BaseSpace® Clarity Lab Information Management System (LIMS): Why Buying is Better Than Building

New LIMS users highlight the 4 main reasons for purchasing LIMS.

Introduction

The complexity of data in research and clinical genomics labs means a lab information management system (LIMS) is a necessity. A LIMS provides greater reproducibility of sample results, minimizes error introduced into the workflow, and enables greater user productivity. The question is no longer whether a LIMS is needed, but whether to build one or buy one.

A full-featured LIMS manages laboratory data from when samples are acquired to when results are reported. However, the unprecedented throughput, experimental complexity, and rapid change associated with genomics, and next-generation sequencing (NGS), create unique challenges for a LIMS. The rapid timescales and expanded workflows require a LIMS that can be configured quickly and easily to accommodate the specific instrumentation chosen by a lab. Scientific programmers and bioinformaticians must be able to adapt the system to support changing technologies and protocols easily. A LIMS must also be able to support the iterative, collaborative work conducted by the different types of scientists engaged.

While most of these scientists agree on the need for a LIMS, many labs grapple with the decision to build one or buy one from a qualified LIS/LIMS vendor. Although many industries are experiencing an increase in the number of homegrown systems,[1] the complexity associated with life sciences makes LIMS development something best left to reputable vendors.

This application note highlights the experience of several labs who have deliberated over whether to buy or build a LIMS, and presents 4 key reasons that guided their decisions.

Purchasing was a Better Use of Resources

Few can do what bioinformaticians do. They employ a specialized set of knowledge and expertise from many disciplines to help others understand biological data. Likewise, scientific programmers, who are often employed in labs, possess a specialized set of skills. While bioinformaticians and programmers are good at wearing many hats and might enjoy the challenge of building a LIMS, their time is better spent elsewhere, instead of tracking samples.

In its first 2 years of operation, a major epigenomics center experienced a 15-fold increase of Illumina sequencing systems as a result of continual reagent and software improvements. Combined with an increasing number of NGS projects, the bioinformatics team saw a clear need for a LIMS to centralize its genomics and NGS research.

They initially considered building a LIMS from scratch to make sure that it would be compatible with the customized downstream analysis tools that the center planned to use. Indeed, one of the major advantages of building an in-house LIMS is that it provides the ultimate

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in customization to meet the particular requirements for each lab. However, developing a LIMS takes a significant investment of time, money, and human resources. The bioinformatics team calculated that a do-it-yourself solution could consume tens of person years and hundreds of thousands of dollars. The ongoing expense of dedicated in-house LIMS support and maintenance costs also contribute to the total cost of ownership. They considered that while a customized system would adapt to their lab now, it might be inflexible when lab needs change.

A well-known contract research lab experienced a similar dilemma. When they saw the need for a LIMS, they estimated that building their own system would consume numerous resources to develop and maintain. Both labs eventually purchased LIMS and are glad they did. In both cases, the bioinformaticians indicated that they preferred working on the science-related aspects of analysis rather than sample tracking, especially when they found the right LIMS. And, when bioinformatics staff can focus on analysis, data and results can get to patients and customers more quickly.

Radium hospital in Norway went down a slightly different path but arrived at the purchase of a LIMS for similar reasons. They initially investigated many of the available freeware applications, thinking they could build on top. But they eventually realized the work would require them to hire a new resource.

Efficient use of resources is a concept that extends past the acquisition of a LIMS. When the right LIMS is purchased, it goes on to protect use of lab resources. Less time is spent on sample tracking, errors are reduced, and many of the better LIMS include features to monitor instrument performance and get the most out of costly reagents.

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Flexibility can be Found in the Right LIMS

A major epigenomics center originally resisted the notion of a vendor-made LIMS. After all, they needed a LIMS flexible enough to meet their specific needs, now and many years into the future. They needed integration capabilities and built-in support for their Illumina sequencing systems and Illumina Infinium genotyping platforms. They needed the ability to connect to their custom analysis tools, which were written in various programs including PERL, Java, R. etc. All this and they needed a long-term solution that could scale with future increases in NGS throughput and frequent changes in lab and analysis workflows. They wondered if an off-the-shelf LIMS does all these things.

The center elected to purchase a commercial LIMS specifically designed for genomics and NGS research. They chose a LIMS that integrates seamlessly to NGS platforms from industry leaders such as Illumina. Within a few months, data from its 3 sequencers was being passed seamlessly through the LIMS via an application programming interface (API) to their existing data analysis pipeline.

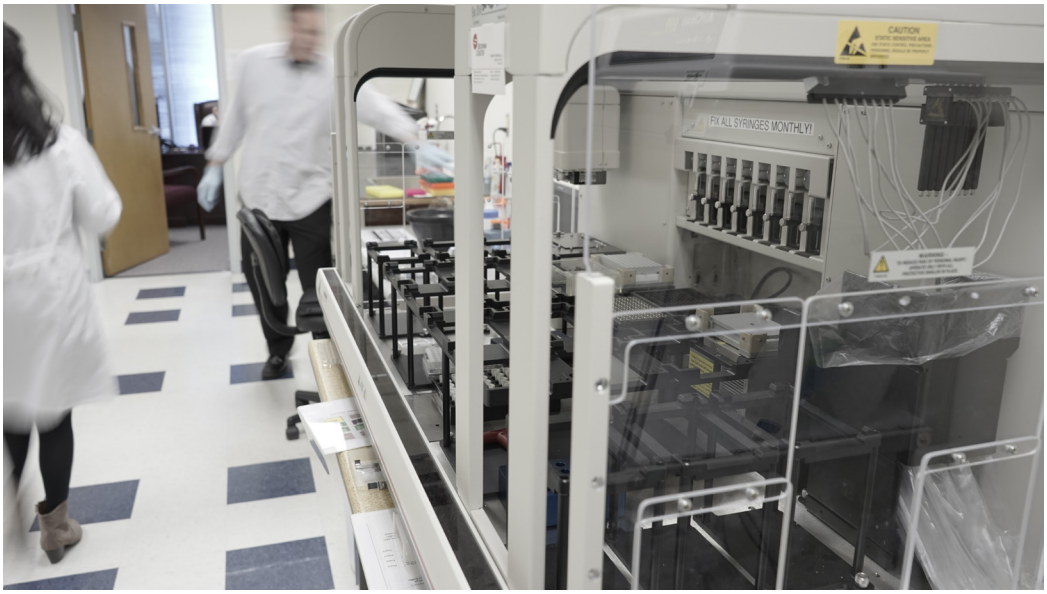
This is in contrast to the 2 years it would likely have taken to build its own LIMS. The LIMS provided a base for which the center could scale their throughput to current levels, which includes runs from 5 Illumina sequencing systems and 2,000 Illumina Infinium genotyping samples per week.

The need to customize is why many labs embark on the journey to build their own LIMS. However, this argument is now moot, thanks to comprehensive application programming interfaces (APIs) and out-of-the-box instrument integrations. A robust API can do everything from integrating with upstream or downstream tools to automating routine tasks, such as liquid handling robots or kicking off pipeline protocol steps. Applications continue to grow, as many API users routinely post and share scripts, creating libraries that add to the value and utility of an API. Many labs claim that a good API provides the best of both worlds: it enables customization and integration with in-house systems, but also satisfies the need for developers or bioinformatics staff to build from a common platform—all while going easy on resources.

Likewise, out of the box integrations with instrument vendors such as Illumina negate the notion that a vendor LIMS can't fit with the instrumentation and tools that each lab already has in place. BaseSpace Clarity LIMS, for example, comes standard with nearly 40 different workflows. Additional workflows can be created in the user interface by nonprogrammers. LIMS vendors who work closely with instrument vendors develop the best integrations and are therefore at an advantage over vendors who don't have these relationships.

Scalability is About Technology and People

The University of Washington Northwest Genomics Center originally developed its own LIMS because the available commercial software did not support its specialized needs. However, when it came to scaling from 3 to nearly 20 Illumina sequencing systems, the center didn't have the time necessary to develop a system capable of handling the expanded throughput. "Building made sense at the



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time, although we quickly found out the development costs add up," explained Mark J. Rieder, Ph.D., who managed the deployment of the LIMS. "That includes paying developer salaries and people's time to sit down and think about the whole problem. Overhead associated with the LIMS must not detract too much from the science that's being done." Whether a lab builds or buys, a LIMS should ultimately scale to its growing throughput and support the lab with fast turnaround and efficiency.

Rapid integration to instruments and the ability to scale to future workflow changes was a key consideration in choosing a commercial LIMS, and the Northwest Genomic Center ultimately selected GenoLogics. Implementation took only 3 months, even as their programmers redefined workflows, created new protocols, and installed new instruments during the process. Johanna Swanson, previously a scientific programmer at Northwest Genomics Center, noted that she spent more time defining requirements for new workflows than writing scripts to enable them.

Labs not only have to consider what technology platforms will be required to meet future demands, but they also have to think about the skill sets of lab staff and how they will evolve. Any environmental changes require additional developer or bioinformatician resources, such as increased throughput, a new instrument, or staff attrition. For example, when Cancer Research UK (CRUK) realized they needed a LIMS, they first looked at vendor solutions, but ultimately decided to build their own because they wanted to customize it to their environment. One of their chief bioinformaticians built an excellent LIMS system for their lab that they used successfully for many years. As a result, much of the knowledge of the system resided with that one bioinformatician. However, when he announced that he was leaving, the lab faced a difficult decision: try to find a bioinformatician with the same skill set or purchase a new LIMS. In the end, they decided to purchase, knowing that with a commercial LIMS, the cost of change would be transferred to the vendor.

The User Experience is Highly Valued

According to the Harvard Business Review, IT projects fail at an alarming rate due to poor implementation or adoption.[2] "LIMS can definitely fall into this category because these systems have a long history of being rigid, unusable, and inflexible," says Michael Elliott, founder, CEO, and chief analyst at Atrium Research and Consulting.[3] Therefore, it makes sense to pay attention to the usability and user experience of a LIMS, whether it is built or purchased.

"We called our homegrown system FrankenLIMS," said one lab manager. He was describing a LIMS built by the biotechnology company where he worked. "We didn't understand how hard it would be to build and maintain such a system, and the result was a system that morphed and changed as scientists redesigned fields, reused components, and created cross-references. Ultimately, we were working around the LIMS to solve problems the LIMS was creating."

"Commercial systems have the potential to resemble FrankenLIMS too", said Elliott, "but that is changing as more LIMS vendors are rethinking LIMS design from the perspective of users."

According to the Technology Acceptance Model (TAM), an information systems theory proposed by Fred Davis, 2 factors prevent adoption of new technology: perceived usefulness and actual ease of use. Generally, the more intuitive something is, the more likely it will be adopted because users have to spend less time learning it and don't form negative attitudes toward it.[4] All these things ring true for software that is both built or bought, but vendor software may have an advantage over internally built software.

User experience has become an important part of the vernacular, especially in technology. Software vendors now hire user experience (UX) engineers or designers. People who fill these positions gain a deep understanding of users and evaluate usage data to design experiences that engage users and simplify user tasks. Vendors such as GenoLogics, who are interested in providing a good user experience, routinely conduct user experience testing to design new intuitive features that reflect scientist workflows.

The right vendor LIMS can help protect resources, adapt to your environment now and in the future, and provide an experience that lab staff want to repeat.

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Software that is developed with the user experience in mind has a better chance of successful adoption because it is more intuitive and easier to learn. Labs who have developers or bioinformaticians building a LIMS are likely aware of the concept of user experience, but don't have the time or resources to devote comprehensive UX studies.

Another thing that favors vendors is that they focus on software development. They have access to more processes, more test resources, feedback from a diverse set of customers, and competition from other vendors. Software development life cycle processes, such as Agile, help vendors quickly develop new features, and fine-tune processes to make sure that these features are free from bugs. Competition from other vendors also provides pressure to be the best and quickest at developing new features.

Conclusion

Although there has recently been a resurgence of build decisions for LIMS noted in the media, the scale still tips in favor of buying. Reputable LIMS vendors, such as GenoLogics, have the ability to get out in front of scientific and technological advancements by forming close relationships with instrument vendors. Working with a diverse set of customers has led to understanding and anticipation of their needs. The right vendor LIMS can help protect resources, adapt to lab-specific environments now and in the future, and provide an experience that lab staff want to repeat.

Learn more about the Illumina products and systems mentioned in this article:

BaseSpace Clarity LIMS
www.genologics.com/clarity-lims

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