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Measurement and Determinants of UPNM Internal Research Grant Performance

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Abstract

The Short-Term Research Grant is a competitive grant and fully funded by the University Pertahanan Nasional Malaysia. This article describes a best practice implementation in research management by the Division of Research and Innovation to a grant batch between the year 2014 and 2024. Although there has been significant investment starting from the year 2014, research publications trend in high-impact journals such as Web of Science, SCOPUS and Indexed Journal are still under par. Data finding consistently shows that most publications are only submitted and accepted in the second year of the grant being awarded. This study evaluates the relationship between the number of publications and total projects funded to the UPNM Internal Research Grant. By employing correlation analysis, a significant positive relationship was identified, with a correlation coefficient of 0.92, indicating that an increase in the number of projects typically leads to a corresponding rise in publications. The relationship is further quantified through a linear model using SPSS, showing that each additional project contributes approximately 0.91 publications. The model's negative intercept suggests an adjustment for baseline publication rates, indicating a threshold of project activity necessary to generate measurable publication output. This analysis underscores the critical role of project volume in driving research productivity and highlights the importance of optimising resource allocation to enhance both the quantity and quality of research outputs. Therefore, the study offers useful information concerning management of research and more specifically utilisation of research funds in universities. Moreover, this data could provide a solid basis for the Division of Research and Innovation, Universiti Pertahanan Nasional Malaysia to refine its research grant management strategy, aiming to enhance its performance in the Malaysia Research Assessment (MyRA) rating.

1. Introduction

This paper reports the best practice implemented in research grant management at the Centre for Research and Innovation Management, Universiti Pertahanan Nasional Malaysia (UPNM) for a grant batch between the year 2014 and 2024. UPNM Short Term Research Grant Scheme (GPJP) hereinafter referred to as GPJP aims to encourage the exploration of the latest ideas, concepts, theories, new findings and provide exposure to research

and innovation to UPNM staff. The main purpose of this grant is to attract more UPNM researchers among the academic and administrative staff of UPNM who are interested in conducting research and development (R&D) projects to improve the quality, performance, and a number of research projects in UPNM.

1.1 UPNM Short Term Research Grant Scheme

The research grant is defined by (Gralka *et al.*, 2019) as monetary rewards that are added to the normal operating budget of a university with the purpose of stimulating academic inquiry and the professional progress of younger scientists. UPNM Short Term Research Scheme is a basic research project conducted in an abbreviated time between a minimum of one year or a maximum period of two years. According to the Guideline of UPNM's Short Term Research Grant version year 2023, total grant allocation is being offered between a minimum of RM 5,000.00 up to a maximum of RM 20,000.00 and is considered to be in line with the main purpose of offering the Grant Scheme.

Moreover, the purpose of offering this grant is in line with UPNM's research and innovation goal to make this grant a platform to encourage researchers to do research. Thus, the fundamental study and data collection from a Project Leader (Davis *et al.*, 2020), would be good motivation to prepare an effective research proposal in order to apply for competitive external fund research grants from the Ministry of Higher Education (MOHE) through the Fundamental Research Grant Scheme (FRGS), Prototype Research Grant Scheme (PRGS), Transdisciplinary Research Grant Scheme (TRGS), Long Term Research Grant Scheme (LRGS) or a grant schemes from the Ministry of Science Technology and Innovation (MOSTI). The research domains for this grant scheme are divided into nine categories. Each application must adhere and meet to one of them, which are Pure and Applied Sciences, Technology and Engineering, Clinical and Health Sciences, Social Sciences, Arts and Applied Arts, Natural and Cultural Heritage, Information and Communication Technology, Sport Science and Teaching and Learning.

In the meantime, this grant scheme assists to increase the amount of writing and publication through research that can contribute to the university's Malaysia Research Assessment (MyRA) score each year for the publication section, Section C. This grant scheme also be a part of a requirement in the Key Performance Indicator (KPI) of an academic staff through the Annual Performance Appraisal Report (LPPT). This grant is given priority to all UPNM staff who do not have a current research grant from any agency as well as the applicant who is currently applying for an external grant. UPNM Short Term Grant is a competitive grant scheme where research proposal papers need to be evaluated and screened at the Faculty / Center level before being recommended to the Division of Research and Innovation (currently known as BPI) for university level screening.

According to Murray *et al.* (2016), in order to protect the legitimacy of the funds that they offer for scientific research, university research committee should adopt processes that firmly maintain fairness and transparency in the assessment process. This suggests that the research committee should prioritise the assessment and evaluation of grant proposals and design a very clear and fair work policy (Bozeman *et al.*, 2020). In addition, there has been no widespread adoption of measures to directly address evaluation skew and bias. (Li & Agha, 2015) has also questioned a further point to consider is that there has not been widespread adoption of solutions that directly address an unfair evaluation.

1.2 Key Performance Indicator (KPI)

Based on several case studies, according to Crane *et al.* (2023); Gralka *et al.* (2019), to define a research indicator, some researchers have decided to concentrate their findings on the overall number of publications, while others have chosen to focus their findings on the total amount of research grant. In this comprehensive study of evaluating performance based on publication works, Rhaiem (2017) showed that several studies use citation ranking to publication numbers in order to rate a quality concern. Thus, this result is a more sophisticated indicator. Based on the Guidelines of the UPNM Short Term Grant, the project leader is demanded to publish a paper or at least register the Intellectual Property/Copyright during the grant period.

The details of KPI in Table 1 show that the project leader must produce at least two (2) publications in an indexed journal. Moreover, the publication must acknowledge the UPNM Short Term Research Grant by stating clearly in each publication. Otherwise, the project leader is encouraged to apply for the registration of Intellectual Property/Copyright at the national level before submitting it to the international level. Intellectual Property that is successfully registered will be the joint property between UPNM and the researcher.

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Table 1 *Key Performance Indicator*

Research Grant Key Performance Indicator, KPI	Research Grant Output
Publication	Two publications in an indexed journal (WoS / Scopus / ERA / MyCITE) are mandatory, during the course of project
Application of External Grants	Compulsory

1.3 Malaysia Research Assessment Instrument (MyRA)

MyRA is known as the Malaysia Research Assessment Instrument. With the existence of a platform known as MyRA, it is possible to measure the inputs, outputs, outcomes, and impacts of Research, Development, Commercialization and Innovation (RDCI) in the Institute of Higher Education. MyRA declared data should be inclusive. Despite having achieved maximum marks, either exceeding the benchmark or exceedingly twice the set benchmark, in a specific section or subsection, the declared data should include and take into account all outputs from all active academic staff members.

The declared data will be used to evaluate the effectiveness of the entire programme. It is essential to have RDCI data that is complete and comprehensive from each University and Institute. This data can then be used to assist the Top Management in making decisions and formulating the direction of the National Higher Education policy. MyRA consists of eight sections to measure the inputs, outputs, outcomes, and impacts of Research, Development, Commercialization, and Innovation as shown in Fig. 1 from MyRA Glossary.

Fig. 1 *The total of eight sections in MyRA*

For the topic of this article, section C for Quantity and Quality of Research, subsection 1.a)ii) define as a total number of publications in SCOPUS/WOS/ERA indexed journals, subsection 1.c) define a total number of publications in MyCite indexed journals, subsection 1.f) define an other publications in other journals, articles in magazines, newsletters, original writings and publications from conferences, digital or print media and a subsection 2 which defines research grants for academic staff are focused on UPNM Short Term Research Grant toward a contribution of Key Performance Indicator from year 2014 to year 2024 by the Division of Research of Innovation, UPNM.

2. Shortage of Publications among Researchers

The shortage of publications among researchers is a multifaceted issue influenced by various interrelated factors, each contributing to the broader challenge of maintaining a robust research output. One significant factor is the heavy workload that researchers often face, which includes not only their primary research activities but also substantial teaching and administrative responsibilities (Jomuad *et al.*, 2021). These additional duties can significantly limit the time available for conducting research and writing for publication, as noted by multiple researchers. For example, Bakhir *et al.* (2023) and Oladejo *et al.* (2019) highlight how the balance between teaching loads and research commitments can impact publication rates, suggesting that adjusting these workloads could allow researchers more time to focus on their scholarly output.

Another factor to consider is the insufficiency of readily available funds and other resources which in the present times inevitably impedes the research agenda. Nongogo & Mashau (2023) discuss inadequate funding for research projects and all aspects associated with the publication of research results limit the growth of the researcher. Additionally, Oluwatoyin O. O. *et al.* (2021) suggest that another factor is the availability of required research infrastructure with proper administrative backing that could allow the researchers to proceed with their work as well as let them share their work effectively.

The pressure to elicit funds also contributes a lot of pressure to this issue. According to Waaijer *et al.* (2018), the need to constantly seek and secure research grants can divert researchers' attention away from the actual process of research and publication. This causes the researchers to publish in order to get research grants while at the same time, funding hinders their chances of publishing. The long-term effects of this dynamic are concerning, as a consistent shortfall in publications can lead to decreased funding opportunities, reduced research capacity, and even brain drain, where talented researchers seek opportunities elsewhere due to the lack of support in their current environments (Squazzoni *et al.*, 2021).

Several strategies have been proposed to address these challenges and increase publication rates among researchers, particularly in public universities. Bakhir *et al.* (2023) suggest providing adequate funding and resources as a fundamental step. This includes direct financial support for research projects as well as ensuring that researchers have access to the necessary equipment and administrative assistance. Additionally, Oladejo *et al.* (2019) propose optimizing workloads by adjusting teaching responsibilities and offering incentives for researchers who publish in high-impact journals. These incentives could range from financial rewards to professional recognition, thereby motivating researchers to prioritize publication efforts (Xu *et al.*, 2021).

Fostering a collaborative environment from others research agency and institution is another critical strategy. Encouraging interdisciplinary collaboration within the university, as well as facilitating partnerships with industry and other research institutions, can expand opportunities for research and publication. Wabulasa & Kihara (2023) underscore the importance of such collaborations in enhancing research productivity and creating a more dynamic research ecosystem. Furthermore, simplifying administrative processes is essential to reduce the bureaucratic burden on researchers. Streamlining procedures related to grant applications, budget management, and project reporting, as discussed by Bakhir *et al.* (2023), can free up more time for researchers to focus on their core activities.

2.1 Real Case Study: A Shortfall in Publications Activity

From the year 2014 to 2021, a total of RM 4,414,550.00 has been allocated by the University to the Division of Research and Innovation (BPI) for short term research grant scheme. A total of 255 research projects have been offered to the academic staffs and university administrative staffs. The purpose of this grant offered is to make this grant a platform to encourage researchers to do research (Davis *et al.*, 2020; Ramaswamy *et al.*, 2021).

In the year 2014, a total of RM 45,000.00 allocation has been given and a total of three research projects were offered. In the first batch, there were a total of three publications published and contributed to the MyRA score, especially in section C. Furthermore, in the year 2015, a total of amount RM 852,550.00 was given to 61 projects. A total of 61 publications have been published in Scopus, Web of Science, ERA indexed journals, and other non-Indexed journals.

The majority of the time spent having the publication published occurs during the first 18 months of the grant offered. Worst case, it continues until the grant period comes to an end which is up to 24 months. Even though it would take some time to get published, the most important criteria to be considered for a research grant are the effectiveness of the project leader in managing time toward a publication. Data from the year 2014 until 2021, consisting of the number of total projects, the total number of publications and the total allocation of grants (in Ringgit Malaysia, RM) are shown in Fig. 2.

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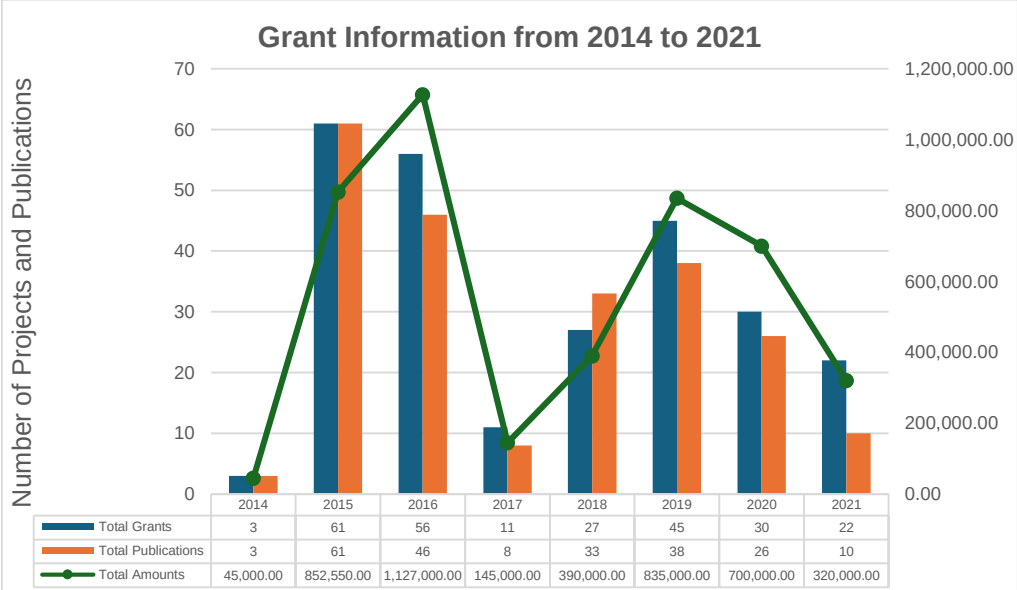

Fig. 2 *Grant information from the years 2014 to 2021*

The graph in Fig. 2 shows that slight fall in the publication in 2016 and 2017. Despite the massive amount of RM 1,127,000.00 allocated for 56 projects, only 46 publications were successfully produced, a shortfall of 10 publications compared to the total project. Similarly, in 2017, with a budget of RM 145,000.00 allocated to 11 projects, only 8 publications have been produced, which are below the KPI target. The most likely cause of a shortfall in the publication are a lack of research grant monitoring and reporting and the readiness of the project leader to fulfill the KPI.

In addition, the shortage in publications in 2016 and 2017 had significant implications and impacts on the MyRA rating score for UPNM especially for subsection 1.a)ii) define as a total number of publications in SCOPUS/WOS/ERA indexed journals, subsection 1.c) define a total number of publications in MyCite indexed journals, subsection 1.f) define an other publications in other journals, articles in magazines, newsletters, original writings and publications from conferences, digital or print media. As a result, the university's MyRA score for 2016 and the following years resulted in only three stars even though a substantial amount of allocation has been invested into university research grants for research and innovation activity.

2.2 Standard Operation Procedure in Application of Research Grant

Process flow and Standard Operation Procedure (SOP) for short term grant applications are divided into four main stages which are the Announcement Stage, the Application Stage, the Screening Stage and the Grant Offering Stage. During the Announcement stage, a grant opening announcement would be made by the Research Officer from Division of Research and Innovation to all university staff, through the university's official email. The announcement email will provide all information regarding the grant scheme, procedure and the important dateline to the researchers.

During the Application stage, an interested researcher would submit a complete research proposal using a Short-Term Research Grant form to the faculty for an early screening process. An endorsement from the faculty is a must before the proposal goes through a screening stage at the Division of Research and Innovation. After the proposal has been successfully screened at the Division of Research and Innovation stage, it will proceed to seek an endorsement from the University Research and Innovation Committee.

The University Research and Innovation Committee is going to make an announcement regarding the final decision at the meeting of the University Research and Innovation Committee. This comes after several processes and procedures that have been followed. An offer letter for a successful project would be issued through an official platform. It is necessary for the leader of the project to sign a contract in order to carry out research and meet KPIs. Fig. 3 depicts a flow chart of the process that must be followed when applying for research funding.

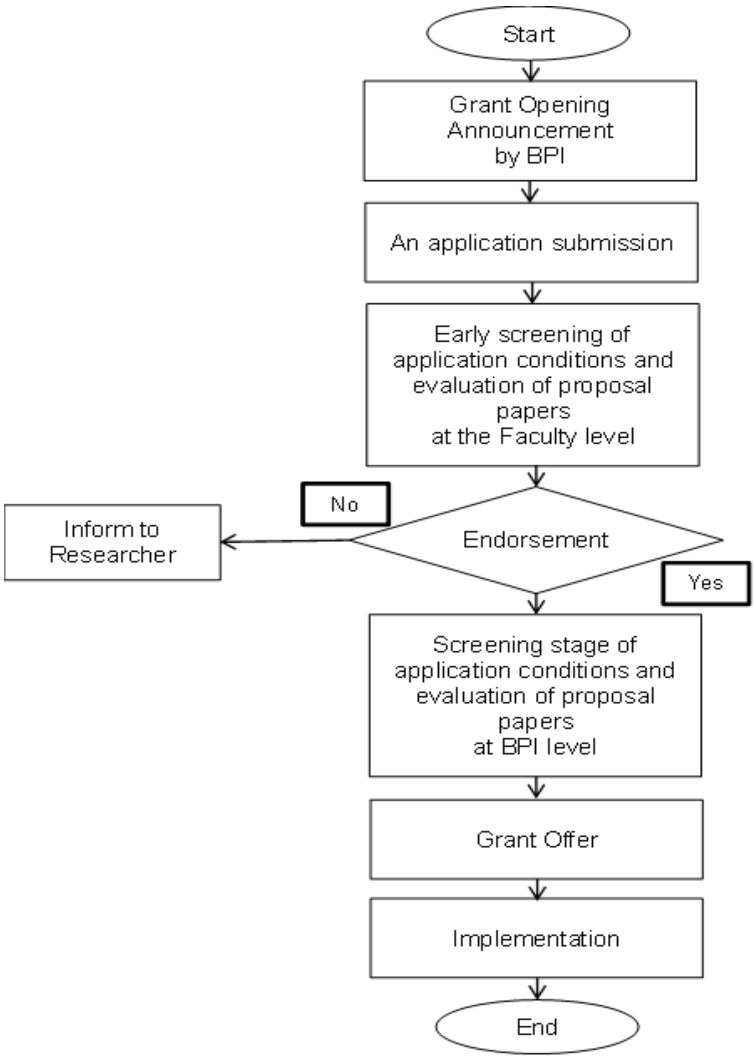

Fig. 3 *The flow chart for an application of research grant*

According to the MyRA definition, several criteria have been identified in Section C for subsection 2 which defines the research grants for academic staff. The criteria outline the total allocation approved for a new research project in the current year as well as the total allocation received for active research projects only in the respective year in review. Therefore, the current implementation of the UPNM offering this short-term research grant scheme is in line with MyRA operational definition for grant funding through University's research funds consideration.

2.3 Research Grant Administration in UPNM

A normal Standard Operation Procedure (SOP) for short-term grant applications consists of the Announcement Stage, the Application Stage, the Screening Stage and the Grant Offering Stage. Therefore, based on the short review of the normal SOP, the Division of Research and Innovation (BPI) decided to implement a smart pilot approach to the work process, as detailed in Figure 3. A successful candidate is a person who meets a few criteria and requirements in the screening stage at the BPI level. The main criteria for the grant offer are as follows.

i. Researcher is not a Principal Investigator for an active research grant in the current year.
ii. The researcher applied for a grant from the Ministry of Higher Education, MOHE (such as the Fundamental Research Grant Scheme, Prototype Research Grant Scheme, or Transdisciplinary Research Grant Scheme) as the Principal Investigator and /or any other external research grant scheme opening in the current year.
iii. Researchers who have received a UPNM Short Term Grant / Self Fund / Collaboration Research Grant (CRG) in the previous phase have completed the KPI and submitted the final report and proof of publication to the Division of Research and Innovation.

iv. The Project Leader of the MOHE grant or any other external grant has completed the KPI and has successfully closed the grant in proper procedure.
v. The researcher should prepare and submit a draft of a publication related to the title of the research project which follows a journal format.

In addition, the data of total internal grants contributing to MyRA data is in Section C, for subsection 2. which defines research grants for academic staff even from university funding. This implementation is expected to simplify the procedure of securing and managing grants, as well as equip researchers with knowledge in handling research grants during the normal process of work.

2.4 Role of the Research Officer in Research Grant Administration

The first author is a research officer from the Division of Research and Innovation, UPNM who is serving as a UPNM Short Term Grant administrator from the years 2018 to 2021. The main responsibility is to work toward refining the procedures that are used in grant administration and facilitate researchers to carry out their research activity and deliver output (Zatz & Dupere, 2018). Despite the fact, a grant administrator is still required to pursue all the annual KPIs that have been set at the beginning of the year. A big challenge to the research officer and research administrator, the target and the strategy suggested in the early year contradicts the current situation (Schiller & Lemire, 2023).

Research Officers are quite central in the research grant management for they actively operationalise the ties between the researchers, the funding agencies, and the institution. The work ranges across various tasks like assisting researchers to get the right funding opportunities, assisting the researchers in writing the right proposals in order to meet institutional objectives as well as funding agency requirements (de Jong & del Junco, 2024). Support in the preparation of the budgets where necessary with details analysed to reflect only relevant costs which are acceptable to the funder. Research Officers manage grant funds after the grant is obtained with the responsibility of accounting for all expenses under the grant and making sure that the money is spent correctly (Crane *et al.*, 2023). Research Officers are also accountable for seeing to it that the activities carried out in research are ethical and conform to institutional policies and other documents that include specific approvals among others (de Jong & del Junco, 2024).

Furthermore, the administrator is also in charge of the management of the grants in that he has the responsibility of overseeing how the projects are progressing, preparing reports on the progress and just as importantly seeing to it that all the deliverables are fulfilled (Woelert, 2023). Sometimes, the Research Officers are responsible for offering work capacity to the faculty with regard to grant proposal preparation, compliance, and generally the management of grants (Crane *et al.*, 2023). Furthermore, for assessment of the general performance of funded projects, on the evaluation of the results, and on the compliance with the time and targets, as well as for the administration of possible changes. Having a multi-faceted duty, the Research Officers oversee the projects, beginning from the project proposal stage to reporting, thus playing a vital role in the overall research success of the institution as well as its financing for future research (de Jong & del Junco, 2024). Grant management is quite a delicate process and requires the right skills which should help the researcher meet his/her goals and have a good standing with funding agencies.

3. Methodology

Application of methodology in the process of the administration of the UPNM Internal Research Grants Scheme entails a certain set of procedures aimed at acquiring correct and credible data collection, data analysis and interpretation. The process starts with the extraction of project and allocation data from the electronic Research Management System (eRMS) which is the centralised database where a range of important information related to the research project and funds is stored including the funding details and timeframes. At the same time, publication data is retrieved from the library database where it connects publications with the specific projects.

Although data is extracted, it is not assumed to be accurate and therefore, a process of verification is carried out on the data, for comparison with the original documents or records with a view of eliminating inaccurate data. After the validation phase, all the retrieved data are gathered in a body list that contains both project and publication records which would be further used in the analysis. The analysis phase uses quantitative analysis such as correlation analysis using Statistical Package for the Social Sciences (SPSS) to establish the relationship between the number of projects and the number of publications with a view of ascertaining the research output. Fig. 4 shows the flow chart of the research methodology.

The research results reliability then must be validated, and specific discussion recommendations of the analysis findings alongside critical patterns are presented with exploratory avenues for future studies. This systematic approach not only serves to maintain the research constitution's credibility but also helps the institution to be better equipped to deal with the allocation and expenditure as part of the academic structure.

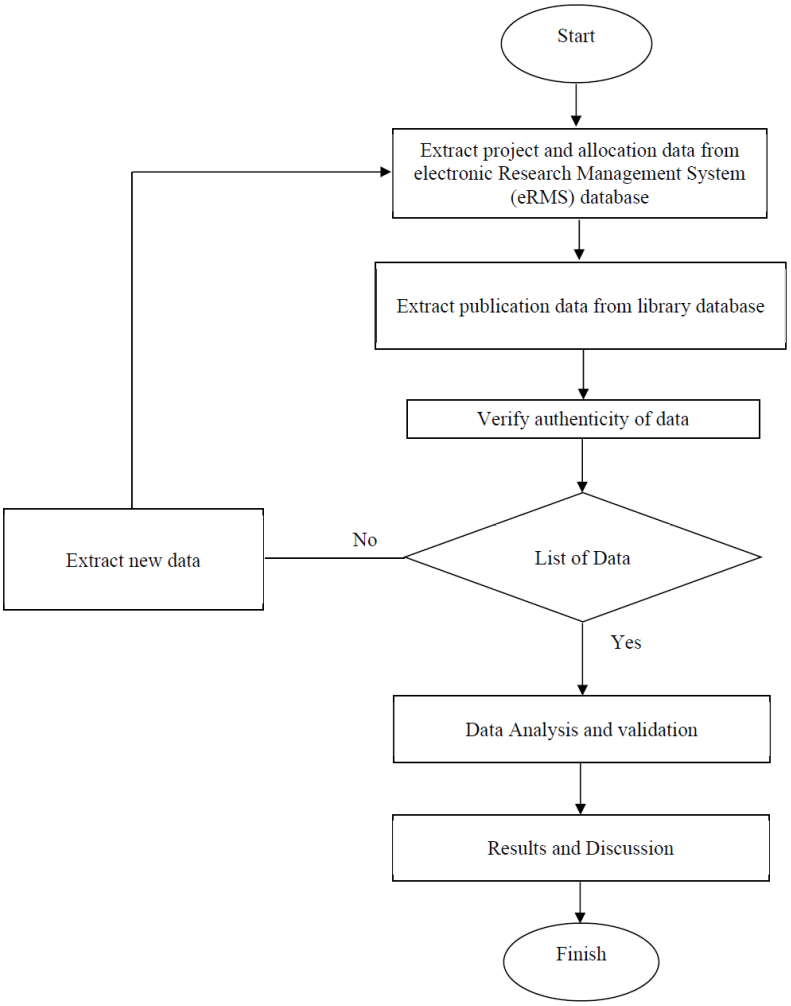

Fig. 4 *The flow chart of research methodology*

3.1 Data Collection from Electronic Research Management System (eRMS)

This methodology involves extracting relevant data on projects, the research grant types, funding rates, and grant allocations from the eRMS database. The eRMS works as an organisational database which contains overall grant information, a timeline of projects and details about the researchers. Some of the challenges which occur include inaccuracy during the extraction of data and it provides the framework for the ensuing analysis. The method of research for the UPNM Internal Research Grants Scheme entails a highly structured six-step process that enhances the accurate collection, analysis and interpretation of data. All these steps are vital towards the internal and external validity of the research undertakings in the effective handling of research projects and their outcomes.

3.2 Data Extraction

The first qualitative data source in this research methodology is extracted information from the electronic Research Management System (eRMS) which compiles all research projects which are being managed by the institution. This comprises project titles and descriptions of project IDs, and more importantly, the funding attachments for each project. For this reason, the eRMS is an ideal place for the institution of a systematic and coherent collection of accurate and inclusive information. The extraction process required data extraction tools in order to get all information related to it. The data extracted at this stage forms the foundation for all subsequent analyses, making accuracy crucial.

3.2.1 Data Extraction from eRMS Library Database

Following the extraction of project data, the next step is to extract publication data from the institution's publication database. This database contains records of all research outputs, such as journal articles, conference papers and books produced by the researchers associated with the projects funded by the internal grant. The

purpose of this step is to link each publication to its corresponding research project, allowing for a comprehensive analysis of research productivity. The publication data typically includes titles, author's information, publication dates, and project IDs. This step is crucial for understanding the tangible outcomes of the funded projects.

3.2.2 Publication Data Authentication

The next critical step is to verify the authenticity and accuracy of the data. This involves cross-referencing the extracted data with original records to ensure that there are no errors or omissions. Data verification is essential because any inaccuracies could lead to faulty analysis and misleading conclusions. This step also involves some statistical analysis to validate the consistency and reliability of the data. The verified data is then prepared for further analysis, ensuring that the research is based on solid and credible information.

3.3 Compilation of Data

Subsequently, following data validation, it is assembled into a master list that combines all information obtained from the UPNM eRMS database. This compilation entails arranging the data in a way that enables an administrator to easily retrieve or analyse it. The list compiled provides information on all details of the projects, the funding attached to the projects and any publications that are associated with the project. Hence, this step is important because it enables the formation of a unified database that forms the basis for the other analysis steps. It is crucial to maintain the integrity of the data collection to perform proper data analysis, and thus the lists must be compiled carefully, followed by careful review.

3.4 Data Analysis and Validation

This phase typically employs statistical tools and methods, such as correlation analysis, to explore the relationship between the number of projects and the number of publications. The aim is to understand how research funding influences research outputs and to identify any significant patterns or anomalies. Validation is a key component of this step, ensuring that the analysis results are robust and reliable. This step involved running various statistical tests using SPSS to confirm the findings and verify their significance.

Using SPSS, correlation analysis quantifies the strength and direction of the relationship between total projects and publications. By calculating the Pearson correlation coefficient, SPSS determines if more projects lead to more publications, revealing a positive, negative, or no relationship between these variables, essential for understanding research productivity trends. In this step, correlation analysis is utilise to measure the strength and direction of the relationship between total projects and publications.

3.5 Results and Discussion

The last stage of the overall research design is to summarize and analyze the outcome of the data in light of the stated objectives of the research. In the process of analysis, the process of quantifying the findings, reviewing the results identified and concluding the efficiency of the internal grant scheme in boosting research output. The discussion also may address the extension of the discussion and identify the further research sections or the potential enhancements in the grant administration. It forms the basis of executing certain information to generate relevant knowledge which is crucial for the institution to achieve its research and development goals. Therefore, the outlined six-step research method systematically in the management and analysis of data, related to the UPNM Internal Research Grants Scheme. The overall aim of the research process can be considered effective in meeting the goals and objectives of the institution's research and innovation goals.

4. Summary of Findings

The UPNM Internal Research Grants Scheme has shown a significant progression in the number of projects and the total allocation approved over the years. Beginning in 2014, the initiative supported three projects with a total allocation of RM 45,000, as shown in Fig. 5. This early phase was likely a pilot stage, testing the feasibility of the scheme. In subsequent years, particularly from 2015 onwards, there was a notable increase in both the number of projects and the funds allocated. For instance, in 2015, the number of projects surged to 61, with a corresponding allocation of RM 852,550. This pattern of growth continued, albeit with some fluctuations, reflecting an expansion in research activities supported by this scheme.

The year 2016 stands out as particularly active, with three phases (1/2016, 2/2016, and 3/2016) contributing to a combined total of 56 projects and over RM 1.1 million in funding. This increase may be explained by an intention to increase research output probably due to institutional or national research agenda. Nevertheless, it is evident that the number of publications which came out of such projects remained variable. What can particularly be observed is that the number of projects can be closely related to the number of publications, but still other factors such as the level of project difficulty or its duration may affect the outcomes of publications. This research initiative has served its purpose of developing research at UPNM as is evident from the increasing project

numbers and the research funding associated to it. However, the variability in publication outputs suggests a need for ongoing evaluation to ensure that the research funded under this scheme consistently leads to high-quality, publishable results.

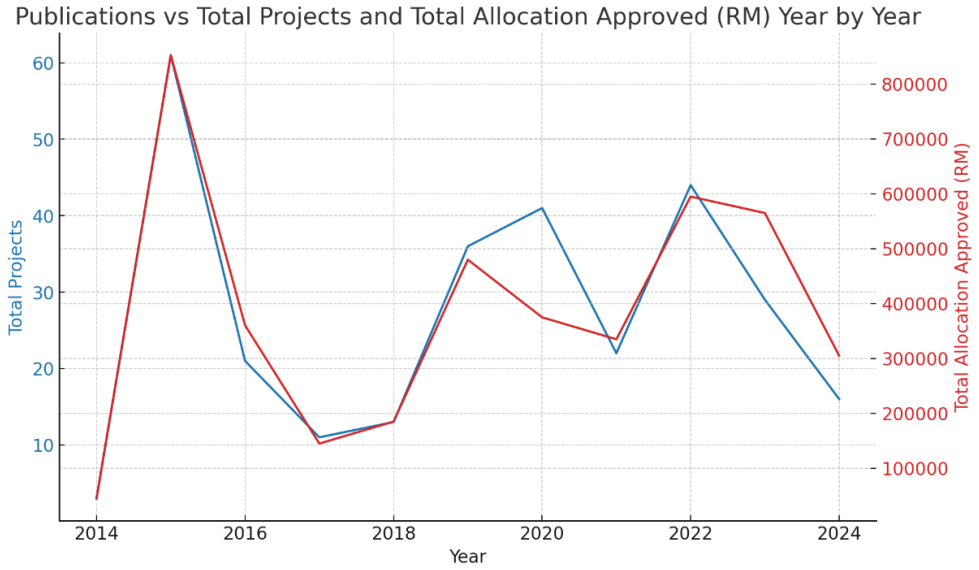

Fig. 5 *Publication trend versus project and allocation approve*

The graph illustrates the relationship between the total number of projects and the total allocation approved (in Ringgit Malaysia) over the years based on the data provided. The blue line represents the total number of projects, while the red line shows the total allocation approved.

4.1 Analysis of Trends in Publications

The number of publications fluctuates over the years, with some years showing higher outputs than others. In year 2014, the starting point shows a modest output of three publications, correlating with the limited number of projects in that year. For the year 2015, there is a significant increase to 61 publications, aligning with the substantial rise in both the number of projects and funding that year. This suggests that the increase in research activity had a direct impact on the number of publications. Besides, in year 2016, the publication output decreased despite multiple phases of funding, indicating that while more projects were initiated, they may have required more time to yield publishable results or faced other challenges in reaching the publication stage.

Overall, the trend shown in Fig. 6 is that while the number of projects and funding generally increased over time, the number of publications did not always correspond directly to these increases. This highlights the complexity of translating research activity into published work, suggesting that factors beyond just funding and project initiation such as project duration, quality of research, and publication timelines significantly impact publication outcomes.

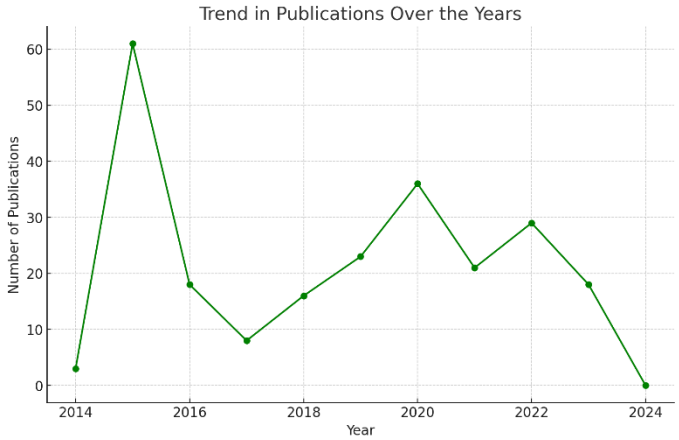

Fig. 6 *Publication trend from 2014 until 2024*

The graph above illustrates the trend in the number of publications over the years based on the UPNM Internal Research Grants Scheme data.

4.2 Analysis of Relationship between publication and total projects

The general trend suggests a positive correlation between the total number of projects and the number of publications. As the number of projects increases, the number of publications tends to rise as well, indicating that more research activity generally leads to more publishable results. Despite this positive correlation, there is noticeable variability. In some cases, a large number of projects does not correspond to a proportionally large number of publications, suggesting that factors other than the sheer number of projects such as project complexity, duration, or the specific field of research also play a significant role in determining publication output.

Understanding this relationship can help institutions optimise the allocation of resources and support mechanisms to maximize both the quantity and quality of publications resulting from funded research projects. The scatter plot as depicted in Fig. 7, illustrates the relationship between the total number of projects and the number of publications. Each point represents a different year, showing how the number of projects corresponds to the number of publications. The correlation coefficient between the total number of projects and the number of publications is approximately **0.92**. This indicates a very strong positive correlation, suggesting that as the number of projects increases, the number of publications tends to increase significantly as well. This strong relationship highlights the importance of project volume in driving publication output.

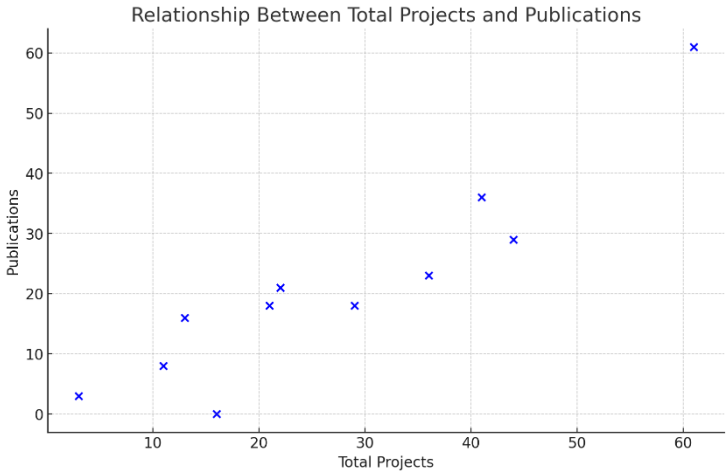

Fig. 7 *Relationship for total project and publications*

The relationship between the number of publications and the total number of projects can be described by the following linear equation:

$$\text{Publication} = 0.91 \times \text{Total Projects} - 3.44 \quad (1)$$

This equation suggests that, on average, each additional project contributes approximately 0.91 publications. The negative intercept indicates that if there were no projects, the model would predict a slightly negative number of publications, which in practical terms represents an adjustment factor for the baseline publication rate. This equation can be interpreted in several keyways.

4.2.1 Slope Interpretation (0.91)

The slope of the line, **0.91**, from Figure 7 indicates that for every additional research project, there is an expected increase of approximately 0.91 publications. This near-one-to-one ratio suggests that most projects are likely to result in at least one publication, which is a strong indicator of the effectiveness of the research process. However, since the slope is slightly less than 1, not every project results in a publication, which could be due to various factors like project complexity, completion rate, or publication challenges.

4.2.2 Intercept Interpretation (-3.44)

The intercept of **-3.44** represents the expected number of publications when the number of projects is zero. Although a negative number of publications is not realistic, the intercept provides an adjustment for the linear

model. This negative intercept might imply that a minimal threshold of projects is required before any publications can be expected. It can also suggest that some projects, particularly those with significant challenges, may not contribute to the publication count, effectively lowering the overall output.

4.2.3 Strength of the Relationship

The correlation coefficient of **0.92** indicates a very strong positive correlation between the total number of projects and the number of publications. This high correlation suggests that the number of projects is a major driver of publication output. While the strong correlation does imply a direct relationship, it's important to consider that other factors could also influence this relationship, such as the duration of projects, their scope and the efficiency of the research and publication processes.

4.2.4 Potential Outliers and Variability

The variability in the data indicates that some years may have more or fewer publications than expected based on the number of projects. This could be due to:

i. Project Duration: Some projects might span multiple years, with publications occurring later.
ii. Project Scope: Larger, more complex projects might result in multiple publications, while smaller projects may produce fewer.
iii. External Factors: Events like changes in institutional focus, funding availability, or unforeseen challenges (e.g., global COVID 19 pandemics) could also affect the number of publications.

4.2.5 Predictive Usefulness

This linear model can be used predictively to estimate the expected number of publications based on the number of projects initiated. This predictive capability is useful for planning and setting realistic targets for research outputs. For instance, if the Division of Research and Innovation, Universiti Pertahanan Nasional Malaysia plans to fund 50 projects in a year 2025, the model predicts approximately as below:

$$\text{Predicted Publications} = 0.91 \times 50 - 3.44$$

$$\text{Predicted Publications} \approx 42 \text{ publications}$$

4.3 Discussion on Implications for Research Strategy

Although, it is apparent that an increase in project numbers of results in an increase in publications, an increase should focus on the quality of the projects. Hence, the quality and number of publications obtained from such projects will be more effective than obtaining many lower-ranked papers. This development means that there should be a balance in the distribution of resources in the projects to enhance publication productivity. Supporting every project could result into better chances of having higher publication rate.

The results show the correlation between number of projects and publications as highly positive and significant, meaning that boosting research productivity through the formulation of more projects is a fruitful way of enhancing publication production. However, this study also provides insights on other factors that institutions should consider better strategy to bring out the best in this relationship while at the same time avoiding a situation whereby the sheer number hampers the quality and efficiency of the research produced.

5. Conclusion

The objective of assessing the relationship between the number of publications and the total number of projects within the UPNM Internal Research Grant has been successfully achieved. The analysis reveals that the relationship can be accurately modeled using the linear equation, (1). This equation indicates that, on average, each additional project contributes approximately 0.91 publications, signifying a near-proportional increase in research output with the initiation of more projects. The negative intercept suggests an adjustment factor that accounts for the baseline publication rate, implying that a certain threshold of projects is necessary before measurable publication output can be expected. The strong positive correlation coefficient of 0.92 further reinforces the finding that the number of projects is a significant determinant of publication activity. However, it is important to recognise that this relationship is also influenced by other variables such as project complexity, completion rates, and challenges in the publication process. Overall, the findings confirm that increasing the number of research projects under the UPNM Internal Research Grant is likely to lead to a corresponding increase in publications, thereby supporting the effectiveness of the research funding strategy in promoting academic output. Furthermore, this data could be a strong justification for the Division of Research and Innovation, Universiti Pertahanan Nasional Malaysia in order to strengthen a strategy in the administration of research grants, with the goal of improving the score in the Malaysia Research Assessment (MyRA) rating.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *M.S.S, N.A.D;* ***data collection:*** *N.A.D;* ***analysis and interpretation of results:*** *M.S.S, N.A.D, K.A.A;* ***draft manuscript preparation:*** *M.S.S, N.A.D. All authors reviewed the results and approved the final version of the manuscript.*

References

Bakhir, A., Nawawi, A. H., & Basrah, N. (2023). How Can Malaysian Public Universities Make the Most of Their Campus Real Estate? – A Conceptual Framework for Managing Corporate Real Estate. *International Journal of Sustainable Construction Engineering and Technology*, 14(1), 110–120. https://doi.org/10.30880/ijscet.2023.14.01.012

Bozeman, B., Youtie, J., & Jung, J. (2020). Robotic Bureaucracy and Administrative Burden: What Are the Effects of Universities' Computer Automated Research Grants Management Systems? *Research Policy*, 49(6). https://doi.org/10.1016/j.respol.2020.103980

Crane, K., Blatch-Jones, A., & Fackrell, K. (2023). The post-award effort of managing and reporting on funded research: a scoping review. F1000Research, 12, 863. https://doi.org/10.12688/f1000research.133263.1

Davis, J. M., Soltis, P. S., Adams, D. C., Larkin, S. L., & Gilbert, R. A. (2020). Seed funds leverage external awards for research in natural resources and agricultural systems. *Forests*, 11(1). https://doi.org/10.3390/f11010076

de Jong, S., & del Junco, C. (2024). How do professional staff influence academic knowledge development? A literature review and research agenda. *Studies in Higher Education*, 49(6), 1042–1065. https://doi.org/10.1080/03075079.2023.2258155

Gralka, S., Wohlrabe, K., & Bornmann, L. (2019). How to measure research efficiency in higher education? Research grants vs. publication output. *Journal of Higher Education Policy and Management*, 41(3), 322–341. https://doi.org10.1080/1360080X.2019.1588492

Jomuad, P. D., Mabelle Antiquina, L. M., Cericos, E. U., Bacus, J. A., Vallejo, J. H., Dionio, B. B., Bazar, J. S., Cocolan, J. V, & Clarin, A. S. (2021). Teachers' workload in relation to burnout and work performance. *International Journal of Educational Policy Research and Review*, 8(2), 48–53. https://doi.org/10.15739/IJEPRR.21.007

Li, D., & Agha, L. (2015). Big names or big ideas: Do peer-review panels select the best science proposals? *Science*, 348(6233), 434–438. https://doi.org/10.1126/science.aaa0185

Murray, D. L., Morris, D., Lavoie, C., Leavitt, P. R., MacIsaac, H., Masson, M. E. J., & Villard, M.-A. (2016). Bias in Research Grant Evaluation Has Dire Consequences for Small Universities. *PLOS ONE*, 11(6), e0155876. https://doi.org/10.1371/journal.pone.0155876

Nongogo, A. P., & Mashau, P. (2023). Revenue Strategies that Encourage Graduates' Funding Initiatives in South African Public Universities. E-*Journal of Humanities, Arts and Social Sciences*, 39–53. https://doi.org/10.38159/ehass.20234145

Oladejo, M. A., Temitope, A., Mulikat, K., & Ghanni, O. (2019). Job Concern Factors and Academic Staff Engagement in Public Universities, Lagos State, Nigeria. *Educational Planning*, 26(4), 57–69.

Oluwatoyin O. Obinyan, Charity O. Adetona, & John M. Adeniyi. (2021). Knowledge Sharing Attitudes of Library and Information Science Professionals in Nigeria. *Information and Knowledge Management*, 11(1), 1–8. https://doi.org/10.7176/IKM/11-1-01

Ramaswamy, A., Pichs, A., Klarich, J. V., Basourakos, S. P., Lee, R. K., Lamb, D. J., Schaeffer, E. M., & Hu, J. C. (2021). Influence of Department Leadership on Scholarly Productivity and Research Funding in Academic Urology. *Urology*, 154, 136–140. https://doi.org/10.1016/j.urology.2021.01.011

Rhaiem, M. (2017). Measurement and determinants of academic research efficiency: a systematic review of the evidence. *Scientometrics*, 110(2), 581–615. https://doi.org/10.1007/s11192-016-2173-1

Schiller, J. L., & Lemire, S. D. (2023). A Survey of Research Administrators: Identifying Administrative Burden in Post-Award Federal Research Grant Management. *Journal of Research Administration*, 55(3), 9–28.

Squazzoni, F., Bravo, G., Grimaldo, F., García-Costa, D., Farjam, M., & Mehmani, B. (2021). Gender gap in journal submissions and peer review during the first wave of the COVID-19 pandemic. A study on 2329 Elsevier journals. *PLOS ONE*, 16(10), e0257919. https://doi.org/10.1371/journal.pone.0257919

Waaijer, C. J. F., Teelken, C., Wouters, P. F., & van der Weijden, I. C. M. (2018). Competition in Science: Links Between Publication Pressure, Grant Pressure and the Academic Job Market. *Higher Education Policy*, 31(2), 225–243. https://doi.org/10.1057/s41307-017-0051-y

Wabulasa, K. F., & Kihara, A. (2023). Strategy Implementation Practices and Performance of Humanitarian and Development Organisations. *Journal of Business and Strategic Management*, 8(2), 47–61. https://doi.org/10.47941/jbsm.1294

Woelert, P. (2023). Administrative burden in higher education institutions: a conceptualisation and a research agenda. *Journal of Higher Education Policy and Management*, 45(4), 409–422. https://doi.org/10.1080/1360080X.2023.2190967

Xu, X., Rose, H., & Oancea, A. (2021). Incentivising international publications: institutional policymaking in Chinese higher education. *Studies in Higher Education*, 46(6), 1132–1145. https://doi.org/10.1080/03075079.2019.1672646

Zatz, M., & Dupere, S. (2018). Careers in Science and Grant Administration: View from the National Institutes of Health. *Cold Spring Harbor Perspectives in Biology*, 10(9), a032847. https://doi.org/10.1101/cshperspect.a032847