TOWARDS DIGITALIZATION:
GRANT MANAGEMENT SYSTEM ADOPTION

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DEDICATION

This thesis is dedicated to:

The sake of Allah, my Creator and my Master,

To my supervisor who always keeps me going and made my thesis happen;

A special feeling of gratitude to my husband, Anas whose words of encouragement and push for tenacity ring in my ears.

My Kids, Adam, Hawa and Yusuf who have supported my tears throughout the process.

This work is also dedicated to my parents, who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve

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To everyone who was in light in this journey;

I dedicate this Project to all the people who have worked hard to help me complete this project.

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ABSTRACT

To monitor the entire grant's lifecycle, including the requirement to meet the deadline, provide accurate details and financial transparency, organizations have to focus and concentrate on making their funding work and eliminate the financial risk of not meeting all project, reporting, and reporting reimbursement deadlines. However, some organizations felt this process are not very critical including MCMC. Thus they have always been overlooked and underappreciated. Therefore, this research has identified the criticality to improve MCMC's grant management processes, particularly the grant application, evaluation, and reporting process. It highlighted that excel software had been actively used to develop data storage, processing, management, preservation, and retrieval. Manual paper, on the other hand, is a solution for proposal and document submission. These issues have arisen in the current process that led to inefficiencies that impacted the staff productivity. Therefore, there is a need to modify MCMC's grant management processes, especially in the Grant application, Evaluation, and Reporting process. To achieve it, three research objectives were developed and a mixed-method approach has been employed to measure the achievement of the research objectives where both quantitative and qualitative research design was done in sequence, respectively. Meanwhile, a Rapid Application Development approach has been used as a methodology for the system development of a prototype grant management system (application, evaluation, and report submission). In line with the MCMC's key initiatives to improve Malaysia's digitalization and connectivity, the researcher proposes a solution, which also serves as the main objective of this research, by creating a User Requirement Specification for the development of a grant management system. This allows for a more systematic grant management system and introduces more efficient ways to offer grant management services. The proposed system was demonstrated through the development of a prototype, which was then used to gauge staff perceptions of its adoption via a user survey. As a result, the prototype was developed successfully and met the user's requirements and specifications. Additionally, the vast majority (94%) of respondents stated that the system will aid in enhancing and improving employee efficiency and productivity. This suggests that they believed in the system's ability to improve the overall grant management process. That is, waste will be eliminated, time and effort will be saved, and operations will be streamlined in accordance with lean principles. In summary, it will boost productivity, promote safety, cut costs, and simplify scheduling. Thus, future research is recommended to focus on the development of a fully working system based on the prototype proposed.

Keywords- Grant, Research Grant Management System, Digitalisation, Information System, Productivity, Implication of Technologies, Information Technology, Impact of Information Technology

ABSTRAK

Untuk memantau keseluruhan kitaran hayat geran, termasuk keperluan untuk memenuhi tarikh akhir, memberikan butiran yang tepat dan ketelusan kewangan, organisasi perlu menumpukan perhatian untuk membuat pembiayaan mereka berfungsi dan menghapuskan risiko kewangan, tidak memenuhi tarikh pembayaran balik projek dan laporan kewangan . Walau bagaimanapun, sesetengah organisasi merasakan proses ini tidak begitu kritikal termasuk MCMC. Oleh itu mereka sentiasa diabaikan dan tidak dihargai. Oleh itu, penyelidikan ini telah mengenal pasti tahap kritikal untuk mengubah suai proses pengurusan geran MCMC, terutamanya proses permohonan geran, penilaian dan pelaporan. Ia menyerlahkan bahawa perisian excel telah digunakan secara aktif untuk membangunkan penyimpanan data, pemprosesan, pengurusan, pemeliharaan dan mendapatkan semula data. Kertas manual, sebaliknya, adalah penyelesaian untuk penyerahan cadangan dan dokumen. Isu-isu ini telah timbul dalam proses semasa yang membawa kepada ketidakcekapan yang menjejaskan produktiviti kakitangan. Oleh itu, terdapat keperluan untuk mengubah suai proses pengurusan geran MCMC, terutamanya dalam proses Permohonan, Penilaian dan Pelaporan Geran. Untuk mencapainya, tiga objektif kajian telah dibangunkan dan pendekatan kaedah campuran telah digunakan untuk mengukur pencapaian objektif kajian di mana kedua-dua reka bentuk penyelidikan kuantitatif dan kualitatif telah dilakukan mengikut urutan, masing-masing. Sementara itu, pendekatan Pembangunan Aplikasi Rapid telah digunakan sebagai metodologi untuk pembangunan prototaip sistem pengurusan geran (permohonan, penilaian, dan penyerahan laporan). Selaras dengan inisiatif utama MCMC untuk menambah baik pendigitalan dan ketersambungan Malaysia, penyelidik mencadangkan penyelesaian, yang juga berfungsi sebagai objektif utama penyelidikan ini, dengan mewujudkan Spesifikasi Keperluan Pengguna untuk pembangunan sistem pengurusan geran. Ini membolehkan sistem pengurusan geran lebih sistematik dan memperkenalkan cara yang lebih cekap untuk menawarkan perkhidmatan pengurusan geran. Sistem yang dicadangkan telah ditunjukkan melalui pembangunan prototaip, yang kemudiannya digunakan untuk mengukur persepsi kakitangan terhadap penggunaannya melalui tinjauan pengguna. Hasilnya, prototaip telah berjaya dibangunkan dan memenuhi keperluan dan spesifikasi pengguna. Selain itu, sebahagian besar (94%) responden menyatakan bahawa sistem itu akan membantu dalam meningkatkan dan meningkatkan kecekapan dan produktiviti pekerja. Ini menunjukkan bahawa mereka percaya pada keupayaan sistem untuk meningkatkan keseluruhan proses pengurusan geran. Iaitu, pembaziran akan dihapuskan, masa dan usaha akan dijimatkan, dan operasi akan diperkemas mengikut prinsip lean. Ringkasnya, ia akan meningkatkan produktiviti, menggalakkan keselamatan, mengurangkan kos dan memudahkan penjadualan. Oleh itu, penyelidikan masa depan disyorkan untuk memberi tumpuan kepada pembangunan sistem yang berfungsi sepenuhnya berdasarkan prototaip yang dicadangkan.

Kata kunci- Geran, Sistem Pengurusan Geran Penyelidikan, Pendigitalan, Sistem Maklumat, Produktiviti, Implikasi Teknologi, Teknologi Maklumat, Kesan Teknologi MaklumaT

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LIST OF ABBREVIATIONS

MCMC   -   Malaysian Communication and Multimedia Commission

SPSS   -   Social Sciences Statistical Package

DSRG   -   Digital Society Research Grant

NMRG   -   Networked Media Research Grant

JENDELA   -   National Digital Infrastructure Plan

IS   -   Information System

UTM   -   Universiti Teknologi Malaysia

IHL   -   Institutions of Higher Learning

SAG   -   SMART Automation Grant

AI   -   Artificial Intelligence

EOA   -   Expert Opinion Analysis

STID   -   Strategic Technology Information Division

NPO   -   National Policy Objective

CFP   -   Call for Proposal

LOA   -   Letter of Award

RAD   -   Rapid Application Development

IS   -   Information System

EUCS   -   End-User Computing Satisfaction

CV   -   Curriculum Vitae

UML   -   Unified Modelling Language

SDLC   -   Software Development Life Cycle

RO   -   Research Objective

URS   -   User Requirement Specifications

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CHAPTER 1

INTRODUCTION

1.1   Introduction

This chapter introduces the entire study; it presents the study's background and organization in a way that provides a clear understanding of the problems in the grant management system, defines the question that the study tries to answer and sets the objectives to be accomplished, discusses the significance of the study has, scope or focus area of the study. Finally, it presents how the whole paper is organized.

In general, grant management is the process and method used by organizations to monitor grants. It covers the whole part of the grant's lifecycle from pre-award to post-award. Generally, the process will always be evolving and encompasses a variety of life cycle tasks through a unique award process.

Thus, grant management is needed to help organizations track grant performance. Besides, it is critical for organizations to consistently monitor the grants and maintain a working relationship with their grant recipients.

To monitor the entire grant's lifecycle, including the requirement to meet the deadline, provide accurate details and financial transparency, organizations have to focus and concentrate on making their funding work and eliminate the financial risk of not meeting all project, reporting, and reporting reimbursement deadlines.

However, some organizations felt this process are not very critical. Thus they have always been overlooked and underappreciated. Most suggested that the technology tool is effective for the entire lifecycle of grant management, which will equip the best practices and meet the organization's needs. Thus, it will keep the process running smoothly and efficiently.

1.2   Case Company Introduction

In 2008, MCMC established a grant-awarding research collaboration program to produce a body of research that will contribute to the evidence base and knowledge resources that support regulatory and policy decision-making and inform the efficacy of policy or regulatory practice and MCMC programs. The Networked Media Research Grant ('NMRG') and the Digital Society Research Grant ('DSRG') are two such MCMC grants.

However, the DSRG, which was launched in July 2020, aims to build a broader evidence-base from studies with a shorter time frame (six months) that contain current data, as well as to promote and foster university-MCMC-stakeholder linkages expertise and knowledge capacity building in line with MCMC's focus areas.

Those grants are managed by MCMC Research Enterprise Department, whose central role is to implement and manage the research collaborations with universities and research institutions that are funded via MCMC's research grants.

Generally, these grants will answer such questions as "What are the implications of technologies and services?" "What are the factors that are enabling user adoption?" and "What is the impact of MCMC initiatives towards the realization of a digitally connected and informed society?".

For those reasons and the investments made for these grants, MCMC has properly managed awarded funding to eliminate the financial risk of not meeting all project, reporting, and reimbursement deadlines.

1.2.1   External Environmental Analysis

In this digital era, the information system (IS) has become an important tool for organizations to facilitate their operations. Thus, nowadays, the number of investments for organizations, either public or private sectors, has significantly increased because of the recognition of its usefulness. This is also in line with the government initiative towards digital services in Malaysia.

According to the Malaysian Administrative Modernization and Management Planning Unit (MAMPU), almost 90 per cent of public services reported transforming their businesses into online services. MAMPU also stated that by the end of 2020, Malaysia has planned to make 40 per cent of its public services "end to end" where the services offered from application until approval is done online. Customers do not have to go to the respective agencies for verification, such as e-filing for tax payments and an online service for university and college applications.

In summary, A PESTEL analysis has been performed to understand the external environment based on six variables: politics, economy, social structure, technological conditions, and the country's legal environment, and it is presented as below:

Table 1-1   PESTEL Analysis

Political	Economical
❑ Malaysia has begun to integrate digital technology into all areas of the economy, and the next step is to carve out its position as the "Heart of Digital Asean." ❑ Malaysia Digital Economy Blueprint under	❑ Budgetary support from government initiatives through the National 4IR (Industry 4.0), the Digital Economy Council, and the

the MyDIGITAL initiative is one of the initiatives to support digitalization ❏ Malaysia lead to launch a global champion to the Fourth Industrial Revolution (Industry 4.0) and will serve as a regional digital powerhouse ❏ Malaysia is committed to transforming into a digital economy that is aligned with the Shared Prosperity Vision 2030 ❏ The stability of the political environment can impact the decision toward digital services ❏ Malaysia has planned to make 40 per cent of its public services "end to end" where the services offered from application until approval is done online, and customers do not have to go to the respective agencies for any verification such as e-filing for tax payments, and an online service for university and college applications.	National Digital Infrastructure Plan (JENDELA)
Social	**Technological**

❏ According to the Malaysian Administrative Modernization and Management Planning Unit (MAMPU), almost 90 per cent of public services reported transforming their businesses into online services
❏ Malaysia Digital Economy Blueprint has stated has targeted that:
    ▪ 100% civil servants to possess digital literacy
    ▪ 80% end-to-end online government services
    ▪ All ministries and agencies to provide cashless payment options in 2022
    ▪ 80% usage of cloud storage across the government in 2022
 	
❏ The Covid-19 pandemic has changed user behaviour to use digital services
	❏ Many software is available for grant management, such as Good Grant, MemberClicks, SurveyMonkey Apply, Smarter Click, Grants Network, Submittable, etc.
	❏ The full life cycle of Grant Management by Dovel Technologies
	❏ Smart Automation Grant (SAG)- Propelling Industrial Digitalization

Legal	Environmental
❏ Copy right Law ❏ Digital Law Business 2021	❏ Green Environment

1.2.2 Internal Environmental Analysis

The Malaysian Communications and Multimedia Commission (MCMC) is the Communications and Multimedia industry regulator, and its key role in the regulation of the communications and multimedia industry is based on the powers provided for in the Malaysian Communications and Multimedia Commission Act (1998) and the Communications and Multimedia Act (1998), Postal Services Act 1991 and licensing of the Certification Authorities under the Digital Signature Act 1997). Pursuant to the Acts, its role is also to implement and promote the government's national policy objectives for the communications and multimedia sector.

Among the powers and functions of MCMC are to advise the Minister on any issue related to national policy objectives ('NPO"), oversee and monitor communication and multimedia activities, encourage and promote self-regulation, and promote and maintain the integrity of all persons licensed or authorized under Communications and Multimedia act.

MCMC has announced a number of initiatives related to the communications and multimedia industries since its inception, as it continues to lead the industry's next phase of growth. One of the initiatives is to promote the development of Malaysia's digital economy, which will be supported by world-class ICT talent and the smooth connectivity of digital infrastructure, as the Prime Minister has stated.

Therefore, MCMC has collaborated with the Malaysian public and private sectors to promote the interoperability and security of public ICT platforms and

applications through digital services to advance the use of public ICT services and public service delivery initiatives widely.

In carrying out policy development and regulatory work and measures to enhance existing initiatives, MCMC always considers all decisions based on sound facts and evidence. Therefore, to ensure the availability of these knowledge resources, the Research Enterprise Department (RED) has the role of establishing collaborative relationships with various parties to improve knowledge resources through cooperation in competency development, research, and information sharing.

Since 2008, MCMC has partnered with Institutions of Higher Learning ('IHLs') through Collaborative Programs aimed at expanding networks and building local expertise capacity. To date, there are two (2) types of research grants sponsored by MCMC, namely Networked Media Research Grants and Digital Society Research Grants:

i.   The Networked Media Research Grant ('NMRG')

Launched in 2008 to assist MCMC in strengthening knowledge, research, and development on networked media and its content and also to support MCMC's role in effective policy and regulatory implementation. To date, four (4) phases have been implemented, including 21 collaboration projects with 11 local universities (public and private). The focus areas of the study that have been implemented and the list are as follows:

     i. digital inclusion
     ii. regulatory
     iii. media literacy and digital literacy
     iv. internet, religion, and spirituality
     v. internet, health and medicine
     vi. impact study of MCMC initiatives
     vii. a study of the impact of new media on society

Under this program, the total estimated funding for a project where the implementation period is for one to two years is RM100,000 - RM 200,000, depending on the scope and needs of the project. The findings of the study and project research results under the completed Networked Media Research Grant program for Phases 3 and 4 were published through MCMC Media Matters Volume 3.

ii.   Digital Society Research Grant - ('DSRG')

Launched on 3 July 2020 where the value of each grant offered is up to RM10,000, with a study period not exceeding six months. For 2021, DSRG was launched at the end of the first quarter of 2021. This short study period is to meet the need to obtain current data and evidence from research more quickly, including through comparative study, benchmarking, and impact study. Like the NMRG program, DSRG is also a program conducted in collaboration with researchers and academics from public and private Institutions of Higher Learning ('IHLs') throughout the country where the field of study is focused on two areas of focus, namely Digital Citizens and Cyber wellness, and Digital Inclusion. These two areas of study are closely related to the priority areas of digital socio-economic development: digital services, e-commerce, digital identity, IoT technology, artificial intelligence (AI), digital security, and privacy issues. To date, under the DSRG 2020 program, MCMC has collaborated with nine (9) researchers from six (6) public and private universities throughout the country.

1.2.3   SWOT Analysis

To further understand the MCMC Grants, a SWOT analysis has been constructed listing the strengths, weaknesses, opportunities, and threats:

No	Strengths(S)	Weaknesses (W)
1	Allows for 'quick' exploratory research on topical issues	The dearth of suitable research proposals- poor suitability of submitted proposals as areas of study unable to provide new insights relevant to MCMC
2	Benchmarking	Lack of alignment to MCMC Business Plan External relevance of research findings- research falls outside MCMC's regulatory scope
3	Strong Financial Position	The inherent limitation of current research activities- grant duration and funding amount
4	Strong support from management	Ownership of research projects- did not benefit from internal research champions
5	Provide key information about the environment	Traditional sequence steps (Manual forms, excel database, Physical folder)
No	Opportunities (0)	Threats (T)
1	Present a guided call identifying specific research topics and outcomes, which are able to provide direct inputs in the fulfilment of internal KPIs	Change of Minister
2	Improve the entire process includes digitalization- Grant Administrative, Selection Process	Restructure of top management
3	Improve feasibility of research	Change of policy and direction
4	Improve alignment & link to MCMC	Budget cut
5	Agility to meet research requirements through ad hoc and special calls	Pandemic

Based on the SWOT analysis, it can be concluded that the MCMC Grants that focus on building a Digital Society continues to be relevant given the role and function of MCMC in meeting the 10 NPOs as follows:

- It is proposed, that to improve the entire process of MCMC grant management from Call for Proposals (CFP) that present a guided call identifying specific research topics and outcomes, which are able to provide direct inputs in fulfilment of internal KPIs; Application form, Evaluation to Report Submission

- The improvements also aim to ensure the availability of research-based evidence which can serve as a means to bridge and close the knowledge gaps for targeted issues and serve to delineate MCMC's role vis-à-vis other ministries, agencies or departments. In so doing, a value-added element of this approach is to emphasize MCMC's leadership and influence in shaping communications and multimedia's positive impact on society and to solidify our close collaborative efforts in ensuring positive outcomes for wide-scale technology adoption.

1.3   Problem Statement

To this day, MCMC grant management still uses the manual process and traditional sequential steps that are mounting pressure on the MCMC, especially on their staff. As a result, it leads to inefficiencies and traceability issues. It puts MCMC at the non-compliance issues and financial risk of not meeting all project, reporting, and reimbursement deadlines due to the challenges faced.

The work processes in MCMC grant management, from pre-award (grant application and evaluation) to award and finally post-award processes, a stage that the researcher completed research submission, are frequently time-consuming. Therefore, excel software has been actively used to develop data storage, processing,

management, preservation, and retrieval. Manual paper, on the other hand, is a solution for proposal and document submission.

As a result, the employees had to deal with bottlenecks issues and redundant processes as they have to participate in the end-to-end process that causes the process to be lengthy and impact their efficiency and productivity.

Furthermore, the employees have a different style of managing the grant; thus, many databases, files, and folders were created. This issues even worse to the admin side as a lot of the process includes communication is still manual.

Therefore, to gain efficient control and ensure timely disbursements, there is a need to streamline the complete grant lifecycle from receiving grant applications to monitoring work post-award.

In line with the MCMC's key initiatives to improve Malaysia's digitalization and connectivity, the researcher proposes a solution, which also serves as the main objective of this research, by creating a User Requirement Specification for the development of a grant management system. This allows for a more systematic grant management system and introduces more efficient ways to offer grant management services. Besides, the system is expected to transform the way MCMC manages the grant and performs the modern times. The proposed system was demonstrated through the development of a prototype, which was then used to gauge staff perceptions of its adoption via a user survey.

1.3.1 Problem Diagnosis
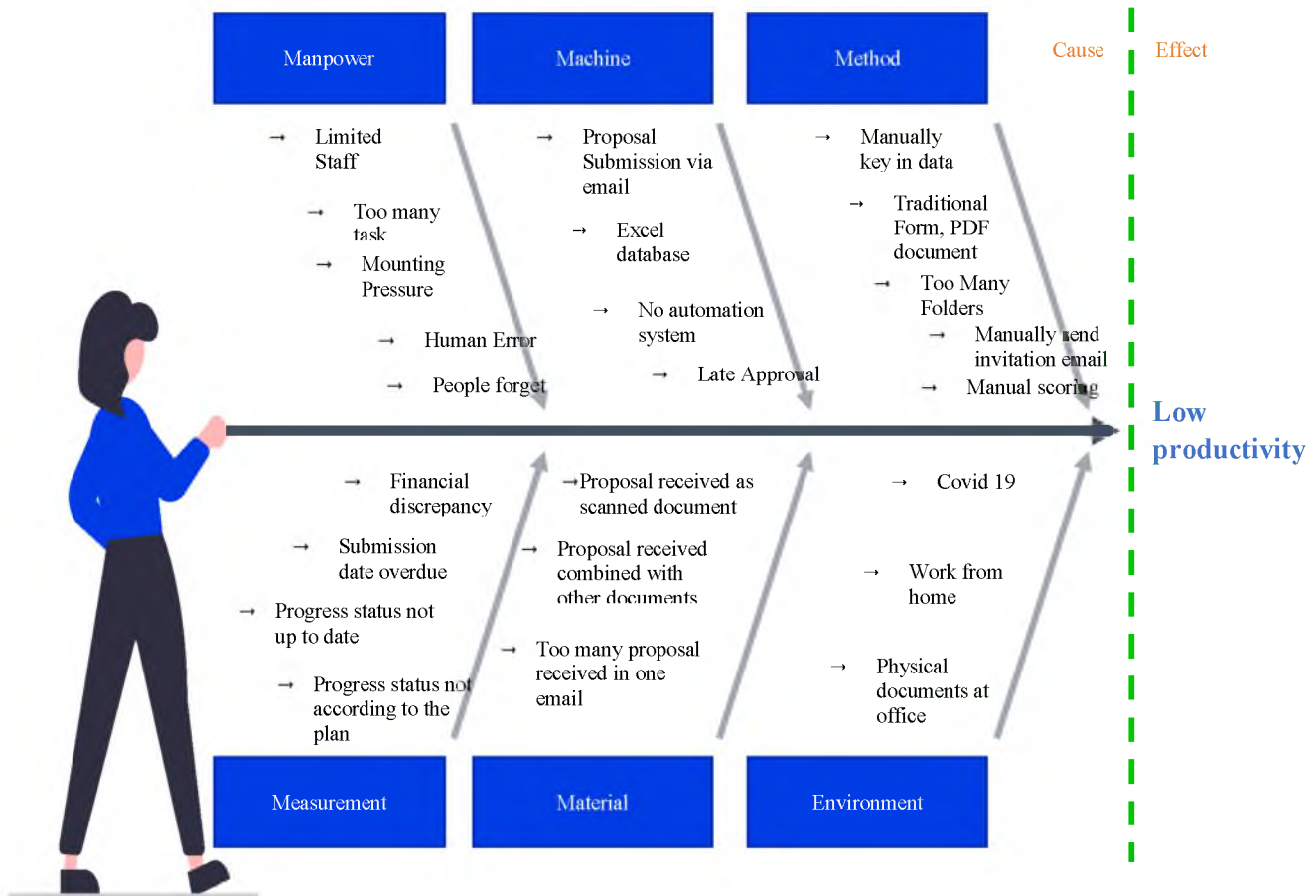
Figure 1-1: Fishbone Diagram

To further identify many possible causes for an effect or problem in the current MCMC Grant Management processes, a fishbone analysis was performed as illustrated above.

According to the figure above, the MCMC Research Enterprise Department consists of only three officers and one administrative assistant. Essentially, the admin staff handled all administrative issues, while the executive staff acted as desk officers for assigned projects.

Tasks are made on a per-staff basis. As a result, each member of staff has a unique approach to grant management. As illustrated in the figure, a large portion of the process is still entirely manual. For instance, all recipients submitted their applications by email during the application process. They has to provide proposal

forms together with all necessary documents, including the CVs of Lead Researchers and Research Members, a Qualification Certificate, and a Gantt Chart.

Once an application is received, admin staff reviews it to ensure it fits the requirement and acknowledges receipt. If an application does not satisfy the requirements, the administrative staff must contact the applicants and request that they resubmit the application.

Executive staff act as desk officers for the MCMC grants they manage. A desk officer is responsible for monitoring and reviewing research projects and the quality of deliverables. It includes monitoring their timelines, budget use, and project completion within the specified time frame. Additionally, they have their own database for tracking deliverables and expenses. As a result, human error will happen, such as missing a project deadline or failing to check financial status.

Additionally, a desk officer is responsible for analysing and providing feedback on the final report's content, as well as acting as a liaison with the MCMC research sponsor. Generally, a desk officer has been involved throughout the process. As a result, they have difficulty concentrating on other tasks.

Additionally, all officers are responsible for reviewing all proposals received and participating in the grant administration process. Their responsibilities include establishing grant schemes, soliciting proposals, evaluating applications, awarding grants, monitoring projects (deliverables and financial), submitting reports, and planning dissemination.

Each officer evaluates the proposals, compiles a summary, narrows the area, and recommends potential proposals for the application process. Due to the fact that all applications and paperwork are sent by email in PDF format, they have manually develop their database and summarise the proposal using an excel sheet.

The final part of the pre-award process is the pitch session and decision, whereby the mark is manually calculated using an excel sheet. Meanwhile, all communication for the award process was conducted manually, with the officer

communicating with the respective potential researchers via the Research management centres or directly with the researchers for proposal negotiation, which included reviewing all details of their grant chart, financial planning, and managing the LOA.

Each officer is responsible for monitoring and reviewing post-award projects and the performance of deliverables. It includes monitoring their schedules, budget use, and project completion within the specified time frame. Additionally, each officer has his or her own database for tracking deliverables and finances. Officers are also responsible for assessing and providing feedback on the final report's content, as well as acting as the liaison with the MCMC research sponsor.

There are many manual processes involved in managing the MCMC grant, from pre-award to post-award processes. As a result, it leads to inefficiencies and traceability issues. In addition, it puts MCMC at the non-compliance issues, and financial risk of not meeting all project, reporting, and reimbursement deadlines due to the challenges faced.

1.4   Research Questions

RQ 1: How does MCMC manage research grants?

RQ 2: What are the requirement needs by the user to develop the grant management system?

RQ 3: Will the developed system improved the grant management processes and increase employee productivity?

1.5   Research Objectives

The proposed study addresses the following research questions and corresponding objectives:

> *RQ 1: How does MCMC manages research grants?*
> **RO1: To gather in-depth information of MCMC current practice in managing research grants**

> *RQ 2: What are the requirements needed by the user to develop the grant management system?*
> **RO2: To create a User Requirement Specification for the development of a grant management system that is expected to transform the way MCMC manage the grant and perform an operation in the modern times**

> *RQ 3: Will the developed system improved the grant management processes and increase employee productivity?*
> **RO 3: To identify the perception of users on the adoption of the grant management system through a prototype**

1.6   Researcher's Role

(a)   The researcher is responsible for the successful implementation of the project according to agreed timelines and the timely submission of the report.

(b)   The researcher is responsible in terms of work, discipline, and all other matters to ensure the smooth progress of the research.

(c)   The researcher is responsible for carrying out the research until completed.

(d)   The researcher is present the Research to UTM upon request by the lecturer.

1.7   Research Ethics

Generally, Research ethics is referring to the guidelines for the responsible for conducting the Research of Research. Thus, below is the general summary of some ethical principles:

(a)   The researcher shall honestly report all the data, findings and methodology. The report is purely written by the researcher where it does not fabricate, falsify, or misrepresent data (refer to Appendix A).

(b)   The researcher shall avoid bias in methodology, findings, interpretation, analyses and other aspects of the research

(c)   The researcher shall avoid carelessness of errors and negligence; carefully and critically assess the research works.

1.8   Significance of the Research

This study provides an important opportunity to discuss the need of more research in light of this limitation. Additionally, it greatly contributes to the knowledge and information about the grant management system's development and the impact on employee productivity and efficiency.

1.8.1   Significance to Theory

Since the focus of this research is on the development of a grant management system, it was found that the scope of this research topic is minimal. The analysis of literature review from the web of science is detailed below:
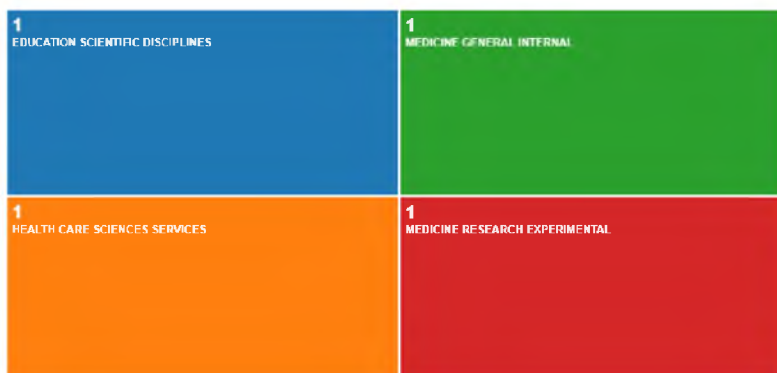
Figure 1-2: Result Analysis of Past Studies from Web of Science

From the tree map, it is shown that there are only three previous studies were conducted from 2021 and below. However, it was found that these studies were not focused on the development of grant management.
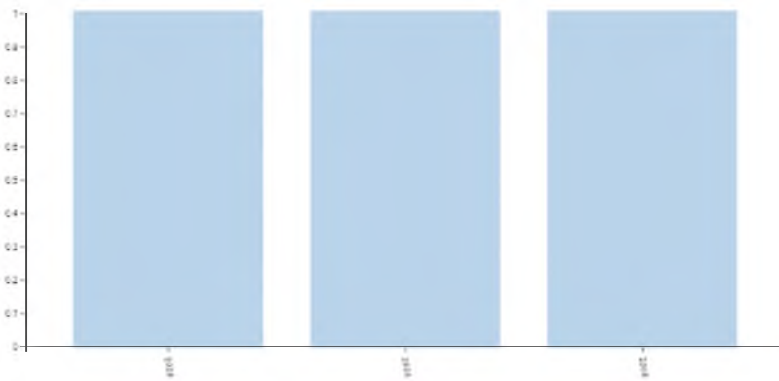
Figure 1-3: Result of Analysis of Past Studies from Web of Science by Year

Figure 1-4: Result of Analysis of Past Studies from Web of Science by Country

In addition, due to the limitation of this study, it can be an opportunity to describe the need for further research on this topic as it was found none of the studies was conducted in Malaysia. Meanwhile, other sources found 34,500 studies on this topic (Google Scholar), while 23 studies in Mendeley.

In summary, some researchers suggested applying metasearch technology and plagiarism detection tools for the Grant Management System development. This, in turn, enables the organization to protect against plagiarism and easily report research productions. Meanwhile, in terms of the impact of information systems, organizations should focus on the permanent improvement of their information systems to keep abreast of technological developments because it reflected positively on functions such as planning, control, and decision-making.

Thus, it can be concluded that this research can serve as an important opportunity to describe the need for further research due to this limitation.

1.8.2 Significance to Practice

In line with the MCMC's key initiatives to enhance digitalization and connectivity in Malaysia, there is a need to modify MCMC's grant management processes. Hence, the development of the system will enable a more systematic and efficient way of grant management offerings.

Besides, it will help MCMC properly manage awarded funding to eliminate the financial risk of not meeting all project, reporting, and reimbursement deadlines. The improvements also aim to:

- Ensure better quality research proposals incorporating pitching exercises and the inclusion of potential research champions in the selection process;
- Improve the feasibility of research, which will address more detailed requirements within the research proposal incorporating the requirement for potential researchers to identify and outline plans for mitigating risks that may affect the viability of the research, including secondary plans to mitigate implementation within the "new norms" addressing the potential extension of movement orders. In the event the projects fall into non-performance, provisions will be instituted to recover fully or partially released funds and action taken to terminate the project, and
- Agility to meet research requirements.

1.9 Definition of Terms

Due to the lack of the previous study on this topic, the description of the terms in this paper has been defined via operation definition:

A.   General terms

Research Grants and funding- A research grant or funding is a sum of money given to a researcher. It is a financial resource to research, program, or project.

Grant management - A process and method used by organizations to monitor grants. It covers the whole part of the grant's lifecycle from pre-award to post-award. Generally, the process will always be evolving and encompasses various life cycle tasks through unique award processes.

Grant Management Software- A web-based platform that supports the management of the entire grant lifecycle that increases efficiency and effectiveness while aiding risk management. It can also help organizations coordinate allocations and facilitate interaction among all stakeholders involved in the grant management process, allowing them to carry out their responsibilities more effectively. Grant recipients can also submit project proposals online. As a result, financial and reporting, and project reviews can be completed in real-time. The system tracks processes, tasks, reminders, and feedback in real-time.

B.   Grant Process

Generally, grant management uses a system-wide management system. It overcomes weaknesses and manages risks, and runs via a linear lifecycle. It means that all the processes are sequential.

The traditional linear project management lifecycle models are defined as definition, planning, execution, and closure. Meanwhile, in grant management, the linear lifecycle model is defined, and the funding opportunity, application, award decisions, and implementation/closeout (Bennett, 2020).

The grant management involves two processes, funder and recipients, which involves the key phases as below:

Figure 1-5: Grant Process (Bennett, 2020)

Pre Award Phase   Application and Submital Review
• Identify the organization's needs and goals
• Review and process the application

Award Phase   Award Decision and Notifications
• Produce contract to the succesfull recepient
• Send notification to those successfull and unsuccesfull recepient

Post Award phase   Implementation, Reporting, and Closeout
• Fund Disbursement
• Monitoring and tracking
• Documentation and Reporting
• Close project-and close report (Fund utilization and etc)
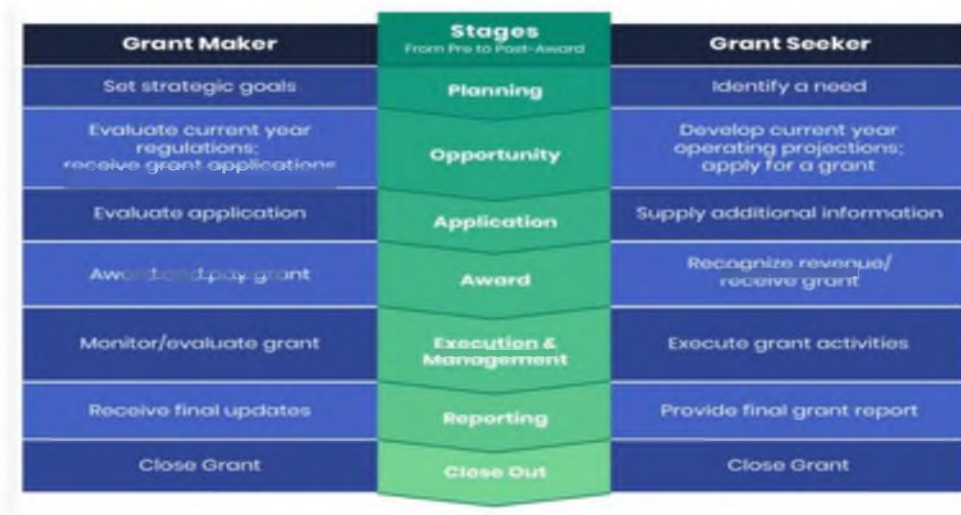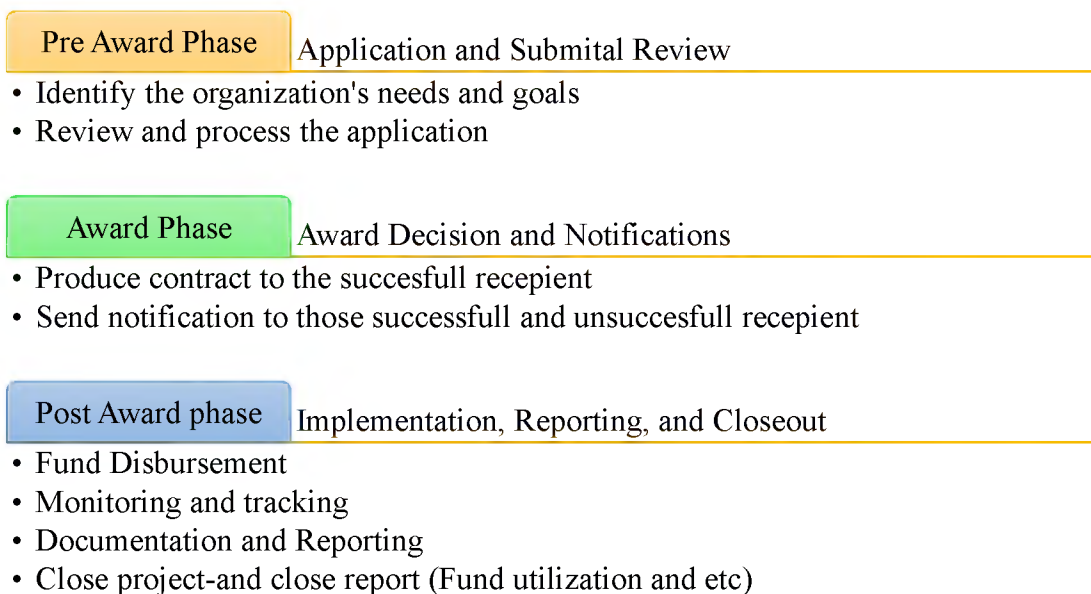
Figure 1-6: Grant Management Processes

Based on the figure above, it is critical to developing a system that can capture all the activities, including reporting and tracking the deadlines. Therefore, successful grant management depends on how strong the organizational system is.

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