Cultivating Open Science: a quantitative exploration of leadership practices in Malaysian academic libraries

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ABSTRACT

This paper explores the characteristics of open leadership to support academic library leaders in promoting open science. It also aims to identify the existing leadership practices related to the implementation of open science from the viewpoint of Malaysian academic library leaders. The research employs a quantitative approach, utilizing online surveys distributed among 50 leaders from Malaysian public and private academic libraries. The study is anchored in the Open Leadership Framework, encompassing three key practices: design (contextualization), build (structure and system creation), and empower (personal leadership skills). Open leadership, viewed as a response to technological advancements and the use of multimedia communication tools, is framed within the principles, practices, and skills that communities can leverage to achieve shared goals. The findings from the design principle indicate unanimous agreement among respondents on the importance of collaboration, both internally and externally, for the success of the open science agenda, aligning with the principles of community interactions. In the build principle, all respondents share the belief that libraries should implement training and competence development programs, aligning with mentoring principles. This adherence corresponds to the principles of commons-based production, emphasizing the encouragement of publication in open-access journals, and project management, highlighting the pivotal role of libraries in determining the university's open data repository. In the empowerment principle, a total response of 61.5 percent under the "makes connection" principle, emphasizes the need for collaboration between the library, the university's Information Technology Center, and the Research Management Center to provide researcher profiles. This study not only provides insights into the current landscape of open leadership practices among Malaysian academic library leaders but also offers valuable implications for fostering collaboration, training initiatives, and empowerment strategies in the realm of open science. By understanding and embracing these principles, academic institutions and libraries can navigate the evolving scholarly environment, effectively contributing to the advancement of open science practices.

Keywords: Open leadership; Library leadership; Open science; Leadership skills; Academic libraries

INTRODUCTION

In response to the evolving landscape of academic librarianship and the imperative to democratize scientific knowledge, Malaysian academic librarians are strongly supporting open science. Their participation in the Data Stewardship for Open Science Training organized by the Malaysia Open Science Platform (MOSP) reflects a heightened awareness among librarians of the need to professionalize their roles in advancing open science. Concurrently, the Ministry of Science, Technology, and Innovation (MOSTI) has demonstrated strategic leadership through the initiation of MOSP, positioning it as a pivotal transformation effort aimed at fostering open science practices in Malaysia (Malaysia Open Science Alliance Working Group 2021). Highlighting a three-year project (2020-2022) funded by MOSTI, spearheaded by the Malaysia Open Science Alliance, and executed by the Academy of Sciences Malaysia (ASM), this initiative focuses on key areas namely guidelines, infrastructure, and capacity building. The overarching goal is to elevate Malaysia's research data to a national asset by establishing a trusted platform that aligns with both domestic priorities and international best practices, as detailed by the Malaysia Open Science Platform (MOSP 2020).

Achieving ambitious goals in fostering open science relies significantly on the commitment and involvement of management within institutions. This commitment was exemplified in 2015 when Scientific Knowledge Services (SKS) and the Library of the University College London (UCL) initiated an effort, organizing a series of events to discuss the principles of open science at the local level. This initiative complemented the ongoing international conversations at conferences. However, the effective management of these tasks and aspirations demands qualities such as bold leadership, endurance, and, at times, perseverance (Ignat 2021). The League of European Research Universities (LERU) Roadmap for Cultural Change in Open Science emphasizes that addressing significant issues and instigating change at universities requires leadership, vision, a strategic approach, and adequate resources for implementation (LERU 2018). Therefore, achieving ambitious goals within MOSP significantly hinges on the leadership, commitment and active involvement of management within its institutions.

Leadership is commonly referred to as the key enabler for achieving the goals and objectives of an organization. In the contect of Malaysia, attaining consensus across government agencies on the scope of legislative, regulatory, and/or policy changes to transform open data into a practical reality and establish its routine requires "a high level of national leadership" (Zijlstra, Vaira and Boothe 2017). Reflecting this sentiment, the Malaysia Digital Economy report asserts that the country still lacks high-level national leadership to achieve a consensus on the scope of open scientific legislation and policy changes (World Bank Group 2018).

Despite the absence of a singular leadership figure, the shared nature of leadership in open science underscores its importance as a collective effort. It is crucial for each institution to acknowledge that the speed and nature of this transition hinge on its unique circumstances. Leaders vital responsibilities, whether at the institutional or broader level, are leading, managing, and engaging. They must not only identify strategies to achieve objectives but also exhibit a readiness to embrace change, viewing it as an opportunity rather than a threat, as emphasized by Deketelaere and Ayris (2019).

Therefore, in the interconnected realm of open science, the strength of academic libraries leadership lies in their leadership actively promoting and advancing open science principles

within the library and information science (LIS) community and the broader research ecosystem. As open science comprises a set of institutional policies, infrastructure, and relationships related to open access publication, open data, and scientific resources (Ali-Khan, Jean and Gold 2018), libraries play a crucial role in supporting open science initiatives by providing resources, services, and expertise to researchers and the public. Open access is a growing movement that promises to transform universities, libraries, and other academic institutions by making scholarly research freely available to the public without restrictions. In alignment with the principles of open access, directing attention towards open leadership is logical (Dewey 2019). This emphasis is pertinent since effective leadership consistently involves mobilizing communities to solve shared problems and accomplish common goals (Sansing 2018). A survey on scientific information and documentation conducted by the French National Centre for Scientific Research (CNRS) revealed that within the European Research and Innovation Framework Programme running from 2014 to 2020, open access to publications has become mandatory (Schöpfel et al. 2016). Moreover, the European Commission is embarking on a policy process to advance open science, considering the transformation, opening, and democratization of science, research, and innovation, with the objective of making science more efficient, transparent, and interdisciplinary (Ramjoue 2015). However, these policy initiatives, in isolation, may not be sufficient to drive the cultural change essential for open science. To embrace open science, universities and researchers need to undergo a transformative cultural shift in the way they work, plan, and operate (LERU 2018).

Recognizing the crucial role of leadership in advancing open science, this study specifically focuses on academic library leaders in Malaysia. The focus on this demographic is driven by the distinctive context of Malaysian academia, where open science through MOSP is actively underway, yet the full impact of cultural change in this initiative remains to be observed. Examining how academic library leaders in Malaysia navigate and champion open science initiatives offers valuable insights into the broader challenges and opportunities within the Malaysian academic landscape. Through an exploration of the perspectives and practices of leaders in this specific context, the study aims to contribute to a nuanced understanding of the leadership dynamics essential for the successful implementation of open science principles in Malaysia.

LITERATURE REVIEW

This literature review delves into the essential skills and competencies required for effective library leadership. This review further explores a research model called the Open Leadership Framework (Sansing 2018). A comprehensive search for relevant research publications, including journal articles from esteemed databases such as Google Scholar, Scopus, Emerald, and ScienceDirect, was conducted using keywords such as "open leadership," "leadership in open science," "library leadership," and "open science management." Additionally, secondary sources of information, including data from Malaysian government portals and published national and international reports addressing open science or open data in Malaysia, were explored. Due to resource limitations, the study also drew upon various internal records and statistics related to open science obtained from MOSTI and its agencies. These resources encompassed presentation materials and speech texts presented during the Official Launch of University Malaya Open Science (UMOS) on June 6th, 2023, as well as workshops and case study reports from the Leadership Excellence Program for Chief Librarian and Deputy Chief Librarian of Institutions of Higher Learning (ExceLib), conducted from February 27th to July 5th, 2023. The

information reviewed and collected contributes to establishing an understanding of the open science landscape in Malaysia, allowing for connections to be drawn with current practices of leadership in open science.

Although leadership is the most explored area in the social sciences (Gill 2006), there is no coherent understanding of the concept of leadership due to its subjective nature (Narang and Kumar 2016). Limited literature exists within the domain of LIS, with scholars such as Ashiq, Rehman and Batool (2019) noticed the scarcity. In an earlier study, Mullins and Linehan (2006) emphasized the essential qualities desired in public library leaders, highlighting the pivotal role of leadership in the library profession. Notably, leadership approaches in libraries is still dominated by traditional models, as highlighted by Wong (2017). This traditional emphasis was reinforced by the findings of Maciel, Kaspar and vanDuinkerken (2018), who examined position descriptions and advertisements for library dean and director roles from 2011 to 2015. Their research indicates a prevalent focus on traditional library experience and management skills rather than attributes associated with service-oriented leadership.

In the digital information landscape, Sullivan (2015) underscores the imperative for excellence in library leadership skills and competencies. His investigation extends to the examination of Academic and Research Library Leadership Institutes, shedding light on the increased demand for library leaders with the knowledge, abilities, and determination to navigate the transition into a digital future and facilitate organizational transformation. Considering the management of varied information needs of researchers and emerging technologies in libraries, there is a great demand for skilled library professionals to enhance their leadership competencies (Narang and Kumar 2016). The Library Leadership and Management Association (LLAMA) further delineates fourteen foundational competencies regardless of the type of organization, role, or experience as a leader. Among them are communications skills, change management, team building, collaboration and partnerships, emotional intelligence, problem-solving, budget creation and presentation, marketing, and advocacy (ALA 2016), aligning closely with the principles of open leadership and other effective leadership models.

Open leaders are typically have a broader accountability to a wider audience of contributors and users compared to traditional leaders (Sansing 2018). Mullins and Linehan (2006), in their data collected through interviews with 30 public library leaders from Ireland, Britain, and the USA, revealed that 80 percent of participants found it challenging to distinguish between library management and library leadership. Consequently, a successful leader in the twenty-first century is characterized by power-sharing, the cultivation of strong relationships, active staff involvement in decision-making, and unwavering focus on the goals and objectives of their respective organizations (Giesecke 2007).

An Open Leadership Framework

The articulated concept of open leadership focuses on the change in leadership characteristics as a function of developments in technology and the use of multimedia communication tools (Uslu, Bulbul and Cubuk 2015). Open leadership is composed of ten attitudinal and behavioral elements that Li (2010) identified as falling into two general categories; information sharing (explaining, updating, conversing, open mic, crowdsourcing, and involving platforms) and decision-making (centralized, democratic, self-managing and distributed). Open leaders are guided by open principles, which strive for understanding; sharing; participation, and inclusion.

Given that the open leadership also focuses on collaboration and partnership, with researchers, institutions, or other stakeholders, to foster the culture of openness, an open leadership framework would delineate principles in networking, community management, and communication for effective application. Through collaborative efforts, stakeholders can formulate open science policies, establish networks for resource and best practice sharing, and engage in joint projects to advance open science goals.Leaders adhering to the open leadership approach are characterized by transparency, inclusivity, and accessibility (Dewey 2019). Areas of open science policy and practice are already relatively well-advanced in several countries and sectors driven by the initiatives of governments, researchers, and the community (Ali-Khan, Jean and Gold 2018). Furthermore, the European Union places a strong emphasis on openness in science, evident in its prioritization of open science on the research agenda (Schöpfel et al. 2016).

Sansing (2018) interlinked the concept of openness with open leadership, exemplified in projects such as Mozilla, Common Voice, openSNP, and The Method Podcast. The leadership aspect comes from significant ideas associated with open leadership, comprising a set of principles, practices, and skills that individuals can employ to mobilize their communities in addressing collective challenges and accomplishing shared objectives. Openness, within this framework, includes deals and practices applicable to any form of community, project, or organization.

To apply these principles in the current study, library leaders in Malaysian academic libraries may adopt practices encapsulated in the Open Leadership Framework (Figure 1) (Sansing 2018). This framework shows that open leaders are guided by open principles, and they strive for understanding (i.e making the work accessible and clear); sharing (making the work easy to adapt, reproduce and spread), and participation and inclusion (making the work inviting, relevant and safe for all). The focus is on three pillars: design, build, and empower.
- Design: Open leaders make contextual and deliberate decisions about how and when to embrace openness.
- Build: Open leaders create structures and systems that ensure clarity and process-based management.
- Empower: Open leaders model personal leadership skills that sustain both themselves and their contributors.

The Open Leadership Framework (Figure 1), offers a comprehensive guide for the implementation of open science principles in libraries. In the Design dimension, the focus such as on content, information-sharing, and governance provides a roadmap for libraries to strategically approach the dissemination of research and knowledge. The Build dimension, covering understanding communication, design, facilitation, maintenance, and project management, guides libraries in establishing effective structures and processes for the successful execution of open science initiatives. Finally, the Empower dimension, with its emphasis on such as maintaining clarity of vision, making connections, embracing failure, and inspiring contribution, serves as a guide for libraries to cultivate a culture that empowers individuals and fosters innovation in the realm of open science.

	Understanding	Sharing	Participation and Inclusion
Design for…	- Content focus - Community interactions - Learning through use - Storytelling	- Information-sharing focus - Community interactions - Gifting - Enhancing value exchange - Networking common interests	- Governance focus - Community interactions - Creating together - Soliciting ideas - Project identity
Build for…	- Communication - Design - Facilitation - Maintenance - Project management	- Commons-based production - Data stewardship - Documentation - Licensing - Networking	- Decision-making - Delegation - Event planning - Community management - Mentoring
Empower for…	- Maintains clarity of vision & purpose - Maintain authenticity & integrity - Stays curious	- Makes connections - Resilence - Self-care	- Embraces failure - Ensures safety - Inspires contribution

Figure 1: Open Leadership Framework (source: Sansing 2018)

OBJECTIVE AND METHOD

The objective of this study is to examine the leadership practices associated with the implementation of open science, as perceived by leaders in Malaysian academic libraries. The guiding research question is: What leadership practices are deemed important in the implementation of open science? The study employed a quantitative approach, and the Open Leadership Framework, illustrated in Figure 1, encapsulates the key principles of design, build, and empower, is used as a valuable guide for library leaders in Malaysian academic libraries, offering a comprehensive approach to fostering openness and effective leadership.

A survey instrument has been developed, comprising questions aimed at assessing the leadership aspects among academic library leaders in the implementation of open science. This scale was employed to examine the current practices of open leadership among Malaysian academic library leaders in promoting open science. The questionnaire, administered in Malay language consists of two sections: the first gathers demographic information of the respondents, and the second incorporates three elements aligned with the Open Leadership Framework for open science implementation, namely Design (5 item statements, Q1-Q5), Build (8 item statements, Q6-Q13, and Empower (3 item statements, Q14-Q16). Each item is measured on a four-point Likert Scale, with anchors ranging from 1 = Strongly Disagree to 4 = Strongly Agree, allowing respondents to express their level of agreement or disagreement with specific statements. The questionnaire can be accessed at https://doi.org/10.6084/m9.figshare.24736794.v1.

The survey population comprised chief librarians, deputy chief librarians, and senior librarians from Malaysian public and private academic libraries. They were chosen based on their roles as assumed library leaders. The online survey was distributed to 50 library leaders from 20 Malaysian public universities and 10 selected private academic libraries through e-mail invitations and shared links using messaging applications. All respondents were provided with detailed information about the study's objectives, procedures, and the

nature of their involvement. Participants were made aware that, by willingly answering the survey, they were providing their consent to be part of the research. Data gathered from the online survey were examined and analyzed using Microsoft Excel spreadsheet. Of the responses, 34 (87.2%) were from public universities, while five (12.8%) were from private academic libraries (as of data retrieved on July 13th, 2023). Consequently, 39 completed questionnaires were used for analysis, resulting in a 78 percent response rate, representing the academic library leaders involved in the study.

RESULTS

The results section describes key findings derived from the evaluation of open leadership practices within the realms of design, build, and empower, shedding light on their impact on the implementation of open science in Malaysian academic libraries.

Design

Design serves as a strategic tool guiding open leaders in setting goals and determining the levels of openness for open science projects concerning operations and interactions with their communities. The analysis of the study in Table 1 demonstrates the design open leadership practices among Malaysian academic library leaders in terms of community interactions – learning through use and governance focus. Both statements received the highest mean responses of 3.72, indicating unanimous agreement among respondents. Specifically 100 percent of respondents affirmed the significance of collaboration between institutions (internal/external) to make the open science agenda a success (Q5) and 94.8 percent (37) agreed that the governance of open science programs in universities should be carried out through a top-down approach rather than bottom-up (Q2).

Table 1: Design Leadership Practices Perceived as Important for Implementing Open Science

No.	Item Statements	Open Leadership Principles	Mean	Strongly Agree % (n)	Agree % (n)	Disagree % (n)	Strongly Disagree % (n)
Q1	Library management should lead the development of an open science policy at my university.	Content-focus	3.00	35.8% (14)	30.8% (12)	30.8% (12)	2.6% (1)
Q2	The governance of open science programs is more suitable to be implemented top-down rather than bottom-up.	Governance focus	3.72	79.4% (31)	15.4% (6)	2.6% (1)	2.6% (1)
Q3	The library needs to be involved in my university's Data Management Plan (DMP).	Information sharing focus	3.62	64.1% (25)	33.3% (13)	2.6% (1)	0% (0)
Q4	Libraries need to propose incentives to academics and researchers to encourage the production of open-access output.	Community interactions - Gifting	3.10	35.9% (14)	41.0% (16)	20.5% (8)	2.6% (1)
Q5	It is important for my library to collaborate with institutions (internal/external) to make the open science agenda a success.	Community interactions – Learning through use	3.72	71.8% (28)	28.2% (11)	0% (0)	0% (0)

Table 1 also shows that a significant majority of the respondents (97.4%, 38, m=3.62) acknowledged the importance of library's involvement in Data Management Plan (DMP) within the information sharing focus (Q3). Notably, there were no respondents strongly disagreeing, and only (2.6%) expressed disagreement with the statement. DMP support refers to any elements, standards, tools, policies, or plans for the details of data

management in the context of open science or research management services. Libraries can take the lead by enhancing the skills of their professionals and introducing research data management (RDM) services, offering consultancy in DMP, facilitating data processing and analysis, providing guidance on data description, and ensuring the preservation of data (Sheikh, Malik and Adnan 2023).

The study indicates a need for libraries to institute incentives and recognition for academics and researchers to encourage the production of open access outputs (Q4), with 76.9 percent (30, m=3.10) accepted the statement, and the others expressing disagreement. This finding contrasts with the survey results from PLOS 2023, revealing that fewer than 20 percent of respondents are inclined to adopt professional incentives for academics engaging in open science-based outputs. Abd Rahman (2023) stated that researchers 'buy-in' and sustainability are key challenges in implementing open science in Malaysia, underscoring the importance of developing incentives to overcome these barriers. Joseph (2021) reported that the NASEM Board on Research Data and Information agreed on the development of a new national-level initiative that aligns incentives to support open science.

Regarding the question about which aspect of library management should lead the development of an open science policy at the university (Q1), the study obtained the lowest mean responses of 3.00 as 66.6 percent (26) of respondents in agreement and 33.4 percent (13) in disagreement. Further analysis by role designation reveals that 85.7 percent (33) of chief librarians and directors concur that library management should spearhead policy development, while only 14.3 percent (6) dissent. This suggests that the top management of libraries considers this open leadership practice significant for the successful implementation of open science.

Build

Build principle in open leadership entails the tangible principles, skills, and competencies that open leaders require to organize and oversee projects and communities. Table 2 shows unanimous agreement among all respondents, with 100 percent expressing a belief that libraries need training and competence development programs that are specific to open science (Q10). This statement garnered the highest mean responses (m=3.59). This consensus may underscore the importance of implementing a mentorship agenda that provides tailored advice to meet librarians' growth needs and contribute to their professional development. It aligns with the notion that effective leadership involves mastering essential practical skills, including project management and the organization of digital collections (Tzanova 2020).

In contrast, only 35.8 percent (14, m=2.36) of the respondents agree with the statement that the library has provisions for successful training programs related to open science (Q12). While acknowledging the significance of this facilitation principle for addressing learning needs, it remains a challenging issue to be addressed. Leaders should learn the needed approaches to understand the constraints on their ability to engage in open science practices (Castille et al. 2022).

The majority of respondents (94.9%, 37) acknowledge that library management should promote the two main pillars of open science - open access and open data - by encouraging publication in open-access journals (Q8) and playing a role in determining the university's open data platform (Q9). For both statements, only 5.1 percent (2) express disagreement, highlighting the significance of commons-based production and project

management principles in the implementation of open science. This emphasis extends to project content, framework, milestones, and documentation, in addition to leading the evaluation, accessibility, and adaptability of the project (Sansing 2018).

The study also found that 87.1 percent (34) of the academic library leaders agreed that their libraries should take the lead in collaborative activities within universities to enhance awareness of open science (Q7). Establishing partnerships with affiliated organizations facilitates collaboration around common issues and values. Abrizah (2023) highlights that promoting open science in libraries can be achieved by encouraging collaboration with external partners, other research organizations, and funding agencies. Given that open science fosters transparent and accessible knowledge shared and developed through collaboration for the benefit of all (Peeters 2021), leaders can initiate small partnerships with confidence, as such collaborations on modest projects can pave the way for significant opportunities (Carpino, Mentkowski, and Nejdl 2020).

Table 2: Build Leadership Practices Perceived as Important for Implementing Open Science

No.	Item Statements	Open Leadership Principles	Mean	Strongly Agree % (n)	Agree % (n)	Disagree % (n)	Strongly Disagree % (n)
Q6	The open science agenda has been clearly communicated at my university.	Communication	2.41	5.1% (3)	30.8% (11)	61.5% (24)	2.6% (1)
Q7	Libraries need to lead collaborative activities in universities to increase awareness of open science.	Networking	3.18	33.3% (13)	53.8% (21)	10.3% (4)	2.6% (1)
Q8	Library management should encourage publication in open-access journals as one of the strategies for selecting journals in universities.	Common-based production	3.23	28.2% (11)	66.7% (26)	5.1% (2)	0% (0)
Q9	Libraries have an important role in determining my university's open data platform (repository).	Project management	3.54	59% (23)	35.9% (14)	5.1% (2)	0% (0)
Q10	Libraries need to have training and competence development programs that are specific to open science.	Mentoring	3.59	59% (23)	41% (16)	0% (0)	0% (0)
Q11	Librarians from my university have followed the Data Stewardship Program offered by the Malaysian Academy of Sciences and MOSTI.	Data stewardship	3.03	51.3% (20)	12.8% (15)	23.1% (9)	12.8% (5)
Q12	My library has provisions for successful training programs related to open science.	Facilitation	2.36	17.9% (7)	17.9% (7)	46.3% (18)	17.9% (7)
Q13	My library has specific provisions for developing and maintaining an open data platform (repository).	Maintenance	2.41	17.9% (7)	23.1% (9)	41.1% (16)	17.9% (7)

Regarding the statement on open science capacity building through the Data Stewardship Program (Q11), 64.1 percent (35) of respondents acknowledge that their librarians have participated in the program offered by the Malaysian Academy of Science and MOSTI. As highlighted in various presentations (Abd Rahman 2023; Abrizah 2023.) the MOSP focuses on national guidelines, awareness, capacity, and infrastructure. One of the targets was to train at least 200 data stewards, a goal achieved by July 2022 when almost 240 data stewards had been trained in the Malaysian research landscape (Akademi Sains Malaysia 2023).

In terms of the library having specific provisions for developing and maintaining an open data platform (Q13), 41.0 percent (16) of respondents agree with the statement. However, budgetary concerns persist, particularly in terms of facilitation and maintenance,

necessitating long-term planning for the sustainability of projects or programs. The "Open Science to Jumpstart Open Innovation" clearly emphasized the importance of minimizing unnecessary duplication of research and enhancing planning in research management and funding within the realm of open science management (Akademi Sains Malaysia 2023). Additionally, barriers to implementing open science include a lack of knowledge, time constraints, and associated costs (El Amin, et al. 2023).

The analysis reveals that only 35.9 percent (14) of respondents agree that the open science agenda has been effectively communicated at their universities. This indicates that communication within the community regarding open science is not yet fully comprehensive. As open science practices transition from closed to more transparent positions (Bowman and Keene 2018), leaders should prioritize clear communication to articulate what is required for organizational success (Johnson and Sobczak 2021).

Empower

In the "Empower" principle, open leaders leverage their leadership competencies and skills to share capacity, passion, and power within and across projects, organizations, communities, and networks. This is how open leaders manage themselves to spread their vision, passion, and openness. In the findings related to empowered leadership practices, Table 3 highlights key principles, including maintaining clarity of vision and purpose, inspiring contribution, and making connections. This illustrates the leadership principles currently embraced by Malaysian academic library leaders, who express strong agreement with these practices.

Table 3: Empower Leadership Practices Perceived as Important for Implementing Open Science

No.	Item Statements	Open Leadership Principles	Mean	Strongly Agree % (n)	Agree % (n)	Disagree % (n)	Strongly Disagree % (n)
Q14	Library management needs to include the open science agenda as the main core of the library's strategic plan.	Maintains clarity of vision & purpose	3.46	46.2% (18)	53.8% (21)	0% (0)	0% (0)
Q15	Libraries need to encourage faculties/institutes/centers in universities to develop and implement open science and open evaluation in the academic publishing process.	Inspires contribution	3.38	38.5% (15)	61.5% (24)	0% (0)	0% (0)
Q16	The library needs to collaborate with the university's Information Technology Center and Research Management Center at the university to provide researcher profiles based on open-access platforms.	Makes connections	3.62	61.5% (24)	38.5% (15)	0% (0)	0% (0)

The statement that received the highest agreement, with a total response of 61.5 percent (24) and the highest mean response of 3.62, was that the library should collaborate with the university's Information Technology Center and Research Management Center to provide researcher profiles based on open-access platforms (Q16). Respondents unanimously, with 100 percent agreement, indicated that library management should incorporate the open science agenda as the central core of the library's strategic plan (Q14). The experience from the National Institutes of Health Malaysia in implementing open science suggests that management or organizations can support the open science movement through the establishment of appropriate data or strategic plans (Muhd Zulfadli 2023).

For the statement that encourages libraries to support faculties, institutes, and centers in universities to develop and implement open science and open evaluation in the academic publishing process (Q15), 61.5 percent (24) of respondents agree. This practice of inspiring contribution aims to encourage and promote research integrity, transparency, and reproducibility through clear guidelines and expectations, reflecting the core value of open science.

DISCUSSION

This study investigates leadership practices among Malaysian academic library leaders in the context of open science. Through a survey using Open Leadership Framework as a guide, the study explores responses from chief librarians, deputy chief librarians, and senior librarians, revealing notable perspectives on issues such as open access, open data, and collaborative activities. The findings contribute to a nuanced understanding of the current state of leadership in open science within Malaysian academic libraries, providing valuable insights into the challenges, opportunities and potential strategies for advancing open science within academic libraries, and shedding light on the broader landscape of leadership in the evolving scholarly environment.

In framing the "Design for" open leadership practices, this study introduces three core principles: content focus (understanding), information-sharing focus, and gifting (sharing), and governance focus (participation and inclusion). These open principles are identified as actionable strategies for implementation among library leaders. These aspects center on advocacy programs dedicated to promoting open science principles and policies at institutional, regional, and national levels, as outlined by Ogungbeni et al. (2018). Given the unclear information and the absence of development plans or policies in the landscape of open science within Malaysian academic libraries (Amanullah and Abrizah, 2023), it is recommended to chart a roadmap for cultural change towards open science. This can be achieved through the establishment of advocacy programs aimed at identifying the benefits of open science approaches, while maintaining a realistic understanding of the associated challenges (LERU 2018). This is associated with policy development aspects where library leaders can provide input on policies related to open access publishing, RDM, copyright, incentives, and licensing to ensure these policies align with open science principles and benefit the research community.

In terms of community interaction within the open leadership design principles, universities have the potential to achieve cost savings by collaborating on shared infrastructure and services. Effectively managing costs is a crucial aspect of the leadership role that every university should embrace. Malaysia has actively promoted open science initiatives to encourage collaboration, transparency, and knowledge sharing within the scientific community. However, one of the significant challenges in implementing open science practices is effectively managing the associated transition costs (Deketelaere and Ayris 2019). Regarding governance-focused aspects, Matthews (2015) cited Professor Abdullah Atalar's statement made during the Times Higher Education BRICS and Emerging Economies Universities Summit in Delhi, where the latter asserted that the top-down approach is more successful when the right person is the leader. Additionally, gaining support from the top management of institutions not only attracts human talent and expertise but also secures development funds, enabling projects to surpass their cycles (Ignat 2021).

In the "Build for" principle, the study examined how academic library leaders can implement open science practices related to communication, facilitation, and maintenance (understanding); commons-based production, data stewardship, and networking (sharing); and mentoring (participation and inclusion). This involves creating infrastructure and services to support open science activities, such as establishing institutional repositories for open-access publications and research data. It also includes providing guidance on DMP and data sharing plans, along with offering tools and platforms for collaborative research. These initiatives align with the findings of Higman and Pinfield (2015), who identified the slow implementation of open science not as a result of insufficient leadership by libraries but rather due to institutional guidance issues in research governance. Notably, MOSP aims to enhance the value of Malaysia's research data by fostering a trusted platform for sharing research outputs, including publications, data sets, and software. This initiative aligns with national priorities and international best practices, promoting accessibility and collaborative sharing of research data as a valuable national asset (MOSP 2020).

Regarding the "Empower for" open leadership practices, the study reveals that the academic libraries should should assume a leading role in open science, ensuring clarity of vision and purpose (understanding), making connections (sharing), ensuring safety, and inspiring contribution (participation and inclusion). This can be achieved by spearheading the design and delivery of education and training for an open science program, particularly in outreach and community engagement. The library can host events, workshops, and actively participate in conferences and seminars to fulfill these empowering practices. The Focus on Open Science in Hungary has reported that the establishment of open science practices is most effective at the university level, where training programs provide support. Across Europe, university libraries have demonstrated success in leading such activities, highlighting their advantageous position to provide leadership in these endeavors (Ignat 2021).

Figure 2 showcases the most exemplary practices within the design, build, and empowerment principles of open leadership, along with recommendations for the future of open science implementation.
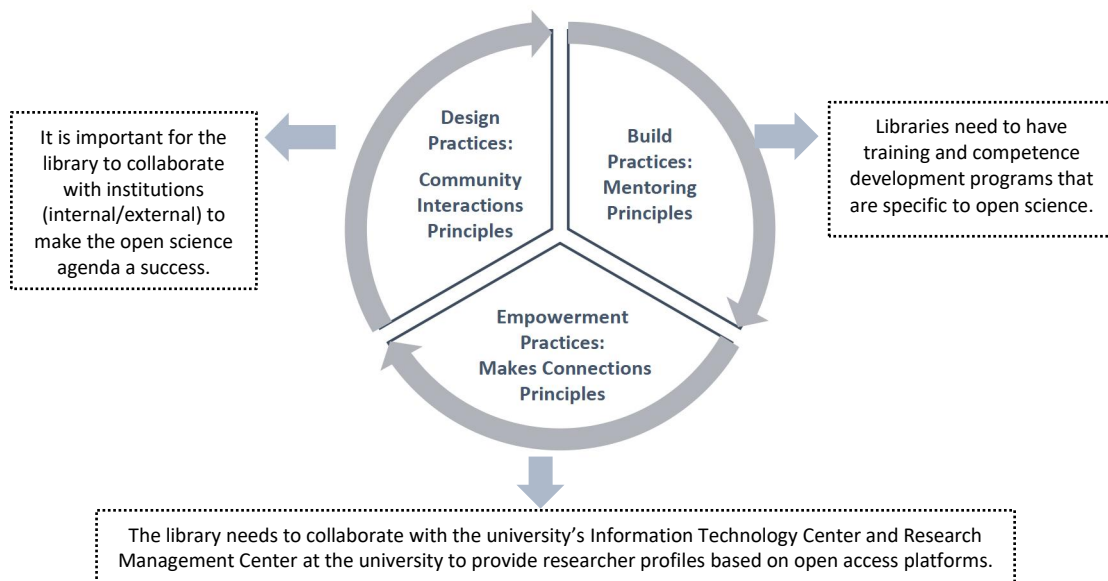

Figure 2: Exemplary Practices in Design, Build and Empowerment Principles for Open Leadership among Malaysian Academic Libraries

CONCLUSIONS

It is apparent that open leadership is an approach that supports the implementation of open science, yet it is not so frequently observed in Malaysia, compared to other leadership styles. The results show that several leadership practices are put forward to support academic library leaders in propagating open science, therefore requiring a comprehensive understanding of the principles and values that encourage the academic library leaders to act and promote these practices within the scientific community and beyond. In summary, open leadership in open science among Malaysian academic libraries focuses on policy advocacy in terms of DMP or policy changes at the institutional, national, and international levels besides working with government and funding agencies to shape supportive policies and legislation.

While there may be challenges and concerns to addressing complex global challenges, mentoring principles in terms of education and training programs for researchers, students, and institutions are essential to raising awareness about open science practices, besides encouraging the integration of open science topics and fostering collaboration, transparency, and inclusivity. By embracing open leadership principles such as making connections through collaboration and networking, being able to establish online communities and networks to share the best practices and discuss the challenges of implementing open science. In the spirit of open leadership, fostering a culture of openness, collaboration, and inclusivity in scientific research can unlock the full potential of open science to address challenges and build a brighter and more equitable future for all.

While this study offers valuable insights into the leadership practices of Malaysian academic library leaders in the realm of open science, it is essential to acknowledge certain limitations. Firstly, the research focused on a specific demographic, namely chief librarians, deputy chief librarians, and senior librarians, potentially limiting the generalizability of the findings to other academic library staff. The scope of the research instrument focused primarily on the perspectives of library leaders, and the inclusion of input from other stakeholders, such as researchers or university administrators, could provide a more comprehensive understanding. Additionally, the study relied on self-reported data, which introduces the potential for response bias and subjectivity. Moreover, it is crucial to acknowledge the dynamic nature of open science and its continual evolution. Leadership practices, as explored in this study, provide a snapshot within a specific timeframe following the launch of MOSP. The ongoing development of open science initiatives may impact the observed practices, emphasizing the need for future research to capture the evolving landscape of leadership in this context.

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AUTHORS DECLARATION

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AUTHORS CONTRIBUTION

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