READINESS TOWARDS THE IMPLEMENTATION OF OPEN SCIENCE INITIATIVES IN THE MALAYSIAN COMPREHENSIVE PUBLIC UNIVERSITIES

BY

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ABSTRACT

This research explored the readiness towards implementing Open Science (OS) initiatives in Malaysian comprehensive public universities; OS stands for a transition to a new, open. A collaborative way of conducting, publishing, and evaluating research is a system in which scientists and researchers worldwide can come together and contribute to all research processes. It also allows for sharing many valuable scientific discoveries beneficial to different aspects of human life at the end of the methods. This practice and procedure are implemented through the readiness and willingness of the stakeholders in most places. However, findings still show that most of the stakeholders were even not fully participating in the system. To achieve the objectives of this research, four comprehensive universities among the public universities in Malaysia were chosen to examine the readiness of the academic researchers and the professional librarians in these universities towards Open Science initiatives. Mixed-method research was implemented, where a questionnaire and interview were used to gather information from the respondents. A total of 255 responses was received from both the academic researchers and the library professionals for the quantitative method. A total of 6 librarians were also interviewed for the qualitative approach to complement the first method. At the end of the research, a triangulation was done to aggregates the significant findings of the research. The results indicated that the comprehensive public universities in Malaysia were partially involved in OS, even though the term was still new to most participants and where most of them assumed that OS is another term for open access. The institutional repository was the commonly known way these universities have been involved in the OS practice. However, only 10% to 30% of their contents were also available to the general public, while some Institutions only provide abstract to the public. The Institutions also provide the specializations, metadata, and the personal contact details of their researchers on their website, for those who may want to work with them. However, these institutions are still working on providing a policy on operating and fully engaging another aspect of the OS practices. While some recommended factors identified by the stakeholders to fully implement the OS practices were the need for more enlightenment on the system, more modern digital facilities or infrastructure such as high-speed internet, and well-managed and secured servers.

خلاصة البحث

إستكشف هذا البحث الاستعداد لتنفيذ مبادرات "العلم المفتوح" (Open Science) في الجامعات العامة الماليزية ، العلم المفتوح يعرف بي نظام التشغيل الانتقال إلى طريقة جديدة وأكثر انفتاحًا وتشاركية لإجراء البحوث العلمية ونشرها وتقييمها. إنه نظام يمكن للعلماء والباحثين من جميع أنحاء العالم أن يجتمعوا فيه ويساهمون في جميع عمليات البحث وفي نهاية العمليات البحوث ، كما يسمح بمشاركة العديد من الاكتشافات العلوم المفيدة التي تعود بالنفع على جوانب مختلفة في حياة الإنسان. لذلك ، ولتحقيق الأهداف المذكورة لهذا البحث ، تم اختيار أربع جامعات شاملة من ضمن الجامعات الماليزية الحكومية في هذا البحث ، لكشف مدى استعداد الباحثين الأكاديميين وأمناء المكتبات المحترفين في هذه الجامعات تجاه مبادرات العلم المفتوح. تم تنفيذ البحث المختلط ، حيث تم استخدام استبيان ومقابلة لجمع المعلومات من المستجيبين. تم تلقي إجمالي 255 ردًا من كل من الباحثين الأكاديميين ومهنيين المكتبات حول الطريقة الكمية ، كما تم إجراء مقابلات مع 6 مجموعة، أمناء مكتبات بشأن الطريقة النوعية لاستكمال الطريقة الأولى. في نهاية البحث ، تم إجراء تثليث لجمع النتائج الرئيسية للبحث. أشارت النتائج إلى أن الجامعات الماليزية الحكومية الشاملة كانت تشارك جزئيًا في نظام التشغيل ، على الرغم من أن المصطلح لا يزال جديدًا بالنسبة لمعظم المشاركين حيث افترض معظمهم أن نظام التشغيل هو مصطلح آخر للوصول المفتوح (Open Access). كان المستودع المؤسسي هو الوسيلة المعروفة التي شاركت من خلالها هذه الجامعات في ممارسة العلم المفتوح . ومع ذلك ، فإن 10٪ إلى 30٪ فقط من محتوياتها كانت متاحة أيضًا لعامة الناس ، في حين أن بعض المؤسسات تقدم الملخصات فقط للجمهور. توفر المؤسسات أيضًا التخصصات والبيانات الوصفية وتفاصيل الاتصال الشخصية للباحثين على موقع الويب الخاص بهم ، لأولئك الذين قد يرغبون في العمل معهم. ومع ذلك ، لا تزال هذه المؤسسات تعمل على توفير سياسة حول كيفية العمل والمشاركة الكاملة في جانب آخر من ممارسات العلم المفتوح. في حين أن بعض العوامل الموصى بها التي حددها أصحاب المصلحة (Stakeholders) للتنفيذ الكامل لممارسات العلم المفتوح كانت ؛ الحاجة إلى مزيد من التنوير على النظام ، والمزيد من المرافق أو البنية التحتية الرقمية الحديثة مثل الإنترنت عالي السرعة ، والخوادم المدارة والآمنة بشكل جيد.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Library and Information Science

……..
Roslina Othman
Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Library and Information Science

……..
Nor Saadah Binti Md Nor
Examiner

This dissertation was submitted to the Department of Library and Information Science and is accepted as a fulfillment of the requirement for the degree of Master of Library and Information Science.

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This dissertation was submitted to the Kulliyyah of Information and Communication Technology and is accepted as a fulfillment of the requirement for the degree of Master of Library and Information Science.

……..
Abdul Wahab Bin Abdul Rahman
Dean, Kulliyyah of Information and Communication Technology

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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DEDICATION

This research work is dedicated to the following:
***Parents**: Alh. Ahmad Imam and Hajiya Rukyat AbdulRahman*
***Sister:** Rayhana Ahmad (Ummi)*

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Since the inception of humans, knowledge has been the power with which many societies and generations advance and lead. For any nation to progress, especially in academic likes, the researchers and the scholars in that society must be willing to share their knowledge with others and to work together within themselves in advancing their research objectives occasionally. It was way back in June 2016; the European and international library community welcomed the idea of open science. They were trying to implement it to support the rapid transition of how research and knowledge are being created, managed and the way it is being disseminated in society at large (EBLIDA et al., 2016).

Research and innovation in all social sectors today, ranging from health, environment, energy, education, transportation, and many others, are changing rapidly. Scientific discoveries and innovations such as vaccination for polio and the invention of mobile phones have resulted in a better life for humanities (Abd. Rahman, 2019). This can also be noticed in the scientific community's current response, decision-makers, and civil society during the covid-19 outbreak, the need for rapid scientific and epidemiological data/information sharing, and the importance of international scientific collaborations (UNESCO Website, 2019).

Information and Communication Technology (ICT) has changed the ways research is being conducted in science and innovation to be more collaborative, more international, and more open to the world. These methods have presented a new scientific process based on cooperative work and new ways of disseminating knowledge

using digital technologies and new collaborative tools known as open science (Mancini et al., 2020). Open science has now created a system of knowledge dissemination using digital technologies and new collaborative tools that promote joint effort in sharing research processes and results of new knowledge as early and as widely as possible. This method of scientific engagement's main objective is to include the broader communities in addressing some universal challenges more effectively and guarantee that science and research are fundamental to the innovation, growth, and development of any society (Pardo Martínez & Poveda, 2018).

Society is now requesting the researchers and the innovators to make their knowledge more universal and visible. Still, the question remains, are the researchers ready to make public their research or provide it on less formal platforms such as blogs, which could make them more visible to the public. This is also seen as an invitation and opportunity for early career researchers to think about social media as a publishing medium without pushing the social media agenda. But findings showed that most of the researchers were still in the opinion that they did not use social media channels to disseminate their research due to time constraints. They were busy writing papers for high impact factor journals because publishing in social media did not recognise their dissemination activities (e.g. not admissible on their CVs). Other reasons were that they lacked the know-how, while some journals forbade the authors to do so (Nicholas et al., 2017).

Thus, open science has introduced new ways through which research and education are being performed. It has created an avenue for researchers to publicize their studies and collaborate, where knowledge can be shared so that everybody can contribute to scientific advancements through more effective use of research outputs. The open science movement was to enhance the educational sector, but as the name

implied, it would be a universal collaboration of research professionals worldwide. They are trying to solve multiple challenges in many areas like food, water, energy, and health because these are universal challenges that can only be solved through international collaborations (Väänänen & Peltonen, 2016).

The European Commissioner for Research, Science and Innovation, Carlos Moedas, (2016). Who was responsible for the research funding programs and promoting international excellence in the region, mentioned in his vision for the future that "in the year 2030, open science will become a reality and offer a whole range of new, unlimited opportunities for research and innovation worldwide. Scientists, citizens, publishers, research institutions, public and private research funders, students and education professionals, as well as companies from all around the globe, will be sharing an open virtual environment, called The Lab".

Many communities ranging from research and academic institutions, manufacturing organizations, and others are now being referred to as knowledge communities as the result of several advancements in the implementation and use of open science to timely and freely communicate and share information and ideas within the larger society (Esch et al., 2020). Such communities mainly were a well-established group of people with a common interest and sometimes faced similar challenges. It was also a fact that such groups of people could learn faster when in a group because the interaction between them created a knowledge base that was of utmost importance to each community member (Johnsen, 2018).

Likewise, various academic and research communities and publishers and their sponsors in places like Canada, United States, and the United Kingdom have introduced a new method, tools, services, and infrastructures for sharing their research output. Organizations such as the Social Sciences and Humanities Research Council of Canada

(SSHRC), the National Sanitation Foundation (NSF International), the Canadian Institutes of Health Research (CIHR), the National Institutes of Health (NIH), the UK Medical Research Council, the Wellcome Trust, and many other similar organizations have all been pioneers in this movement of open science. Each of these organizations has supported PubMed Central's establishment as an open-access digital repository for all their funded research outputs (Lasthiotakis et al., 2015).

Research and academic institutions worldwide are now trying to utilize the benefits attached to internet technology fully. As many online platforms with which people could communicate and promote their research are being developed, they can collaborate and work together simultaneously as a team. Some of these essential web-based tools for researchers range from social networking sites, scientific research support tools, labs and data management tools, and others (Crouzier, 2017). Likewise, these tools are now being used to promote excellent research, teaching, and learning as the goals in academic institutions (Brennan et al., 2019; Singh & Hurley, 2017).

The drastic change in academic publications and information communication mediums, which has introduced many educational institutions to divert into more digital, has also led to the birth of an institutional repository (Ebong et al., 2017). Institutional repositories are developed mainly by libraries and research centres, universities, governments, multidisciplinary schools, and laboratories, primarily to preserve and communicate their intellectual properties internally and externally (Adam & Kaur, 2019). In the libraries' case, several economic downturns being experienced in their budgets during the past decades. The budget cutbacks have influenced the collection policies because these repositories are now being implemented globally (Saarti, 2018).

1.1.1 Open Science

The speedy advancement in technology and the internet has led to a quick improvement in almost all social sectors. It has enabled and provides a means for scientists and researchers worldwide to collaborate and contribute to all research processes and share many valuable scientific discoveries beneficial to different aspects of human life. Today, research data, lab notes, and other research processes were being made freely available for the public. Also, they allowed them to reuse, redistribute, and reproduce the research and its fundamental data and methods (Federer et al., 2018). In a nutshell, many societies now have a kind of transparent and open system of knowledge developed and shared through collaborative platforms (Vicente-Sáez & Martínez-Fuentes, 2018). For example, the Open Science Framework (https://osf.io/) is a free and open platform that supports research and enables collaboration between researchers to the publishing stage. The FOSTER portal, which is also an e-learning platform that brings together training resources for those who need to know more about open science or need to develop strategies and skills for implementing it in their daily research workflows. Many different users, ranging from early career researchers, librarians, research administrators, data managers, and graduate schools can all benefit from the portal.

The European University Association (EUA) was identified as one of the leading drivers in open science initiatives globally. It is likely to result from their new approach to the scientific processes, based on their cooperative work and new ways of disseminating knowledge using digital technologies and other new collaborative tools (EUA, 2017).

The Organization for Economic Co-operation and Development (OECD), while promoting open science, explained it as the act of making the primary outputs of all

public-funded research findings and data accessible in an electronic format with no or minimal restriction available to the public (OECD, 2015).

Open science can also represent the acts of spreading the values of openness to the whole research stages. It is clearly shown in Figure 1:1 below; likewise, open science is about sharing knowledge where research data and its fundamental methods and processes are made "freely" available for the public to use, redistribute and reproduce by those other than the researchers themselves (Abd. Rahman, 2019). These efforts have been all to promote collaboration in research and learning and provide more reliable research findings.

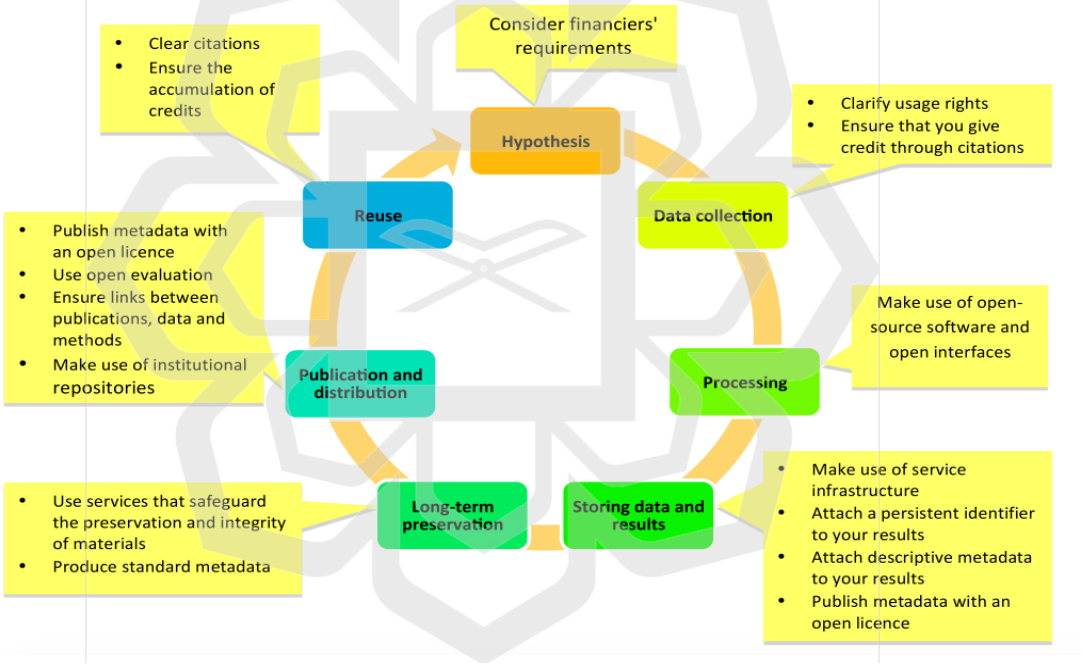

Figure 1.1 Promoting openness at different stages of the research process (Open Science and Research Initiative, 2014)

Open Science has represented a new method to the scientific process of cooperative work and a new way of disseminating knowledge using digital technologies and new collaborative tools (LERU, 2018). Numerous scientific research data are now accessible to all individuals in communities, either unprofessional or professionals. The public is

currently voluntarily participating in the research process to enable real-world challenges to be discussed (Abd. Rahman, 2019).

Open science practices have been growing in acceptance and necessity over time. However, the widespread adoption of these practices has still not yet been achieved universally (McKiernan et al., 2016). It was because researchers were still uncertain about how sharing their work would affect their professional careers. Studies have revealed the benefits gained by researchers who subscribed to open science initiatives as increased citations, media attention, potential collaborators, job opportunities, and funding opportunities (Carpi et al., 2017).

Many government and international organizations across the globe such as the European Commission, the European Parliament, the European Council, the Organization for Economic Cooperation and Development (OECD), the United Nations, the World Bank, and the World Health Organization (WHO) are now recognizing the importance of open science to address most of the substantial societal challenges faced by humanities. Examples include public health emergencies, sustainable food production, climate change, efficient energy, smart transport, and many more (Vicente-Sáez & Martínez-Fuentes, 2018).

Likewise, in the contemporary United Nations Sustainable Development Goals (UNSDGs), a new approach in addressing universal challenges that humanity faces. Ranging from poverty, protecting the planet, and improving the lives and prospects of everyone, everywhere, Open Science has been a key contributing factor in realizing most of the objectives defined in the 17 SDGs goals. Most especially by the development of Science Technology and Innovation (STI) and the immediate access to international research outputs available for all (OpenAIRE, 2020). Specifically, open science will significantly impact realizing the SDGs' 4th goal, to increase access to

education and school enrollment rates at all levels. These could be achieved through open educational resources and citizen science, which are all components of open science.

The inception of the open science movement has been traced back to the early publication of scientific journal through the internet. Today this movement is part of the framework of tension between new forms of collaborative, interactive, and shared production of information, knowledge, and culture on the one side. The mechanisms to capture and preserve the knowledge that is collectively and socially produced on the other (Zillur, 2016). But as this system is increasingly being implemented in most scientific research and technological societies, not all the researchers and relevant stakeholders in the field have a clear idea of the whole system of open science covers (Banks et al., 2019). As many still assume, open science is all about open access, which is only one of the final stages of the open science research process. It has also made most of the existing studies focused on the definition of open data and the development and impact of open access (Mancini et al., 2020). In line with this research's objectives, there is a need to examine the readiness of Malaysian academic researchers and information professionals to implement open science initiatives. Open science readiness here would cover the awareness, practices, and perceived benefits of Malaysian Universities' open science initiatives (Abdullah, 2019).

The Organisation for Economic Co-operation and Development (OECD, 2015) summed up the benefits and why scientists should get involved in open science.

A. **Efficiency:** This will allow for greater access to scientific inputs and outputs and provide practical and productive research.

- It is reducing duplication and costs of creating, transferring, and reusing data.
- They are allowing more research to be carried out from previously used data.

- Providing opportunities for domestic and universal collaboration in the research process, and
- The user of open search tools can help in increasing the efficiency of research and its dissemination.

B. **Quality and integrity:** open access to scientific data and research process will allow more comprehensive evaluation and scrutiny by others in the scientific community, which can guarantee greater and more accurate replication and validation of research findings.

C. **Economic benefits:** increased access to research results can foster spillovers to scientific society and innovators more widely and can also increase awareness and conscious choices among consumers. Science plays a crucial role in today's knowledge economies, and the higher efficiency related to open science would benefit advanced economies and develop.

D. **Innovation and knowledge transfer:** Open Science will reduce delays in the use and re-use research findings by firms and individuals and promote a rapid path from research to innovation to supply new products and services.

E. **Public disclosure and engagement:** Science should be open to society to promote citizens' awareness. The outcomes of public-funded research are supposed to be for public policies and investments. Moreover, open science will also promote citizen's engagement and active participation in scientific experiments and data collection.

F. **Global benefits:** Open Science is international and promotes collaborative efforts and knowledge communication to understand better challenges that need coordinated universal actions like global climate change or the aging population and help identify solutions more effectively.