



DELIVERABLE 2.2

GUIDELINES

TO IMPLEMENT AN ELECTRONIC LABORATORY NOTEBOOK IN A RESEARCH CENTRE

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Executive Summary

Electronic Laboratory Notebooks (ELNs) are increasingly recognised as essential infrastructures for documenting experimental work, enhancing collaboration, ensuring data integrity, and supporting alignment with Open Science and FAIR (Findable, Accessible, Interoperable, Reusable) principles.

This document provides practical guidance for the structured and sustainable implementation of ELNs in research institutions.

The proposed framework describes four key steps for the ELN implementation. The first step, **Landscape Analysis**, is a crucial initial phase that provides a snapshot of existing research data management practices and assesses researcher readiness. The second step, **ELN Selection**, focuses on defining institutional requirements and evaluating available solutions based on usability, security, interoperability, cost, and sustainability; this step concludes with the selection of a platform aligned with the needs of the research institution. The third step, **Pilot and Evaluation**, allows the ELN to be tested with representative research groups in order to assess performance and refine workflows. The fourth step, **Training and Capacity Building**, runs in parallel with the other phases to ensure effective adoption through hands-on training, user support, and community engagement.

The adoption of Electronic Laboratory Notebooks represents a strategic investment for research institutions, strengthening institutional data management and research operational efficiency. By supporting reproducibility, transparency, and long-term data stewardship, ELNs provide a foundation for responsible, sustainable, and efficient research practices.

Disclaimer: CIIMAR EXPERIENCE

This document is based on a case study of the ongoing Electronic Laboratory Notebook (ELN) implementation at **CIIMAR – Interdisciplinary Centre of Marine and Environmental Research**, carried out within the framework of the **FAIRWAY project action**. At CIIMAR, the ELN implementation is currently in an ongoing pilot phase, and the content reflects preliminary findings, the institutional context, and the evidence available at the time of writing.

A subsequent version of this document will be issued following the completion of the CIIMAR ELN implementation, with the aim of presenting a more comprehensive and validated account of workflows, outcomes, and best practices.

Introduction

The digital transformation of research has profoundly reshaped scientific practices across disciplines. Data is now a central asset of scientific activity, making its secure, transparent, and reproducible management throughout the research lifecycle essential. In parallel, the global move toward Open Science and the increasing requirements of funding agencies place growing expectations on research institutions regarding data integrity, traceability, openness, and long-term preservation.

In this context, the digitalisation of research workflows has become a strategic priority for universities and research centres. Electronic Laboratory Notebooks (ELNs) are key components of this transformation. Far more than digital replacements for paper notebooks, ELNs operate within a networked digital environment through their import and export functions and seamless interfaces with other software tools. As such, they can play a central role in an institution's Research Data Management (RDM) strategy, supporting the consistent handling of data, metadata, and documentation across the research lifecycle.







ELNs also enable and enhance collaboration, both within research groups and across institutional or disciplinary boundaries, by providing a shared and structured working environment. By facilitating the systematic tracking, tracing, and documentation of research processes and results over time, ELNs make a significant contribution to Good Research Practice (GRP), while reducing the risks of data loss and strengthening data security.

By standardising documentation practices and enabling controlled access, versioning, and long-term preservation, ELNs directly support the FAIR data principles by improving the findability, accessibility, interoperability, and reusability of research data, for example through the use of metadata, tags, and persistent identifiers (PIDs). Recent institutional experience indicates that successful ELN adoption requires clear governance structures, shared guidelines, and sustained user support, positioning ELNs as a cornerstone of FAIR, high-quality, and trustworthy science.

The Action Plan

This document provides practical, **step-by-step guidance** for the implementation of an Electronic Laboratory Notebook (ELN) in research centres and universities. It outlines the implementation process in four steps, reporting a general overview, the purpose, key activities, and expected outcomes for each.

The proposed action plan for ELN adoption is structured into four clearly defined, action-oriented steps, each corresponding to a distinct stage of implementation. Each step is guided by a primary action verb that defines its main objective and focus, and is designed to build systematically on the outcomes of the preceding step. Together, these steps form a coherent and progressive implementation pathway that supports effective decision-making, adoption, and long-term integration of ELNs within the research environment. Bearing in mind that each institution may require a solution tailored to its specific needs.

STEP  1 Landscape Analysis	Assess 
STEP  2 ELN Selection	Select 
STEP  3 Pilot and Evaluation	Test 
STEP  4 Training and Capacity Building	Enable 

STEP 1: Landscape analysis



Assessing Current Practices, Tools, and Researcher Readiness

General description

The first step of the ELN implementation process consists of a comprehensive landscape analysis aimed at understanding current research data management (RDM) practices, existing digital tools, and the overall readiness of researchers within the institution.

This stage provides the foundational evidence needed to support informed decision-making in subsequent implementation phases.

Purpose

This step aims to guide ELN selection by ensuring alignment with research workflows, disciplinary needs, and institutional priorities, while identifying adoption barriers and support needs.

Key activities

- **Assess** how research data are generated, documented, stored, shared, and preserved across research groups.
- **Capture** the diversity of research practices, data types, and documentation standards across disciplines.
- **Identify** gaps, inefficiencies, and risks related to data loss, reproducibility, and compliance with institutional and funder requirements.
- **Map** existing digital tools in use (e.g. shared drives, cloud services, laboratory systems, ad-hoc solutions) to avoid duplication and ensure interoperability.
- **Collect** quantitative and qualitative data through surveys, structured forms, and targeted interviews. Evaluate researchers' digital literacy, previous experience with ELNs or similar tools, and expectations regarding usability, functionality, and support.
- **Engage** researchers early to foster awareness, trust, and commitment.

OUTCOMES

- ✓ A clear, evidence-based overview of current RDM practices and digital tool usage within the institution.
- ✓ Identification of user needs, risks, and readiness levels to inform ELN selection and implementation.
- ✓ Increased researcher engagement and institutional buy-in, reducing resistance and supporting sustainable ELN adoption.

STEP 2: ELN selection



Defining Requirements and Choosing a Fit-for-Purpose Solution

General description

Step 2 focuses on selecting an Electronic Laboratory Notebook platform that best fits the institution's research workflows, technical infrastructure, and strategic priorities. Building on the evidence gathered during the landscape analysis, this stage involves defining functional and technical requirements, engaging IT and research support services, and systematically evaluating available ELN solutions. The process emphasises transparency, comparability, and alignment with long-term sustainability and compliance needs.

Purpose

The purpose of this stage is to ensure that the chosen ELN:

- Responds to real user needs and disciplinary diversity
- Integrates effectively with existing institutional systems
- Meets security, compliance, and data protection requirements
- Represents an optimal balance between functionality, cost, and sustainability

Key activities

- **Analyse** survey and interview results to identify common and discipline-specific requirements
- **Coordinate** with IT staff early to define technical constraints and integration needs
- **Identify** required ELN features (e.g. collaboration, data capture types, instrument and system integration)
- **Compare** open-source, commercial, and in-house ELN solutions
- **Validate** technical and functional features, including:
 - a) *Hosting options (local vs. cloud)*
 - b) *Data protection, security, and authentication*
 - c) *Backup and confidentiality controls*
 - d) *Interoperability, usability, and scalability*
 - e) *Experiment documentation, versioning, and export options*
- **Use** structured tools (e.g. ELN Finder) and provider demonstrations to support comparison
- **Develop** an ELN comparison matrix to support transparent, evidence-based decision-making

OUTCOMES

- ✓ A clearly defined set of institutional and laboratory-specific ELN requirements
- ✓ Shortlisted ELN solutions evaluated against transparent selection criteria
- ✓ A documented comparison matrix supporting cost–benefit and sustainability analysis
- ✓ Selection of an ELN solution that is technically viable, user-oriented, and aligned with institutional research and Open Science objectives

STEP 3: Pilot and Evaluation



Testing the ELN in Real Research Environments

General description

Step 3 focuses on piloting and evaluating the selected ELN in real research settings. This phase allows institutions to test the ELN platform selected, under practical conditions, assess usability and performance, and evaluate how well the tool integrates into existing research workflows. Beyond technical testing, the pilot phase is also critical for fostering community engagement, collaboration, and confidence among researchers prior to full-scale deployment.

Purpose

The purpose of this stage is to validate the suitability of the selected ELN in real-world research contexts by identifying usability issues, workflow challenges, and integration gaps, while gathering structured feedback from researchers and laboratories.

Key activities

- **Establish** representative pilot groups composed of volunteer laboratories from different disciplines and data practices
- **Encourage** inter-laboratory participation to promote shared learning and cross-disciplinary perspectives
- **Begin** with a limited number of laboratories to enable controlled testing and close monitoring
- **Designate** a local ELN contact point in each laboratory (e.g. lab manager) to liaise with PIs, IT services, and the Data Management Office
- **Provide** standardised templates for experiments, protocols, and metadata
- **Monitor** usage patterns, adoption levels, and technical performance throughout the pilot

OUTCOMES

- ✓ Validated evidence on ELN usability, performance, and workflow integration
- ✓ Refined templates, configurations, and support materials based on user feedback
- ✓ Identification of barriers, training needs, and technical adjustments
- ✓ Increased researcher engagement and readiness for broader ELN deployment

STEP 4: Training and Capacity Building



Ensuring Adoption, Quality of Use, and Long-Term Sustainability

General description

Step 4 focuses on training and capacity building as the cornerstone of successful ELN implementation. This stage ensures that researchers have the skills, confidence, and ongoing support needed to use the ELN effectively and consistently. Training activities combine practical instruction, documentation, templates, and responsive support services, and are designed to embed ELN use into everyday research practice across laboratories.

Purpose

The purpose of this stage is to:

- Maximise ELN adoption and quality of use across research groups
- Support a smooth transition from paper-based to digital workflows
- Reduce resistance to change through early engagement and tailored training
- Build long-term institutional capacity for sustainable ELN use

Key activities

- **Start** training and awareness-raising early (from STEP 1) and continue in parallel with all implementation phases
- **Apply** a flexible, “soft” training approach adapted to different levels of digital literacy
- **Deliver** hands-on training using diverse formats (workshops, tutorials, documentation, templates, and live support), including onboarding, vendor-supported sessions, and peer-exchange events.
- **Engage** the research community by addressing concerns and resistance, particularly among some PIs and research groups. Involve bachelor’s and master’s students, PhD candidates, and early-career researchers as key drivers of adoption, leveraging them as bridges between implementation teams and senior researchers.

OUTCOMES

- ✓ High adoption rates and consistent ELN use across laboratories
- ✓ Improved data organisation, documentation quality, and reproducibility
- ✓ Increased researcher confidence and digital competence
- ✓ Reduced resistance to change and smoother cultural transition
- ✓ Sustainable, institution-wide integration of ELNs into research practices

CONCLUSION:

Benefits and Challenges of Implementing Electronic Laboratory Notebooks

The adoption of Electronic Laboratory Notebooks (ELNs) offers substantial benefits for research centres and universities, while also requiring careful management of organisational, cultural, and technical change. When effectively implemented, ELNs **accelerate scientific discovery** by enabling structured documentation, improving traceability, and supporting timely sharing of research activities. These capabilities reduce duplication of effort and foster more collaborative and reproducible research environments.

ELNs also provide significant **educational value**. As living digital records of real research workflows, they function as powerful training tools for students and early-career researchers, promoting good research data management practices and offering insight into experimental design, data analysis, and the iterative nature of scientific work. In doing so, ELNs help embed responsible research practices early in scientific careers.

Furthermore, ELNs **contribute to transparency and public trust**. Within ethical, legal, and intellectual property constraints, improved access to well-documented research processes aligns institutional practices with growing expectations for accountability, particularly in publicly funded research, and supports broader engagement with Open Science principles.

Successful ELN adoption, however, depends on recognising that ELNs are not merely technical tools but socio-technical systems embedded in everyday research practice. Institutional commitment is essential: ELN implementation should follow a **top-down approach**, with leadership-driven decisions, dedicated resources for software, support and training, and the formalisation of ELN use through policies and best-practice guidelines.

At the same time, sustainable adoption requires **bottom-up engagement**. Meaningful and lasting use depends on researchers' personal conviction, perceived benefits, and alignment with disciplinary workflows.

Addressing **cultural concerns**—such as intellectual property, data security, usability, and extra workload —through clear communication, tailored training, and continuous support is therefore critical.

Although the **learning curve** can be demanding and requires researchers to dedicate time to training and adaptation, this initial effort is a critical component of successful ELN adoption. Over time, it is rewarded with more efficient workflows, stronger collaboration, improved data quality, and increased confidence in research results.

From a strategic perspective, ELNs are a key **enabler of Open Science and FAIR data** practices. As scalable and adaptable infrastructures, they support reproducibility, long-term data stewardship, and evolving research needs. Investing in ELNs thus positions institutions to meet future scientific challenges while fostering a more open, collaborative, and robust research ecosystem.

