Research data governance activities for implementation in Malaysia research performing organizations: insights from data practitioners via Delphi study

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ABSTRACT
The rapid growth of research data and its influence on research practices has heightened global awareness of the significance of research data governance (RDG). However, there is a lack of literature explicitly outlining the implementation of RDG and the practices adopted by research performing organizations (RPOs). This study intends to bridge this gap by utilizing a three-round modified Delphi method, which involves a systematic solicitation and collection of feedback from a pool of experts comprising research data practitioners. This is accomplished through a series of carefully designed sequential surveys focused explicitly on RDG activities concerning tasks associated with governance roles, areas and decision domains within RPOs in Malaysia. The objective of this study is to develop consensus among research data practitioners on the importance of RDG activities. Statements were evaluated using a 5-point scale, and consensus was determined as an interquartile deviation (IQD) ≤ 0.5, a median ≥ 4, and a consensus level (CL) ≥ 85%. Analysis of the responses revealed a significant consensus among the experts on 106 out of 119 RDG task statements on various roles, nineteen areas, and eight decision domains deemed significant to the RDG implementation within RPOs. This study can potentially develop an RDG framework based on the consensus achieved. By providing an RDG framework that can be used as a set of best practices, this study can assist RPO leaders in considering implementing RDG and its efforts in their organizations.

Keywords: Research data governance; Research data management; Data stewardship; Open science; Delphi study.

INTRODUCTION

Research data governance (RDG) plays a crucial role in organizations' data management strategies, aiming to maximize the value of data while minimizing costs and risks associated with data-related activities (Abraham, Schneider, and vom Brocke 2019). However, the sensitivity of data governance to different domains and actors within organizations makes it a complex issue to address (Manik et al. 2022; Kabanda et al. 2023;

Paparova et al. 2023). In developed countries, RDG has become standard practice, and research institutions typically provide information about data governance, such as data management and sharing policies on their official websites. This ensures proper management of data assets i.e.; providing accessibility to high-value datasets, and promotes transparency and accountability in data-related processes i.e.; enabling validation of research results. However, the situation is different in developing countries, where research on data governance is limited (Manik et al. 2022) and many have not developed strong research governance structures and processes (Juma et al. 2021).

Developing countries often face significant disparities in data governance, which can lead to inequalities in access to and use of research data. It is still being determined which Research Performing Organizations (RPOs) in the developing world that have data governance structures and processes, and there may be a lack of formal policies in place, as data governance is often perceived as unnecessary. Nevertheless, in the absence of formal policies, researchers in developing countries often engage in informal data governance practices as part of their daily research work (Buhomoli and Muneja 2022). Despite the lack of explicit guidelines, they may adhere to specific principles and procedures to ensure research data's quality, integrity, and security. However, by establishing formalized guidelines and receiving institutional support, the effectiveness and consistency of these practices can be uphold and even enhanced (Napis et al. 2019).

RPOs are essential to producing innovations and human capital, resulting in extensive research data. As per the findings of Yu and Jin (2022), universities accounted for approximately two-thirds of the total publications in Asia, surpassing research institutes. However, the substantial contribution of research institutes should not be disregarded. According to Scimago Journal & Country Rank[1], institutions in the Asian region, with China at the forefront with a total publication count of 9,239,029, have placed a significant emphasis on research. Even Malaysia, ranking 26th globally, made a notable contribution with 454,998 papers. The Malaysian government, aligning with the National Higher Education Plan Beyond 2020 and the Malaysia Education Blueprint 2015–2025 (Ministry of Education Malaysia 2015), aims to transform the country into a knowledge and innovation hub through research and development (R&D). Higher education reforms have been implemented to boost research outputs for national development and social welfare. In 2018, the Ministry of Higher Education increased university funding by 13.15 percent from RM12.28 billion to RM13.89 billion, resulting in enhanced global rankings for Malaysian universities due to their research achievements (Jusoh 2018). Notably, Malaysian universities generated RM7.17 billion from federal research funding of RM5.58 billion from 2007 to 2015, showcasing a substantial return on investment of 28.5 percent (Chik et al. 2018).

Beyond financial investments, the Malaysian government actively promotes a knowledge-based economy, emphasizing data-driven R&D. This involves the implementation of policies and standards for effective and secure research data management. The Malaysian Code of Responsible Conduct in Research, established in 2016 (National Science Council 2020), emphasizes data management and sharing, requiring researchers to ensure accuracy, completeness, reliability, and secure preservation of data, along with a willingness to share upon request. Furthermore, the National Policy on Science, Technology, and Innovation 2013-2020 by the Ministry of Science, Technology, and

[1] SJR Scimago Journal & Country Rank. *Country Rankings*. Available at: https://www.scimagojr.com/countryrank.php (accessed on 4 November 2023)

Innovation (MOSTI 2013) and the Malaysia Education Blueprint (2015-2025) underscore the importance of research data sharing and collaboration (Ministry of Education Malaysia 2015). The NPSTI 2021–2030, as part of ongoing efforts, prioritizes open data, highlighting the value of research data in the context of scientific and technological progress (MOSTI 2021).

In view of these developments, this study seeks to fill a research gap by examining RDG activities, concentrating on tasks associated with various roles, governance areas, and decision domains that hold particular relevance for RPOs in the Malaysian context, with the goal of developing a consensus. To accomplish this objective, the study formulated the following research question for guiding inquiry: *What research data governance activities do data practitioners believe are essential for implementation within research performing organizations?*. The study outlines an effort to achieve the consensus among research data practitioners through a three-round modified Delphi study. The findings of this study are expected to contribute to the establishment of best practices in RDG, enabling leaders of RPOs to consider the implementation of data governance efforts.

LITERATURE REVIEW

RDG plays an essential role in the generation and dissemination of scientific knowledge. Its effective implementation is imperative for constructing a robust data governance framework that supports high-quality research, fosters collaboration, and attracts funding and partnerships. There are four key research themes related to data governance, namely: finding a balance between data governance and digital innovation, employing diverse mechanisms for data governance, transitioning from a focus on data governance to actively governing data, and adopting a service-oriented perspective in the context of data governance (Vial 2023).

Various factors influence the organizational success of RDG implementation. Organizations aiming for successful RDG implementation must possess a comprehensive understanding of the entities involved, their responsibilities, and the factors influencing the adoption of data governance practices. As elucidated by Kouper, Raymond and Giroux (2020), RDG encompasses multiple entities contributing to the governance process, serving as decision-makers vital for governing research data and fostering research communities that contribute to scientific knowledge. The involvement of researchers in various research communities underscores the significance of interconnectedness and collaboration for effective RDG. Increasing researchers' awareness of technology transfer and RDG has a positive impact on their attitudes and adoption of data governance practices, emphasizing the need for organizational strategies to integrate these principles into researchers' routines (Manik et al. 2022). Adhering to ethical and legal standards is crucial for a data repository, allowing researchers to effectively participate in an open science paradigm. This involves not only safeguarding sensitive data but also fostering trust among stakeholders (Alvarez-Romero, Rodríguez-Mejias, and Parra-Calderón 2023). In a similar vein, Bak et al. (2023) propose three dimensions of trust crucial for establishing a responsible research environment. The paper delves into a research consortium's experiences in navigating the complexities of conducting research under the General Data Protection Regulation (GDPR) and sheds light on the implications of the privacy-solidarity debate.

Australian Research Data Commons (ARDC 2023) offers guidance and recommendations to universities and research institutions on the effective management of research data. This report significantly contributes by highlighting the importance of research data appraisal and introducing ten additional elements within the Research Data Management (RDM) framework. The framework underscores the imperative for organizations to adhere to standards and best practices in RDM, encompassing considerations for sensitive data, support, training, retention, and disposal. The report advocates for the implementation of RDM practices within institutions and underscores the necessity for collaborative efforts among universities.

However, the absence of adequate RDG can pose challenges for organizations in effectively managing research data. A case in point is Western Sydney University (WSU), where Cooper et al. (2023) outlined the challenges faced, including difficulties in storing and finding data, automating data workflows, and ensuring robust data governance. Despite having a research data management policy, the university lacks a robust mechanism for managing data and ensuring compliance. Addressing the challenges of collaborative data sharing networks, Becker et al. (2022) highlight the important role of organizations in role assignment within health research data sharing networks. Their study emphasizes the importance of adopting a systematic and principled approach to facilitate efficient data sharing while addressing legal and ethical concerns associated with GDPR and health research.

In conclusion, the literature review briefly highlights the significance of RDG, emphasizing the need for formalized guidelines for implementation, validated capabilities, enhanced awareness and collaborative networks to ensure effective governance, promote data sharing and suitable research practices.

METHOD

Considering the limited information available on RDG in Malaysia, the modified Delphi approach is deemed suitable, as suggested by Barrett and Heale (2020), De Lima and Seuring (2023), and Drury et al. (2023). This method is especially well-suited when information is scarce, as it enables the systematic gathering of expert opinions and the achievement of consensus among a group of data practitioners on RDG practices that are particularly significant for RPOs. Anonymity plays a significant role in this approach as it allows professionals to express their thoughts freely without concerns about criticism or bias (Goodman 1987; Barrett and Heale 2020). Additionally, it provides a systematic methodology for gathering and synthesizing expert opinions.

Ensuring the validity of the results, the recruitment of suitable experts is crucial in the Delphi study (Barrett and Heale 2020; Beiderbeck et al. 2021; Brown 2018; Hall et al. 2018; Olsen et al. 2021). Therefore, participants in the study will rely on their various direct knowledge and experiences to reach specific conclusions (Barrett and Heale 2020). A purposive sampling method was employed to assemble a panel of experts with comprehensive research data experience throughout its lifecycle. The panel consisted of data practitioners, encompassing individuals involved in various aspects of RDM throughout its entire life cycle. This includes researchers, librarians, policymakers, information technology and research officers who actively engage in activities such as data generation, management, and utilization. The three general sampling criteria for the modified Delphi study are as follows:

(a) Participants should have affiliations with any RPO in Malaysia;
(b) They demonstrate a willingness to engage and share their valuable experiences actively;
(c) They acknowledge having practical expertise and knowledge encompassing diverse research data handling and support facets, including data generation, management, and consumption.
Additionally, having previous experience or ongoing engagement in the formulation of research data policies for their affiliated institution(s) provided an additional advantage to the participants.

The instrument was drafted in the English language and its development was informed by a prior content analysis of policy documents issued by prominent RPOs globally (Hazmi, Abrizah, and Yanti Idaya 2023). The instrument designed for this study underwent a rigorous testing phase involving a small group of eight data practitioners from all levels of governance. This pilot test was conducted to identify issues related to question interpretation, wording, structure, and sequence. Additionally, this testing phase helped evaluate the comprehensibility of response categories and determine the average time required for completion (Check and Schutt 2012). The insights gained from this testing phase were instrumental in refining the instrument. The refined instrument aims to enhance participant engagement while ensuring the validity and accuracy of their responses (Check and Schutt 2012).

This study was approved by the Universiti Malaya Research Ethics Committee (UMREC) (Approval No. UM.TNC2/UMREC_2372). Data collection was conducted in three phases, with each round's survey instrument being available to respondents for approximately between 1-4 weeks:

1. Phase I: Identification of expert participants for inclusion (3 January – 24 May 2023) and commencement of round 1 modified Delphi study (4 April – 31 May 2023)
2. Phase II: A 2-round modified Delphi study conducted to build first consensus (16 - 28 June 2023)
3. Phase III: A 3-round modified Delphi study to explore more dimensions and build consensus (9 – 25 August 2023)

The analysis employed descriptive statistics, utilizing Microsoft Excel to analyze the dataset. Descriptive statistics were used to summarize participants' demographic characteristics (comprising age, gender, management level, affiliation, position, and roles related to research data) and participants' responses to each item statement in all three rounds of the Delphi process. As a subsequent step, it is essential to predefine the consensus level and clearly define it before initiating the rounds of analysis (Jünger et al. 2017). A prior consensus criteria was established to achieve an interquartile deviation (IQD) of ≤ 0.5, a median of ≥4, and a consensus level (CL) of ≥85%. The CL indicates the percentage of participants who rated an item as either 4 (highly important) or 5 (very highly important) on the scale.

Phase I: Identification of Expert Participants for Inclusion and Commencement of the Initial Round of Modified Delphi Study

In addition to the general sampling criteria for inclusion, there exist specific criteria for the initial round, where most participants were selected based on their contributions and involvement in the Malaysia Open Science Platform (MOSP)[2], categorizing them based on

[2] Malaysia Open Science Platform is an initiative with five research universities for a duration of a three-year (2020-2022) project funded by the Ministry of Science, Technology and Innovation (MOSTI), spearheaded by Malaysia Open Science Alliance and implemented by the Academy of

three levels of data governance: strategic, tactical, and operational (Korhonen et al. 2013). Notably, participants at the strategic level included Deputy Vice-chancellors, Directors and Deputy Directors of Research Management Offices, Chief Librarians, and Malaysia Open Science Alliance (MOSA) members. Tactical-level participants included certified data stewards who had received training under MOSP, while operational-level participants comprised those who completed the upskill training program to become data stewards organized by the Academy of Science Malaysia (ASM). The operational-level participants consisted of librarians, research officers, information technology officers responsible for institutional/digital repositories, and liaison librarians. In addition to these data practitioners, the other individuals consist of researchers who have made their research data and datasets accessible in various digital repositories, such as Dimensions, Lens and MOSP. Consequently, the study categorized expert participants into four groups: strategic, tactical, operational, and researcher. This categorization was achieved using four distinct sets of questions: Set A (strategic), Set B (tactical), Set C (operational), and Set D (researcher). The question sets were tailored to align with the roles and responsibilities of the participants within their respective institutions. The questionnaire is accessible at https://doi.org/10.6084/m9.figshare.24517702.

After thoroughly reviewing the available literature on data governance and incorporating insights gathered during desk research conducted prior to the current study, a set of statements was crafted for the instrument used in the initial round. The survey instrument was administered electronically, using the secure online form builder Cognito Forms (Cognito 2023). The recruitment process involved sending emails in stages to individuals identified as meeting the inclusion criteria for each specified category. These recruitment emails not only explained the study's purpose, procedures, and privacy measures but also included a secure link for each question set. Additionally, it included an attached file containing the expert's criteria, a consent form, and a demographic information form. The request for demographic information served as an additional document, enabling the study to obtain a more comprehensive profile of each expert participant. A total of 292 eligible expert participants were invited to take part in the study, comprising 67 in the strategic category, 27 in the tactical category, 51 in the operational category, and 147 in the researcher category.

The instrument featured specific statements aimed at exploring the significance of RDG task areas associated with various governance roles. A 5-point scale was employed, allowing expert panels to select the most appropriate response, with options ranging from 1 = Not Important to 5 = Very Highly Important. The questions were divided into eleven subsections, as follows: Organization (18 items), Executive Sponsor (2 items), Data Governance Leader (7 items), Research Data Governance Committee (7 items), Office of Research Data Governance (4 items), Research Data Governor (13 items), Research Data Steward (17 items), Administrative Offices (17 items), Research Data Consumer (3 items), Researcher (24 items), and External Bodies (7 items). The different question sets (A, B, C, and D) were tailored to varying roles, with statements related to the organization being included in all sets. In addition, participants assigned to both Sets C and D were required to respond to the task areas related to external bodies. This resulted in a total of 119 unique item statements across the four sets: Set A (38 items), Set B (48 items), Set C (45 items) and Set D (49 items). The rationale for categorizing expert panels into distinct groups, each answering a tailored set of instruments with different roles based on their level of

Sciences Malaysia (ASM). See https://www.akademisains.gov.my/mosp/about/what-is-malaysia-open-science-platform/

governance and profession, was to enhance the accuracy and reliability of the responses. The estimated time needed to complete all the questions was 45 minutes. Table 1 provides an overview of the distribution of questions in each set.

Table 1: Distribution of Questions in Each Set for Round 1

Construct	**Set A (n)**	**Set B (n)**	**Set C (n)**	**Set D (n)**
The Organization	√ (18)	√ (18)	√ (18)	√ (18)
Executive Sponsor	√ (2)	-	-	-
Data Governance Leader	√ (7)	-	-	-
Research Data Governance Committee	√ (7)	-	-	-
Office of Research Data Governance	√ (4)	-	-	-
Research Data Governor	-	√ (13)	-	-
Research Data Steward	-	√ (17)	-	-
Administrative Offices	-	-	√ (17	-
Research Data Consumer	-	-	√ (3)	-
Researcher	-	-	-	√ (24)
External Bodies	-	-	√ (7)	√ (7)
Total (Construct + No. of Item)	**5 (38)**	**3 (48)**	**4 (45)**	**3 (49)**

Set A (strategic); Set B (tactical); Set C (operational); Set D (researcher)

Phase II: Modified Delphi (Round 2)

Expert panels who completed the Round 1 questionnaire were invited to participate in Round 2 of the Delphi exercise, where they continued to provide responses within their assigned groups. For clarity, they were sent an email containing a summary of the Round 1 analysis and group responses. They were also given a Cognito Forms link to access the Round 2 questionnaire, which included items that did not reach consensus in Round 1. Round 2 questions consisted of the same statements as in the previous round (items that did not reach the identified consensus threshold) and were presented using the same 5-point scale. Panel participants were instructed to specify the importance of each listed item statement. This round consisted a total of 41 unique items, distributed across the four sets: Set A (17 items), Set B (9 items), Set C (12 items), and Set D (7 items). Notably, panels from both Sets C and D still need to address the level of importance for task areas related to external bodies. Table 2 provides the distribution of the questions across each set in Round 2. At the conclusion of Round 2, the analysis and feedback processes were reiterated using the a priori consensus criteria. This iterative process yielded two sets of items: one set retained by consensus (where expert panels consistently agreed or consistently disagreed with each item) and another set without a consensus.

Table 2: Distribution of Questions in Each Set For Round 2

Construct	**Set A (n)**	**Set B (n)**	**Set C (n)**	**Set D (n)**
Data Governance Leader	√ (6)	-	-	-
Research Data Governance Committee	√ (7)	-	-	-
Office of Research Data Governance	√ (4)	-	-	-
Research Data Governor	-	√ (5)	-	-
Research Data Steward	-	√ (4)	-	-
Administrative Offices	-	-	√ (7)	-
Research Data Consumer	-	-	√ (1)	-
Researcher	-	-	-	√ (3)
External Bodies	-	-	√ (4)	√ (4)
Total (Construct + No. of Item)	**3 (17)**	**2 (9)**	**3 (12)**	**2 (7)**

Set A (strategic); Set B (tactical); Set C (operational); Set D (researcher)

Phase III: Modified Delphi (Round 3)

In Round 3, participants from Round 1 were invited via email to continue their participation in the Delphi exercise. They received a summary of the Round 2 results as part of the invitation. They were provided with access to a unified instrument designed specifically for this round. Round 3's questions included 19 items related to RDG areas and 8 items related to RDG decision domains. The objective of Round 3 was to assess the importance of each item in the context of RDG implementation within Malaysian RPOs and to establish a consensus on the RDG functional dimension. In this round, the approach shifted away from grouping expert panels into specific sets. This adjustment was driven by the belief that it would be more beneficial for all panels to engage with the same Delphi instrument. The questions explored a broader construct and a more diverse perspective related to the subject, while also maintaining connections with the preceding task areas that are considered crucial for the implementation of RDG among RPOs in Malaysia. This was done to achieve a dual consensus on the perceived importance of RDG activities for which the first consensus on RDG tasks had been previously achieved.

RESULTS

Demographics

In the first round, 47 participants responded. The study collected demographic information, which included details such as age, gender, management level, affiliation, position, and roles related to research data. It is worth noting that not all participants provided their demographic information. Majority of them were in the 35-39 and 40-44 age category. In terms of gender distribution, the majority were female (68%, 32). Regarding the category of participants, three eligible participants responded to two different sets (A and B), resulted in a total of 15 (31.9%) responses in Set A and 11 (23.4%) responses in Set B. Additionally, 13 (27.7%) participants responded to set C and 11 (23.4%) participants responded to set D.

In terms of organizational affiliation, the majority (80.9%, 38) were affiliated with public universities. The remaining participants represented research institutions, government agencies and private university. Participants were asked to indicate their professional positions within their organizations, and they could choose multiple positions. Most of the participants (n=21, 44.7%) were librarians, with various roles and experiences (including Chief Librarians, MOSP data stewards, liaison librarians, IT librarians, and archive librarians). Principal investigators and researchers each accounted for 23.4 percent (n=11). The remaining participants included research officers, executives, heads of research and information technology officers, an administrative officer and an honorary professor.

In addition to asking about participants' professional positions, questions about their specific roles related to research data were also included. Many participants held diverse data-related responsibilities, covering a wide range of tasks and roles. Out of the 47 participants, 53.2 percent (25) were involved in activities such as accessing, analyzing, and manipulating research data, 38.3 percent (18) were providing support for the implementation of RDM policies, 34.0 percent (16) were engaged in conducting research, and 29.8 percent (14) were developing and leading research/publication data policies. Additionally, 21.3 percent (10) were responsible for overseeing the overall management of data and information governance, while another 21.3 percent (10) were ensuring the quality and compliance of RDM. Other reported roles included ensuring legal and regulatory compliance for research data; overseeing the implementation of research data

governance policies; and having specific responsibilities for monitoring key risk indicators related to data misconduct. Under the category of 'Other' data-related tasks and activities, participants mentioned tasks such as raising awareness about open data on campus; serving as a member of the RDM team; validating publications and grants; and establishing a unit dedicated to managing RDM and formulating policies. The demographic profiles of the participants, along with their research data roles, are presented in Table 3.

Table 3: Demographic Profiles and Research Data Roles of Participants

Characteristics	**Participants**	**[a]n = 47**	**(%)**
Age	30-34	2	4.3
	35-39	12	25.5
	40-44	12	25.5
	45-49	10	21.3
	50-54	4	8.5
	55-59	2	4.3
	>60	1	2.1
	Not known	4	8.5
Gender	Female	32	68
	Male	14	29.8
	Not known	1	2.1
Affiliation	Public University	38	80.9
	Private University	1	2.1
	Research Institution	4	8.5
	Government Agency	3	6.4
	Not known	1	2.1
Position[b]	Administrative Officer	1	2.1
	Executive	3	6.4
	Head of Research	2	4.3
	Honorary Professor	1	2.1
	Information Technology Officer	2	4.3
	Librarian	21	44.7
	Principal Investigator/Research Lead, Supervisor/Mentor	11	23.4
	Research Officer	4	8.5
	Researcher	11	23.4
Research Data-Related Roles[b]	Accessing, analyzing, and manipulating research data	25	53.2
	Developing and leading research/publication data policies	14	29.8
	Ensuring legal and regulatory compliance for research data	8	17
	Overseeing overall management of data governance	10	21.3
	Ensuring the quality and compliance of RDM	10	21.3
	Involving in conducting research	16	34
	Monitoring key risk indicators of data misconduct	4	8.5
	Ensuring the implementation of research data governance policy	6	12.8
	Providing support for the implementation of RDM policies	18	38.3
	Raising awareness about open data on campus	1	2.1
	Being a member of the RDM team	1	2.1
	Validating publications and grants	2	4.3
	Establishing a unit dedicated to RDM and preparing policies	1	2.1
Years of experience in research data-related roles	<3	20	42.6
	3–5	13	27.7
	6-10	8	17
	>10	3	6.4
	Not known	3	6.4

[a] Sample size n=47 at Round 1

[b] Participants were allowed to select more than one answer

Modified Delphi

Based on the results of a three-round modified Delphi study, this research addresses the following question: *What research data governance activities do data practitioners believe are essential for implementation within research performing organizations?* In Rounds 1 and 2, the instrument used the following rating scale for item statements: 1 = Not Important, 2 = Slightly Important, 3 = Moderately Important, 4 = Highly Important, and 5 = Very Highly Important. In Round 3, the instrument employed a scale with ratings from 1 = Not At All Important, 2 = Slightly Important, 3 = Moderately Important, 4 = Important, and 5 = Extremely Important. For a priori consensus among expert panels, criteria included an interquartile deviation (IQD) of ≤ 0.5, a median of ≥4, and a consensus level (CL) of ≥85%.

(a) Round 1

The first round of the Delphi study involved 47 (16%) data practitioners who met the specified inclusion criteria. Among them, 15 individuals (22%) were from Set A (Strategic), 11 individuals (41%) were from Set B (Tactical), 13 individuals (25%) were from Set C (Operational), and 11 individuals (7%) were from Set D (Researcher). It is important to note that, despite the 47 participants, three individuals responded to two sets of questions, Set A and Set B, resulting in a total of 50 responses. Table 4 displays the distribution of expert panels across the four categories.

Table 4: Distribution of Expert Panels by Categories

Category	Invited (n)	Responses n (%)
Set A (Strategic)	67	15 (22)
Set B (Tactical)	27	11 (23.4)
Set C (Operational)	51	13 (27.7)
Set D (Researcher)	147	11 (23.4)
Total	**292**	**50**

Overall, the findings show a substantial level of consensus among the expert panels concerning the significance of the RDG task areas considered in this round. Among the 119 statements assessed, 78 (65.5%) of them met the a priori consensus criteria, and 41 items were advanced to the next round for further evaluation. The results are detailed in Table 5.

Table 5 underscores that within the assessed task areas, 23 item statements (29%) related to various RDG roles have achieved unanimous agreement (100%) on their importance. Expert panels consistently rated these statements as either 'highly important' or 'very highly important. Among these, 18 item statements (highlighted in blue in Table 5) received the highest group consensus level (M= 5; IQD of 0.5). This implies that the majority of participants consider these tasks to be of 'very high importance.' The majority of the statements are linked to the role of Researchers, with a few are attributed to the role of Research Data Stewards.

The tasks rated as ‘very highly important’ by majority of panel experts comprise the following 14 items for Researchers:

1) selecting data for long-term preservation based on verification, replication, and reuse needs,
2) handling intellectual property in research outputs as per obligations,
3) publishing research data in disciplinary, institutional, or established repositories,
4) ensuring the integrity, quality, security, and persistent availability of research data,

5) transferring data, materials, and records after projects or upon leaving the institution.
6) managing data throughout the research data lifecycle,
7) arranging secure storage for research data, records, and materials,
8) understanding the limitations and risks of third-party storage solutions,
9) safeguarding confidential, personal, and sensitive research data in accordance with legal and ethical requirements,
10) upholding the principles of rigorous, reproducible research,
11) regularly backing up research data and records,
12) collaborating with information security teams to ensure system controls for data protection,
13) identifying integrity and quality issues in research data, and
14) periodically reviewing data access and usage agreements.

On the other hand, the 'very highly important' tasks attributed to Research Data Stewards as unanimously agreed upon by the panel experts, include:

1) ensuring that research data is archived for long-term preservation,
2) ensuring that research data is licensed for reuse under permissible terms,
3) ensuring ongoing custodial responsibilities for research data is maintained even after researchers leave the university, and
4) provide training and support for researchers in data management.

This assessment of beliefs indicates that the expert panels acknowledge the importance of these tasks in promoting effective RDG. It suggests a common understanding among the participants regarding the essential nature of these task areas in promoting ethical practices, ensuring responsible use, and safeguarding research data over the long term. This is particularly significant concerning one of the primary governance roles, i.e. researchers, who play a pivotal role in generating research data.

However, some participants do not consider tasks such as acknowledging research data sources; adhering to controls outlined in the research data management plan; providing long-term stewardship for selected research data; recognizing the contributions of researchers involved in generating, preserving, and sharing key research datasets; reviewing the research data management policy; establishing a robust infrastructure; and organizing training events and workshops, as well as furnishing templates for both incoming and outgoing research data as top priorities. Nevertheless, it is important to note that collectively, these tasks fulfil the minimum a priori consensus criteria.

Table 5: Results of RDG Task Areas Consensus Assessment in Round 1

No	Item ID	Task Statements	N	M	IQD	CL
		THE ORGANIZATION				
1	1	Ensures that research data are made available, wherever possible, for use by the research community.	47	4	0.5	87%
2	2	Ensures that compliance with policy requirements by grant holders is adequately supported.	47	4	0.5	96%
3	3	Maintains an institutional metadata catalogue of research datasets, especially for publicly funded research.	47	4	0.5	91%
4	4	Protects the rights of researchers, including, but not limited to, the right to access their own research data.	47	5	0.5	91%
5	5	Constitutes a governance committee with oversight of research data governance implementation.	47	4	0.5	89%

6	6	Maintains research data governance policies at the institutional level.	47	5	0.5	94%
7	7	Enables research data management planning and execution of good research data management practice.	47	5	0.5	91%
8	8	Engage with funders, policymakers, and other stakeholders to ensure that research data governance policies and services align with sector requirements.	47	4	0.5	91%
9	9	Ensures the appropriate use of animals, human subjects, recombinant DNA, biological agents, radioactive materials, and the like.	47	5	0.5	91%
10	10	Facilitates the investigation of unethical practices, such as scientific misconduct or conflict of interest.	47	5	0.5	89%
11	11	Takes custody of the data where necessary to ensure needed and appropriate access.	47	4	0.5	87%
12	12	Owns all research data and the intellectual property created during the collection or use of the research data.	47	5	0.5	91%
13	13	Develops best practices for data sharing in different fields by recognising that different research data types raise distinct issues and challenges.	47	5	0.5	91%
14	14	Provides suitable training for researchers on good research data management.	47	5	0.5	91%
15	15	Provides long-term stewardship for some research data, depending on institutional/national data infrastructure provision and eligibility.	47	4	0.5	85%
16	16	Provides facilities, advisory services, and resources for the safe and secure storage and management of research data and records.	47	5	0.5	89%
17	17	Ensures that facilities provided for the storage and management of research data are compliant with legal and regulatory requirements.	47	5	0.5	89%
18	18	Recognises the contributions of researchers who generate, preserve, and share key research datasets.	47	4	0.5	85%
		EXECUTIVE SPONSORS				
19	1	Provides the facilities and support required for efficient research data management.	15	4	0.5	93%
20	2	Oversees the implementation of research data governance as a good research data management framework.	15	4	0.5	87%
		DATA GOVERNANCE LEADER				
21	4	Develops and maintains a central repository for research data governance policies, guiding principles, and decisions.	15	4	0.5	93%
		RESEARCH DATA GOVERNORS				
22	1	Arranges the availability of necessary resources, facilities, and support for research data management.	11	5	0.5	91%
23	2	Approves the action of storage, retention, disposal, publication or licensing arrangements for research data and records.	11	5	0.5	91%
24	3	Models responsible research data management behaviours to researchers.	11	4	0.5	91%
25	4	Ensures an efficient transmission of general research data management information between the central level and the research community.	11	5	0.5	91%
26	5	Ensures all research grant and contract applications include a research data management plan and that it is attached to the relevant record.	11	4	0.5	91%
27	6	Ensures the principal investigators/research leads adhere to their obligations.	11	5	0.5	91%
28	7	Reports incidents involving IT security breaches or unintended disclosure, loss, or destruction of research data.	11	5	0.5	91%
29	8	Supervises and monitors the correct execution and updating of the research data management regulations and procedures in accordance with legal, policy and ethical rules as well as regulations.	11	5	0.5	91%

		RESEARCH DATA STEWARDS				
30	1	Store active research data securely and protect them from loss, unlawful or unethical access, and in accordance with all other applicable requirements.	11	5	0.5	91%
31	3	Ensures that research data are appropriately classified and managed in accordance with their sensitivity.	11	4	0.5	100%
32	4	Ensures any confidential data and material, including data and materials held in computing systems, are kept appropriately secure according to any applicable privacy laws.	11	4	0.5	91%
33	5	Ensures that research data are archived for long-term preservation and stored in either an established subject-specific repository or in the institution's own research data repository.	11	5	0.5	100%
34	6	Ensures that research data are licenced so that it can be reused and disseminated under as permissible terms as possible.	11	5	0.5	100%
35	7	Ensures the ongoing custodial responsibilities for the research data upon researchers leaving the university.	11	5	0.5	100%
36	8	Provides appropriate training and support to researchers with research data management, curation, or access queries and other relevant research data management regulations and procedures.	11	5	0.5	100%
37	9	Ensures the retention of research data for the duration specified by the organization.	11	4	0.5	91%
38	12	Supervises and monitors the correct execution and updates of the group's research data management regulations and procedures.	11	4	0.5	100%
39	13	Ensures that every research project starts with a research data management plan in accordance with the funder and organization's expectations.	11	4	0.5	91%
40	15	Ensures relevant members of the project team are granted appropriate access to the active research data (at appropriate times) as authorised users.	11	4	0.5	100%
41	16	Establishes and maintains clear research data management responsibilities within their research group to ensure good research data management is practised throughout the project and by all group members.	11	4	0.5	100%
42	17	Arranges the availability of the necessary resources, facilities, and support for research data management in the research group.	11	5	0.5	91%
		ADMINISTRATIVE OFFICES				
43	1	The Library coordinates a network of data stewards.	13	4	0.5	92%
44	6	The Library reviews the research data management policy in consultation with relevant governance bodies.	13	4	0.5	85%
45	9	IT provides a standard, robust, and high-quality infrastructure to facilitate good research data management and storage where possible.	13	4	0.5	85%
46	10	IT provides technical advice and support research data management, including data storage, backup, and archiving.	13	4	0.5	92%
47	11	IT provides secure access management to research data according to ICT security guidelines.	13	5	0.5	92%
48	12	Research Office advocates and develops organizational awareness of research data management issues.	13	4	0.5	92%
49	13	Research Office ensures that the research data governance policies are updated to take into account the latest funder requirements and national research directives and guidelines.	13	4	0.5	92%
50	15	Research Office organises research data management training events and workshops.	13	4	0.5	85%
51	16	Research Office provides advice, guidance, and assistance to researchers in the preparation of a research data management plan.	13	4	0.5	92%
52	17	Research Office provides templates for both incoming and outgoing research data and the drafting and negotiation of the agreements concerned.	13	4	0.5	85%

		RESEARCH DATA CONSUMERS				
53	1	Acknowledges the sources of the research data and abides by the terms and conditions under which they are accessed.	13	5	0.5	85%
54	2	Complies with controls outlined in the research data management plan.	13	4	0.5	85%
		EXTERNAL BODIES				
55	1	National funder defines research data governance principles that support the funding body principles.	24	4	0.5	88%
56	2	National funder reviews implementation of research data management plans.	24	4.5	0.5	88%
57	3	National funder specifies retention periods for significant research data.	24	4	0.5	88%
		RESEARCHERS				
58	1	Researcher selects research data and related materials for long-term preservation based on what is needed for verification/replication and reuse.	11	5	0.5	100%
59	2	Researcher retains research data in a secure environment for a period determined by the organization.	11	5	0.5	91%
60	4	Researcher ensures that a written agreement is in place to cover research data and materials ownership, sharing, storage, accessibility, retention, and disposal for research with other institutions, government agencies, or any third party.	11	5	0.5	91%
61	6	Researcher protects and manages intellectual property in research outputs according to the funder or contractual obligations.	11	5	0.5	100%
62	8	Researcher publishes research data and records to disciplinary, institutional, or other established repositories to maximise research value unless prevented by ethical or legal obligations.	11	5	0.5	100%
63	9	Researcher guarantees the integrity, quality, security, and persistent availability of the collected or generated research data.	11	5	0.5	100%
64	10	Researcher fulfils the responsibility to dispose of research data and materials in a secure and safe manner.	11	5	0.5	91%
65	11	Researcher includes a data access statement that links to the data record in publications to enable readers to discover the dataset and explain how it can be accessed.	11	4	0.5	91%
66	12	Researcher reports circumstances where a suspected or known security breach might have resulted in unauthorised access, unintended disclosure, loss, theft, destruction or alteration of research data.	11	5	0.5	91%
67	13	Researcher hands over research data, primary materials, and research records after research projects or after leaving the institution, including information about its access and reuse.	11	5	0.5	100%
68	14	Researcher manages research data to the highest standards throughout the research data lifecycle in accordance with the organization's policies, guidelines and standards, and funder, legislative, and ethical requirements.	11	5	0.5	100%
69	15	Researcher arranges safe and secure storage of research data, records, and primary materials.	11	5	0.5	100%
70	16	Researcher understands data management limitations, issues, and risks of third-party storage solutions, and able to take appropriate measures to protect research data stored on these services.	11	5	0.5	100%
71	17	Researcher protects confidential, personal, and sensitive personal research data in accordance with legal and ethical requirements related to the research conducted.	11	5	0.5	100%
72	18	Researcher participates in appropriate training to familiarise with pertinent research data, primary material management needs, and contractual obligations.	11	4	0.5	91%
73	19	Researcher upholds the institution's principles in rigorous, reproducible research by adopting open-source file formats and	11	5	0.5	100%

		file types recommended for long-term preservation.				
74	20	Researcher backs up research data and records regularly in accordance with best practices in the relevant field of research.	11	5	0.5	100%
75	21	Researcher develops systematic operating procedures to comply with research data governance policies and principles.	11	4	0.5	100%
76	22	Researcher works with the information security team to ensure that system controls are in place to flag suspicious activities or potential data breaches.	11	5	0.5	100%
77	23	Researcher identifies research data integrity and quality issues and develops plans to address them.	11	5	0.5	100%
78	24	Researcher periodically reviews research data access and usage agreements to ensure appropriate access is maintained.	11	5	0.5	100%

Note: M – Median IQD – Interquartile deviation CL – Consensus Level
*The highlighted items in blue reach the highest group consensus

(b) Round 2

For Round 2, invitations were extended to the same group of data practitioners (n=47) who took part in Round 1. However, 34 (72.0%) of them responded, contributing a total of 37 responses, including the three participants who were eligible to respond to two sets of instruments. In this round, the remaining 41 items that did not achieve consensus in Round 1 were re-evaluated. At the end of Round 2, an additional 28 items (23.5%) reached consensus among the participants. Notably, 11 of these items received unanimous agreement (100%) from all participants.

Some participants reconsidered their initial responses and acknowledged that these items are either 'highly important' or 'very highly important'. Nevertheless, 13 items, making up 11 percent of the total, failed to achieve consensus and were subsequently excluded from the list. The item "Monitors compliance with the research data governance policies and supporting processes" received the lowest rate of agreement (69%). Many participants did not reach a consensus on the importance of this task, which falls under the purview of the Office of Research Data Governance. The exclusion of these 13 items does not necessarily imply their irrelevance; instead, it suggests that, at this point, they are perceived as less critical for implementation within RPOs. The participants' Round 2 responses are listed in Table 6.

Table 6: Results of RDG Task Areas Consensus Assessment in Round 2 (with and without consensus)

No	Item ID	Task Statements	N	M	IQD	CL
		DATA GOVERNANCE LEADER				
1	1	Ensures that research data governance policies are reviewed and maintained in accordance with sector requirements.	13	5	0.5	92%
2	2	Decides on day-to-day matters concerning research data governance.	13	4	0.75	77%
3	3	Directs decision-making to the appropriate stakeholders when required.	13	4	0.75	77%
4	5	Maintains the Research Data Governance Committee agenda and convenes meetings.	13	4	0.5	85%
5	6	Communicates the Research Data Governance Committee outcomes.	13	4	0.5	92%
6	7	Serves as a point of expertise on research data governance and recommend data governance solutions.	13	4	0.5	85%
		RESEARCH DATA GOVERNANCE COMMITTEE				
7	1	Provides a standard and common vocabulary for primary research data entities and research data types and sources that are essential to the organization.	13	5	0.5	85%

8	2	Develops tools, guidelines, principles, and policies pertaining to research data, including classification, access, usage, integrity, retention, roles/responsibilities, incident response, and integration.	13	4	0.75	77%
9	3	Expresses strategic research data requirements that reflect the organization and management needs.	13	4	0.75	77%
10	4	Oversees initiatives aiming to increase effective and efficient research data utilization.	13	4	0.5	85%
11	5	Supports research data management for institutional initiatives	13	4	0.5	85%
12	6	Periodically reports how research data management delivers value.	13	4	0.75	77%
13	7	Cultivates a research data management culture that provides value to the institution.	13	4	0.5	85%
		OFFICE OF RESEARCH DATA GOVERNANCE				
14	1	Signs off policy, supports appropriate cultural and behavioural changes, and allocates appropriate resources to research data governance activities.	13	5	0.5	92%
15	2	Approves and implements processes that support the research data governance policies.	13	4	0.75	77%
16	3	Monitors compliance with the research data governance policies and supporting processes.	13	4	1	69%
17	4	Provides advice, guidance, and reviews on research data management concerning research integrity and ethics.	13	4	0.5	92%
		RESEARCH DATA GOVERNORS				
18	9	Approves annual attestations to ensure researchers are aware of the relevant research data usage requirements.	8	4.5	0.5	100%
19	10	Fosters a culture and training regime for research data awareness, including data usage agreements, disclosure process, and security controls.	8	4.5	0.5	88%
20	11	Makes decisions where standard research data guidelines are ambiguous or not applicable.	8	4.5	0.5	100%
21	12	Sets expectations for managing research data such as research data classification and research data retention.	8	4.5	0.5	88%
22	13	Sponsors, secures, and/or influences resources for research data management.	8	4.5	0.5	100%
		RESEARCH DATA STEWARDS				
23	2	Assists the institution in the event of an external audit, including granting access to research data as required.	8	4.5	0.5	100%
24	10	Examines the research data management plan and provides recommendations on its conformity with the research data governance policies.	8	4.5	0.5	100%
25	11	Develops and records procedures and processes for selection, collection, storage, use (including reuses), access, and retention of research data related to their research programme, including protection of essential records in the event of a natural disaster or other emergencies.	8	4.5	0.5	100%
26	14	Ensures that research data management requirements are costed in the research proposals.	8	4	0.5	88%
		ADMINISTRATIVE OFFICES				
27	2	The Library acts as the custodian of centrally managed research data collection metadata records by publishing sufficient appropriate metadata describing every shared dataset on a publicly available catalogue.	10	5	0	1
28	3	The Library develops and/or maintains a research data repository which may be used to register research data and other relevant research outputs.	10	5	0.5	1
29	4	The Library defines the institution's core offering in support of research data management and communicate that to researchers.	10	5	0.5	
30	5	The Library provides high-quality infrastructure and facilities for collecting, storing, accessing, sharing, and archiving	10	5	0.5	

		research data.				
31	7	The Library provides training and advice on all aspects of research data management including minimum standards for metadata description, the writing of research data management plans, funders requirements, ownership, copyright and licences, linked identifiers, data citation and legal and ethical issues related to the collection, storage, access, sharing and archiving of research data.	10	4.5	0.5	1
32	8	The Library advises on research data costs associated with the capturing, managing, archiving, and sharing of research data during the project lifetime and following its completion.	10	4.5	0.5	90%
33	14	Research Office facilitates, coordinates, and supports the execution of the processes in the research data governance policies.	10	4	0.5	80%
		RESEARCH DATA CONSUMERS				
34	3	Enters into a data use agreement with the data provider for accessing the embargoed research data.	10	4	1	70%
		EXTERNAL BODIES				
35	4	National funder provides advice directly or through data services.	16	4	1	75%
36	5	National journal publisher endorses research data deposits in existing domain-specific data infrastructure or other trustworthy repositories.	16	4	0.75	75%
37	6	National and/or institutional repository defines a preference for non-proprietary international and community standards that facilitate access, use and interpretation of research data.	16	4	0.5	81%
38	7	National and/or institutional repository specifies required contextual information and metadata, including provenance, quality, and uncertainty indicators.	16	5	0.5	94%
		RESEARCHERS				
39	3	Researcher budgets the costs associated with the capturing, managing, archiving, and sharing of research data during the project lifetime and time investment for research data management.	6	4.5	0.5	83%
40	5	Researcher writes a research data management plan with clear procedures for the collection, storage, use, reuse, access, and retention or destruction of the research data and records associated with their research.	6	5	0.5	1(
41	7	Researcher provides sufficient metadata and explanatory documentation about their research data to ensure that the data are discoverable, understandable, and re-usable.	6	5	0	1(

Note: M – Median IQD – Interquartile deviation CL – Consensus Level
*The highlighted items in grey do not reach group consensus and eliminated

(c) Round 3

The instrument for Round 3 was developed based on insights gathered from the previous two rounds. The item statements were structured to assess the perceived importance of RDG areas and decision domains. All 47 data practitioners were invited once again to participate in Round 3. In this round, 34 expert panels took part, but one participant's responses required re-submission, which unfortunately did not occur before the survey concluded. Consequently, responses from 33 participants (70.0%) were accepted and analyzed. The majority of participants (28, 84%) demonstrated commitment by engaging in all rounds. Unlike the previous rounds, they were not categorized into specific groups this time, with the goal of obtaining a broader perspective on RDG activities.

Table 7 displays the results for Round 3, providing descriptive analysis for each RDG area and decision domain. It is worth noting that Compliance Monitoring and Research Data

Integrity are areas that achieved unanimous agreement with a 100 percent CL, indicating a robust consensus on their critical importance. Similarly, Research Data Ownership & Intellectual Property Rights, Issue & Risk Management, Research Data Stewardship, Research Data Custodianship, Research Data Privacy, and Training received high approval, each securing a 97 percent CL, indicating a robust collective acknowledgement of their significance. The CL for Research Data Policy and Research Data Repository, both at 94 percent, emphasized a shared recognition of their importance in the RDG landscape. Additionally, Research Data Sharing and Research Data Strategy, at 94 percent and 91 percent respectively, indicate a strong consensus regarding their considerable relevance. Performance Measurement, Research Data Retention & Disposal, Research Data Licensing, and Research Data Citation, all with a 91 percent CL, indicate a shared acknowledgment of their crucial roles in the RDG framework. Decision-Making Coordination achieved an 88 percent CL, signifying a notable level of agreement on its importance. Research Data Selection and Communication, each with an 85 percent CL, demonstrate a substantial but slightly less unanimous consensus.

Table 7: Descriptive Anaysis for RDG Areas and Decision Domains in Round 3

No	tem ID	Items	N	M	IQD	CL
		RDG AREAS				
1	1	Research Data Policy	33	0.5	5	94%
2	2	Research Data Strategy	33	0.5	5	91%
3	3	Research Data Ownership & Intellectual Property Rights	33	0.5	5	97%
4	4	Performance Measurement	33	0.5	4	91%
5	5	Issue & Risk Management	33	0.5	5	97%
5	6	Compliance Monitoring	33	0.5	4	100%
7	7	Research Data Stewardship	33	0.5	5	97%
8	8	Research Data Custodianship	33	0.5	5	97%
9	9	Research Data Selection	33	0.5	4	85%
10	10	Research Data Repository	33	0.5	5	94%
11	11	Research Data Retention & Disposal	33	0.5	4	91%
12	12	Research Data Privacy	33	0.5	5	97%
13	13	Research Data Citation	33	0.5	4	88%
14	14	Research Data Integrity	33	0.25	5	100%
15	15	Research Data Licensing	33	0.5	4	91%
16	16	Research Data Sharing	33	0.5	5	94%
17	17	Communication	33	0.5	4	85%
18	18	Decision-Making Coordination	33	0.5	4	88%
19	19	Training	33	0.5	5	97%
		RDG DECISION DOMAINS				
20	1	Research Data Principle	33	0.5	4	100%
21	2	Research Data Lifecycle	33	0.5	5	100%
22	3	Research Data Architecture	33	0.5	5	94%
23	4	Research Data Storage & Infrastructure	33	0	5	97%
24	5	Research Data Security	33	0.25	5	100%
25	6	Metadata Management	33	0.5	5	100%
26	7	Research Data Quality	33	0.5	5	94%
27	8	Research Data Access	33	0.5	5	94%

Note: M – Median IQD – Interquartile deviation CL – Consensus Level

Meanwhile, within the RDG decision domain, Research Data Principle, Research Data Lifecycle, Research Data Security, and Metadata Management achieved a CL of 100 percent, indicating unanimous agreement on their fundamental importance. Additionally, the

Research Data Storage & Infrastructure received a strong CL approval rating of 97 percent, underlining its significance. The 94 percent CL for Research Data Architecture, Research Data Quality, and Research Data Access reveal a broad acknowledgement of their critical roles in the RDM landscape. These ratings collectively indicate a high degree of consensus regarding the importance of these principles and practices within the framework of RDG.

The importance ratings assigned to different RDG areas and decision domains underscore the necessity of prioritizing tasks aimed at safeguarding data integrity, ensuring compliance, and enhancing the efficient management of data within research settings. Consequently, these findings can provide valuable insights for decision-making processes and guide resource allocation strategies aimed at improving RDG practices and implementation.

DISCUSSION

Overall, the research findings offer a comprehensive understanding of the significance assigned by data practitioners to various task areas within different RDG roles. This insight sheds light on the key priorities and areas of focus as identified by the expert panels, addressing the primary research question concerning the essential RDG activities within RPOs. The findings underscore the critical nature of tasks related to ensuring data integrity, data quality, data security, and long-term accessibility, along with the protection of sensitive and confidential research data in accordance with legal and ethical standards as supported by Brous, Janssen, and Vilminko-Heikkinen (2016), Thompson, Ravindran, and Nicosia (2015) and DAMA International (2017). These insights offer guidance for prioritizing and focusing on key RDG activities, which, in turn, can inform decision-making and resource allocation for the enhancement of RDG practices and implementation within RPOs.

Research organizations should invest resources and effort into developing and implementing effective governance frameworks that will contribute to enhancing RDM practices (Lefebvre and Spruit 2021; Marlina and Purwandari 2019; Wong, Maarop, and Samy 2020; Abraham, Schneider, and vom Brocke 2019). Preserving researchers' rights and intellectual property rights emerged as significant priorities in this study. Furthermore, acknowledging the contributions of researchers and ensuring the responsible utilization of research materials were also deemed highly important tasks. These findings emphasize the need to foster an environment that promotes innovation (Sharif et al. 2018), recognizes researchers' contributions, and upholds ethical practices in research (Nielsen 2017; Parmiggiani and Grisot 2020; Hendey, Gold, and Pettit 2018). Engaging with stakeholders and providing training on RDM were identified as important tasks. These findings highlight the importance of fostering collaboration and enhancing capacity building in effective RDM. It is evident that research organizations should invest in initiatives that facilitate stakeholder involvement and provide comprehensive training programs to equip researchers with the necessary skills for managing and sharing data effectively (Liu, Zotoo, and Su 2020; Gunjal and Gaitanou 2017; Lefebvre, Schermerhorn, and Spruit 2018).

However, some tasks were regarded as less critical when compared to others. For example, participants assigned lower importance to the Research Data Governance Committee periodically reporting on the value contributed by RDM. On the other hand, they emphasized the significance of the Data Governance Leader in conveying the outcomes of the Research Data Governance Committee. Similarly, participants assigned lower importance ratings to researchers budgeting for the costs associated with capturing,

managing, archiving, and sharing research data throughout a project's lifespan, as well as the time investment required for research data management. However, they suggested that these tasks should fall under the responsibility of Research Data Stewards instead. Consequently, the perceived importance of tasks is assessed in alignment with assigned roles. It is important to note that a lower CL does not imply insignificance; rather, it indicates that the task is considered less critical for that particular role.

The insights derived from this study have the potential to significantly impact RPOs striving to enhance their RDM practices. Additionally, policymakers seeking to establish guidelines and optimal procedures for RDG may find these findings valuable. These RDG best practices, when developed into a framework, will serve as a valuable resource that promotes efficient RDM, facilitating collaboration, and ensuring the reliability and usability of research data. The framework may act as a comprehensive guide, making it easier to implement and evaluate the effectiveness of RDG within organizations.

CONCLUSIONS

In conclusion, this study employed a modified Delphi technique to gather valuable insights from data practitioners regarding the importance of various RDG activities within RPOs. The development of RDG best practices based on the consensus achieved in this study is anticipated to serve as a comprehensive guide for implementing and evaluating RDG effectiveness within research organizations. This study demonstrates significant strengths. The use of a modified Delphi technique for consensus building upheld participant anonymity, granting them the freedom to express opinions without restrictions. This approach effectively minimized the influence of dominant personalities and bias. Additionally, the technique is cost-effective and flexible, allowing data practitioners to contribute from various geographical locations through the use of the Cognito Forms online survey, eliminating the need for physical contact. The study also benefited from the diverse professional backgrounds of data practitioners involved in handling research and publication data. However, it is important to recognize that this study is not without its limitations. The recruitment process proved to be challenging and time-consuming. The overall response rate in Round 1 (47 out of 292 invited data practitioners i.e. 16%) was relatively low. This further reduced in Round 2, with 34 out of 47 invited experts responding. The low response rates may be attributed to competing commitments, given that the invited individuals are professionals with demanding daily schedules. Despite the challenges, this study offers valuable insights into RDG priorities and can inform decision-making processes and resource allocation strategies to enhance RDG practices and implementation within RPOs.

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AUTHORS DECLARATION

The authors declare no conflicts of interest regarding the publication of this paper.

AUTHORS CONTRIBUTION

Conceptualization: [all authors], Methodology: [all authors], Formal analysis and investigation: [N.R.Hazmi], Writing - original draft preparation: [N.R.Hazmi]; Writing - review and editing: [A.Abrizah, A.M.K. Yanti Idaya]

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