

Deciding on the right Electronic Laboratory Notebook – Not as simple as it looks!

Searching for the right Electronic Laboratory Notebook (ELN) has many organizations turned upside down. Because the Paper Laboratory Notebook (PLN) is at the heart of most research activities it is often treated as sacred space for the research community. Replacing the PLN with an ELN is often considered to be a one-for-one replacement project – simply automate the paper notebook process. As anyone who has been through a PLN replacement will admit, it's not so simple.

Perceptions of an ELN

From the outside looking in, it seems straightforward – capture experimental notes in the PLN: hypothesis, experiment, results, analysis, conclusions, sign and date, witness and date, archive – DONE! Yet, with the researcher being the point of integration, there are many important activities going on that the researcher makes up for with time, talent, and scissors. Also, the framework of the PLN is quickly left behind as visions evolve for the ELN: dreams of electronically searching personal notebooks; searching across multiple researcher notebooks; automatic integration of data sources, instrumentation, analytical tools, and more; ability to capture ad hoc information/notes; automatic review and approval; archiving; detailed intellectual property protection; etc. Perhaps it really isn't so simple after all!

Another complication is the variation in researcher workflow. Just within the chemistry domain alone there are many disciplines and the workflows vary greatly. Whereas a discovery chemist needs a great deal of flexibility in his/her work, a process chemist is structured in their workflow. System interactions are also different. The sign-off process may be quite different from one group or domain to the next. In addition, linkages upstream or downstream can be different. Now consider analytical chemists, synthetic chemists, and how about biologists.

Finding an ELN

Of course, there are many ways that companies approach the process of finding an ELN. Several different methods are described here:

1. *"We'll know it when we see it"*: This particular method is a favorite going back to the heyday of LIMS (Laboratory Information Management System). It involves countless people going to countless demonstrations of countless systems. It allows the vendor to show off their product hoping to stir interest by hitting at least one hot button for each of the key people attending the demonstration.
2. *"Try it, you'll like it"*: Otherwise cast as "The Pilot" of software allowing researchers to play with the system for anywhere from just a few days to months. The pilot gives people freedom to come and go when they have time. It is usually open and ad hoc with little structure. Without that structure however, the only barometer is "did you like it?"
3. *"Request for Proposal (RFP)"*: Depending on the company, a formal RFP process may be required. This is the classic approach to acquiring systems which could come after one of the above approaches. Few RFP's are done well. Many are written in such a way that it is too easy for vendors to be "yes men".
4. *"Make it up as you go along"*: In the absence of objectives, some groups stumble from one approach to the next. Try some demonstrations; create a bulleted list of requirements; stick them in an RFP; invite several vendors to pilot their solution; vote on the vendors each step of the way. In the end, researchers can get worn out during this approach evolving into skepticism wondering if any solution will ever occur.

5. “Wait ‘til next year”: Unless everything magically lines-up exactly in any of these approaches, a clear solution with buy-in from all stakeholders is rarely apparent, thus the only decision is to postpone the decision.

This is all reminiscent of a famous exchange:

<p><u>Alice</u>: Oh, no, no. I was just wondering if you could help me find my way. <u>Cheshire Cat</u>: Well that depends on where you want to get to. <u>Alice</u>: Oh, it really doesn't matter, as long as... <u>Cheshire Cat</u>: Then it really doesn't matter which way you go. Lewis Carroll, Alice in Wonderland</p>

A Structured Approach to ELN Definition & Selection

The course of action to defining and acquiring an ELN requires a structured approach based upon business objectives that support the organization’s business processes.

First, determine business drivers for the ELN project. There could be one overriding objective or several including: to increase research productivity and effectiveness; to broaden the ability to search experiments and results across the company; to link experiments in related areas; to better protect intellectual property, etc. While there may be far more benefits that come of an ELN, it is critical to establish a foundation for the initiative with measurements of success.

Second, orchestrate an approach that involves the researchers. Whether the ELN is targeted for all researchers, all chemists, all medicinal chemists, or some other subset, it is crucial that every group be well represented on the project team. That said, the approach needs to optimize people’s time and input so they can continue to conduct research while providing valuable insights to their current business processes and preferred workflows.

Next, take time to clearly understand current workflows. Workflows differ with researcher type. Also, there are variations on systems they use, data sources required, analysis they provide, what they are required to capture in notebooks, the approval process, etc. Use the understanding of current workflows and knowledge of industry standards to derive future workflows. Strong researcher representation and solid facilitation is crucial to the decision-making on future workflow definitions. Without understanding workflows, it may be easy to assume that one notebook fits all.

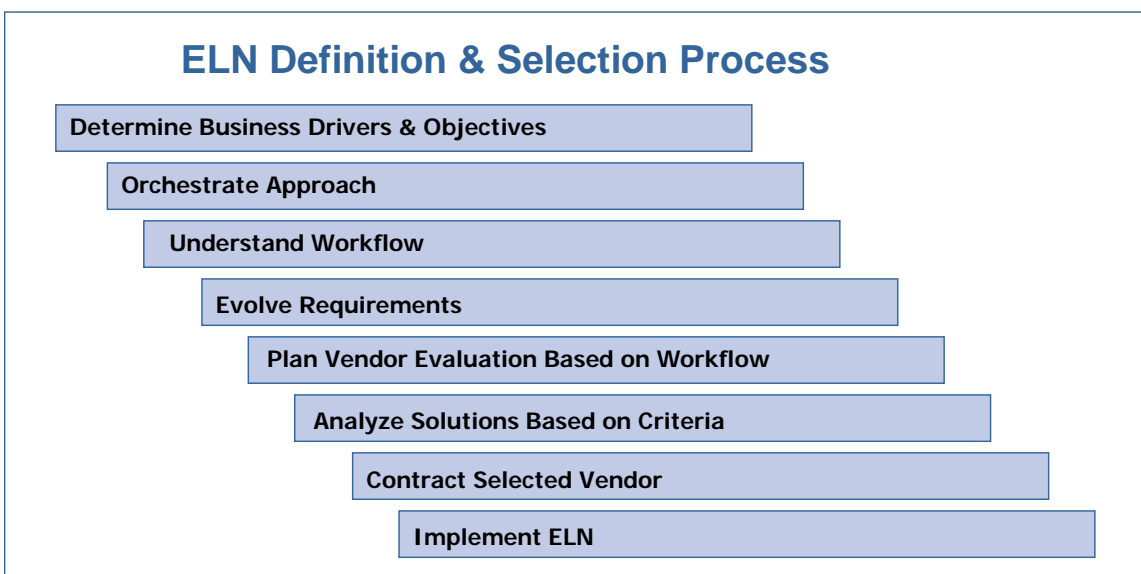
With workflows in-hand, evolve the requirements. Requirements are best stated in terms of a researcher’s ability to perform a function (e.g. a peer researcher requires the “ability to” review and electronically sign a closed experiment.). Once captured, requirements should be weighted to facilitate tradeoffs that will inevitably arise when comparing multiple vendor offerings, and to drive user acceptance testing later in the process. This is especially critical if any of the groups using the ELN will require it to be validated for regulatory purposes. After a baseline set of requirements are drafted, strong researcher participation and facilitation will be required to refine and agree on priorities.

At this point attention turns toward vendor solutions. Carefully plan and execute the vendor interactions. Vendors need to be responsive to workflows and requirements in both written form and in how they demonstrate solutions. Put the onus on the vendor to show how they meet workflow needs. If they don’t show it, likely they cannot do what you need.

Have a process for reviewing and analyzing vendor solutions. Pre-agreed criteria should consider the ability of the vendor products to meet requirements and map to workflows with the current product version as the starting point. Reduce the candidate systems to two or three solutions that

if chosen will meet the needs. Customer reference checks and costs could also be a rated factor at this point in the process or these could be left to due diligence during the negotiation process depending on the procurement process.

Finally, have a strategy for the contracting process and for implementation. Often these are serial processes. However, there are ways that the activities can be managed together. For example, a working installation, over a defined period of time, with the selected vendor can be of value. The installation should serve as a preview to how the system will truly be used after implementation using workflows based on an agreed future process and supporting configurations. The use of the system should be focused rather than being a time to “play” with the system. This is a time of collaboration between the users and the selected vendor, when issues can be resolved, configurations refined, and implementation expedited. It also leads more rapidly to a return on investment for the client.



Conclusions

Electronic Laboratory Notebooks are not direct replacements for paper notebooks. ELNs deliver so much more, and they represent a major opportunity to improve the way research is conducted. ELNs are informatics solutions which require a structured approach to define workflows and requirements, to evaluate vendor solutions, and then to carefully implement the best solution for the organization.

At the heart of the approach are the researchers whose future workflow is at stake. A structured, well managed approach will optimize the use of their time. It will allow for variations among researcher workflows. It will ultimately get them a system they will want to use while making them more effective. In the end, they will look back on the process and say *“we couldn’t have done it any other way.”*