ADVANCING ACADEMIC EXCELLENCE: THE STRATEGIC IMPORTANCE OF RESEARCH DATA MANAGEMENT TOOLS IN RESEARCH WRITING AND LEARNING

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Research management tools are software applications that assist researchers in planning, tracking, and executing their research project seamlessly as they create tasks, assign roles and setting of deadlines for progress management and performance of research. This paper provides an overview of the importance of research and the significance of tools for academic research along with examples and guidelines for readers and writers on how the tools could be used efficiently. The paper highlighted the need for every researcher to avail themselves of the opportunities of the tools in their research, while identifying the proper tools and resources for data collection and viability, data quality, and analysis towards better policy formulation, improvement, dissemination and contribution of data findings for advancement of knowledge.

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Introduction

In today's digital age, with a plethora of tools available at our fingertips, researchers can now collect and analyze data with greater ease and efficiency. Research today is dynamic as it is performed to find solutions, make decisions and identify gaps to fill which necessitate a researcher to consult different sources of information from the internet, analytics and diverse sources including videos etc. The dynamic nature of research is the application of these interactive, and media-rich research tools in every step of the research process for time saving, productivity, and provision of accurate, efficient and reliable results. This is why the use of essential research tools is crucial for every researcher while conducting their research (Blog, 2023).

The importance of significance of research is of paramount importance to every research study irrespective of fields, areas covered and its advancement and contribution towards every stakeholder that will benefit immensely during the course of the study. Research in common parlance refers to a search for knowledge. Research is a scientific and systematic investigation and search for pertinent information on a specific topic. Jonker & Pennink (2010) defined research as "a careful investigation and inquiry through a search for new facts in any branch of knowledge (Jonker & Pennink, 2010).

Similarly, Creswell (2008), defined research as a "systematized effort to gain new knowledge." This inquisitiveness is the mother of all knowledge and the method, which man employs for obtaining the knowledge of whatever the unknown, can be termed as research (Singh, 2021).

According to Barret (2022), research is a careful or diligent search; studious inquiry or examination; the collecting of information about a particular subject through the search for knowledge in an objective and systematic method for finding a solution to a problem. This systematic approach is the generalization and

formulation of a theory (Barett, 2022; Creswell, 2008). This shows that research is a contribution to the existing stock of knowledge for its advancement, and pursuit of truth with the help of study, observation, comparison and experiment.

Significance of Research

All progress is born of inquiry. Doubt is often better than overconfidence, for it leads to inquiry, and inquiry leads to invention." According to Hudson Maxim, the increased amounts of research make progress possible when it inculcates scientific and inductive thinking to promote the development of logical habits of thinking and organization in finding solutions to an identified gap (Creswell, 2008). The importance of research is the ability of a researcher to assess a problem and end with solving that problem through access to an array of essential research tools that can help simplify the research process from data collection, analysis, verification and presentation for accessibility, accurate and efficient information. When researchers leverage these tools, they can improve their work and produce more high-quality research.

Importance of Research Data Management Tools

Managing data is a daunting and challenging task. It needs careful monitoring from when the data is made until it is thrown away. When data is managed well, researchers can reduce risk and improve the usability and quality of the data. Data management tools can archive, back up, restore, search, and more. These solutions let companies manage data across multi-cloud setups. Scaling and working with data from several sources can be challenging for researchers and businesses. The use of data management tools will provide a platform to overcome challenges including, data duplication, isolation, or complex management problems (Questionpro, 2022). The significance of these tools is important to assist authors, researchers, and information seekers with sound research tools needed for their academic writing. The use of these tools is categorized into various forms and functions free and commercial:

Tremblay (2023) opined that effective research data management is a crucial component for the success of scientific investigations with a direct impact on the quality and reliability of research outcomes. It is worth noting that research data management (RDM) has grown significantly as researchers across disciplines, and fields seek to ensure reproducibility, facilitate data reuse, and acknowledge data as a piece of valuable scholarly information needed for decision-making.

According to Thomson (2024), Research Data Management (RDM) refers to practices and ways an organization stores, preserves, shares, and publishes information and data collected to enhance the research process of students and information users and for decision-making. This platform gives a researcher prompt information for the use of sound scientific data, preserves data in the short and long term in line with regulatory compliance, saves time, and resources and supports open science needed for information sharing across the globe.

Also, Bradley (2023), defined Reference data management (RDM) as the process of collecting, organizing, maintaining, and ensuring the accuracy and consistency of reference data across an organization. It also included creating standardized definitions, procedures, and guidelines for managing reference data throughout its lifecycle to ensure that data is accurate, up-to-date, and readily

available for use by researchers, students, and information users.

D'Anna, Jareborg and Jetten (2024) in their study on a research data management (RDM) community for ELIXIR posits that institutions, funding agencies and publishers are placing increasing emphasis on good research data management (RDM). They also reported that research data auditing had an overall positive effect on self-reported RDM awareness, compliance and reception for both research PIs and researchers. Researchers agreed more that Research Data Management was important to scientific reproducibility, were more aware of proper RDM, had higher RDM strength in their laboratories and were more compliant with the Data Management Plan (DMP). As researcher believed data auditing helped them to be more compliant with data deposition in the repository for their research report.

Relevance of Research Data Management (RDM) tools

RDM offers critical relevance for researchers, students and organizations, including:

a. It improves accuracy and consistency in Data Management: the use of RDM tools will ensure data remains consistent across all systems and data sets which will enhance consistency reduce error and improve data quality of information.
b. It promotes operational efficiency: the use of RDMt tools during the research process and information usage will eliminate errors through automation, reduce the need for manual use of data and handling towards saving time, and improve the efficient use of information resources.
c. Adherence to Regulatory compliance: With the use of RDM practices during information usage, students can maintain accurate data records support in line with compliance with data governance and legal standards to use accurate data.
d. Streamlined Data Integration: the use of RDM tools with standardized reference data simplifies integration across platforms and systems, making it easier for researchers, students and information users to merge data from different sources for efficient data exchanges and prompt data-driven decision-making when reporting their findings in a research report.
e. Enhances the use of data quality: By implementing a robust RDM process and strategy, researchers, students and information users can improve overall data quality through the use of accurate and consistent reference data to minimize, ensuring that businesses can rely on their data for critical decision-making.
f. Boosting the credibility of research outcomes: The transparency associated with the use of high-quality RDM tools helps researchers present their conclusions to the scientific community with results from clearly notated, repeatable experiments, supported by well-documented, verifiable data.
g. It fosters collaboration and data sharing: A well-implemented RDM tools and framework will promote collaboration between departments, data centres, and teams by providing a shared understanding of data that will enable organizations to break down data into silos and facilitate effective data sharing across the researchers, students, information users and data centres.
h. Promotion of Increased discoverability: With the proper documentation and metadata that will improve data accessibility and discoverability, researchers can easily locate, access well-managed, disseminated and use to promote increased visibility to new

research opportunities and improved scientific communication.

i. Cost Savings: The use of RDM Tools for information research will prevent duplication of effort and human and material resources including the need to recreate or recollect data. This efficiency allows more funds to be allocated to other critical aspects of research.

Types of Research Data Management Tools for Researchers

Research Data Management tools can be classified into various categories including, planning and management of research projects, literature search, data collection and analysis, reference management, editing and paraphrasing, plagiarism verification, collaboration and communication with the world. They include the following:

1. Margin Note: is a licensed commercial all-in-one reading and highlight tool available on smart devices like Mac, iPad, and iPhone for users to organize and manage large volumes of PDFs and EPUBs. The application takes notes, creates the mind map, reviews flashcards, and therefore saves time for users from switching endlessly between different applications while conducting their research (Gupta, 2023).
2. Zotero: Zotero is a license-free, easy-to-use tool application that assists researchers in collecting, organising, citing, and sharing research from various sources, including journal articles, websites, newspapers, and PDFs by providing managing bibliographic data, and related research materials (such as PDF files). The application has unique features like web browser integration, notification of retracted papers, online syncing, generation of in-text citations, and footnotes, identification and extraction of cited quotations and comments, saved as notes and bibliographies, as well as integration with the word processors Microsoft Word and LibreOffice Writer (Gupta, 2023).
3. RefWorks is a license-free web-based commercial reference management software package. It provides a platform for linking users with electronic editions of journals to which the institution's library subscribes promoting academic integrity and excellence (Wilagama, 2023).
4. EndNote is a licensed Commercial industry software tool used for collecting, curating research materials and formatting bibliographies with greater ease and control in the coordination of information resources saving researchers the tedious work of manually collecting (Wilagama, 2023).
5. Mendeley Reference Manager: is a free desktop license software used for organizing, sharing, and generating bibliographies of researchers. This tool allows researchers to create references, citations, and bibliographies in multiple journal styles with just a few clicks; stores and manages these sources for information usage (Gupta, 2023; Pandey, 2021).
6. Read cube is a license commercial desktop browser-based program used on desktop (Mac/PC), and mobile devices (iOS/Android/Kindle) for managing, annotating, accessing academic research articles, and syncing for library collections for easy accessibility and usage for diverse information users (Questionpro, 2022).
7. Docear is a license-free programme that recommends papers in full-text for download, tailored to every information needs of diverse users (Questionpro, 2022)
9. Paperpile is a licensed commercial web-based reference management integration

software for Google Chrome browser extension and plugins that searches information from Google Docs and Google Scholar based on search inquiry using the interface (Questionpro, 2022).

10. JabRef is a free open-source bibliography reference manager used for the production of BibTeX, the standard LaTeX bibliography format for journals and publishing houses. The application runs on the Java VM (version 8), on Windows, Linux, and Mac OS X. Example sources include arXiv, CiteseerX, Google Scholar, Medline, GVK, IEEEXplore, and Springer (Questionpro, 2022).
11. Content Mine is a content text mining and conversion tool that researchers can use to find, download, analyze, and extract data knowledge from tables and graphs in academic papers (Questionpro, 2022).
12. Google Cloud Platform: Google Cloud is a Cloud-based data management that provides an efficient workflow manager that binds the different components of Google Data Studio with graphical user interface analysis, dashboard creation and Google Big Query to store tabular data which could be accessed on different smart devices platform like mobile phones, computers and tablet (Questionpro, 2022)
13. Informatica PowerCenter: is an application used by researchers for the movement of data from one source to another with an enhanced data visualization interface for displaying data in graphical form with its sources (Questionpro, 2022).
14. Profisee: Profisee is a master data management software that creates and provides reliable and pertinent data for use in both business and research. Using analytics-based feedback, such as real-time governance and progress measurements, you may impose business procedures and give data stewards the authority to master data.
15. Ref-N-Write Academic Writing Tool: Ref-N-Write is a Microsoft Word add-in search and grammatical correction tool used for importing research papers from files in your computer into MS Word. This tool provides features of a text-to-voice option that helps users pick up grammatical errors and sentence structural issues (Refnwrite, 2018).
16. Publish or Perish: Publish or Perish is a software program that retrieves and analyses academic citations from Google Scholar and Microsoft Academic Search to obtain the raw citations, analyze, and present the metrics on the total number of papers citations, and citations per year for reference. This tool assists researchers with detailed search tips and additional information about the citation metrics of articles consulted and used for scientific impact factors (Department of Applied Information Systems, 2022).
17. Idea Rover: is a dissertation writing software that helps researchers to retain, organize, and evaluate assertions, ideas, and concepts for their dissertation, prepares outline-structured notes, and by saving researchers time and eliminates tedious cut-and-paste work to reduce plagiarism (Corcoran,2023).
18. iThenticate: iThenticate is a plagiarism detection software developed by Turnitin an online plagiarism checker used by researchers and academics to review, and check their manuscripts for originality, and citing of sources appropriately before journal submission and publication. This tool compares the author's submission with an extensive database of web pages, and

scholarly content before producing a similarity detection of plagiarism levels with scores and reports. With the use of this tool researchers eliminate any inadvertent instances of plagiarism contents, and other blunders in their research papers and articles (iThenticate, 2024; Gupta, 2023; Corcoran, 2023)

19. Grammarly: is a writing enhancement tool used by researchers for proofreading and spellchecking their articles for a professional outlook that saves writers/ authors a ton of time and effort used for basic spellchecking and corrections. The tools include a grammar checker, a punctuation checker, a vocabulary enhancer, and plagiarism checker tools that scan and correct articles with error-free writing from 250 types of grammar mistakes in six distinct writing genres (Grammarly, 2024; Blog, 2023).
20. Plagiarism Checker X: Plagiarism is an AI detection and similarity tool used by researchers to identify works of plagiarism and copyright infringement contents of your articles against billions of published articles and webpages across the globe over the internet. The tools provide users with documents' originality and highlights of works in reports to promote academic excellence and reduce plagiarism levels of contents with authors' own words. In order to avoid plagiarized articles authors are advised to consult plagiarism detection software and online checking tools to check their articles and text overlap with previously published material before submitting their academic essay and paper (Plagiarismcheckerx, 2024; Refnwrite, 2018).

Implementing Reference Data Management Best Practices

Implementing reference data management best practices is essential for any organization to ensure data quality, consistency, and compliance with regulatory requirements. These best practices will provide a framework for researchers, students, information users and organizations to follow, enabling them to manage reference data effectively and efficiently. For example, the banking industry faces stringent regulations and security concerns on data privacy, security, and compliance. Consequently, the practices involve the use of stricter access controls, encryption, and auditing processes compared to other industries. In an organization like the Finance department handling payment of civil servants in Nigeria, a student researching the fiscal balance of unpaid salaries of staff in salaries and measures put in place might be faced with a problem of inaccessibility to data sets regarding staff affected and this could jeopardize the research process. On the other hand, industries like healthcare and retail may prioritize data accuracy, security of patients, and consistency to support decision-making and enhance medical diagnosis and treatment experiences.

Effective research data management can contribute significantly to solving scientific problems in several ways. By implementing good RDM practices, researchers can improve the quality of the data used during the research process leading to accurate and reliable results. It can also increase research efficiency by streamlining data organization, analysis, and sharing which can enhance the impact of research outcomes and results needed for decision making.

Finally, RDM enhances the reproducibility and transparency of research results to the academic community, making it easier for other researchers to verify and build upon existing research findings to support their research report and solve scientific problems through

improved data quality, increased research efficiency and transparency.

Common Challenges in Managing Reference Data Tools

Managing reference data tools effectively presents unique challenges that can impact its use for students, researchers and information users:

a. Storage in Siloed data: Most reference data is often stored in isolated systems or departments, leading to inconsistencies and version control issues with the inability to access due to data regulations. For instance, the Coca-Cola Company has data laws that prohibit employees and guests who are not in the ingredients unit from accessing the chemical laboratory where the ingredients for Coca-Cola products are used. As a result, a student undertaking research in this area may have difficulties when performing their study.

b. Inadequate RDM tools: Many organizations rely on spreadsheets to track reference data for decision-making, and during the course of data entry, spreadsheets are prone to errors and are difficult to scale which could alter the data information.

c. Data integration complexities: it is worth noting that Reference data must be synchronized across systems, and without a proper integration process, inconsistencies may arise, increasing operational risk and reducing data reliability for use.

Conclusion

Research is an important component in any academic discipline as it provides access to appropriate research tools, techniques and foundations needed to facilitate the research process and identification of a gap, phenomena. Researchers from every discipline require access to various research tools, and software to conduct their research inquiry, analyze data, and report research findings. Effective Reference Data Management is foundational for any researcher, student and information user to maintain data consistency during the research process, and meet regulatory demands. Researchers need to keep up with data management trends and full use will help their research process smart, discoveries, breakthroughs and successful research. As data complexity and volumes grow, robust RDM practices, supported by advanced tools like Alation, Kohezion will allow researchers, students and information users and businesses to confidently manage, make better decisions, work efficiently and leverage their reference data while embracing automation aimed at driving better decisions and fosters sustainable growth.

Recommendation

To overcome the challenges of Research Data Management and promote best practices that organizations can adopt to optimize their reference data management efforts, the following is recommended:

1. Establishment of Clear Governance and Ownership: Organizations, industries, Schools, and academic libraries must identify key stakeholders, and establish a governance structure with defined, maintained and updated reference data to ensure accountability and compliance with RDM policies and procedures when using information and sharing during research processes.
2. Creation of centralized Reference data repository: With the use of a centralized repository in all institutions for libraries and information science centres, data banks will ensure consistency and ease of access when there is a need for research after a

researcher secures clearance to reduce discrepancies and data quality issues.

3. Implementation of Standardized Data Definitions, Monitoring and Procedures of Data Quality: With the development of standardized definitions, procedures, and guidelines for managing reference data throughout its lifecycle to address data quality metrics, implementation, validation processes, and identifying and correcting errors, inconsistencies through regularly review and update of reference data that is accurate and up-to-date.
4. Facilitating the collaboration and communication of Data Stewards: The collaboration and communication between data stewards, data owners, and other stakeholders like students, researchers and information users involved in reference data management will provide proper channels for feedback and sharing best practices.
5. Development of a Data Management Plan (DMP): The use of developed data management plan will help students, researchers, and information users to collect, organize, store, and share data with sets of clear goals to avoid data management issues and compliance.
6. Provision of training and support on the use of RDM Tools: With the provision of in-house, workshops and training for students, staff, researchers and information users involved in reference data management skills and techniques to be equipped with the necessary skills and knowledge to effectively carry out research, understand and adhere to RDM best practices and guidelines.

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