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STRENGTHENING INFORMATION AND KNOWLEDGE MANAGEMENT PARADIGMS IN THE ERA OF ADVANCED TECHNOLOGIES

**PROCEEDINGS OF THE 5TH BIENNIAL CONFERENCE OF THE
DEPARTMENT OF LIBRARY AND INFORMATION STUDIES,
UNIVERSITY OF BOTSWANA HELD AT THE**

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PERCEPTION OF FACULTY MEMBERS ON THE ADOPTION OF OPEN SCIENCE IN A UNIVERSITY OF TECHNOLOGY

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Abstract

The adoption of Open Science (OS) has gained global momentum, fostering transparency, collaboration, and accessibility in scholarly research. However, faculty members' perceptions toward OS significantly influence its implementation and impact within academic institutions. This study examines faculty members' attitudes, awareness, and challenges regarding the adoption of OS in a university of technology. Using a mixed-methods approach, the research integrates survey responses and qualitative insights to evaluate the extent of OS adoption, perceived benefits, and barriers. Findings indicate that while faculty members acknowledge the advantages of OS such as increased visibility, enhanced research collaboration, and accelerated knowledge dissemination concerns over data security, intellectual property rights, and institutional support remain prevalent. Additionally, disparities in OS awareness and adoption exist across disciplines, with STEM fields demonstrating a higher inclination toward OS practices compared to the humanities. The study underscores the critical role of institutional policies, technological infrastructure, and capacity-building initiatives in fostering a robust OS culture. Recommendations include targeted training programs, institutional incentives, and the development of supportive policies to encourage wider OS adoption among faculty. By addressing faculty members' concerns and promoting a conducive OS ecosystem, universities can enhance research efficiency, global engagement, and knowledge democratization. This study contributes to the growing discourse on OS by providing empirical evidence on faculty perceptions and offering actionable insights for academic policymakers and stakeholders.

Keywords: Faculty Perception, Open Science (OS), Institutional Support, and Research Accessibility

INTRODUCTION

The research ecosystem has been revolutionised in recent times with trends such as open science. Open Science (OS) is the movement to make scientific research, and all the underlying process, data, outputs and dissemination available to any member of an inquiring society, from professionals to non-professionals. It promotes transparency, collaboration and most importantly accessibility, especially for researchers in fund-constrained countries and institutions. Notable OS practices according to the European Union, include, early and open sharing of research, providing immediate and unrestricted open access to not only the final scientific publication, but the outputs of the processes-research data, models, algorithms, software, protocols, notebooks, workflows, and all other research outputs. Others are, ensuring verifiability and reproducibility of research outputs and responsible research output management (publications, data, and other outputs) in accordance with the FAIR (Findable, Accessible, Interoperable, and Reusable) principles.

In developing regions, including Africa, discussions around open science practices are gaining attention due to its potential to democratise knowledge production and dissemination. Although the benefits of OS are not in doubt, there are evidences of disparities across disciplines and practices reported in the literature from the developed countries. Conversations about open science have reached the mainstream, yet many open science practices such as data sharing remain uncommon. (Thibault, et. al. 2023). In Nigeria, while some open science practices such as uploading final published outputs in institutional repositories are prevalent, due to enablers like promotion assessment, other equally important OS practices are rarely discussed. Interestingly, this trend is global. For instance, Ferguson et. al. (2024) affirmed that open science practices such as posting data or code and pre-registering analyses are increasingly prescribed and debated in the applied sciences in North America, while in Tanzania, faculty had poor data-sharing practices (Msonde et. al. 2024). In Spain, researchers familiar with open science principles were more likely to deposit multiple versions of articles and datasets, with disciplinary and institutional differences (Palomera, 2025).

These studies indicate that despite the potential benefits OS offers, adoption of OS practises among researchers in Nigeria have not been documented in the literature. Thus, this study investigates how faculty members at the Federal University of Technology, Minna perceives open science practices, their readiness for adoption, and perceived barriers with the following objectives to:

1. Explore faculty members' perceptions of Open Science.
2. Identify factors that influence faculty adoption of OS practices.
3. Assess the challenges and benefits faculty perceive in OS.

LITERATURE REVIEW

CONCEPTS OF OPEN SCIENCE

Aside the fact that open science focuses on making scientific research and its procedures open, it includes practices like: publishing open research, campaigning for open access, Encouraging scientists to practice open note-book science such as: openly sharing data and code, broader dissemination and engagement in science and Generally making it easier to publish, access and communicate scientific knowledge (Alhassan, 2023). Open science represents a movement for wider transparency and openness in science which is broadly having a significant impact on day-to-day scientific work and life in all scientific disciplines Maedche *et. al.* (2024). In the same vein, OS is a universal term which brings together several movements and practices which aims at making multilingual scientific knowledge openly and easily available, accessible and reusable so as to increase visibly, scientific collaboration and sharing of information for the benefits of science and society and also to open a process of scientific knowledge creation, evaluation and communication too societal actors beyond the traditional scientific community.

Universite Savoie Mont Blanc (2018) also viewed OS as an international movement which aims at making the results of scientific research, particularly, publications and research data universally accessible. This definition however, means that OS has brought to an end, the era of pay-per-view, closed journals and databases and any other method of information dissemination which hinders researchers and other individuals from having free and uninterrupted access to scholarly publications. Universite Savoie Mont Blanc further highlighted that OS is that practice which makes collaboration and Contribution with others possible where research data, laboratory notes and other research procedures are freely and easily available under conditions that permits reuse, redistribution and reproduction of research and its underlying data and methodologies. OS has all it takes to make the scientific process more transparent, inclusive and democratic. It is increasingly acknowledged as a critical accelerator for the achievement of the United Nations sustainable development goal and a notable game changer in bridging the gaps in science, technology and innovations, thereby fulfilling the human rights to science, (UNESCO 2024).

DEFINITION AND COMPONENTS OF OPEN SCIENCE

The following are the components of OS as highlighted by Chakravorty *et.al.* (2022)

1. **Open Data /Open Research Data** – refers to how freely and accessible which research data can be used, reused, and distributed feely hence the original source is duly acknowledged. Open research data requires open data sharing platforms, these platforms are also not without its own challenges handling privacy issues, copyright protection, ownership and legal issues.
2. **Open Access** – As the name implies, has to do with the way, scholars and researchers experience unrestricted access to peer reviewed scientific contents and scholarly

publications under proper licencing agreements and respecting copyright laws. All scholarly publications fall under the context of open access; hence it is considered by many as the structural backbone of OS.

3. **Open Peer Review** – This is another giant step towards ensuring research transparency. Several mechanisms are put in place to enhance open peer review, though none is without one challenge or the other. For instance, revealing reviewers' names no doubt promotes transparency and originality, but on the other hand, it may lead to personal grudges between the reviewer and the author.
4. **Open Resources** – open resources are often referred to as open educational resources. These materials aid teaching, learning and research. Based on the Recommendation b UNESCO in 2019, there should not be restrictions on the availability and use of these resources.
5. **Open Methodology** – Is a broad concept, it has to do with being open with the methods involved in conducting a research. The major concern about open methodology is that it may encourage prior publication which may delay or hinder the patenting of an innovation. Open methodology is therefore, is not advisable for such intellectual products that requires patenting. Another challenge which researchers face with open methodology is the fear of scientific data theft. But then, Internet-based platforms with proper time stamps can be a solution to this problem.
6. **Open Source** – Refers to the way in which software codes are freely made available for users. These codes are made available under the terms and conditions of software license.

HISTORICAL DEVELOPMENT OF OPEN SCIENCE

The origin of OS can be traced back to the 17th century with the advent of the academic or scholarly journal. This was when the demand for access to scientific knowledge got to a point when it became necessary for groups of scientists to share their resources. Nielsen (2011) and Gomez *et. al.* (2022) pointed that the issues that led to open science movement emanated from the scientists' desires to have access to shared resources versus the desire of authors to make profit when other researchers partake in their resources.

The National Academies of Science, Engineering and Medicine (2018) expressed that in the 15 years since the Budapest Open Access Initiative issued its declaration, there had been numerous efforts to promote and realize open science. They further noted that a growing number of public and private research sponsors are seriously mandating open publication and open data on the part of the grantees (authors) with some variety in the specifics of their policies including the National Institutes of Health, the National Science Foundation, the European Commission and the Wellcome Trust.

The open science movement has catalysed new investment, prompted controversy and significantly impacted the global research enterprise and its stakeholders. Science-Matrix (2014) noted that several entities have monitored the growth and status of open science, most of these

efforts majorly focused on open publication with evidence form the findings of Science-Metrics that as of 2013, over half of the articles published during the period 2007-2012 were available for free download.

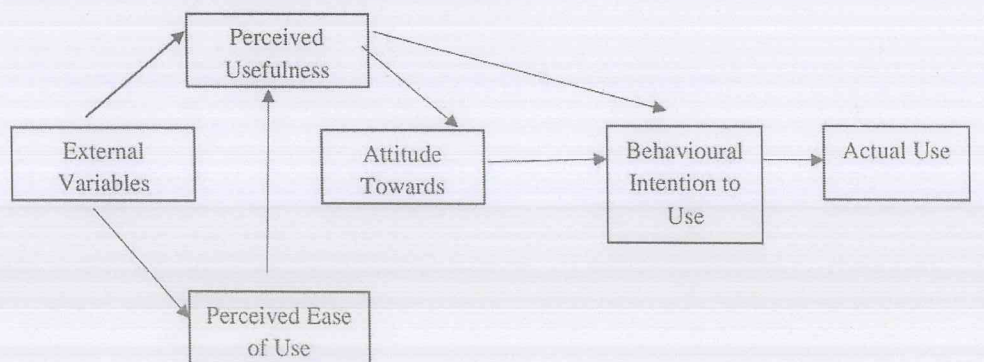
TECHNOLOGY ACCEPTANCE MODEL 1 (TAM1)

The researchers adopted the Technology Acceptance Model 1 (TAM1) as the theoretical frame work for this research. TAM was first founded by Fred Davis, 1986. It is practically taken from the Theory of Reasoned Action (TRA) by Fishbein and Ajzen in 1975 (Durodolu, 2016). TAM is specially fashioned towards demonstrating users' acceptance of information systems or information technologies. TAM included and tested two specific beliefs which stands to constitute its major constructs which are: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived usefulness means the possible users believe or the level to which a user thinks a particular system is useful for him. Meanwhile, perceived ease of use represents the level to which any user expects a system to work effortlessly which also shows how simple it is for a user to make use of a particular technology.

In TAM, the belief of a user about a particular system may be subjective by other elements which the model grouped as external variables. TAM lays emphasis on the fact that users' perception about how useful an information is and how easy it is to use are powerful factors that influences the adoption of a particular technology. According to Durodolu, (2016), TAM is of particular interest to the field of library and information science (LIS) specialists considering the fact that it aids them to improve their wish in adopting and using of information systems which is the leading technology of the modern world, and has improved the usefulness of models that forecast and clarify information technology reception and utilisation.

The TAM model will equally help in examining the behavioural intentions of the faculty members on the perception and adoption of open science.

Framework for Technology Acceptance Model 1



The theoretical model proposes that when a new technology is presented to a user, there are certain elements which affect their choices concerning the way they will access and utilise it. Based on the submission of Alzahrani (2023), Patil, (2016), focuses on two main constructs, which are: perceived ease of use (PEOU) and perceived usefulness (PU). In the context of this study, perceived usefulness (PU) of open science explains how the creators of the intellectual scientific products believes that the technologies will be useful to the end users. On the other hand, perceived ease of use (PEOU) can be achieved by ensuring that faculty members are aware of and confident in using the open scientific products. It is also pertinent to note that individuals perceive technological products and systems as being more useful if they consider the use of those products/systems simple and easy (Tsourela & Nerantzaki, 2020). This shows the interrelation between the two TAM constructs and that the perceived ease of use can predict perceived usefulness (Alzahrani, 2023). Tsourela and Nerantzaki (2020) further explained that behavioral intention (BI) also plays a significant role in predicting acceptance, where individuals with higher BI are more likely to adopt technology when compared to those with lower BI. This factor is usually influenced by both perceived usefulness and perceived ease of use.

RESEARCH METHODOLOGY

RESEARCH DESIGN

This study adopts a descriptive survey research design to explore faculty members' perceptions of Open Science (OS) and the factors influencing its adoption. The descriptive approach is appropriate for gathering, analyzing, and interpreting data regarding attitudes, opinions, and challenges faced by faculty members in adopting OS practices.

POPULATION AND SAMPLE SIZE

The study population comprises faculty members at the Federal University of Technology, Minna. A purposive sampling technique was used to select 15 respondents, ensuring diversity in academic ranks, disciplines, and familiarity with OS practices. The small sample size allows for in-depth exploration of individual perceptions while providing preliminary insights into broader faculty attitudes.

DATA COLLECTION INSTRUMENT

A structured questionnaire was designed as the primary data collection instrument. The questionnaire consists of four sections:

1. **Demographic Information:** Captures respondents' academic rank, years of experience, and department.
2. **Awareness and Perception of Open Science:** Measures familiarity with OS concepts and attitudes toward its adoption.
3. **Factors Influencing Adoption:** Assesses the role of technological readiness, institutional policies, and personal motivation in adopting OS practices.

4. Challenges and Benefits: Identifies perceived barriers and advantages of OS in scholarly communication and research dissemination.

The questionnaire includes both closed-ended (Likert scale) and open-ended questions to allow for quantitative analysis while capturing qualitative insights.

DATA COLLECTION PROCEDURE

The questionnaire was administered via an online survey platform and in-person distribution to ensure maximum participation. Respondents were given one week to complete the survey, with follow-up reminders sent to enhance response rates.

DATA ANALYSIS

Quantitative data from closed-ended questions were analyzed using descriptive statistics such as frequency distributions, percentages, and mean scores. Qualitative responses from open-ended questions were subjected to thematic analysis to identify recurring themes and patterns in faculty perceptions and experiences with OS.

ETHICAL CONSIDERATIONS

The study adhered to ethical research standards. Participants were informed about the study's purpose, assured of confidentiality, and provided with the option to withdraw at any time. Data collected were anonymized to protect respondents' identities and ensure honest responses.

LIMITATIONS OF THE STUDY

Given the small sample size of 15 respondents, findings may not be generalizable to the entire faculty population. Additionally, self-reported data may introduce biases related to social desirability or recall limitations. Future research with a larger sample and mixed-method approaches could provide more comprehensive insights into OS adoption among faculty members.

DATA AND ANALYSIS

Familiarity on the Concept of Open Science

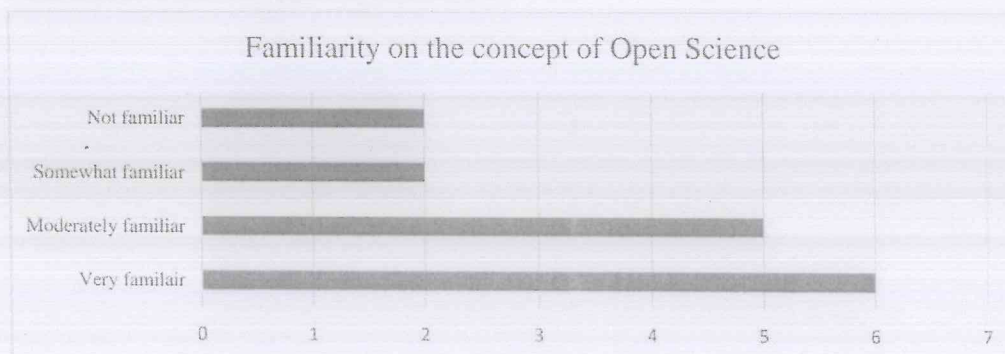


Figure 1: Familiarity on the Concept of Open Science

The bar chart illustrates the level of familiarity with the concept of Open Science among respondents. The data reveals that the majority of participants are either "Very familiar" or "Moderately familiar" with Open Science, as indicated by the longest bars, with six and five respondents, respectively. This suggests a relatively high awareness and understanding of Open Science principles among the surveyed group. In contrast, fewer respondents reported being "Somewhat familiar" or "Not familiar," with each category having two respondents. This indicates that while a small portion of participants lacks familiarity with the concept, the majority possess at least a moderate understanding.

The findings suggest that Open Science is a well-known concept among the respondents, but there remains a minor gap in awareness. The presence of individuals who are only "Somewhat familiar" or "Not familiar" implies a need for further educational initiatives or outreach programs to enhance understanding among those who are less informed. Promoting awareness of Open Science principles, such as open access, data sharing, and collaboration, could be beneficial in ensuring that more individuals are equipped with the knowledge necessary to engage in open research practices.

Impact of open Science on Academic Scholarship

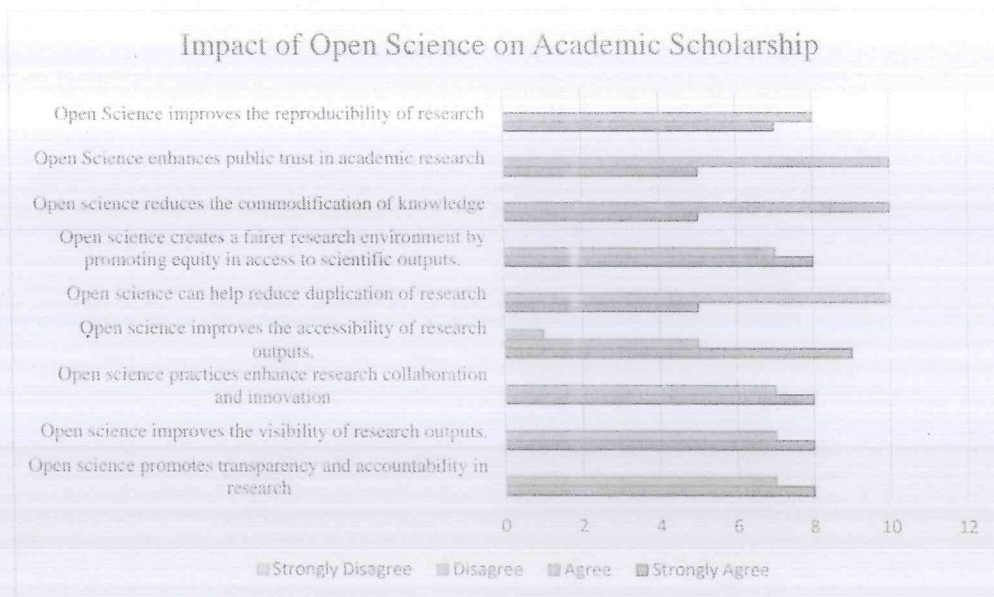
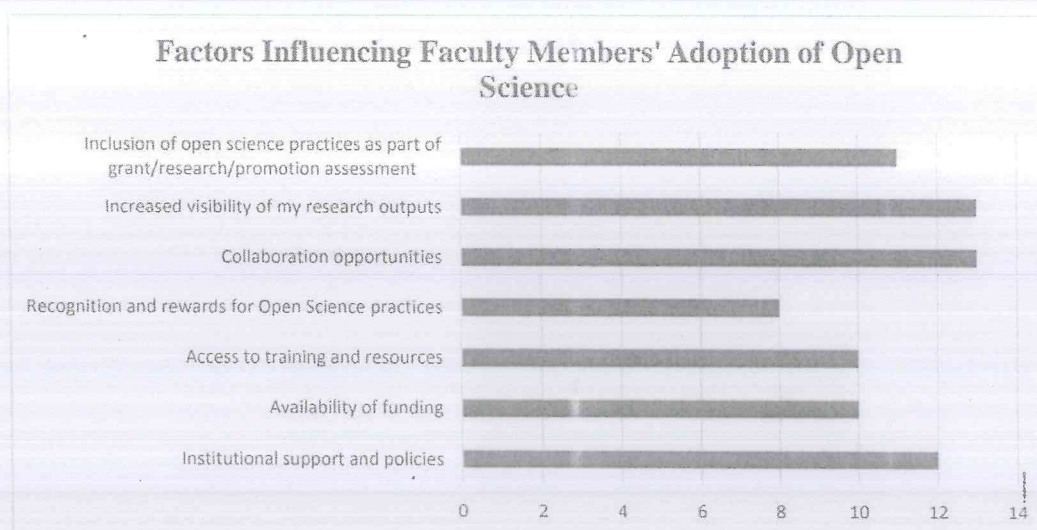


Figure 2: Impact of open Science on Academic Scholarship

The bar chart illustrates the perceived impact of Open Science on academic scholarship, categorized into different aspects such as research reproducibility, public trust, accessibility, collaboration, and transparency. The majority of respondents either "Agree" or "Strongly Agree" with the positive impacts of Open Science across all categories, suggesting a strong consensus on its benefits. Key areas with the highest agreement include Open Science enhancing public trust in academic research, reducing the commodification of knowledge, and improving accessibility and collaboration in research. Notably, very few respondents selected "Disagree" or "Strongly Disagree," indicating minimal skepticism about the benefits of Open Science.

Despite the overwhelmingly positive responses, some variations exist in the level of agreement. While aspects like public trust and reducing research duplication received high endorsement, factors such as creating a fairer research environment and accessibility show slightly lower agreement levels. This suggests that while Open Science is widely recognized for its advantages, there may be challenges in fully achieving equitable access and research inclusivity. These findings highlight the need for continued efforts to address barriers to Open Science adoption, ensuring that its principles translate into tangible improvements in academic scholarship.

Figure 3: Factors Influencing Faculty Members' Adoption of Open Science

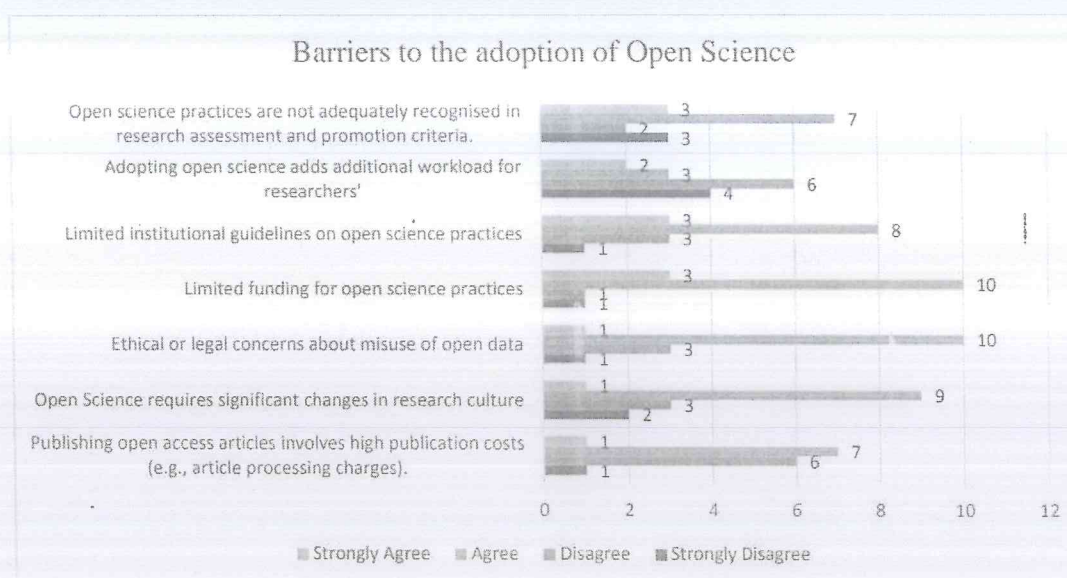


The bar chart presents various factors that influence faculty members' adoption of Open Science. Among these factors, "Institutional support and policies" appears to be the most significant, receiving the highest number of responses. This suggests that faculty members view institutional backing as a crucial enabler for integrating Open Science practices into their work. Similarly, "Increased visibility of my research outputs" and "Collaboration opportunities" are also strong

motivators, highlighting the importance of Open Science in enhancing scholarly reach and fostering research partnerships. The inclusion of Open Science in grant, research, and promotion assessments is another key factor, indicating that faculty members may be more inclined to adopt Open Science practices when it aligns with career advancement incentives.

Other influential factors include "Recognition and rewards for Open Science practices," "Access to training and resources," and "Availability of funding," all of which received moderate responses. This implies that while faculty members acknowledge the benefits of Open Science, practical constraints such as financial resources, institutional recognition, and access to necessary training play a role in their willingness to engage with these practices. Overall, the graph underscores the need for strong institutional frameworks, funding opportunities, and policies that incentivize and facilitate Open Science adoption among faculty members.

Figure :Barriers to the adoption of Open Science



The bar chart above illustrates the key barriers to the adoption of Open Science among researchers. The most significant obstacles identified include "Limited funding for open science practices" and "Ethical or legal concerns about misuse of open data," both of which received the highest level of agreement. This indicates that financial constraints and potential risks associated with open data sharing are major deterrents to researchers embracing Open Science. Additionally, "Limited institutional guidelines on open science practices" and "Open Science requires significant changes in research culture" were also highly rated as barriers, suggesting

that the lack of clear institutional policies and the need for a cultural shift in research practices are considerable challenges.

Other notable barriers include the perception that "Adopting Open Science adds additional workload for researchers" and that "Publishing open access articles involves high publication costs (e.g., article processing charges)." These concerns highlight practical difficulties researchers face in implementing Open Science, particularly regarding time management and financial burdens. Furthermore, "Open Science practices are not adequately recognized in research assessment and promotion criteria" suggests that researchers may be less motivated to adopt Open Science if it does not contribute to their career advancement. Overall, the graph emphasizes the need for institutional support, funding, and policy reforms to facilitate the broader adoption of Open Science.

DISCUSSION OF FINDINGS

The findings of this study reveal that faculty members generally perceive open science positively, recognizing its potential to enhance collaboration, research visibility, and knowledge dissemination. This aligns with previous research by Tennant et al. (2019), who argue that open science fosters transparency and increases the reproducibility of research. The study found that faculty members acknowledge the role of open-access publishing in increasing the accessibility of scholarly work, which is consistent with Piwowar et al. (2018), who observed that open-access articles receive more citations than those behind paywalls. However, despite this awareness, challenges such as funding constraints and institutional support gaps were highlighted as major barriers to open science adoption.

A significant finding from the study is that concerns about research integrity and intellectual property rights remain a key impediment to the full adoption of open science. Faculty members expressed apprehensions regarding data misuse and the risk of plagiarism, a concern also noted by Friesike et al. (2015), who emphasized that while open science democratizes knowledge, it also raises ethical and legal challenges. Additionally, the study found that the perceived lack of institutional mandates for open science contributes to hesitancy among faculty members. This observation supports the argument by Fecher and Friesike (2014) that institutional policies play a crucial role in shaping researchers' willingness to embrace open science practices.

The role of digital infrastructure in enabling open science was also underscored in the findings. Faculty members noted that limited access to high-quality repositories and open-access journals poses a significant challenge, which is consistent with the findings of Huang et al. (2020), who highlight the digital divide in open science implementation. The study also revealed that researchers in science and technology disciplines are more inclined to adopt open science compared to their counterparts in the humanities and social sciences. This aligns with studies by Vicente-Saez and Martinez-Fuentes (2018), who found that open science is more widely embraced in data-intensive fields where collaboration is essential.

Another important observation from the findings is the role of training and awareness in fostering open science adoption. Faculty members indicated that workshops and institutional capacity-building initiatives would encourage greater participation in open science activities. This is in line with the work of McKiernan et al. (2016), who argue that lack of training is a significant barrier to open science, as many researchers are unaware of how to navigate open-access publishing and data-sharing platforms effectively. The study suggests that integrating open science education into faculty development programs could significantly boost adoption rates.

Finally, the study highlights the importance of incentives in motivating researchers to engage with open science. Faculty members noted that institutional rewards, such as promotion criteria that recognize open-access publishing and data-sharing efforts, could drive greater participation. This corroborates the findings of Grand et al. (2012), who argue that without proper incentives, researchers may lack motivation to engage in open science practices. Overall, the study emphasizes that while faculty members acknowledge the benefits of open science, systemic challenges ranging from funding constraints to policy gaps must be addressed to ensure wider adoption and sustainability.

SUMMARY

This study examines faculty members' perceptions of adopting open science at a university of technology, highlighting both opportunities and challenges. The findings reveal that faculty members acknowledge the benefits of open science, such as increased research visibility, collaboration opportunities, and transparency. However, despite recognizing these advantages, actual adoption remains inconsistent due to several barriers. A significant factor influencing adoption is the availability of institutional policies and support mechanisms that encourage open science practices. Faculty members in departments with strong institutional backing were more likely to engage in open science compared to those lacking such support.

One of the major challenges identified is the lack of adequate training and awareness about open science principles. Many faculty members reported insufficient knowledge of how to effectively use open-access platforms, data-sharing tools, and preprint servers. Additionally, concerns about intellectual property, research integrity, and potential misuse of openly shared data emerged as key barriers to adoption. Faculty members expressed apprehension about plagiarism and the loss of research ownership, indicating the need for well-defined policies and ethical guidelines to protect researchers while promoting openness.

The study concludes that while faculty members recognize the value of open science, addressing institutional and individual barriers is essential for widespread adoption. Universities must take proactive steps to integrate open science training into faculty development programs, provide incentives for open-access publishing, and establish clear policies that balance transparency with intellectual property protection. Strengthening institutional support and addressing faculty

concerns will be crucial in fostering a research culture that embraces open science for the benefit of academia and society at large.

CONCLUSION

In conclusion, the study reveals that while faculty members acknowledge the potential of open science, several challenges hinder widespread adoption. Addressing gaps in awareness, mitigating concerns about intellectual property, and strengthening institutional support are critical steps toward fostering a culture of openness. Universities must take proactive measures to provide the necessary resources, incentives, and policy frameworks to encourage faculty engagement with open science. These efforts will not only enhance research visibility and collaboration but also contribute to the broader goal of knowledge

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