Choosing and implementing a LIMS in a small laboratory

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Small laboratories can face substantial information demands despite even modest sample volumes.

A single analyst may register samples, perform tests, review results and prepare reports, while information remains split between paper, spreadsheets and instrument files. A laboratory information management system (LIMS) can connect these activities and improve control of the sample record.

Its value, however, depends on a close fit with the laboratory's workflow and the capacity of the team in a small laboratory to maintain it.

This paper sets out a practical approach to defining requirements, selecting a system and introducing it in manageable stages.

Define the sample journey

The starting point is to understand the path drawn from the receipt of a sample to an authorised report. Therefore, record how samples are identified, what tests are requested, where they are stored, who performs each step and how results are reviewed. Include rejected samples, repeated tests, corrected results and amended reports. These exceptions can expose weaknesses that a demonstration which is based solely on routine work will miss.

A useful first deployment may cover registration, status tracking, result entry, review and reporting. Barcode labels, instrument transfers and order-system links can follow where they remove a real handoff or transcription step. A LIMS should preserve sample identity and link the final result to its underlying observations, units, calculations, analyst and reviewer. The laboratory remains responsible for defining methods, acceptance criteria and release authority. Software can apply those decisions but that does not mean that it makes them scientifically sound.

Nothing stays the same, so be prepared for workflow requirements that will vary. Routine testing may call for predictable test panels, specifications, due dates and certificates of analysis. But research work may require flexible sample descriptions, changing protocols and links to experimental records or reagent lots. Supervisors should test whether the software supports the actual work that is required – including deviations – rather than assume that a long list of features will be able to translate into an efficient process.

A workflow map should distinguish data capture from decisions. For example, a test result may be imported automatically but a trained person still has to investigate an out-of-specification value and determine whether a repeat of a test is justified.

Define the status terms which users will see, such as received, in progress, awaiting review and released. Consistent status definitions help a supervisor identify genuine delays without interpreting each analyst's private spreadsheet. This will also make it easier to explain processes to any new staff members and for a supplier to configure the system.

Build traceability into everyday work

A structured electronic record can make it easier to find outstanding work and reconstruct a reported result. For laboratories working to ISO/IEC 17025, information management and reliable reporting form part of the broader system for demonstrating competence whereby the standard explicitly recognises computer systems and electronic results.1 The controls required in any particular laboratory still depend on its activities, accreditation scope and other applicable obligations.

Consider what must be retained when a result changes. The original entry, reason for correction, identity of the person making it, date and approved version may, ultimately, all matter.

Compare total costs across several years of use and not just the initial licence period



Permissions should reflect job roles and audit trails should be understandable to reviewers. In applicable GxP settings, data integrity guidance emphasises the ability to reconstruct processing and review activities.2 Electronic signatures and US 21 CFR Part 11 controls should be specified only where the relevant records and regulatory rules bring them into scope.3 Buying a system advertised as compliant cannot replace appropriate procedures, training and testing.

Instrument connections can reduce re-entry but they can also introduce questions of their own such as which sample identifier is sent, which value and unit return, how failed transfers are handled, and whether a reprocessed result can be distinguished from the first, or prior, result that was recorded. A small laboratory should prioritise interfaces for clarity and ease of use, and test both normal and exceptional cases before relying on them.

Evaluate suppliers against real work

Write a short set of requirements from one or two representative sample journeys. Separate essentials for launch from later improvements. In a supplier demonstration, use anonymised examples and ask a working analyst to register a sample, enter or import results, correct an error, approve a report and retrieve the record behind it. Ask the supplier to identify what is standard, configurable, custom-developed or dependent on another product. These distinctions affect implementation time, support and the need or desirability of future upgrades.

The supervisor should also establish who maintains test lists, specifications, report templates and user permissions after go-live. A highly configurable product is useful only if the team can safely manage that configuration. References from laboratories of similar size and discipline may reveal how much internal effort was needed and whether support has been responsive.

Compare total costs across several years of use and not just the initial licence period. Include configuration, migration, training, validation where required, instrument interfaces, subscriptions, support, internal staff time and changes post-launch. Model the per-user, and per-sample, charges using realistic growth projections. A hosted service may reduce local server work, but assess availability, backups, recovery, security responsibilities, data location and any exit terms in your service provider's contract. Ask for an export of a complete sample record, including attachments and relevant history, in a form that remains intelligible without the supplier's interface. WHO guidance on computerised laboratory information systems likewise highlights access control, backup and continuity of information.4

Confirm with prospective suppliers about routine maintenance as well as installation. Who tests updates, how much notice is given, and can the laboratory defer a release while it completes its own checks? Clarify service hours, response targets and the route for recovering data after an outage. For a small team, a simple arrangement with clear ownership can be more valuable than an elaborate set of features that require near constant specialist attention.

Implement a controlled first phase

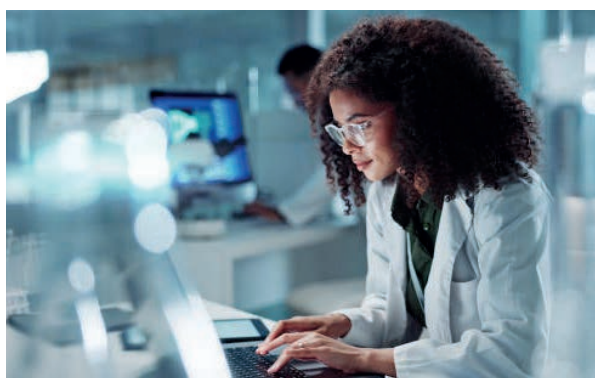
Begin with a complete, high-value process rather than configuring every possible function. Agree the scope, ownership and acceptance criteria before the process of configuration starts. Ensure clean reference data such as test names, units and limits. Historical spreadsheets may contain duplicate identifiers or incomplete records so it is important to decide which data must be migrated, and reconcile them before import, as well as following up with verification of a sample afterwards. Older records can remain in a controlled archive if staff know how to retrieve them and retention requirements are met.

Testing should balance requirements and risk. Check sample identity, calculations, permissions, reports, amended results and interfaces with both normal and adverse examples. For regulated work, document the plan, expected outcomes, deviations, approvals and the effect of subsequent changes. Installation, operational and performance checks can provide useful structure, but the evidence should demonstrate fitness for the laboratory's configured use. Supplier testing alone does not establish that a local workflow is implemented and is fit-for-purpose as intended.

Train staff with the tasks which they already have high familiarity and use their institutional knowledge to flag unnecessary screens or confusing handoffs. A phased launch by sample type can limit disruption while the team resolves issues. Before go-live, assign responsibility for reference data, access requests, change control, backup checks and supplier contact. Keep a clear route for recording errors and deciding whether to pause reporting or use a controlled fallback process.

The transition needs an explicit cutover point. State when new samples enter the LIMS, who checks open work at that point and how results begun in the previous system will be completed. Keep a reconciled list of active samples so none can disappear in the shift between systems. During the first weeks, a named owner should review incidents and agree controlled corrections promptly. This short period of close supervision is especially valuable when routine testing must be kept running by the same staff.





Measure whether the system helps

Take a baseline before deployment with records of time to find a sample, number of manual data transfers, overdue work, report corrections and turnaround time. Review the same measures after staff have used the LIMS for routine work.

Also consider whether staff have introduced parallel spreadsheets or even paper workarounds, given that their sudden appearance may indicate missing functionality or additional training needs. Interpret changes in light of sample volume and staffing, rather than attributing every improvement to deployment of the software.

A small laboratory has finite time for administration, so each added module or interface should earn its place 'on the team'.

Once the first workflow is stable, observed bottlenecks can guide investment in inventory control, instrument links or further reporting. The most effective LIMS is one that keeps the sample record coherent, supports sound review and can be maintained by the people who use it.

Contact details

More detailed papers covering all the points above and including worked examples can be requested from the author to help justify your next LIMS project.

Please email Dr Phil Williams, at phil@lims4u.co.uk or visit the LinkedIn group 'LIMS4U'. Phil has more than 40 years of experience in laboratory automation. He founded LIMS4U in 2019 and offers LIMS marketing services primarily through LinkedIn.

References

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