How Logilab ELN helps Organizations in Research Data Management

What is Research Data Management (RDM)?

Research Data Management (RDM) refers to the methods of recording, organizing, storing, processing, and caring for information that is produced from a research project or used during a research project. It is an iterative and continuous process. The decisions that are taken in the early stages will substantially affect what will be carried out in the later ones. It is the most efficient way to properly manage the data, rather than trying to reconstruct everything after anything occurs. The term is often mentioned nowadays in relation to open science — the general movement in the world of research to make scientific data open, accessible, and reusable.

Importance of Research Data Management

There has been a growth in research-related data for several reasons. But the advancement and use of sophisticated research technology combined with the advent of immediate and low-cost communications and collaboration technology are enabling the creation of massive amounts of research data. These data must be managed properly in order to facilitate quality research.

Research today not only has to be rigorous, innovative, and insightful - it also has to be organized! As improved technology creates more capacity to create and store data, it increases the challenge of making data [FAIR: Findable, Accessible, Interoperable, and Reusable](#) (The FAIR Guiding Principles for scientific data management and stewardship).

To address these challenges, funding agencies require a data management or data sharing plan to be submitted with grant applications. Additionally, many academic journals require the submission of relevant data with manuscripts to promote open access and reproducibility of research. Early and attentive management at each step of the data lifecycle will ensure the discoverability and longevity of your research.

Data Management Plans have been a requirement of various funding agencies for most of the past decade. Governmental agencies have been issuing policies on data and management for much longer. The basics are the same across all of the plans: preserve data & provide access. There are other components to be considered, however the basic premise is to make the data available for future research and evaluation for the purposes of reproducibility, research integrity, further research, or challenge.

The U.S. Health & Human Services Office of Research Integrity web page sums up the reasons which are as follows:

- ✓ To establish good work practices.
- ✓ To teach people in your lab.
- ✓ To meet contractual requirements.
- ✓ To avoid fraud.
- ✓ To defend patents.
- ✓ To allow work to be reproduced by others.
- ✓ To facilitate preparation of formal reports, presentations, and papers.
- ✓ To validate your research.
- ✓ To serve as a source for assigning credit to lab members.

Of all the above reasons, the most basic part of science is the reproducibility of research. Without strong data management policies, documentation, and data management, reproducibility is at risk. Research labs of all disciplines have varying types of equipment, but there is at least one standard among them: Research is to be documented in accordance with the scientific method. Good data is data that is documented, stored, and accessible.

Challenges in Research Data Management

Laboratory data i.e., the data produced in the practice of the scientific method, is not consistently managed within academic labs or even to the level of many academic research institutions. As data on which research is based upon becomes more openly available, Data Management Plans will more often be enforced. Thus, Data integrity, Data lifecycle, Data Security, Perpetual Revision History, Permanence, and unchangeable date & time stamps, will be concerns that will evolve into the management of laboratory research data. Proof of research and discovery is a major concern among researchers and there are more instances of research fraud, unintended or intentional, than most people realize.

Research funding agencies make statements regarding data management and publishers provide for the submission of supplemental data. Yet there are research retractions for faulty and falsified data every now and then. Good data management tools and process can help to limit "bad" research.

Role of an ELN in Research Data Management

ELN in General

There are tools in the marketplace that can help researchers maintain their independence, provide researchers and their administrators with the ability to protect their work product and enable scientific reproducibility. They are Electronic Laboratory Notebooks (ELN). It has been originally designed to replace the analog paper notebook with a much-improved digital version.

Any ELN must have the basic capabilities namely

- ✓ Data integrity - single source of truth
- ✓ Easy but secure readability
- ✓ Revision history (perpetual)

- ✓ Time stamps
- ✓ Electronic signature
- ✓ Ability to comply with regulations related to data accessibility and the security of data and research
- ✓ User access rights management.

When data is entered into an ELN or made to capture automatically – and data means research data, notes, observations, formulas, equations, sketches, data sets, image or any other type of data – the product must have the ability provide the ability to support several interested parties:

- ✓ a funding agency's requirement for a Data Management Plan;
- ✓ the researcher's need to document their research;
- ✓ the administration's need to be able to protect and prove discovery; and
- ✓ the publisher's need to review and publish data supporting the research.

The data upon which research is published needs to be kept in a secure environment, but that environment must also provide for research collaboration. Some cloud-based ELNs provide such a capability, some even to the point of enabling thousands of researchers to collaborate on a single platform for the purposes of data gathering. But security must be contemplated. The ELN should enable different levels of access, comply with industry standard security protocols and, when used in conjunctions with institutional policies, protect personally-identifiable information.

Finally, an ELN must have the ability to scale to support thousands of users combined with the ability to be completely configurable and should be agnostic to scientific discipline.

About Logilab ELN

Logilab ELN is an Electronic Lab Notebook agnostic to scientific discipline where it is put to use and will enable the users to document protocols & procedures, enter lab results, scientific and research observations, notes and other data & perform calculations in a paperless format.

Logilab ELN is a proven and dependable system that provides a fully configurable templates with test/task-based workflow design to meet the needs of both regulated QA/QC and non-regulated R&D operations for industries including pharmaceutical, life sciences, biopharmaceutical, chemical, petrochemical, environmental, manufacturing, food, feed, and dairy.

Logilab ELN is designed to capture data in a spreadsheet like template called as Labsheet or lab notebook. Labsheet templates can be designed by scientists by dragging and dropping generic fields into the Labsheet and creating a form like input template depending on the type of test, experiment or research task. This makes the ELN usable for any digital data capture application for lab personnel, research scientists, process, and process research personnel.

Labsheets can be designed with data fields like text, numeric, dop-down list, date, time, formula, image, hyperlinks etc.,

Logilab ELN also provides protocol-based approach for recording of experiments. Protocols are laboratory procedures and instructions which can be executed in a step-by-step manner and corresponding result outcomes can be recorded. It has very wide variety of rich features namely text data input, research conditions, tables, images, charts, preparation, drawing of chemical structures, equations, tagging of fields, etc.

It ensures easy adaptability, time-savings due to faster configuration and operations and Reduced complexity to use resulting in better customer experience.

Logilab ELN's Role in Research Data Management

1) Logilab ELN can help to store the Data Management Plan (DMP) in a central repository that can be shared among the group of users in collaborative manner. This forms the basis of the best practice for managing the research data.

2) Logilab ELN helps the research organizations to setup independent data security policy, data sharing policy and data retention policy.

3) Logilab ELN has the very important feature namely project management. Using this feature, project id or grand id can be configured which will help the users to manage the research projects. Project team with authorized users (role-based) can be configured in the Logilab ELN.

4) Logilab ELN allows wide variety of data and data types to be collected. It may be raw data, documents, protocols, observations, notes and other data directly from instrument and mobile devices.

5) Logilab ELN allows the data to be enriched with metadata. It is also possible to index and search the data using metadata.

6) The data, records and files can be version-controlled easily.

7) Logilab ELN supports attaching or recording of different image format files.

8) Logilab ELN supports multiple security requirements namely authentication of users (using unique username and password combination), role-based user access permissions, password policy setup and able to work only in authorized network.

9) The data collected and stored can be made to go through review/approval process by using the workflow feature of Logilab ELN.

10) Logilab ELN has the audit-trail functionality by which the actions performed on the data is stored with date and time more accurately.

11) Logilab ELN is more secure in use and complies data integrity principles, Copyright and Intellectual property rights can be ensured for research data as they are stored in a unique and original way in a secured central database.

12) Logilab ELN ensures faster and accurate data accessibility in a user-readable format using easy-to-use flexible search engine (data can be searched with wide variety of criteria). Export using pdf and spreadsheet makes accessibility and readability very easy.

13) Logilab ELN ensures that data is well-documented, properly organized and stored, licensed, easily identifiable, can archived for a specific period and can be easily shared. This makes the task of reproducibility much simpler and accurate.

Following are few advantages that Research users may obtain:

Prevention of data loss and human error

This is achieved by using protected databases and storing information in an organized manner significantly reduces the risk for loss, and tracking experiments, supply quantities and equipment usage prevents unnecessary repetitions and mistakes.

Improvement in research processes

This is achieved by adopting best practices in research activities.

Ensuring continuity

This is achieved by having all information in an easily accessible and searchable format enables different teams to collaborate along the process of research or production, and enables laboratories to continue research done by former lab members.

Fulfilling the requirements for publication

There are many journals require raw data to be submitted along with the manuscript. Using Logilab ELN data can be presented in a user-readable format (PDF, excel, etc), gathering relevant data is much easier when the data is properly structured and organized.

Meeting requirements for funds

Now-a-days, many grant institutions require researchers to provide an RDM plan detailing their methods of research data management. RDM plan can be prepared, approved and stored in the system by using Logilab ELN.

Meeting regulatory requirements

Identifying, formatting, protecting, and structuring research data leads to better protection against compliance infractions and improves organization's ability to comply with regulations.

CONCLUSION

ELNs can support the Scientific Method in ways traditional paper notebooks cannot and Logilab ELN does the same. In addition, it also supports institutional research policies and objectives. It provides a platform for institutional data management and research support.

As a robust ELN, Logilab ELN supports Data Integrity, Data Lifecycle Management, Data Management, Data Accessibility, Collaboration, and Research Reproducibility. In today's world of global collaborative research, digital information, and robust, advanced information technology, ELNs are becoming the "must have" tool for researchers.

For more information about Agaram Technologies' Logilab ELN, please refer to the website page: https://www.agaramtech.com/product/logilab-eln-software/

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