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2025 LAB INFORMATICS TRENDS

Laboratory Informatics, or Lab Informatics, uses technology to improve efficiencies via automation and streamlined processes, taking advantage of data analytics while ensuring compliance. Some of these tools include Laboratory Information Management Systems (LIMS), Electronic Lab Notebooks (ELN), Lab Execution Systems (LES), Chromatography Data Systems (CDS), and many others. Organizations are recognizing the need for more robust laboratory systems; therefore, Lab Informatics is expected to grow at a compound annual growth rate of 5.1% between 2024 and 2030.

In this report, we will focus on 2025 Lab Informatics trends, looking at platform diversification, Lab 4.0, and advanced technologies.

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2 LAB 4.0

3 ARTIFICIAL INTELLIGENCE AND BUSINESS INTELLIGENCE IN LIMS

4 INCREASED USE OF ADVANCED TECHNOLOGIES

1 DIVERSIFICATION OF LIMS PLATFORMS

Competition in the LIMS space is on the rise, which has resulted in noticeable strategy adjustments among the top vendors. Vendors are increasingly diversifying their platforms in an attempt to become the one-stop-shop for laboratory informatics.

Veeva, for example, released their LIMS platform in Fall 2022, which has allowed them to increase their market coverage as a vendor. Still in its infancy, they are continuing to add functionality to become a competitor in the market. On a similar note, Confience recently acquired Computing Solutions, Inc, allowing them to strengthen their position in the chemicals and the food & beverage spaces. Benchling has also been investing in their platform to expand functionality for GxP laboratories, while LabVantage and LabWare have made significant progress in the Advanced Analytics and Artificial Intelligence (AI) spaces, challenging the need for additional analytics software.

The diversification of these platforms should benefit the customer, but this does pose some additional questions to consider when selecting a vendor or investing further into an existing platform. Laboratories typically have multiple specialized software systems, creating an architecture landscape that is time consuming, and potentially challenging and/or expensive to maintain. Each system needs careful selection, implementation, proceduralizing, and identification of staff to support. Organizations should consider vendor investments in platform growth when selecting a solution or continuing to invest in a current solution through increased enhancements. Organizations selecting a new vendor in 2025 should have an opportunity to simplify their landscape and reduce overhead.

Diversification allows for a few critical benefits for your organization, such as:

- Allows multiple business functions to use the same platform, such as Research and Development (R&D) and Quality Control (QC)
- Easier enforcement of data governance, as master data can be maintained in a single platform
- Streamlined approach to implement cross-functional workflows
- Harmonization of processes governing the maintenance of your systems
- Significant simplification of support structure and overhead costs

Many of the commercial LIMS vendors now provide options of some combination of LIMS, ELN, LES, SDMS, Analytics, and Reporting tools across multiple markets, such as Pharmaceuticals, Oil & Gas, Food & Beverage, and Personal Care, to name a few. Those vendors not investing in diversification of their platform will likely see challenges with growth or struggle to hold their position in the market.

2 LAB 4.0

Integrations in Lab Informatics continue to gain momentum as organizations drive towards seamless laboratory operations. We are in the landscape of the Fourth Industrial Revolution, or Industry 4.0, where digital technologies, such as cloud computing, artificial intelligence (AI), Internet of Things (IoT), robotics, and automation are incorporated into industrial and manufacturing processes. These technologies are also becoming prominent in the laboratory space, a subsection called Lab 4.0, resulting in higher productivity, greater employee satisfaction, and cost reductions, and allowing labs to operate with end-to-end automation.

One of the main technologies for Lab 4.0 is the IoT, which relates to all the physical components of the laboratory (instruments, systems, applications, etc.) to be incorporated into one central network. This facilitates automating laboratory processes so systems can communicate across LIMS, ELN, CDS, and other instruments, for example, seamlessly passing data, driving higher productivity, and eliminating transcription errors from instrument data. Laboratories working with this type of ecosystem also gain the benefit of cost reduction due to the decline in errors and retesting, saving on resources and laboratory inventory. Additionally, having all systems integrated into one network allows for full traceability in Lab Informatics.

Another benefit of Lab 4.0 is being able to monitor instruments and processes in real time, recognizing errors, issues, or where results have an outlier. Having immediate knowledge of these types of errors, the lab becomes efficient and high-quality, gaining a competitive edge. Adding in automated processes and use of robotics, the lab can become a seamless end-to-end operation with little to no human interaction on the bench for a “lights out” operation.

3 ARTIFICIAL INTELLIGENCE AND BUSINESS INTELLIGENCE IN LIMS

We have seen an increase in the use of AI over the past year and expect even further increases in 2025. Organizations are producing more data than ever; testing is becoming more complex, the number of tests per year is growing, and with increased instrument integration into LIMS, more data is being generated and stored. In many cases, this also means creating a data lake.

Vendors are starting to incorporate these AI and Business Intelligence (BI) solutions into their LIMS platform, and AI and BI both need clean, robust, and high volumes of data to be effective and reliable. When thinking of AI, the large datasets captured are used to train the computer by using models and algorithms to interpret data; therefore, having weak data can impact the outcomes the intelligence provides. Similarly, BI also needs large datasets; however, this data determines patterns and can display large amounts of data in an easy-to-understand format to assist in making business decisions.

AI in a LIMS system can utilize different algorithms to make decisions without extensive programming or customization, ensuring the platform is sustainable and scalable. It can also identify trends quicker as it may be a small difference in pattern - just enough for an algorithm to detect but less evident to a person. Additionally, it can aid in automation and predictive maintenance, such as detecting when an instrument may be in need of calibration prior to its scheduled date. Separately, BI focuses on interpreting the data and providing reports and a visualized output so organizations can make informed decisions. Often, LIMS uses BI to track performance metrics in the laboratory like turnaround times, trends in data over time, and identify opportunities for improvements. Together, they are powerful laboratory tools that are becoming increasingly used, and needed, to reduce the precious time of laboratory personnel spent on reporting activities.

4 INCREASED USE OF ADVANCED TECHNOLOGIES

We are increasingly seeing emerging technologies being incorporated into LIMS platforms and across Lab Informatics, making strides towards the Lab of the Future. In March 2024, Technology Networks listed the technologies of the Lab of the Future to include digital transformation to one platform, cloud-based solutions, AI, robotics, and wearables – proving that the Lab of the Future, or Lab 4.0, is very much the Lab of Today. Several industries and vendors are investing more into these advanced technologies, and some platforms already have these readily available.

In 2022, for example, LabVantage partnered with Holo4Labs to integrate Microsoft HoloLens2 goggles with LabVantage, adding the capabilities for Mixed Realities within the laboratory. This technology allows guided execution of an analysis or experiment, including reagents, sample locations, and instrument management, greatly reducing the risk of error and increasing confidence the experiment or analysis is done the same way every time. Additionally, the goggles remove transcription errors from non-connected instruments as the lenses can transcribe the data into the LIMS seamlessly.

Other technology enhancements lab informatics platforms are adding are some we use in our everyday lives, such as voice recognition and voice commands. As of November 2024, it is estimated 8.4 billion people worldwide use some type of voice assistance. Having this technology in the laboratory as a digital assistant makes for a hands-free experience, ensuring tasks are easier to automate, reducing risk of errors, and allowing lab personnel to perform multiple tasks simultaneously. This enables the analyst to then spend more time testing and less time having to pause to enter data. Collectively, these technologies offer an enhanced, seamless, and consistent laboratory experience to ensure efficiency and quality.

LOOKING AHEAD

There are many commonalities within the 2025 lab informatics trends - the use of AI, a central network, and enhanced technologies: all these together create a high-quality lab that runs efficiently, even with high throughput, and will become increasingly more productive. The laboratory adopting the technologies of Lab 4.0 is rapidly making the Lab of the Future, the lab of right now. Contact our lab informatics experts at Clarkston Consulting to enhance your laboratory efficiency and improve quality.

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