. In comparison to the leading world universities, Malaysian universities demonstrated a pronounced research focus in Engineering and Technology that reflects national development priorities.

Table 6: Research performance and collaboration metrics of the top 10 universities in the world.

No.	Name of University	Scholarly Output	Citation Count	Authors	Citations per Publication	Field-Weighted Citation Impact	Outputs in Top 10% Citation Percentiles (%)	Publications in Top 10% Journal Percentiles (%)	International Collaboration (%)	Academic-Corporate Collaboration (%)
1	University of Oxford	107,406	2,429,266	43,144	22.6	2.21	21.6	47.2	62.2	6.6
2	Stanford University	100,898	2,594,846	44,257	25.7	2.32	23.6	49.3	42.7	8.3
3	Massachusetts Institute of Technology	70,323	2,076,835	34,449	29.5	2.40	25.4	54.2	53.3	10.3
4	Harvard University	186,885	4,551,927	81,167	24.4	2.20	22.4	48.8	49.7	7.3
5	University of Cambridge	81,923	1,921,043	33,874	23.4	2.08	21.3	48.1	62.0	7.1
6	Princeton University	29,843	713,141	10,587	23.9	2.17	23.4	49.0	48.3	6.6
7	California Institute of Technology	29,411	726,547	12,097	24.7	2.09	22.8	44.0	54.1	7.7
8	Imperial College London	92,513	2,238,625	38,744	24.2	2.17	21.0	48.0	64.9	8.9
9	University of California, Berkeley	61,343	1,515,589	27,536	24.7	2.16	22.9	48.9	47.1	7.4
10	Yale University	69,497	1,460,937	28,943	21.0	2.04	20.2	46.9	41.5	6.4

Table 7: Research performance and collaboration metrics of the top 10 Malaysian universities.

No.	Name of University	Scholarly Output	Citation Count	Authors	Citations per Publication	Field-Weighted Citation Impact	Outputs in Top 10% Citation Percentiles (%)	Publications in Top 10% Journal Percentiles (%)	International Collaboration (%)	Academic-Corporate Collaboration (%)
1	Universiti Malaya	27,844	441,835	13,348	15.9	1.41	13.8	21.9	58.7	2.6
2	Universiti Teknologi Petronas	10,118	128,815	4,545	12.7	1.41	16.5	20.8	60.7	5.0
3	Universiti Kebangsaan Malaysia	26,215	333,754	14,937	12.7	1.26	11.6	15.9	41.2	1.5
4	Universiti Sains Malaysia	28,107	325,032	15,245	11.6	1.27	12.0	13.3	48.5	1.4
5	Universiti Teknologi Malaysia	25,334	298,731	13,402	11.8	1.17	13.8	15.8	52.3	1.4
6	Universiti Utara Malaysia	5,993	53,635	3,020	8.9	1.11	11.2	9.3	44.8	0.3
7	Universiti Putra Malaysia	25,023	283,228	15,211	11.3	1.05	10.7	13.7	45.2	1.0
8	Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA)	9,225	98,819	4,860	10.7	1.23	14.8	11.8	43.2	1.5
9	Universiti Pendidikan Sultan Idris	3,250	24,188	1,841	7.4	1.07	10.9	9.5	44.3	0.9
10	Sunway University	4,808	68,598	1,161	14.3	1.74	19.8	23.0	69.3	1.4

Table 8: Research publication preferences of the top 10 universities in the world.

	University of Oxford	Stanford University	Massachusetts Institute of Technology	Harvard University	University of Cambridge	Princeton University	California Institute of Technology	Imperial College London	University of California, Berkeley	Yale University
Computer Science	8.3	11.3	20.7	4.5	8.9	16.8	12.9	10.5	16.4	4.5
Mathematics	6.3	5.7	10.9	2.6	6.2	12.5	9.6	6.4	9.4	3.2
Physics and Astronomy	11.4	12.3	23.1	8.4	16.5	29.3	44.2	12.4	20.5	7.7
Chemistry	5.5	5.7	9.0	3.5	7.6	7.7	8.1	7.8	8.5	4.0
Chemical Engineering	2.5	3.2	5.1	1.8	3.8	3.9	3.6	4.7	4.2	1.8
Materials Science	4.8	6.5	11.8	2.9	8.2	7.6	11.6	8.8	10.2	2.5
Engineering	7.5	11.0	22.1	4.8	12.0	14.7	22.4	15.9	18.3	4.0
Energy	1.8	2.3	4.4	0.5	2.8	3.0	2.3	4.0	4.2	0.8
Environmental Science	5.2	3.6	4.0	2.6	5.3	5.9	4.7	4.8	8.3	3.9
Earth and Planetary Sciences	5.3	4.6	8.3	4.3	7.7	15.2	41.2	4.0	10.5	3.4
Agricultural and Biological Sciences	5.4	2.9	2.5	3.0	5.6	4.6	3.2	3.3	7.1	3.9
Biochemistry, Genetics and Molecular Biology	13.8	14.7	16.5	18.1	15.7	9.0	7.7	15.4	11.1	15.9
Immunology and Microbiology	5.0	3.5	3.8	4.8	3.6	2.2	1.7	5.5	2.9	4.2

Table 8: (cont.) Research publication preferences of the top 10 universities in the world.

	University of Oxford	Stanford University	Massachusetts Institute of Technology	Harvard University	University of Cambridge	Princeton University	California Institute of Technology	Imperial College London	University of California, Berkeley	Yale University
Veterinary	0.3	0.1	0.1	0.2	0.7	0.1	0.0	0.2	0.1	0.2
Medicine	35.0	44.4	15.4	59.2	24.4	5.3	3.3	44.4	12.9	53.5
Pharmacology, Toxicology and Pharmaceutics	1.8	1.6	1.4	2.4	1.4	0.4	0.4	2.2	0.8	2.6
Health Professions	1.2	1.6	0.7	1.9	0.8	0.3	0.1	1.3	0.6	1.4
Nursing	1.8	1.9	0.4	3.1	1.3	0.2	0.0	1.9	0.6	2.9
Dentistry	0.1	0.2	0.1	0.7	0.0	0.0	-	0.1	0.0	0.2
Neuroscience	5.5	5.5	5.6	7.3	5.5	3.7	1.9	3.9	3.5	7.0
Arts and Humanities	9.7	2.9	2.3	2.9	9.5	8.2	0.7	0.7	5.4	4.8
Psychology	3.4	3.5	1.8	4.1	3.8	2.7	0.5	1.2	3.3	6.3
Social Sciences	14.7	7.9	5.8	6.7	14.4	11.7	1.4	3.1	13.0	9.3
Business, Management and Accounting	2.1	1.3	2.1	1.2	2.3	1.4	0.3	1.1	2.1	0.9
Economics, Econometrics and Finance	2.8	1.6	2.0	1.4	2.4	3.0	0.6	0.9	2.6	1.7
Decision Sciences	1.0	1.2	2.1	0.7	1.3	1.6	0.6	1.1	1.8	0.7
Multidisciplinary	4.2	4.3	5.9	4.4	4.4	4.7	4.3	3.6	4.7	4.0

Table 9: Top five most-published subject areas by the top 10 universities in the world.

No.	University of Oxford	Stanford University	Massachusetts Institute of Technology	Harvard University	University of Cambridge	Princeton University	California Institute of Technology	Imperial College London	University of California, Berkeley	Yale University
1	Medicine	Medicine	Physics and Astronomy	Medicine	Medicine	Physics and Astronomy	Physics and Astronomy	Medicine	Physics and Astronomy	Medicine
2	Social Sciences	Biochemistry, Genetics, and Molecular Biology	Engineering	Biochemistry, Genetics, and Molecular Biology	Physics and Astronomy	Computer Science	Earth and Planetary Sciences	Engineering	Engineering	Biochemistry, Genetics, and Molecular Biology
3	Biochemistry, Genetics, and Molecular Biology	Physics and Astronomy	Computer Science	Physics and Astronomy	Biochemistry, Genetics, and Molecular Biology	Earth and Planetary Sciences	Engineering	Biochemistry, Genetics, and Molecular Biology	Computer Science	Social Sciences
4	Physics and Astronomy	Computer Science	Biochemistry, Genetics, and Molecular Biology	Neuroscience	Social Sciences	Engineering	Computer Science	Physics and Astronomy	Social Sciences	Physics and Astronomy
5	Arts and Humanities	Engineering	Medicine	Social Sciences	Engineering	Mathematics	Materials Science	Computer Science	Medicine	Neuroscience

Table 10: Research publication preferences of the top 10 Malaysian universities.

	Universiti Malaya	Universiti Teknologi Petronas	Universiti Kebangsaan Malaysia	Universiti Sains Malaysia	Universiti Teknologi Malaysia	Universiti Utara Malaysia	Universiti Putra Malaysia	Universiti Malaysia Pahang Al-Sultan Abdullah	Universiti Pendidikan Sultan Idris	Sunway University
Computer Science	12.5	24.5	16.6	12.7	25.0	28.9	12.5	20.3	20.0	15.2
Mathematics	5.2	8.9	6.2	5.3	8.6	8.0	5.4	7.0	4.3	6.4
Physics and Astronomy	15.2	15.6	12.0	12.1	17.2	8.6	9.6	14.7	12.6	19.6
Chemistry	8.9	14.2	7.9	9.1	10.2	1.8	10.0	10.0	6.4	15.6
Chemical Engineering	6.8	17.3	7.0	8.6	13.5	2.6	9.0	16.0	4.3	8.9
Materials Science	14.2	21.9	13.1	14.8	20.1	3.3	14.3	27.6	8.2	17.0
Engineering	22.3	42.3	23.6	22.1	41.3	23.1	20.0	50.5	21.2	18.0
Energy	6.4	19.3	6.1	4.8	9.5	5.5	5.2	9.9	2.9	8.7
Environmental Science	8.7	16.7	12.3	11.0	16.0	8.5	13.8	9.6	7.7	10.2
Earth and Planetary Sciences	2.9	10.0	3.4	3.5	6.6	1.4	3.4	4.5	2.9	1.7
Agricultural and Biological Sciences	6.5	2.6	8.2	7.0	4.5	2.0	20.4	3.3	6.9	3.6
Biochemistry, Genetics and Molecular Biology	9.3	4.4	9.2	9.5	6.5	2.6	10.8	4.9	7.5	8.8
Immunology and Microbiology	4.0	0.4	2.1	3.1	0.9	0.1	3.6	0.8	1.2	3.8
Veterinary	0.6	0.0	0.2	0.3	0.1	0.0	2.2	0.0	0.2	0.4
Medicine	22.8	3.5	19.3	21.2	3.7	3.6	15.3	2.6	9.4	14.3

Table 10: (cont.) Research publication preferences of the top 10 Malaysian universities.

	Universiti Malaya	Universiti Teknologi Petronas	Universiti Kebangsaan Malaysia	Universiti Sains Malaysia	Universiti Teknologi Malaysia	Universiti Utara Malaysia	Universiti Putra Malaysia	Universiti Malaysia Pahang Al-Sultan Abdullah	Universiti Pendidikan Sultan Idris	Sunway University
Pharmacology, Toxicology and Pharmaceutics	3.3	1.0	3.3	4.5	1.2	0.9	4.0	1.3	3.5	3.3
Health Professions	1.2	0.3	1.3	1.7	0.3	0.3	1.0	0.2	3.7	1.1
Nursing	1.8	0.1	1.9	1.6	0.2	0.6	2.0	0.2	0.6	1.5
Dentistry	1.4	0.0	0.6	1.4	0.1	0.0	0.1	0.1	0.0	0.3
Neuroscience	1.7	0.4	1.2	1.3	0.2	0.2	0.8	0.1	0.1	1.4
Arts and Humanities	4.2	0.4	3.9	2.9	1.0	7.7	2.5	0.5	9.9	2.3
Psychology	1.4	0.4	1.3	1.3	0.5	2.4	1.1	0.1	2.7	2.7
Social Sciences	13.2	7.0	12.4	11.6	9.2	28.6	10.0	3.9	33.3	10.8
Business, Management and Accounting	4.9	3.2	4.8	6.2	5.3	28.4	5.7	3.8	9.3	11.6
Economics, Econometrics and Finance	3.6	1.5	3.1	3.8	2.0	16.3	4.1	1.1	4.4	6.7
Decision Sciences	1.4	3.9	2.1	2.4	2.9	10.7	1.5	3.9	3.3	4.0
Multidisciplinary	3.4	1.9	6.2	3.2	2.5	2.6	4.0	2.3	2.7	3.3

Table 11: Top five most-published subject areas by the top 10 Malaysian universities.

No.	Universiti Malaya	Universiti Teknologi Petronas	Universiti Kebangsaan Malaysia	Universiti Sains Malaysia	Universiti Teknologi Malaysia	Universiti Utara Malaysia	Universiti Putra Malaysia	Universiti Malaysia Pahang Al-Sultan Abdullah	Universiti Pendidikan Sultan Idris	Sunway University
1	Medicine	Engineering	Engineering	Engineering	Engineering	Computer Science	Agricultural and Biological Sciences	Engineering	Social Sciences	Physics and Astronomy
2	Engineering	Computer Science	Medicine	Medicine	Computer Science	Social Sciences	Engineering	Materials Science	Engineering	Engineering
3	Physics and Astronomy	Materials Science	Computer Science	Materials Science	Materials Science	Business, Management and Accounting	Medicine	Computer Science	Computer Science	Materials Science
4	Materials Science	Energy	Materials Science	Computer Science	Physics and Astronomy	Engineering	Materials Science	Chemical Engineering	Physics and Astronomy	Chemistry
5	Social Sciences	Chemical Engineering	Social Sciences	Physics and Astronomy	Environmental Science	Economics, Econometrics and Finance	Environmental Science	Physics and Astronomy	Arts and Humanities	Computer Science

4. Conclusion

During the COVID-19 pandemic, social distancing was one of the crucial measures in breaking the chain of virus spread. This study provided a comparison of the research performance of the top ten universities in the world and the top ten Malaysian universities based on the THE World University Rankings 2024. The leading world universities share common characteristics such as high scholarly outputs, citation count, and citation per publication, which receive twice as many citations as the world average for similar publications. Additionally, they also have a high number of publications in top-cited and top-ranked journals, as well as strong scientific collaborations with international and corporate institutions. The analysis of the research performance of the top ten ranked universities in Malaysia offers an overview of the Malaysian universities' scholarly output and focus areas. This provides insights for refining the research focus of Malaysian universities and strengthening international and corporate partnerships as well as unique regional research areas. However, having emphasized the significance of research in determining university rankings, Malaysian universities should adopt a more holistic approach that includes quality teaching and research, industry relevance and an international outlook to become a top-ranked world university.

We acknowledge that this study has several limitations since we only relied on Scopus datasets and are confined to the performance indicators in the THE WUR 2024 methodology. We have not conducted a comprehensive analysis of the research ecosystem, such as funding opportunities and research policies, of each country. Future studies should conduct a more in-depth study of the research ecosystem in Malaysia and evaluate the impact of inter-organizational collaborative research, including international and corporate collaborations on Malaysian universities.

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SHORT COMMUNICATION

Framework to Humanise Research Support in Academic Institutions

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ABSTRACT

Purpose

The purpose of the study is to identify the attributes to build a successful research management ecosystem, to understand the extent to which identified attributes contribute to successful research support environment, and to develop a framework for strong research management in Higher Education Institutions (HEIs).

Methodology

This study used a mixed-method approach. Through recorded discussion with academics and non-academics involved in research and research support, we identified the areas to be addressed for an efficient research experience. We then conducted a pilot study with 50 participants to validate the findings from the qualitative analysis.

Findings

We found that a research management ecosystem system requires ethical conduct from individuals and an ethical culture which is grounded on honourable behaviour of all organisational participants. This is not only aligned to Malaysian codes of responsible conduct in research but is also in accordance with existing guidelines. A new framework is suggested in this paper based on which, universities can create a research ecosystem that balances global goals with local relevance, resulting in a collaborative working model that is more strategic.

1. Introduction

The ever-evolving landscape of research management is a fundamentally human endeavour that encompasses individuals and institutions. Research management activities and/or guidelines are crucial for research integrity which is of concern not only in HEIs in Malaysia but also in several other parts of the world (Nguyen & Gremberg, 2018). According to Olsen et. al. (2018) the 'publish or perish' culture in Malaysia is of concern since it could lead to research misconduct, which could have a spillover effect on institutional reputation. Putri et. al. (2023) indicate that environment, values, figure organisation, habit, network culture, and adaptability to environmental change are crucial to inculcate a sound research culture in HEIs. A good research management, therefore, requires research management committees to address concerns regarding research integrity and reputation management. Ideally research management will involve the planning, coordination, and control of research activities towards achieving individual and institutional research objectives. Yang-Yoshihara et. al. (2023) suggest the need for adequate resources and resources management to enhance research activities in HEIs. This encompasses a range of responsibilities across different stakeholders, from proposal development review, legal aspects, due diligence, project planning and resource allocation to the monitoring of progress, finance, risk management and compliance with regulation. Effective research management and governance are, therefore, crucial for maximising the impact of research activities, ensuring accountability, facilitating the smooth progress of projects from inception to completion and enhancing institution's reputation (Miotto et. al., 2020). Within the Higher Education Institution (HEIs), research managers and administrators are pivotal in ensuring success and effectiveness of research management landscape and sustainability of stakeholder engagement. Governance without human integrity and ethics can cause serious flaws in decision-making, strategic alliances, and sustainable education, which means that humanising governance is integral to good governance and management (Mino, 2020). Therefore, a paradigm shift towards human-centric approaches must be emphasised. However, this area has not been explored in the past specifically in the context of research management. There is indeed a dearth of research work that have explored the role of research management centres in developing research culture within HEIs. The specific role of research management centres can involve recognising and valuing the contributions of individuals involved in research, fostering a supportive and collaborative environment, and exploiting technology for sound research outputs, all of which require strong ethical leadership, ethical culture, integrity and openness. To the best of our knowledge, this is the first study that explores the aspect of humanising the research support system in HEIs through the lens of virtue ethics, which emphasises the importance of individual character and wisdom in decision making (Ainley, 2017). Although some studies have contributed to the understanding of virtues in teaching specially in online classes (Harisson & Laco, 2022), none have focused specifically on research.

The virtues (integrity of the researcher) of ethical research practices are, therefore, explored in this study through qualitative methodology. While studies have been conducted on a similar area in the corporate context, there is a lack of focus on academia, particularly in articulating the ways in which virtues are embedded into research management skills. We focus on this limitation and expand on previous studies by studying the contribution of virtues in research management. We contribute by committing ourselves to the United Nations' principles of responsible management education through a transformative journey that is not just an organisational necessity but also a commitment to recognise and enhance the human dimension towards driving research excellence. This approach acknowledges that behind every research project, there are people with unique perspectives, skills, and needs. The

principles identified in this paper set the stage for a deeper exploration into reshaping the operational models for research management and fostering a high-performance culture that drives impactful research and leads the university towards overall success in a dynamic environment.

To summarise the specific objectives of this study are as follows:

i) To identify and understand the virtues that lead to a successful research management ecosystem.
ii) To understand the extent to which the virtues identified contribute to a successful research support environment.
iii) To develop a virtue-based framework for effective research management in HEIs.

2. Literature Review

2.1 Research management and integrity

In line with good research practices, research management emphasises the need for individuals, institutions and nations to be committed throughout the research process from priority setting to completing the research and in the use of financial, intellectual and physical resources. Many institutions have therefore developed guidelines for potential researchers. For example, Quitoras and Abuso (2021) explain that the research management in the Philippines encompasses best practices such as funding deserving researchers, screening quality research and showcasing such best practices to encourage young researchers and organising research ethics workshops. Similarly, the Malaysian code of responsible conduct in research covers many practices for the researchers. However, there is little information on how institutions can manage research ethically. This seems to be dependent on the research management leadership in institutions. Supporters of ethical leadership describe the importance of communication, transparency and managerial practices that lead to sustainable institutions.

2.2 Ethical Leadership and virtues

The concept of ethical leadership involves leaders who not only possess virtues but actively integrate these principles into their managerial practices. Ethical leadership is important for sustainability of organisations specifically if they operate in a highly competitive environment (Hsies et. al., 2021). Higher education industry has not only become complex but is also global, facing challenges, such as of sustainability, rankings and accreditations, which eventually leads to good brand image (Pucciarelli & Kaplan, 2019). This justifies the need for ethical leadership in educational sectors. The foundation of ethical leadership is built on two fundamental pillars, the individual who personally and independently possesses moral character and that of a leader (manager) who adheres to moral principles and sets the tone at the top helping to nourish the organisational culture (Crews, 2015). Being recognised as an ethical leader goes beyond personal ethical conduct. An ethical leader role must actively direct the followers to focus on organisation's values, instilling principles that will shape the actions of all employees (Al Halbusi et. al., 2024). Ethical leaders are instrumental in establishing and promoting a moral tone within the research management ecosystem and creating organisational citizenship (Pio & Lengkong, 2020) They create a tone driven by morals and virtues by consistently demonstrating ethical behaviour, fostering an environment where ethical considerations are prioritised in decision-making

[1]https://accountancy.uitm.edu.my/images/e-Sharing/Booklet_The_Malaysian_Code_of_Responsible_Conduct_in_Research.pdf

processes. The ethical leadership model developed by Kar (2014) suggests prioritising virtues through vision, voice and values for success.

For academia however, the pressures of securing funding, monitoring expenditure and navigating the research landscape can contribute to stress, anxiety, and other psychological well-being challenges (Yousaf et. al., 2019) for the researchers. Thus, another virtue of an ethical leader involves being cognizant of employees well-being. In a research context, this goes beyond ensuring the success of the projects by actively prioritising the well-being of researchers, acknowledging the importance of work-life balance and the psychological well-being of staff by voicing our concerns so that constructive changes can be made on timely basis (Yousaf et. al., 2019) thus enhancing employee performance through strong bonding with employees (Baloyi, 2020). By fostering a workplace culture that values well-being, leaders set the stage for increased job satisfaction, motivation, and productivity among researchers (De Hoogh & Den Hartog, 2008). This approach is in line with the principles of ethical leadership that prioritizes the development and welfare of team members.

The third virtue in ethical leadership encompassing inclusion, equity and diversity (Coleman, 2023). Inclusion involves creating an environment where every individual, regardless of their background, feels valued, respected, and included. Diversity encompasses the myriad of differences that individuals bring to the workplace, including but not limited to race, ethnicity, gender, age, and cultural background (Coleman, 2023).

Finally, effective communication lies at the heart of ethical leadership, serving as the cornerstone for building trust, transparency, and a positive organisational culture. Ethical leaders recognise and prioritise communication mechanism, ensuring that information is shared openly and honestly (Abu Bakar & Connaughton, 2022). Ethical leaders share information openly, even when faced with difficult decisions or challenges. Transparent communication builds credibility and helps foster a culture of honesty and integrity (De Cremer et al., 2009).

While these four virtues have been suggested by previous researchers, collaboration is also very important for success in academia and research. Collaboration, in the context of research management, serves as a foundational element for accelerating knowledge generation and maximising resource utilisation. Thomson and Perry (2006) pointed out that collaborative efforts facilitate the pooling of diverse expertise, expediting the generation of new knowledge (Aldieri et. al., 2020). This pooling of expertise not only encourages interdisciplinary approaches but also accelerates the exploration of research questions, leading to innovative breakthroughs. Additionally, Kotsonis (2022) emphasised the importance of virtue-based collaboration for success in academia and explained the need for good collaborators in every segment of academia following the principles of virtues. This would mean developing mutually beneficial relationships whilst foregoing self-interest. For ethical leaders it would imply sharing authority, responsibility and accountability (Modha, 2021).

Ethics and compliance play significant roles in collaborative initiatives, as emphasised by Olsson and Meek (2019). Effective management and advisory services concerning legal obligations, compliance, and funding requirements are critical for ensuring that collaborative efforts adhere to established standards.

Managing these aspects not only safeguards the integrity of research but also streamlines the collaborative process.

Resource optimisation is another significant benefit of collaboration in research management as mentioned by Nguyen and Meek (2016). Collaborative efforts significantly contribute to cultivating a supportive research culture and help to enhance knowledge sharing and contribute to incremental innovations (Le et. al., 2020). Shabbir & Khalid (2016) highlighted the fact that collaboration nurtures an environment where mutual support and shared goals prevail among researchers and research support personnel. This collaborative culture not only strengthens individual researchers but also enhances collective research endeavours, fostering an ecosystem that nurtures innovation and growth.

Good Governance

Governance, management, and leadership are all integral to ethical leadership which can maximise stakeholder value. Since research involves multiple stakeholders comprising of internal and external parties, it is imperative for research managers to ensure that research expectations are met, and institutions are benefitted through quality research and reputation enhancement (Ariail & Crumbley, 2016). The implementation of robust governance structures is not merely a compliance measure but a fundamental building block for establishing trust among managers and stakeholders. A good manager is known to be open, accountable and fair, and respectful.

Past experiences of people suggest that employees are fully aware of the rights in their respective roles and when they demand these rights, managers are morally bound to support employees to develop mutual trust and respect (Bhana & Bayat, 2020). In academia, this helps to strengthen the relationship between research managers and researchers. The accountability of the research managers and researchers towards their external stakeholders is important to maintain organisational reputation. Similarly, leaders are expected to upskill themselves following technological, regulatory and situational changes order to portray competence.

In most cases, inclusivity and respect are inextricably linked to each other. Respect will lead to the practice of allowing equal opportunities to deserving individuals rather than being biased towards preferred individuals. Such culture is indicative of the professionalism of leaders (Fu et. al., 2020). Research managers will need to ensure inclusion in diversity since diverse teams are known to lead to better governance and higher performance (Creary, 2019). This is because the research team is likely to become motivated as they feel a sense of belonging, trust, and support throughout the execution of the project.

3. Methods or materials and just methods or premise

We used a mixed method approach whereby the qualitative study involved focus group discussions with academic, researchers and research administrators in a private university in Malaysia. The interview questions were drafted to get a generic understanding of research culture and virtue-based ethics within the university. The conversations were recorded, and then decoded using NVivo and interpreted by the researchers. A total of 14 participants were put together in a focus group discussion. The participants for the focus group belonged to a private higher education institution. Further, a questionnaire was

developed based on the response from focus group. The questionnaire was distributed to 50 participants from different departments at the same institution. The basic criterion used to choose the participants for both methods was that they must be involved in either conducting research or assisting academic researchers, for example at the Research Management Centre (RMC). The sampling method involved convenient sampling. The potential participants were contacted via email or phone calls and their willingness to participate in the study was sought prior to inviting them for focus group discussion/ filling the questionnaire. Ethics approval was obtained from the University's Ethics Committee prior to the focus group discussions or sharing the questionnaire with the participants. The key questions that this study sought to answer through the focus group discussions were:

i) What qualities of an individual guide his or her actions in successful management of research in higher education?
ii) How do individuals behave differently or through shared beliefs in a group setting?
iii) What individual traits can be nurtured to form organisational culture?

For the quantitative data analysis simple analysis of mean scores and standard deviations were used to interpret the outcome which provided guidance to develop a fundamental framework of policies that can nurture good behaviour and help to humanise research management within the university.

4. Findings and Discussion

The interviews of 14 individuals were used to answer the questions presented in section 3 of this paper. There were 55% males and 45% females which ensured gender balance. There was a mix of different positions held by the participants within the institution's hierarchy which included representatives from middle, lower and top management. The thematic analysis revealed that participants valued ethical individualism (a belief that practice of ethics is vested on individuals) and ethical culture which will have to be demonstrated and practiced by top leaders. Participants felt that it was important for institutions to practice integrity, accountability, fairness, commitment and transparency in supporting the researchers throughout their research process. However, to cultivate ethical practice of ethical individualism by leaders and researchers was found to be very crucial. To achieve ethical individualism, researchers and research managers must practise professionalism in decision making, involve continuous two-way communication and demonstrate virtuous behaviour through high levels of commitment in achieving organisational objectives. Some excerpts from the thematic analysis are included in Table 1.

Table 1: Excerpts from the thematic analysis.

Participant(s)	Excerpts
1 & 4	*Having compassion for staff with specific difficulties and cherishing their good work motivate them to commit their time and effort to their job*
3, 8 & 10	*It is important to recognise the skill set of all researchers to utilise their strengths for organisational growth*
11	*Employees must be accountable for their assigned roles and tasks (FG1) as well as actions and decisions. If researchers make decisions that are unfavourable, researchers must be accountable for it*
9 & 2	*An individual should demonstrate professionalism and independence in order to ensure an equal treatment to all staff*
5	*Commitment is demonstrated when employees take initiatives for self-improvement and self-development*

Table 1: (cont.) Excerpts from the thematic analysis.

Participant(s)	Excerpts
6 & 7	*Being transparent to each other in an organisational setting as well as being open to others' criticisms and opinions would contribute to positive motivation employees and enhance commitment to the organisation*
12	*Researchers help to create future leaders for the betterment of the country through appropriate succession planning and staff grooming*

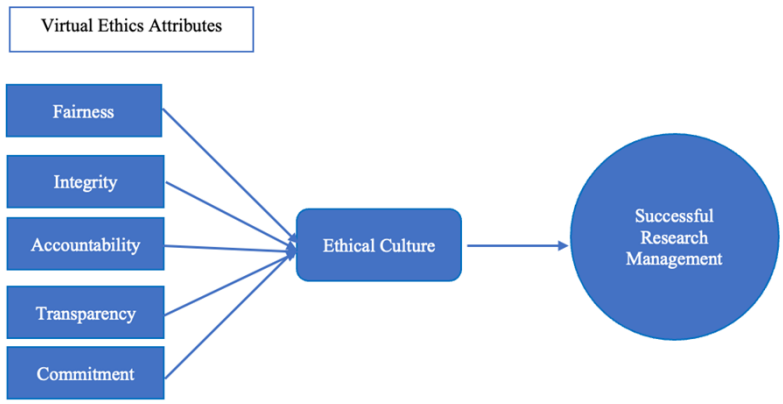
The excerpts suggest that strong researchers and good research managers can together create an environment of good practices that set the right tone and forms a culture in the organisation. The findings are in agreement with research conducted by (Bhana & Bayat, 2020; Fu et. al, 2020). Apart from the factors identified in past researcher, our study identified other factors such as commitment and integrity. In contrast there were little discussions on collaborations suggesting that some fundamental virtues must be entrenched in universities before delving into collaborations.

Through the quantitative study this research tried to gain a broader understanding of the perceptions of research participants with regards to how important they perceive certain attributes to be. We surveyed 50 participants on their views of ethical individualism and ethical culture. A questionnaire consisting of five items each for ethical individualism and ethical culture was developed and disseminated through convenient sampling. A total of 40% of the responses came from males while 60% was from females. In terms of age group, 65% responses were from ages between 20 to 40 years. For organisational hierarchy almost equal contributions came from middle and lower management (45% each).

With respect to ethical individualism, more than 80% participant agreed to the importance of integrity while 90% agreed that two-way commitment of every individual was important and 96% agreed that they had to align with the organisational objectives through ethical two interactions. To form ethical culture, 70% participants agreed on instilling values such as responsible use of resources, while 90% agreed that leaders set the tone at top and set the right examples. Another] 76% agreed that openness and equal opportunities are important for ethical culture.

Based on the finding, a conceptual framework was developed for strong research management in institutions of higher education as shown in Figure 1.

Figure 1: Framework for humanising research management in institutions of higher education.



5. Conclusion

We found that a research management ecosystem system requires an ethical individualism and ethical culture that is a result of the virtuous behaviour of all organisational participants. This is not only in line with the guidelines of the Malaysian codes of responsible conduct in research but also helps to enhance the responsibility of the researchers and research managers in conducting and managing research. By embracing such a framework, universities can create a research ecosystem that balances global goals with local relevance, resulting in a more strategic collaborative working model. The findings reported in this paper is generalisable across institutions. However, the implementation may be tailored to individual institutions depending upon their size and objectives. Hence, the effectiveness of the implementation of the approaches and tools can be studied further. By contributing to humanising research management through ethical behaviour we can collectively contribute to United Nations' principles of responsible management education.

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RESEARCH ARTICLE

Reshaping Research Ecosystems: Recommendations for Equitable Recognition of Non-STEM Research in Higher Institution Management

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ABSTRACT

Historically, the trend in academia towards measurable measures has marginalised non-STEM, arts, and humanities subjects, often at the price of their inherent academic principles and capabilities. This review of the literature explores the shift in university policies and practises, emphasising the need for a more compassionate and inclusive approach to research administration. This study analyses a variety of scientific articles using an extensive keyword search on Lens.org to evaluate the obstacles and recommendations for equal career progression in non-STEM disciplines. The findings indicate a rising appreciation for the multifaceted nature of knowledge and the significance of varied academic contributions. The study highlights the importance of widening the concept of research impact, including qualitative evaluations, and embracing interdisciplinary approaches. It also discusses the impact of university rankings and the incorporation of SDGs in reframing the value of non-STEM disciplines. In addition, the study suggests practical methods for university administrators, such as the creation of customised appraisal forms, customised career trajectories, and equal resource allocation. The study finishes by considering the future role of the arts and humanities in an increasingly automated and technologically driven world, emphasising the relevance of human values and ethical considerations in societal growth. This study adds to the discussion about developing a balanced and human-centred approach to research management, calling for the recognition and support of all academic disciplines in the changing landscape of higher education.

Keywords: Empathy in Academia, Non-STEM Recognition, Research Management, Academic Equity, Interdisciplinary Approaches, University Rankings Impact, Arts and Humanities in Higher Education

1. Introduction

The bias in academia towards quantifiable metrics, particularly in research and teaching, can be traced back to several historical developments, with the Humboldt model of higher education serving as a significant turning point (Rouse 2016) Wilhelm von Humboldt's integration of research and teaching advocated for the integration of research and teaching in universities. It emphasised knowledge creation through research as a critical component of higher education. The Humboldtian model, which initially supported a wide range of disciplines, including the arts and humanities, valued academic freedom and the pursuit of knowledge for its own sake.

The Humboldt model's emphasis on research and the creation of new knowledge laid the foundation for the modern research university. However, as the model evolved and was adopted by universities worldwide, including those in Malaysia, it inadvertently contributed to the development of biases favouring quantifiable metrics and research outputs. The Humboldtian ideal of the unity of research and teaching gradually gave way to a greater emphasis on research productivity, which could be more easily measured and compared across institutions.

In the Malaysian context, the influence of the Humboldt model can be seen in the establishment of research universities and the increasing focus on research performance. The Malaysian government's strategic plans for higher education, such as the National Higher Education Strategic Plan Beyond 2020, set ambitious targets for research output and university rankings. These targets have led to the prioritization of STEM disciplines, which are perceived to be more aligned with the nation's economic development goals and more readily produce quantifiable research outputs.

While the Humboldt model's original vision encompassed a wide range of disciplines, including the arts and humanities, its modern interpretation has contributed to the marginalization of these fields. The pressure to perform in global university rankings and to demonstrate research productivity has led to an imbalance in resource allocation and recognition, favouring STEM disciplines over non-STEM fields. This bias has had significant implications for the career progression and wellbeing of academics in the arts, humanities, and social sciences in Malaysian universities.

With the rise of the ‘knowledge economy’ in the late twentieth century, we see a shift towards quantifiable metrics. With the advent of the knowledge economy in the late twentieth century, there was a growing emphasis on the economic and practical utility of university research. Following that was a period in which universities were increasingly viewed as engines of economic growth rather than institutions of pure learning and knowledge dissemination. Governments and funding agencies began to use performance-based funding models, emphasising measurable outcomes such as research publications, citations, and grants.

In Malaysia, these developments favoured STEM disciplines, which more readily produce quantifiable outputs and are often more directly linked to economic benefits. As a result, the arts and humanities began to be seen as less valuable in this new paradigm, given their more qualitative, interpretive, and less immediately economically quantifiable nature. With the goal of bolstering Malaysian research universities even more, the National Higher Education Strategic Plan Beyond 2020 projects that two

Malaysian universities will rank among the top 100 in the world. The University of Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Putra Malaysia (UPM), and Universiti Teknologi Malaysia (UTM) are the five research universities that currently exist in Malaysia. It is anticipated that these research-driven institutions will see an increase in both the number and quality of researchers, postgraduates, and research (Sheriff, 2017). The introduction of global university rankings can indeed be seen as a significant factor that further entrenched the bias towards quantifiable metrics in academia (Wan, 2016), affecting the perception and valuation of different disciplines, especially non-STEM fields like the arts and humanities. It contributed to the amplification of quantifiable metrics favoured by rankings. University rankings typically rely heavily on quantifiable metrics such as research output, citation counts, funding amounts, and faculty qualifications, resulting in an emphasis on research and publication during promotion assessment (Sidek, 2012). These metrics inherently favour STEM disciplines, which tend to produce more frequent publications and receive more citations and research funding. To improve their rankings, Malaysian universities often adjust their policies and resource allocations to align with the metrics used in these rankings. This can lead to a disproportionate allocation of resources towards STEM departments and research areas that are more likely to boost ranking metrics.

Significant consequences for non-STEM disciplines are now evident. The emphasis on metrics that favour STEM disciplines can lead to the undervaluing of the arts and humanities, which often have different research outputs and impacts. Non-STEM departments may face pressure to align their research and teaching practises with these metrics, potentially at the expense of their intrinsic academic values and strengths. The introduction of university rankings can be seen as a culmination of the trends towards marketization, quantification, and economic utility in higher education. Rather than introducing a new bias, rankings reinforced and gave a more formal and globally visible structure to existing biases towards quantifiable, STEM-oriented metrics. There is increasing criticism of the over-reliance on university rankings and their impact on academic diversity and quality. This has led to calls for more comprehensive and nuanced approaches to evaluating and ranking universities, taking into account the diverse contributions of all academic disciplines. In recent years, there has been a growing critique of the overemphasis on quantifiable metrics and its impact on non-STEM fields. There is an increasing call for a more holistic approach to evaluating academic contributions, recognising the value of diverse disciplines and the limitations of purely quantitative assessments.

In this literature review, we examine if issues of performance recognition in non-STEM fields such as social sciences, arts, and humanities have been discussed and what recommendations have been laid out so that university administrators can be more empathetic to the welfare and career progression of their faculty members.

2. Methodology

This literature review utilised a systematic approach to identify, select, and analyse relevant research papers. The search was conducted using Lens.org, a comprehensive and open research platform that aggregates data from various sources, including scholarly publications, patents, and datasets. Lens.org is used to search for literature in reviews because it provides a reliable search strategy for finding review papers, systematic reviews, and meta-analysis. The Lens database provides an accessible and cost-free

platform for accessing patents and scholarly literature. Patent Lens, which was established in 1998, initially aimed to offer a more transparent means of accessing patent literature. According to the Lens *About* page, they anticipate that they will have the capacity to store over 95% of the global patent literature within a span of two years. More recently, scholarly literature has been incorporated into the database (Jeffersons, 2019). This literature has been obtained from multiple providers, with PubMed, CrossRef, and Microsoft Academic Graph being the main sources. This index, which contains more than 200 million academic publications, is one of the largest indexes currently available (Tay, 2018). By incorporating both scholarly and patent information, this tool becomes highly effective in examining the relationship between research and invention. It also offers added benefits such as research metrics and citation impact, which can be used to assess an organisation's research output (Penfold, 2020).

The initial search strategy involved using a combination of keywords and phrases relevant to the research question. These terms were derived from an initial scoping review of the existing literature and through consultation with subject experts. The initial search terms included: "academic career," "faculty," "non-STEM," "arts and humanities," "social sciences," "university rankings," "research assessment," "performance appraisal," "promotion criteria," "interdisciplinary research," and "research impact." Boolean operators (AND, OR) were used to combine these terms and refine the search results.The subsequent search used the Boolean terms "career AND (Malaysia AND (faculty AND lecturer))" to narrow down the scope to articles associated with higher education in Malaysia. To further refine the results, the built-in filter function on Lens.org was used, setting the field of study to "higher education." After applying this exclusion criterion and removing duplicates where some publications were published in both journals and proceedings.

The inclusion criteria for the selected articles were:

i) Relevance to the research objective, focusing on issues of performance recognition in non-STEM fields and recommendations for fostering inclusivity in research management
ii) Publication in peer-reviewed journals or conference proceedings
iii) English language publications

The exclusion criteria were:

i) Articles not directly related to the Malaysian higher education context
ii) Articles focusing solely on STEM disciplines without addressing non-STEM research outputs or career progression
iii) Duplicate publications or preprints

The literature was further categorised using Lens.org's integrated reference management tool, enabling efficient retrieval and analysis. The platform's data visualisation features such as word cloud were used to analyse trends and patterns in the research landscape. The insights gained from this systematic review were used to formulate practical recommendations for university administrators in Malaysia to promote equity and support for non-STEM faculty members.

3. Results and Discussion

The initial search produced 313 articles covering the period from 1950 to 2023. After implementing the inclusion and exclusion criteria and eliminating duplicate articles, a total of 65 papers were considered appropriate for further study. These publications underwent a systematic evaluation, during which major themes and findings were extracted and synthesized. The analysis primarily aimed to uncover the obstacles encountered by non-STEM academics in terms of advancing their careers and receiving recognition, while also providing suggestions for promoting a more inclusive and empathetic research management strategy.

When examining the patterns of published research related to academic career, particularly among academics and lecturers, the data obtained from Lens.org offers valuable insights into how these tendencies have changed over time. The keyword search conducted using Lens.org yielded 313 publications spanning from 1950 to 2023 (see Figure 1), revealing a substantial rise in the volume of literature, especially in the last two decades. This increase is a clear indication of the growing interest and expanding research in the field of academic career development.

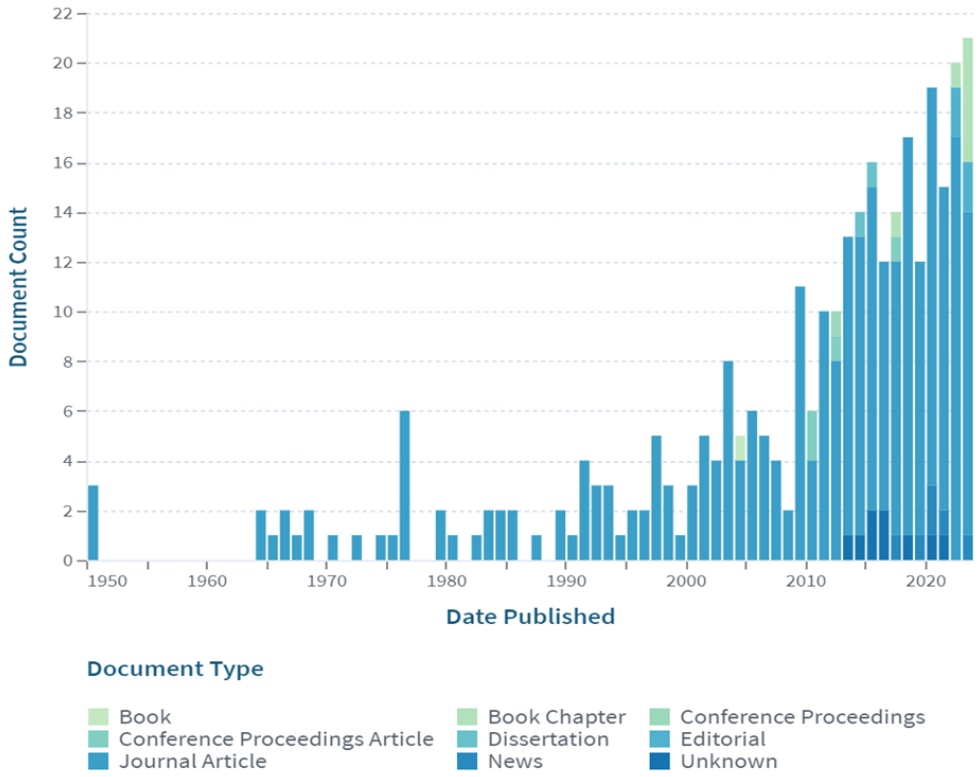

Figure 1: Trends in Academic Publications by Type, 1950-2023

Note: This figure presents a temporal analysis of academic publications in Malaysia. Green bars indicate book publications, varying shades of blue represent journal articles and dissertations, purple bars for book chapters, yellow bars for editorials, grey bars denote news articles, and black bars reflect documents of unknown type.

The proliferation of publications, particularly after 2000, underscores a heightened focus on academia and reflects the sector's evolution in the recognition and sophistication in career management. This global trend can be attributed to several factors, such as the increasing importance of higher education in driving economic growth (Mallick 2016, Hamid 2022, Li et al., 2024), the government's emphasis on developing a knowledge-based economy (Asian Development Bank, 2008, Mustapha & Abdullah, 2004) and the evolution of the higher education's third mission (Compagnucci, 2020).

A comprehensive analysis of narrowed down 65 research papers on Malaysian faculty members' careers reveals significant categorisation trends and notable gaps in the existing literature. Key studies predominantly focus on specific institutional dichotomies, with little attention given to recent developments like the inclusion of non-traditional research outputs, particularly in the arts, humanities, and social sciences. Key categorisation patterns include comparisons between private and public universities (Arokiasamy, 2011, 2014; Basarudin, 2016), research and non-research universities (Ab Rahim, 2013; Abu Said, 2015; Fauzi, 2023; Tan, 2016; Janib et al., 2021, 2022; Sadeghi et al., 2012), and private versus public sector institutions (Adi Badiozaman, 2021; Dilou, 2022; Hei & Sohail, 2006; Leong & Sohail, 2006; Mustapha & Ghee, 2013; Nadarajah et al., 2012; Noor, 2011; Wilkinson &Yussof, 2005). Other studies focus on gender-related career issues (Asaari, 2013; Luke, 2001; Ismail & Rasdi, 2006, 2007, 2008; Ehido et al., 2019) or present multi-country comparisons (Bennion & Locke, 2010; Guraya et al., 2018; Safaria, 2012). It is important to note that many publications either mention Malaysia tangentially as part of broader comparisons or focus on student careers rather than faculty careers. This inclusion in the corpus stems from the broad applicability of keywords like 'faculty' and 'career', which inadvertently captured studies not specifically focused on academics and faculty members. A significant gap in the literature is the absence of studies addressing recognition metrics beyond traditional publications and grants. This oversight particularly affects academics and faculty members in arts, humanities, and social sciences, whose outputs may not align with conventional metrics. The lack of research in this area suggests that it has not yet been prioritised by Malaysian researchers.

Our literature review unveils a critical gap in studies examining faculty career trajectories in Malaysia, particularly in relation to recent global trends that acknowledge diverse contributions from non-STEM fields in academia (Alperin, 2022). The majority of Malaysian studies focus on traditional metrics such as publication counts and citations, which have historically favoured STEM (Science, Technology, Engineering, and Mathematics) disciplines. This bias can be largely attributed to the establishment of the Malaysian Research Assessment (MyRA) in 2009 (Kasim et al., 2021). MyRA was introduced to systematically evaluate the research performance of Malaysian universities and research institutions. Its evaluation framework heavily relies on quantitative metrics, particularly publication counts and citation indices, as primary indicators of research output and impact (Huang & Lin, 2011). This emphasis aligns with global trends in research assessment, where institutions are increasingly judged based on their ability to produce high volumes of publishable research that garners citations. Consequently, Malaysian researchers are incentivized to prioritize quantity over quality in their publication efforts, often leading to a proliferation of research outputs aimed at meeting MyRA's criteria rather than pursuing innovative or socially relevant research.

The reliance on publication and citation metrics in MyRA reflects a broader trend in academia where

such metrics are often viewed as proxies for research quality and impact. This perspective is supported by studies indicating that the counting of papers and citations is fundamental to assessing research productivity (Elango & Rajendran, 2017). However, this approach has faced criticism for potentially distorting research priorities. Researchers may focus on publishing in high-impact journals primarily to boost their citation counts, potentially at the expense of pursuing truly innovative or socially relevant research. While MyRA aims to enhance the quality of research in Malaysia, its focus on quantifiable metrics can inadvertently marginalize valuable contributions that do not conform to traditional publication norms.

The need to refocus academic evaluation goes beyond issues of fairness or equity; it is about recognising the vast and diverse nature of knowledge and understanding. A more compassionate and comprehensive view of research contributions to society acknowledges that insights from all fields are critical to addressing the complex issues confronting our world today. The traditional focus on metrics like publication counts and citations has historically favoured STEM fields, creating a need to foster inclusivity for equitable recognition of non-STEM research in higher education management.

Our examination of 313 publications revealed several recent topics not addressed by Malaysian researchers studying career development in academia. These include the inclusion of Non-Traditional Research Outputs (NTROs), embracing qualitative assessments, and implementing tailored performance appraisals. The absence of recent literature on these topics in the Malaysian context highlights a significant opportunity for future research. By addressing these gaps, Malaysian academia can move towards a more holistic approach to evaluating and recognizing diverse academic contributions. These approaches can be recommended for adoption by higher management to create a more inclusive and comprehensive evaluation system.

3.1 Recommendation 1: Inclusion of Non-Traditional Research Outputs (NTROs):

Recognising diverse forms of scholarly output, such as artistic performances, exhibitions, and policy contributions, is becoming crucial in the global academic landscape. However, the literature shows that Malaysian researchers are still preoccupied with conventional research outputs such as publications, intellectual property, and consultation (Azman et al., 2016; Da Wan et al., 2015; Yunus & Pang, 2015; Da Wan & Morshidi, 2018; Sarjidan & Kasim, 2023). This focus contrasts sharply with the global trend towards recognising and acknowledging the unique contributions of non-STEM research (Lewandowska, 2023), which fosters a more inclusive academic environment.

Several countries have begun to recognise and include non-traditional outputs in their assessment processes. Among them are:

i) Australia: The University of Sydney and the Excellence in Research for Australia (ERA) have formulated one of the most comprehensive guidelines for NTRO assessment (Barwick, 2017). Their framework includes five categories: Original Creative Works, Live Performance of Creative Works, Recorded/Rendered Creative Works, Curated/Produced Exhibition/Event, and Research Reports of External Bodies.
ii) North America: Institutions are increasingly acknowledging the value of diverse scholarly outputs, with efforts to integrate NTROs into faculty evaluation processes (Alperin, 2022).

iii) Hong Kong: The University Grants Committee has introduced measures to recognise creative outputs in research assessment exercises (Leong, 2014).

The need for a more inclusive approach in Malaysia is further supported by a survey of thirty-eight universities, which found that more than 66% of the institutions are not satisfied with the current research assessment methods (Abdullah et al., 2022). This dissatisfaction underscores the urgency for reform in the Malaysian academic evaluation system. Inclusion of NTROs would particularly benefit arts and humanities disciplines, allowing for a fair and balanced instrument of measure. This approach would be especially valuable for institutions like the Malaysian National Academy of Arts Culture and Heritage (ASWARA) and faculties such as the School of Creative Industry Management and Performing Arts (SCEMPA) at Universiti Utara Malaysia, enabling their performance to be more accurately measured and recognised.

To implement this recommendation effectively, Malaysian higher education institutions should:

i) Develop a comprehensive framework for identifying and evaluating NTROs, drawing inspiration from successful models like the ERA guidelines.
ii) Establish clear criteria for assessing the quality and impact of NTROs, ensuring they are given appropriate weight in faculty evaluations and institutional assessments.
iii) Provide training and support for evaluation committees to understand and appreciate the value of diverse research outputs.
iv) Collaborate with international partners to share best practices and refine assessment methodologies for NTROs.
v) Regularly review and update the NTRO framework to ensure it remains relevant and inclusive, particularly in rapidly evolving fields like digital arts and online education.

By embracing NTROs, Malaysian academia can foster a more diverse and innovative research environment, ultimately enhancing the global competitiveness and relevance of its higher education institutions. This shift would not only benefit arts and humanities disciplines but also encourage interdisciplinary collaboration and creativity across all fields of study.

3.2 Recommendation 2: Enhanced Visibility Through Subject-Specific Rankings:

Rankings serve as influential tools in shaping perceptions of academic quality and institutional reputation. They are widely used by stakeholders, including students, policymakers, and funding agencies, to assess and compare universities. The reliance on rankings has been shown to significantly impact institutional strategies, as universities often leverage their positions in these rankings to attract qualified faculty and enhance their research outputs (Véliz & Marshall, 2021). However, the methodologies underlying these rankings frequently emphasise a narrow set of metrics, primarily focussing on research output, faculty qualifications, and internationalization. This narrow focus can lead to an inadequate representation of the diverse contributions made by non-STEM fields, as many ranking systems tend to favour institutions with strong performance in STEM disciplines (Tandilashvili, 2024; Sorz et al., 2015).

In light of these issues, there is a growing recognition that rankings should evolve to incorporate a broader range of indicators that reflect the multifaceted roles of universities in society. Subject-specific rankings can highlight universities that excel in specific research areas, irrespective of their overall research output. If a university is particularly strong in a non-STEM specific field such as creative media, subject-specific rankings would provide a more accurate representation of its research prowess. The granularity of these rankings has been demonstrated to impact students' application decisions (Chevalier, 2015).

Recent initiatives in global ranking systems have begun to address this gap, for example:

1) Times Higher Education Impact Rankings: These rankings evaluate universities based on their contributions to the United Nations' Sustainable Development Goals (SDGs), providing a broader perspective on institutional impact (Torabian, 2019).
2) QS World University Rankings by Subject: This system offers a more nuanced view of institutional strengths across various disciplines, including non-STEM fields (Bautista-Puig et al., 2022).

The adoption of subject-specific rankings in university evaluations has provided a corrective approach to the traditional ranking systems, which have often shown a predisposition towards STEM disciplines. These newer elements in ranking methodologies can be seen as a form of improved recognition for non-STEM, arts, and humanities disciplines, offering them more visibility and recognition. The use of these novel rankings allows for a more comprehensive evaluation of academic disciplines, providing a framework to assess the arts, humanities, and social sciences based on their respective qualities.

Subject-specific rankings recognise achievements in a wider range of disciplines, including those beyond STEM. This, in turn, affirms the importance of these subjects within the academic domain (Maričić, 2016). The benefits of this approach are multifaceted and include the following:

i) Increased Funding: Enhanced visibility can lead to improved funding opportunities for non-STEM departments, as their strengths become more apparent to stakeholders and funding bodies.
ii) Student Enrolment: Subject-specific rankings can attract more students to non-STEM programs by highlighting institutional strengths in these areas.
iii) Faculty Recruitment: High rankings in specific subjects can help universities attract and retain talented faculty members in non-STEM fields.
iv) Resource Allocation: The modifications in external assessment standards can prompt universities to adapt their internal policies, potentially resulting in a fairer allocation of resources and assistance for non-STEM departments.
v) Research Collaboration: Increased visibility of non-STEM strengths can foster interdisciplinary collaborations, enriching the overall research ecosystem.

To implement this recommendation effectively in the Malaysian context, higher education institutions and policymakers could consider the following steps:

i) Develop a national framework for subject-specific rankings that aligns with international best practices while reflecting local priorities and strengths.
ii) Encourage Malaysian universities to participate in global subject-specific ranking initiatives, providing support and resources for data collection and submission.

iii) Create awareness among stakeholders about the importance and interpretation of subject-specific rankings, ensuring they are used appropriately in decision-making processes.
iv) Establish partnerships with international ranking organizations to ensure Malaysian institutions are accurately represented and evaluated.
v) Use subject-specific ranking data to inform strategic planning and resource allocation within universities, promoting a more balanced approach to institutional development.
vi) Regularly review and refine the use of subject-specific rankings to ensure they continue to serve the diverse needs of Malaysian higher education.

By embracing and promoting subject-specific rankings, Malaysian higher education can create a more inclusive and diverse academic landscape. This approach not only provides a fairer representation of institutional strengths across all disciplines but also encourages excellence in non-STEM fields, ultimately contributing to a more well-rounded and globally competitive higher education system.

3.3 Recommendation 3: Embracing Qualitative Assessments:

Non-STEM research often yields results that are qualitative and interpretive in nature, defying simple quantification and requiring a more nuanced approach to evaluation. Incorporating narrative evaluations and case studies into research assessment processes significantly enhances the understanding of non-STEM research by acknowledging its complexity and context. This approach contrasts sharply with traditional metrics, which often fail to capture the qualitative dimensions and broader societal impacts of research outcomes. The shift towards more comprehensive evaluation methods is gaining traction globally, with several countries and regions implementing frameworks that recognise the multifaceted nature of research impact.

The UK's Research Excellence Framework (REF) stands out as a pioneering model, assessing research impact beyond academia and evaluating the research environment holistically. It employs case studies to demonstrate research impact and uses expert panels to ensure nuanced evaluation (Bornmann, 2017, Khazragui & Hudson, 2015). Similarly, the Excellence in Research for Australia (ERA) incorporates a broader range of impact assessments, considering societal implications and the research environment. It utilizes a combination of quantitative indicators and expert review, recognizing diverse research outputs, including creative works (Williams & Grant, 2018). The EU's Horizon Europe funding programme further exemplifies this trend, emphasizing societal concerns and interdisciplinary research while showcasing the societal and environmental impacts of research through dedicated impact pathways (Veugelers, 2015).

To implement a more qualitative approach to research assessment in the Malaysian context, several steps could be considered. Developing a Malaysian Research Impact Framework (MRIF) that adapts best practices from global models to the local context would be a crucial first step. This framework should include diverse impact categories that reflect national priorities and the unique contributions of Malaysian research. Implementing narrative impact case studies would allow researchers and institutions to demonstrate the impact of their work beyond academia, supported by training in articulating and evidencing research impact. Establishing expert review panels comprising both local and international experts would ensure fair assessment of diverse research outputs, particularly from non-

STEM fields.

Integrating qualitative metrics into existing evaluation systems, such as the Malaysian Research Assessment (MyRA), would be essential. This integration should include guidelines for evaluating non-traditional research outputs like creative works, policy briefs, and community engagement activities. Promoting interdisciplinary research by encouraging and rewarding collaborative projects that bridge STEM and non-STEM disciplines would foster innovation and comprehensive problem-solving. Enhancing research environment assessment by evaluating institutional support for researchers, including mentoring programs and research facilities, would contribute to a more holistic evaluation process.

Implementing stakeholder engagement by involving non-academic stakeholders in the assessment process would capture broader societal impacts and develop mechanisms for evaluating public engagement and knowledge transfer activities. By adopting these qualitative assessment methods, Malaysian higher education institutions can create a more inclusive research evaluation system that recognises the diverse nature of research outputs across all disciplines, encourages researchers to consider and articulate the broader impacts of their work, and provides a more accurate representation of the contributions made by non-STEM fields. Such a system would align research activities with national priorities and societal needs, fostering a research culture that values both academic excellence and real-world impact. Ultimately, implementing this approach would not only enhance the visibility and recognition of non-STEM research but also encourage a more holistic approach to academic inquiry, strengthening Malaysia's position in the global research landscape.

3.4 Recommendation 4: Interdisciplinary and Transdisciplinary Approaches:

The growing emphasis on interdisciplinary research underscores the importance of non-STEM fields in addressing complex global issues. Incorporating knowledge from these domains is crucial for developing comprehensive solutions to multifaceted problems. This shift towards interdisciplinary approaches is reflected in recent changes to global university rankings and assessment criteria, which, while not explicitly presented as an acknowledgment of non-STEM, arts, and humanities disciplines, create significant opportunities for these fields to gain recognition and appreciation within the academic community.

The incorporation of Sustainable Development Goals (SDGs) into global university rankings exemplifies this trend, emphasizing the broader societal impact of research and education (De la Poza, 2021). Non-STEM fields frequently excel in addressing these goals, which focus on social, cultural, and environmental issues. This move can be interpreted as a way of providing indirect recognition to these fields, correcting past imbalances in academic evaluation. Ranking systems now implicitly recognise the value of research and education that addresses complex societal challenges, areas where non-STEM subjects often thrive. The integration of SDGs in university assessments, therefore, raises the profile of non-STEM fields in international academic rankings, emphasizing their unique contributions and areas of expertise.

Interdisciplinary and transdisciplinary approaches significantly enhance the research productivity of non-STEM researchers by fostering collaboration, expanding research networks, and integrating diverse

perspectives. These methodologies facilitate the creation of innovative solutions to complex problems, which are increasingly recognised as essential in addressing contemporary societal challenges. One of the primary benefits of interdisciplinary collaboration is the ability to integrate diverse methodologies and theoretical frameworks, leading to innovative research outputs. Timmis and Williams (2017) argue that interdisciplinary partnerships create new "in-between" spaces where different discourses and methodologies can converge, allowing for the development of alternative research practices and knowledge sites. This integration is crucial for non-STEM researchers, who often face challenges in accessing the technical expertise and resources available in STEM fields. By collaborating with STEM researchers, non-STEM scholars can enhance their research quality and productivity through shared methodologies and insights (O'Leary et al., 2015).

Moreover, the establishment of collaborative networks is vital for enhancing research visibility and impact. Dardas (2023) emphasizes the importance of fostering research environments that promote interdisciplinary collaborations and engagement with global research networks. This engagement not only broadens the reach of research outputs but also enhances the potential for impactful findings that resonate across various fields. The collaborative nature of interdisciplinary research allows non-STEM researchers to tap into broader funding opportunities and resources, which are increasingly favouring transdisciplinary approaches (Lawrence et al., 2022).

To effectively implement and promote interdisciplinary and transdisciplinary approaches in Malaysian higher education, the following strategies could be considered:

i) Develop Interdisciplinary Research Centres: Establish dedicated centres that bring together researchers from various disciplines to work on complex societal issues aligned with Malaysia's national priorities and the SDGs.
ii) Create Interdisciplinary Funding Schemes: Design grant programs that specifically support collaborative projects between STEM and non-STEM researchers, encouraging innovative approaches to pressing challenges.
iii) Revise Promotion and Tenure Criteria: Modify existing evaluation systems to recognise and reward interdisciplinary research efforts, ensuring that faculty members are not penalized for engaging in collaborative work that may not fit traditional disciplinary boundaries.
iv) Enhance Interdisciplinary Education: Develop interdisciplinary degree programs and courses that integrate knowledge from multiple fields, preparing students for the complex challenges of the modern workforce.
v) Promote Knowledge Translation: Develop mechanisms to effectively communicate interdisciplinary research findings to policymakers and the public, enhancing the visibility and impact of non-STEM contributions to societal challenges.
vi) Organise Interdisciplinary Conferences and Workshops: Host events that bring together researchers from diverse fields to share insights, methodologies, and foster new collaborations.

By implementing these strategies, Malaysian higher education institutions can create a more inclusive and innovative research ecosystem that leverages the strengths of both STEM and non-STEM disciplines. This approach not only enhances the quality and impact of research outputs but also positions Malaysian universities to better address complex national and global challenges. Furthermore, it provides non-

STEM researchers with expanded opportunities for recognition, funding, and impactful contributions to society, ultimately strengthening Malaysia's position in the global academic landscape.

3.5 Recommendation 5: Management Support for Non-STEM Faculty:

The evolution of Malaysian universities has led to diversified academic employment and advancement structures, particularly in public institutions. Despite a uniform grade and salary system, substantial variations exist in promotion processes among these universities. To support non-STEM faculty effectively, universities should develop tailored performance appraisal forms that capture the unique contributions of these disciplines, establish customized assessment standards, and recognise a variety of professional contributions and trajectories. This support also extends to equitable resource allocation and professional development opportunities, which are crucial for career advancement in non-STEM fields.

To effectively recognise and support non-STEM faculty, universities should consider implementing the following strategies:

i) **Tailored Performance Appraisal Forms:** Non-STEM faculty often engage in a variety of activities, including teaching, research, and community service, which may not be adequately captured by standardized metrics typically used in STEM fields. Performance appraisal systems that include criteria specific to the arts, humanities, or social sciences can better reflect the contributions of non-STEM faculty (O'Meara, 2022). These tailored forms should:
    a) Include qualitative assessment criteria that capture the nuanced nature of non-STEM work.
    b) Recognise creative outputs, such as exhibitions, performances, and literary works.
    c) Assess the impact of research and creative work on society, culture, and policy.
    d) Consider the quality and innovation in teaching methodologies specific to non-STEM disciplines.

ii) **Recognition of Diverse Contributions:** Acknowledge the importance of teaching, mentorship, proactive community engagement, and cultural contributions (Abu Said, 2015). This recognition should:
    a) Value the impact of public engagement activities, such as public lectures, media appearances, and community workshops.
    b) Consider the role of non-STEM faculty in preserving and promoting cultural heritage.
    c) Recognise leadership roles in academic and professional organisations.
    d) Appreciate the development of innovative teaching materials and methodologies. Efforts on recognising Non-Traditional Research Outputs (NTRO) have started with the inaugural guidelines for Malaysian universities (Abdullah, 2022). These guidelines should be further developed and widely implemented to ensure comprehensive recognition of non-STEM contributions.

iii) **Varied Professional Trajectories:** Recognise that career paths in non-STEM fields may differ from traditional trajectories and adapt promotion and tenure policies accordingly (Adi Badiozaman, 2021). This adaptation should:

a) Allow for flexibility in the weighting of different aspects of academic work (teaching, research, service) based on individual strengths and departmental needs.
b) Recognise alternative forms of scholarship, such as engaged scholarship or practice-based research.
c) Consider the long-term nature of some non-STEM research projects when evaluating productivity.
d) Acknowledge the importance of interdisciplinary work and collaborations that may not fit traditional disciplinary boundaries.

iv) **Professional Development Opportunities:** Provide targeted development programmes for non-STEM faculty, including grant writing workshops and digital scholarship training. Mentoring, social support, and organisational support are all important development factors in one's career path (Arokiasamy, 2011). These opportunities should:
a) Offer workshops on securing funding from arts and humanities-specific grants.
b) Provide training in digital tools and methodologies relevant to non-STEM research.
c) Establish mentoring programs that pair junior non-STEM faculty with experienced colleagues.
d) Create networking opportunities with peers from other institutions to foster collaboration and knowledge exchange.

v) **Equitable Resource Allocation:** Advocate for fair distribution of research funds and institutional support for non-STEM disciplines. This should include:
a) Providing funds specifically for interdisciplinary projects that include both STEM and non-STEM disciplines to foster collaboration and innovation.
b) Allocating resources for non-STEM specific research infrastructure, such as performance spaces, art studios, or specialized archives.
c) Ensuring equitable access to research assistants and administrative support.
d) Supporting travel to conferences and research sites, which is crucial for many non-STEM disciplines.

As noted by Ahmad (2012) and Uddin (2021), institutional encouragement and flexible funding can lead to effective outcomes in interdisciplinary research, enhancing the productivity of non-STEM fields by integrating diverse perspectives and methodologies.

To implement these recommendations effectively, Malaysian universities should:

i) Establish a task force comprising representatives from various non-STEM disciplines to review and revise existing policies and practices.
ii) Conduct regular surveys and focus groups with non-STEM faculty to identify specific needs and challenges.
iii) Develop clear guidelines for promotion and tenure committees on how to evaluate non-STEM contributions.
iv) Create a dedicated fund for non-STEM research and creative activities.
v) Regularly review and update policies to ensure they remain relevant and supportive of non-STEM

faculty.

By implementing these strategies, Malaysian universities can create a more inclusive and supportive environment for non-STEM faculty. This approach not only enhances the career satisfaction and productivity of these academics but also enriches the overall academic ecosystem. Recognizing and nurturing the diverse contributions of non-STEM disciplines is crucial for addressing complex societal challenges and maintaining a well-rounded, globally competitive higher education system in Malaysia.

3.6 Future Implications

Concerns have been raised about the future implications of Industry 5.0, micro-credentials, direct employer recruiting, and the increasing influence of artificial intelligence (AI) and robotics in the labour market on university roles. These factors are expected to have a significant impact on the value and demand for arts and humanities education (Sirat 2018). Micro-credentials offer a flexible and specialised approach to gaining expertise in a variety of subjects, including the arts and humanities. They have the potential to make these subjects more accessible and relevant to a broader audience. As the concept of lifelong learning becomes more popular, the arts and humanities can play an important role in providing ongoing intellectual and cultural enrichment. Soft skills such as critical thinking, creativity, empathy, and ethical judgement are becoming increasingly important to employers. These abilities are frequently developed through education in the arts and humanities. Graduates of the arts and humanities have a diverse set of perspectives that can enrich the workplace by fostering problem-solving skills and encouraging innovation. With the increasing involvement of AI and robotics in tasks that can be measured or quantified, it is critical for the human workforce to focus on areas where humans have a distinct advantage, such as creativity, emotional intelligence, and ethical decision-making. The arts and humanities fields provide valuable perspectives on the societal implications of technology and can play a critical role in shaping its ethical advancement and implementation.

As the 'last bastion of humanity, the arts and humanities preserve the essence of humanity - our culture, values, and history - in a highly automated world. These disciplines are critical for critically analysing the implications of technological advances and making ethical decisions about their application.

4. Conclusions

The literature review underscores the increasing acknowledgement of the significance of fields outside of STEM in academia, as well as the necessity for a research management approach that is more equitable and compassionate. As a result of the historical predilection for quantifiable metrics and the subsequent implementation of university rankings, the arts, humanities, and social sciences have been disadvantaged. Nevertheless, the transition towards recognising the varied contributions of these disciplines is an encouraging progression that signifies a deeper comprehension of the essence and worth of knowledge. In summary, this review of the literature advocates for a fundamental change in the way academic support and recognition is approached, placing particular emphasis on the imperative for university administrators and policymakers to implement tangible measures that foster a more diverse and fairer academic environment. By recognising and cultivating the contributions of fields outside of STEM, we can cultivate a higher education system that is more robust, adaptable, and beneficial to society at large.

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RESEARCH ARTICLE

Empowering Research Ecosystems: Profiles and Bibliometrics Analysis of Research Officers at Universiti Malaya

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ABSTRACT

The future trajectory of Universiti Malaya (UM) as a prominent regional research institution in Malaysia is intricately intertwined with the expertise and contributions of its research workforce, including the Research Officers (ROs). Given the pivotal role played by ROs in UM's research and innovation landscape, this paper briefly highlights an overview of their general roles in empowering UM's research and innovation landscape. The UM's ROs were profiled according to their gender, educational background, position, and grade. The study employs bibliometric analysis using data from the Scopus database to examine the scholarly output of ROs, focusing on their H-index, research fields, and the number of scientific publications produced between 2018 and 2022. The bibliometric impact analysis was performed by focusing on the citation of the publications, joint-publications network, and correlation of publications' contribution between the ROs over all the researchers in UM. The profile analysis indicates that ROs in UM are dominated by females, with postgraduate education qualification, and mostly holding entry-level positions (grade 41). The impact analysis shows that UM's ROs had an international network with 27% of their publications being jointly authored with international collaborators. They consistently contribute dto scholarly output by showing a coherent trend with the overall publication of UM. This work highlights the significant role of ROs in a Malaysian research university, setting the benchmark for other national universities in enhancing the credibility of ROs in achieving research and innovation excellence.

Keywords: Research officers, Roles, Profiles, Research impact, Universiti Malaya, Scopus, bibliometric analysis.

1. Introduction

1.1 Overview

The age of globalisation necessitates that Malaysia adapts and accommodates new realities, particularly within the realm of education. This underscores the immediate requirement for a more innovative workforce capable of generating prosperity within the nation, with the goal of enhancing the overall quality of life. With strong aspirations to be at par with other world-class universities, five research universities which are Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Putra Malaysia (UPM) and Universiti Teknologi Malaysia (UTM) (Saadatian et al., 2009) are being closely scrutinised for their capability to mitigate diverse challenge (Mohamad Sheriff & Abdullah, 2017).

One prevailing challenge is the utilisation of human capital to produce impactful results that will improve university performance (Salau et al., 2016; Kucharčíková, Tokarčíková, & Blašková, 2015), especially in promoting research and development (R&D) growth to produce outputs, results, and generation of income for the university. To foster a culture of R&D in Malaysia, the Public Services Department, responsible for overseeing human capital in the public or civil service sector (Johari &Yahya, 2019), has established a flexible category of career positions known as Research Officers (ROs) and Social Research Officers (SROs).

The ROs are responsible for conducting R&D tasks, providing expert services, and training, legal services based on their areas of expertise. They also have to publish articles in relevant fields. Meanwhile, the SROs are responsible for carrying out research activities, and operational tasks related to social marketing, such as advertising for educational purposes, publishing and the dissemination of knowledge, as well as providing professional and community services (Suruhanjaya Perkhidmatan Awam Malaysia, 2020). Overall, both positions are placed strategically in ministries, government agencies, and various government departments that require R&D work.

Due to the specialised and specific job roles of ROs, these positions were deemed particularly well-suited for placement within Malaysian Research Universities (MRUs). As one of the recognized MRUs, Universiti Malaya is tasked with expanding its research and commercialisation activities due to the relationship between economic growth and R&D activities (Tan & Md. Noor, 2013). UM employs research management and governance practices to bolster and further improve the existing research management and governance, aligning with the Malaysian government's goal of attaining high-income nation status (Md Kasim et al., 2021). Within UM, ROs were categorised as professional staff, typically situated in research centres and research management offices, assuming various significant roles and responsibilities. Professional staff in a university play a crucial and diverse role in supporting the institution's mission and overall functioning (Veles et al., 2023). In fact, the Malaysian Department of Higher Education Strategic Plan 2018 – 2022, aimed at advancing human capital development by transforming higher education (Department of Higher Education, Ministry of Higher Education, 2023). This plan seeks to address the nation's development requirements and elevate its standing on the global stage by prioritising and bolstering the culture of R&D and enhancing teaching and learning across all segments of society.

1.2 Bibliometric Analysis

The Scopus database is exceptionally suitable for bibliometric analysis due to its comprehensive coverage of scholarly publications, spanning various disciplines and encompassing a vast global research landscape (Burnham, 2006). Its extensive indexing includes a wide array of academic journals, conference proceedings, and patent literature, making it a valuable resource for assessing research output and impact (Pranckutė, 2021). Scopus provides detailed citation data, allowing for the analysis of citation patterns and collaborations, thus facilitating the evaluation of research influence and trends. Its user-friendly interface and search functionalities further enhance its utility in conducting bibliometric studies, enabling researchers to extract valuable insights into academic productivity, collaboration networks, and research trends, making it an indispensable tool for bibliometric analysis (Ghani et al. 2022). Scopus-based bibliometric analysis has been employed to understand the trends of academic publication in a case study of Malaysian research universities (Mohd Sarjidan and Md Kasim 2023).

1.3 Importance of the Study

Several studies on the professional staff in universities have been previously carried out. Baltaru (2019) evaluated the impact of changes in the ratio of professional staff to students (from 2003 to 2011) on subsequent university performance, utilizing a sample of 100 British institutions. It was observed that institutions with a slight increase in professional staff have elevated degree completion rates. Nevertheless, no notable variations were found regarding research quality, high honours degrees, or graduate employability.

Gander (2018) conducted a study on the job requirements, values, attitudes, and behaviours of university professional staff members utilizing a modern career profile framework. His findings, which were based on a mixed methods study design, enhanced the professional profile hypothesis by emphasizing individual demands, associated behaviours, and outcomes, while proposing that several psychological factors influence career behaviours. In another study, this time on the psychological contracts of university professional staff, Gander (2023) found that the expectations of psychological contracts for modern professional characteristics were among the most significant predictors of psychological contract violation, in conjunction with satisfaction.

Other studies focus on the skills of professional research staff, and among them was one by Berman and Pitman (2010) who examined the degree to which universities, which advocate for the importance of generic skills among research degree candidates, leverage the research and transferable skills of PhD graduates who are employed as professional staff within the university sector. Their findings found that research-trained professional workers at an Australian university were effectively applying their research and general abilities in management positions, therefore benefiting the institution.

Despite a significant cohort of professional research staff in the university, there is a dearth of studies about ROs in the Malaysian landscape. The importance of this study is underscored by its primary objectives, which revolve around shedding light on the roles, profiles, contributions, and impacts of ROs within academic institutions. By examining the ROs in-depth, this study provides valuable insights into their organisational structure, functions, and the contributions they make to the R&D landscape. Such insights are not only crucial for enhancing the internal operations of ROs but also hold broader

implications. As the study aspires to become a reference point for the formulation and design of R&D policies in universities, it offers insights that may guide and shape the strategic direction of research initiatives within the academic sphere.

1.4 Roles of Research Officers at Universiti Malaya

MRU needs to continue to evolve to become more competitive, driving the remaining challenges in education, inter- and transdisciplinary research and innovation, career development, and governance (Ramli et al., 2013). Moreover, MRU has played a role in relation to university-based incubators in facilitating the entrepreneurial process (Liow & Wong, 2021). In line with the development of MRUs, the role of a RO in most RUs has become increasingly important in today's complex and competitive academic landscape (Mohamad Sheriff & Abdullah, 2017). At UM, ROs play an increasingly important and integrated role in managing research activities and shaping institutional policies and strategies to meet the growing complexities and demands of modern research environments. From the job description analysis of 70 ROs, we have summarised the role of the ROs at UM into eleven (11) main pillars as explained in the following sections.

1.4.1 Grant Acquisition and Management

ROs are responsible for identifying and securing various types of research funding including government, industry, private, and international grants, assisting research centres and researchers/academicians in preparing grant applications, ensuring compliance with funding guidelines, and pre- and post-award as well as non-financial management. In an era of shrinking public funding and increasing competition, RO's ability to navigate the intricacies of grant applications and develop successful proposals is critical in maintaining research programs (Sato et al., 2021).

1.4.2 Writing, Editing, and Manuscript Submission

The ROs are usually involved in writing research papers, reports, or articles. This includes drafting manuscripts, creating figures and tables, and adhering to the publication guidelines. This also includes assisting in submitting research papers to targeted journals, conferences, or other publications which involves preparing the cover letters, tracking submission progress, and dealing with any reviewer comments. (Ecarnot et al., 2015).

1.4.3 Collaboration and Partnership

Most research universities are fostering interdisciplinary research collaborations to address complex and real-world problems (Azman et al., 2019). ROs serve as intermediaries in connecting researchers/ academicians from different disciplines, facilitating interdisciplinary projects, supporting cross-disciplinary work, and helping to negotiate agreements. They coordinate the collaborative processes and ensure researchers have the resources and support to effectively pursue cross-disciplinary engagement.

1.4.4 Research Consultancy and Special Service

The role of ROs extends across multiple dimensions, including providing consultancy services, delivering specialised expertise, and conducting comprehensive characterisation and analytical assessments for both internal and external researchers affiliated with the university. In this capacity, the RO plays a

pivotal role in assisting and supporting the research landscape in university by delivering expert guidance, tailor-made solutions, and rigorous investigative work to meet the needs of researchers within and outside the institution (Quaglione et al., 2015).

1.4.5 Compliance and Regulations

With the growth in interdisciplinary and interinstitutional research, there is a greater need to navigate complex regulatory and ethical considerations. ROs assist in ensuring that research activities meet legal and ethical standards, including human subjects' protection, animal welfare, and intellectual property rights (Roets, 2017).

1.4.6 Research Strategy and Capacity Building

The ROs contribute to the development and shaping of the university's research strategies by identifying emerging trends and opportunities in various fields. By keeping an eye on the broader research landscape, ROs help institutions align their efforts with evolving priorities, and provide input on how best to allocate resources. By engaging in training and capacity-building efforts with stakeholders, the University's management can enhance their understanding and application of research in policy and decision-making. (Hellström, 2018).

1.4.7 Technology Transfer and Commercialisation

Promoting the commercialisation of research outcomes and fostering innovation are key components of RO roles. They help bridge the gap between academic research and potential real-world applications, fostering innovation and economic development (Brantnell & Baraldi, 2022).

1.4.8 Data and Analytics

With the increasing importance of data-driven decision-making, ROs play a role in analysing and interpreting research data to inform strategic decisions and provide insights into research performance. They assist in tracking and reporting progress and outcomes and evaluating the impact of research projects. This information is important for accountability, assessing the return on investment, and demonstrating the university's contribution to knowledge and society (Unwin, 2020).

1.4.9 Advocacy and Outreach

ROs are often involved in advocacy efforts to encourage research interest and gain support from government bodies, industry players, and the public. This enables the university to communicate its research achievements and its societal impact to various stakeholders (Buenestado-Fernández et al., 2019).

1.4.10 Managing Research Infrastructure

In today's technology-driven world, ROs are also involved in managing research technology and infrastructure. They assist and provide support for research infrastructure including research computing, space, equipment, and shared research facilities. As an entrepreneurial university, UM needs to establish a strategic direction for leadership in developing large-scale research infrastructure (Rådberg & Löfsten, 2023).

1.4.11 Policy Development

Research policies establish the essential framework for the effective and efficient management of research within higher education institutions and academic programs (Millones-Gómez et al., 2021). In UM, ROs contribute to policy development and formulation by providing evidence-based insights and recommendations. They help identify policy gaps, assess the impact of existing policies, and propose new policy solutions for the betterment of society.

2. Methodology

2.1 Data collection

The data collection timeline for this study was meticulously executed to ensure the accuracy and reliability of the gathered information. Initially, on March 8, 2022, a comprehensive list of ROs at UM was obtained. Subsequently, on January 3, 2023, the list was reviewed, and out of the initially identified 74 staff, only 70 were considered for analysis, as four of them had resigned before the conclusion of 2022. Access to the Scopus database, a vital resource for data collection, was granted on January 9, 2023. In addition, UM's ROs profile was extracted from the publicly available UMExpert database (https://umexpert.um.edu.my/).

The data collection process involved searching Scopus profiles for the 70 retained ROs. Among these, 58 individuals (83 %) were found to have active Scopus profiles, from which data, including documents published and citation counts, was gathered for the period spanning 2018 to 2022. It's important to note that documents classified as "Erratum" were excluded from the data.

To maintain data accuracy, in cases where multiple Scopus profiles were associated with the same individual, a merging process was implemented. Subsequently, the collected data underwent a comprehensive analysis, with a primary focus on assessing the research output and impact of the ROs at UM during the specified 2018-2022 timeframe. This analysis involved the application of various statistical methods to identify trends, correlations, and patterns in the research productivity and impact of the ROs.

2.2 Data analysis

The analysis in this study employed a multifaceted approach to assess various aspects of ROs at UM. In profiling the individuals, key attributes such as gender, educational background, current position, grade, and H-index were examined, providing insights into the composition of the academic community. Scholarly activity was scrutinised, focusing on their respective fields of research and the number of publications, shedding light on their research productivity and areas of expertise.

Furthermore, the impact delivery from the ROs was evaluated by considering their research publication citation counts and examining co-authorship patterns, which shed light on collaborative efforts in research. These two impact-related metrics served as indicators of the influence and collaborative engagement of these professionals in the academic and research domains. Collectively, this analytical approach offered a thorough understanding of the ROs' profiles and their contributions to research and collaborative initiatives at both local and global levels.

2.3 Limitations

However, it is essential to acknowledge certain limitations in this research. Firstly, the analysis is contingent on the data available in the Scopus database and may not encompass research outputs that are not indexed in Scopus. Furthermore, the study is confined to the designated time frame of 2018 to 2022 and may not account for earlier or later publications and citations. Next, this study excludes several critical data sources due to limited access, such as research project and grant databases, awards, and recognition, as well as intellectual properties and commercialisation. These exclusions may impact the comprehensiveness of the findings and limit a holistic assessment of the ROs' contributions and impact.

3. Results and Discussion

3.1 Profile Analysis

In UM, the profile of ROs reflects a diverse and dynamic workforce. **Figure 1(a)** shows the gender distribution among ROs with a relatively balanced representation of males constituting 24.34 % and females comprising 46.66 % of the total. The educational qualification of these professionals varies, with 9.13 % holding bachelor's degrees, 31.44 % possessing master's degrees, and 30.43 % having attained a PhD, reflecting a substantial number of highly qualified individuals (**Figure 1(b)**). In terms of job roles, ROs dominate the landscape, constituting 58.83 % of the positions. Social ROs make up 11.16 %, while Research Managers form a smaller segment at 1.1 % (**Figure 1(c)**). This distribution indicates a hierarchical structure within research-related roles, with the majority actively involved in the execution and management of research projects. Notably, a significant proportion of UM ROs (87%) possess postgraduate qualifications.

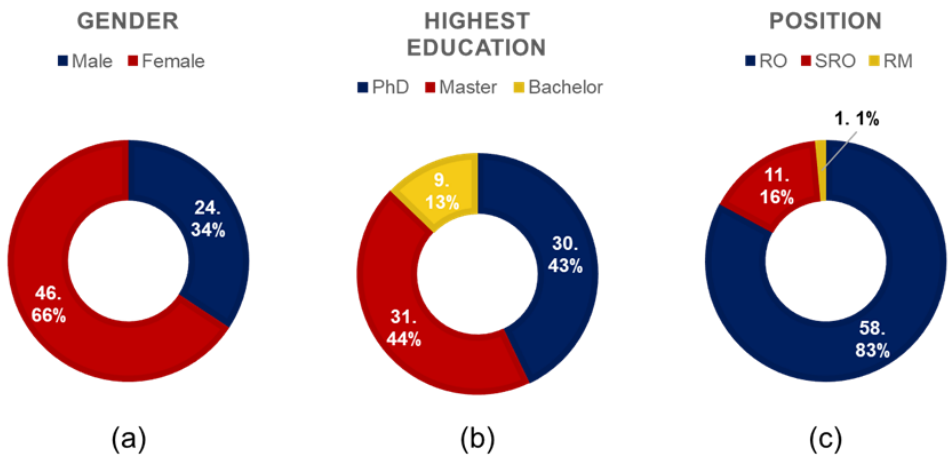


Figure 1: Composition of (a) gender, (b) highest education, and (c) management and professional position of UM's Research Officer (RO), Social Research Officer (SRO), and Research Manager (RM).

The positions of ROs are categorised into different grade levels, reflecting a structured hierarchy within the institution. In which the grade of Q41/N41 is equivalent to an entry-level position, where Q43/Q44/ N44 is parallel to a senior officer position, Q47/Q48 refers to a manager position, and Q52/Q54 corresponds to a senior manager position. **Figure 2** displays the distribution of UM's ROs according to position grade indicating a diverse range of responsibilities and expertise across various grades. Among these, Grade Q41 is the most prevalent, with 24 ROs falling into this category, signifying a substantial workforce engaged in research activities at a foundational level. Following this, Grade Q44 accommodates 11 ROs, while Grade Q43 and Grade Q48 each have 8 and 7 individuals, respectively. Smaller groups exist in Grades Q54 and Q47, with 2 ROs in each grade. Grade Q52 encompasses 5 ROs, adding to the multifaceted composition of the research workforce at UM. For the category of SROs, the distribution is similarly structured by grade. Three individuals hold the N44 grade, indicating a specialised role within this category. Eight Social ROs are in the N41 grade, suggesting a slightly larger cohort engaged in more foundational aspects of social research and as early career researcher or manager. This distribution showcases the institution's commitment to structuring its workforce in a way that accommodates varying levels of experience based on expertise position and responsibilities within the field of research and management, ensuring a comprehensive and well-rounded research ecosystem.

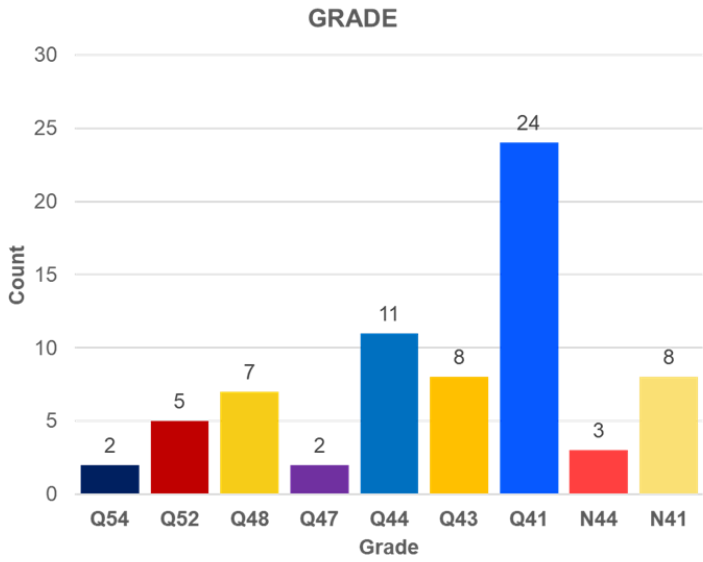


Figure 2: Number of ROs according to position grade in UM.

The h-index distribution among ROs at UM provides insights into the productivity and impact of their scholarly output (**Figure 3**). A significant number of ROs, 31 individuals to be precise, fall within the h-index range of 0 to 5. This suggests that a substantial number of researchers are at the early stages of their research careers or have a focused body of work with moderate citation impact.

In the h-index range of 6 to 10, there are 16 ROs, indicating a cohort that establishing an impactful scholarly profile. This group likely includes individuals whose research has garnered attention and

citations within the academic community. Moving further up the h-index scale, 9 ROs have achieved h-index in the range of 11 to 15, signifying a higher level of influence and recognition for their scholarly contributions. Additionally, a smaller yet distinguished group consists of a single RO with h-index in the range of 16 to 20, reflecting a notable impact in their respective fields. Notably, one RO at UM boasts an h-index exceeding 20, underscoring an exceptional level of scholarly influence and recognition. This achievement likely represents the contributions of a highly esteemed researcher whose work has made a significant impact in their field. Overall, the distribution of h-indices among ROs at UM reflects a diverse spectrum of scholarly impact, encompassing both emerging talents and established experts within the institution.

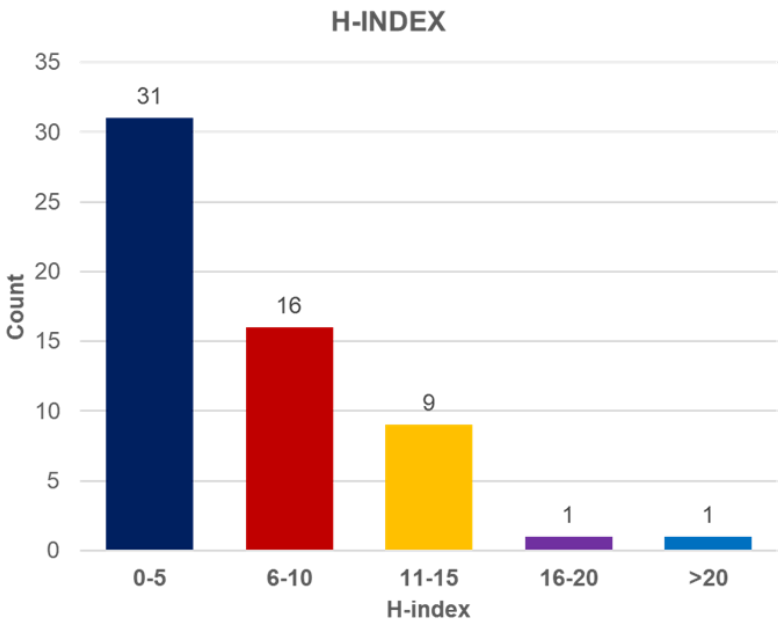
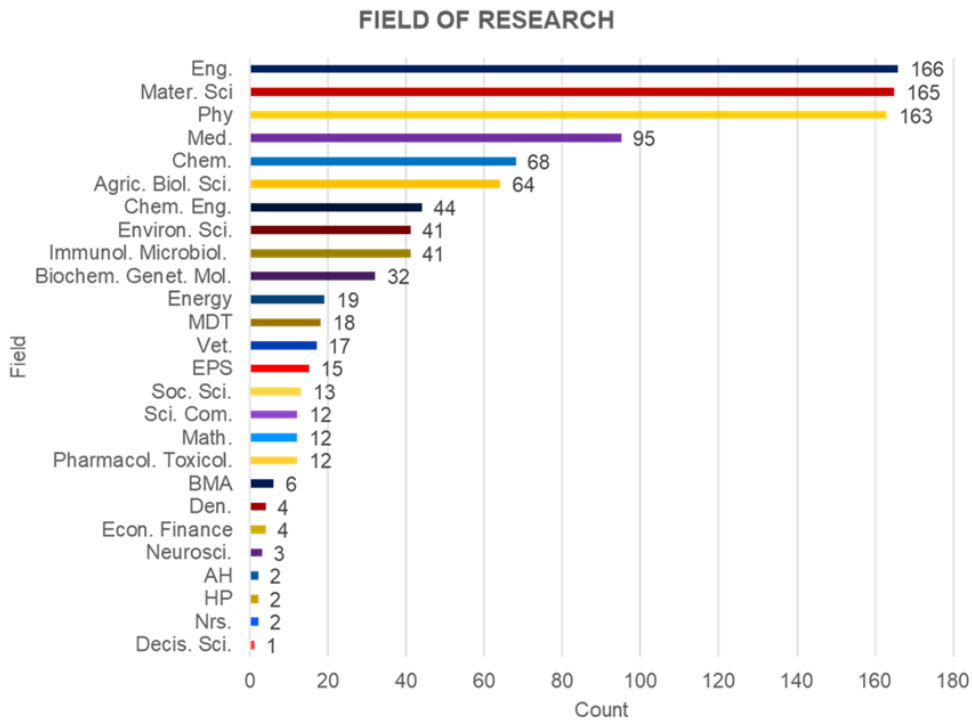


Figure 3: Number of ROs according to H-index in UM.

Figure 4 portrays UM's ROs who have made significant contributions to a diverse array of fields, as evidenced by their publication output from the year of 2018 to 2022. The top five fields of publication by UM's ROs counted in this work timeframe were Engineering, Material Science, Physics, Medicine, and Chemistry. The top three fields; Engineering, Material Science, and Physics recorded a close gap of 166, 165, and 163 counts respectively. It can be observed and analysed that these three fields are related to the contribution of ROs from the Photonic Research Centre (PRC) and are ranked the top three in the document count (**Table 1**). This output reflects a commitment of UM's ROs to advancing technological solutions and addressing challenges within the physics-related discipline in the practice of material application and development as well as technological device mechanisms.



Field	Abbreviation	Count	Field	Abbreviation	Count
Engineering	(Eng.)	166	Earth and Planetary Sciences	(EPS)	15
Materials Science	(Mater. Sci)	165	Social Sciences	(Soc. Sci.)	13
Physics and Astronomy	(Phy)	163	Computer Science	(Sci. Com.)	12
Medicine	(Med.)	95	Mathematics	(Math.)	12
Chemistry	(Chem.)	68	Pharmacology, Toxicology and Pharmaceutics	(Pharmacol. Toxicol.)	12
Agricultural and Biological Sciences	(Agric. Biol. Sci.)	64	Business, Management and Accounting	(BMA)	6
Chemical Engineering	(Chem. Eng.)	44	Dentistry	(Den.)	4
Environmental Science	(Environ. Sci.)	41	Economics, Econometrics and Finance	(Econ. Finance)	4
Immunology and Microbiology	(Immunol. Microbiol.)	41	Neuroscience	(Neurosci.)	3
Biochemistry, Genetics and Molecular Biology	(Biochem. Genet. Mol.)	32	Arts and Humanities	(AH)	2
Energy	(Energy)	19	Health Professions	(HP)	2
Multidisciplinary	(MDT)	18	Nursing	(Nrs.)	2
Veterinary	(Vet.)	17	Decision Sciences	(Decis. Sci.)	1

Figure 4: The number of ROs' fields of research contributed to the publications from 2018 to 2022 from the Scopus database.

Table 1 highlights the top ten authors among UM's ROs, ranked by their prolific publication output from 2018 to 2022. The results reflect a diverse range of expertise and contributions spanning various research centres and disciplines. Dr. Muhamad Zharif Samion leads with the highest document count of 55 publications. Notably, the top three authors are affiliated with the Photonic Research Centre (PRC), underscoring significant contributions in the fields of Engineering, Materials Science, and Physics, as illustrated in **Figure 4**. The list in **Table 1** also reflects the hierarchical distribution of academic qualifications and gender representation. Among the top ten authors, men dominate, with only one

female researcher, Dr. Siti Aisyah Reduan, included. Additionally, while nine authors hold doctoral degrees, one author, Mr. Khor Chee Sieng, has a master's degree. The h-index values of these top contributors exhibit a diverse range, spanning from 6 to 21, highlighting varying levels of scholarly impact among UM's leading researchers.

Table 1: Top 10 UM's ROs with the highest number of publications from 2018 to 2022, based on data from the Scopus database.

Author	Placement	Position	Highest Academic Qualification	H-Index	Document Count (2018-2022)
M.Z. Samion	Photonic Research Centre (PRC)	RO	PhD	13	55
M.F. Ismail	Photonic Research Centre (PRC)	RO	PhD	17	53
S.A. Reduan	Photonic Research Centre (PRC)	RO	PhD	15	39
C.D. Chen	Deputy Vice-Chancellor (Research & Innovation)	RO	PhD	21	34
S.K. Loong	Tropical Infectious Diseases Research & Education Centre (TIDREC)	RO	PhD	9	30
M.K.A Zaini	Photonic Research Centre (PRC)	RO	PhD	6	29
K.M. Lee	Deputy Vice-Chancellor (Research & Innovation)	RO	PhD	14	26
V. Balakrishnan	Pusat Pengkhususan Tenaga Kuasa Termaju UM (UMPEDAC)	RO	PhD	12	26
C.S. Khor	Tropical Infectious Diseases Research & Education Centre (TIDREC)	RO	Master	10	23
M.Z. Kufian	Faculty of Science	RO	PhD	14	19

3.2 Impact Analysis

As portrayed in **Figure 5** between the years 2018 and 2022, there has been a discernible upward trend in both publications and citations, indicating a growing interest and recognition of the work produced. In 2018, a total of 88 publications were produced, accompanied by 38 citations. While the number of publications was relatively modest, the citation count suggests a certain level of impact and influence within the academic community.

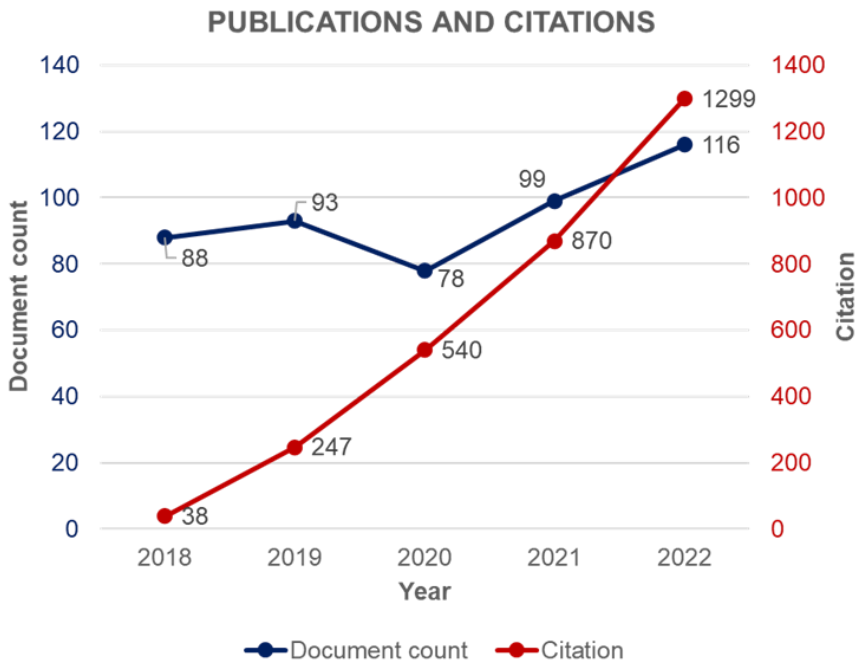


Figure 5. Document count and citation metrics for publications contributed by ROs at UM from 2018 to 2022, based on data from the Scopus database.

The following year, 2019, saw a notable increase in both publications and citations. The number of publications rose to 93, indicating a continued commitment to research output, while the citations experienced a substantial leap to 247. This significant rise in citations suggests that the research from the previous year gained traction and recognition within the scholarly landscape. In 2020, despite a slight dip in the number of publications to 78, there was a remarkable surge in citations to 540. This suggests that the quality and impact of the research output may have compensated for the slight reduction in quantity. The increased citations could also be indicative of the growing relevance and applicability of the work to the wider academic community.

The year 2021 witnessed a resurgence in both publications and citations. The number of publications reached 99, signalling a renewed vigour in research productivity. The citations, however, saw a substantial jump to 870, indicating that the research output not only continued to be prolific but also

garnered increased attention and acknowledgment. The trend continued into 2022, with a further increase in both publications and citations. A total of 116 publications were produced, showcasing a commitment to expanding the breadth of research. The citations skyrocketed to 1299, marking a significant elevation in the impact and recognition of the scholarly work. This suggests that the research conducted in 2022 continued to build upon the momentum of the previous years, solidifying its position as a notable contributor to the academic discourse.

Between 2018 and 2022, ROs at UM have produced numerous highly influential and widely cited publications (Table 2). Leading the list is a 2019 review article authored by Dr. Cheah Mei Yee, titled 'Sustainability of Direct Biodiesel Synthesis from Microalgae Biomass: A Critical Review', published in the *Journal Renewable and Sustainable Energy Reviews*. With an impressive 209 citations, this work underscores the critical importance of sustainable biodiesel synthesis and establishes Dr. Cheah as a leading authority in the field. The analysis of the top four most-cited documents in Table 2 reveals that review articles dominate, consistently garnering high citation counts. Review papers provide a comprehensive overview of a specific field, summarising existing literature, key developments, and current trends. Their value lies in serving as a one-stop resource for researchers seeking to understand the state of knowledge in a given area, which explains their significant citation impact.

Additionally, it is noteworthy that among the top four most-cited documents, two are centred on solar research, which has attracted more citations compared to other fields. This prominence can be attributed to the global emphasis on sustainable and renewable energy sources, particularly solar energy. As the world strives to transition from fossil fuels to address pressing challenges such as climate change and energy security, research in solar energy garners extensive attention and citation, reflecting its global relevance and significance.

Table 2 also shows that all the ten top-cited documents recorded are in Q1 journals. This is due to the Q1 journal being in the top 25% of their subject category, indicating a relatively high impact within their field. These journals are typically well-established, prestigious, and widely recognized within their respective fields (Yan & Li 2018). Researchers often prefer to publish in or cite articles from these journals to enhance the visibility and impact of their own work. Furthermore, Table 2 highlights that an author's H-index does not necessarily correlate with the high citation count of a specific work or, in this context, a highly cited document. Another notable factor is that early-career researchers, or those in the initial stages of their career journey, may possess a relatively high h-index due to a few impactful papers but may not have had sufficient time to accumulate a substantial total citation count. In this case, the top-cited document, with 209 citations, is authored by Dr. Cheah Mei Yee, who has a comparatively low H-index of 5. This discrepancy is likely attributable to her status as an early-career researcher, which reflects the initial phase of her academic contributions despite producing highly influential work.

Table 2. Top 10 cited documents authored by ROs in UM from 2018 to 2022, based on data from the Scopus database.

Document Title	Publication Year	Journal Title	Journal Rank	Citation	Author / RO	H-Index
Sustainability of direct biodiesel synthesis from microalgae biomass: A critical review	2019	Renewable and Sustainable Energy Reviews	Q1	209	M.Y. Cheah	5
Advances in approaches and methods for self-cleaning of solar photovoltaic panels	2018	Solar Energy	Q1	113	N.N. Adzman	3
Pyrethroid resistance in the dengue vector Aedes aegypti in Southeast Asia: Present situation and prospects for management	2018	Parasites and Vectors	Q1	77	C.D. Chen	21
Electron transport properties analysis of titanium dioxide dye-sensitized solar cells (TiO2-DSSCs) based natural dyes using electrochemical impedance spectroscopy concept: A review	2020	Solar Energy	Q1	62	M.S. Ali	7
Differentiation of chromoplasts and other plastids in plants	2019	Plant Cell Reports	Q1	55	N. Mohd Sadali	2
Facile one-pot solvothermal method to synthesize solar active Bi2WO6 for photocatalytic degradation of organic dye	2019	Journal of Alloys and Compounds	Q1	49	K.M. Lee	14
Physicochemical property enhancement of biodiesel synthesis from hybrid feedstocks of waste cooking vegetable oil and Beauty leaf oil through optimized alkaline-catalysed transesterification	2018	Waste Management	Q1	49	M.Y. Cheah	5
Removal of methylene blue dye by solvothermally reduced graphene oxide: A metal-free adsorption and photodegradation method	2019	RSC Advances	Q1	43	K.M. Lee	14
Effective photoreduction of graphene oxide for photodegradation of volatile organic compounds	2019	RSC Advances	Q1	37	K.M. Lee	14
A review of recent developments on kinetics parameters for glycerol electrochemical conversion – A by-product of biodiesel	2020	Science of the Total Environment	Q1	32	C.S. Lee	8

The data presented in **Figure 6** reveals a robust international networking landscape, with 320 international affiliations accounting for an impressive 27% of the total 1,177 affiliations during this period. This highlights the university's strong commitment to fostering global collaborations and contributing to the international scientific community. As anticipated, national networking constitutes a significant portion of UM's research landscape. During the same period, there were 857 national affiliations, representing 73% of the total affiliations. This distribution reflects a balanced approach between local and global collaborations, underscoring the ROs' active engagement in advancing both national and international research agendas. Such collaborations, whether local or global, play a pivotal role in improving the quality of research outcomes and impact. They are particularly crucial for research universities (RU) to secure external funding for their research projects, as noted by Amran et al. (2014).

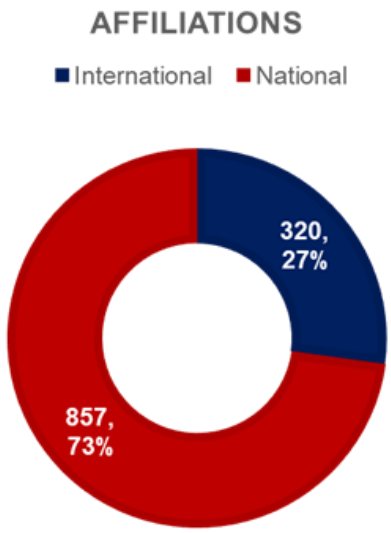


Figure 6. Percentage of national and international affiliations in publications authored by ROs in UM from 2018 to 2022 based on data from the Scopus database.

Figure 7 illustrates a global map highlighting countries (in blue) involved in publication collaborations with UM's ROs. Analysing the top 10 countries in these affiliations offers valuable insights into the geographical reach of UM's research network. Unsurprisingly, Malaysia leads with 474 affiliations, underscoring the university's active engagement in the national research ecosystem. Regionally, Indonesia ranks second with 73 affiliations, reflecting strong collaborative efforts within Southeast Asia. Internationally, the United Kingdom, with 40 affiliations, demonstrates UM's robust connections with Western academic institutions. Similarly, China and Taiwan, with 24 and 19 affiliations respectively, highlight the university's partnerships with prominent institutions in Asia. Additionally, Saudi Arabia, Japan, the United States, India, and France, each with 14 to 19 affiliations, contribute to the global diversity of UM's research collaborations. A study revealed that international media had induced high citation of Malaysian publications (Noorhidawati et al., 2017). It is highly encouraged for UM's ROs to proliferate research networking regionally or internationally as networking is the source of intellectual

resources such as research mentors or co-authors to assist RO in their research or publications completion (Mullen et al, 2008).

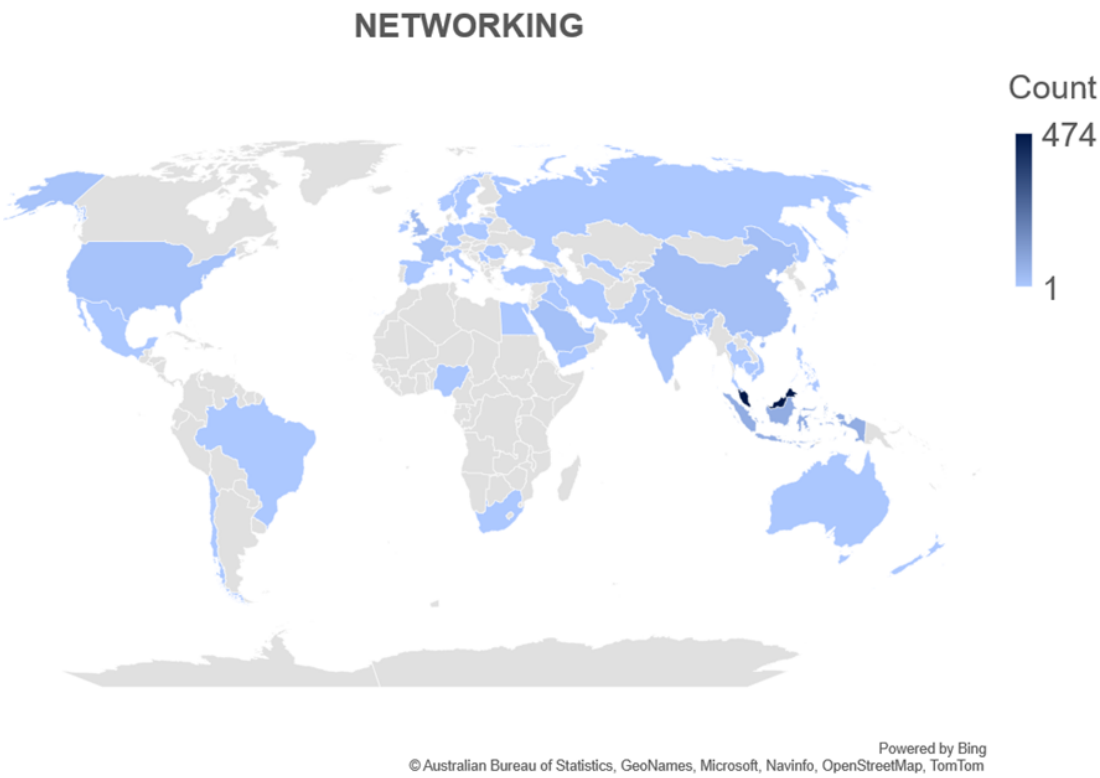
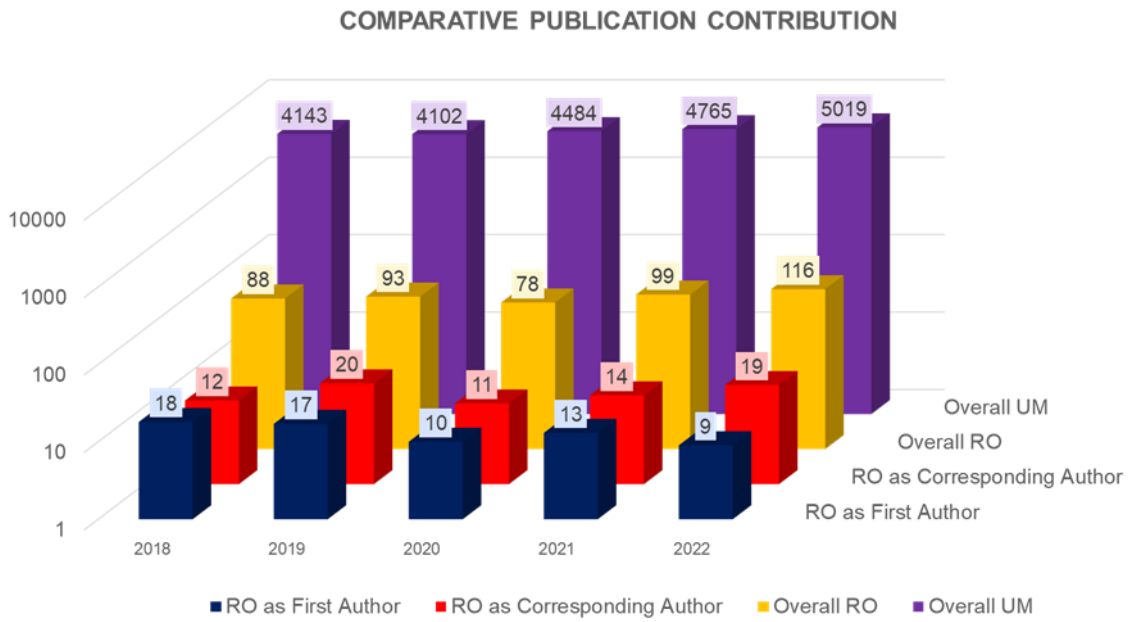


Figure 7. Map of publications networking collaboration by ROs in UM from 2018 to 2022, based on data from the Scopus database.

The performance of publications authored by ROs at UM, analysed within the context of the university's overall scholarly output from 2018 to 2022 (**Figure 8**), demonstrates a consistent and significant contribution to advancing academic research. In 2018, ROs contributed 88 publications, constituting a modest but significant portion of the 4,143 overall publications from UM during that year. While the percentage may seem relatively small, the impact and quality of these publications should be considered, as they contribute to the diversity and depth of the university's research profile. In 2019, a similar trend was observed, with ROs contributing 93 publications out of a total of 4,102 produced by the entire university. This highlights the ROs' stable and active engagement in research activities, underscoring their sustained importance within UM's broader academic and research landscape.

Figure 8. The number of publications authored by ROs in comparison to the overall number of publications in UM from 2018 to 2022 based on data from the Scopus database.



In 2020, the number of publications authored by ROs slightly decreased to 78, while the overall university output rose to 4,484 publications. Despite this reduction, the ROs' contributions continued to represent a significant portion of UM's scholarly output, demonstrating their sustained commitment to research excellence. The following year, 2021, marked a notable increase in both ROs' publications and overall university publications. ROs produced 99 publications out of a total of 4,765, demonstrating an upward trajectory in their research output. This suggests a growing influence and involvement of ROs in shaping the academic landscape of the university. In 2022, ROs at UM further strengthened their research contributions, producing 116 publications out of a total of 5,019 for the university. This not only reflects an increase in quantity but also underscores the expanding role and impact of ROs in driving the university's research agenda.

Figure 8 also presents a significant contribution of RO in which they consistently became the corresponding and first author for the publication every year. The highest number of corresponding and first authors among UM's ROs were 20 in 2019 and 18 in 2018, respectively. Conventionally, in the context of research publication, the extent of involvement decides the order of authorship; for example, the person who has done the majority of the groundwork would be considered eligible to be the first author, and the person who planned and conceived the study would be the last author (supervisor) (Singhal & Kalra, 2021). Usually, the corresponding author is the supervisor or principal investigator of the project, but in some cases, there is more than one corresponding author in a publication, depending on the rules and regulations of the publisher. This is an important highlight that the ROs are not only for writing the publications but are actively involved in other major scholarly and scientific endeavours.

4. Conclusions

The role of ROs at UM has evolved to encompass a wide range of responsibilities that are critical for the success and growth of research programs. Their roles and credibility to navigate the complex and competitive research landscape, facilitate interdisciplinary collaboration, secure funding, and publications, and ensure compliance with regulations are significant to the success of the university.

The publication records of UM's ROs from 2018 to 2022 reflect a diverse and comprehensive engagement with scholarly communication. UM's ROs have established a broad and impactful presence across various fields of study, driving advancements in knowledge, technology, and practical solutions to real-world challenges. This multidisciplinary approach solidifies the university's position as a key contributor to research at the intersection of scientific and engineering disciplines. The top ten authors exemplify areas of prominent expertise within UM, making substantial contributions to the institution's research landscape across multiple fields and research centres.

A consistent upward trajectory in both the quantity and impact of RO's publications, as reflected in the increasing citation counts, suggests a positive and dynamic research environment, with a growing influence on the work within the research community. The diverse network of collaborations demonstrates their commitment to fostering a well-rounded research environment that leverages both local expertise and global perspectives. RO contribution consistently represents a significant proportion of the overall scholarly output at UM, indicating a vital role in the university's research ecosystem, and contributing to its research excellence.

Besides scholarly output, the intellectual properties could be a valuable indicator for assessing the innovation performance of the ROs in the future (Mohd Sarjidan et al., 2023). Other research outputs such as research projects, grants, awards, and recognitions could also be beneficial to capture the holistic impact of the ROs. It is recommended that each faculty at UM establish RO placements to support and enhance the university's research excellence. It is a complementary force with the academics in which this synergy has the potential to significantly elevate the quality and impact of research and innovation, ultimately benefiting the university, the nation, and the global community.

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