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LIMS, a Comprehensive Enterprise Solution

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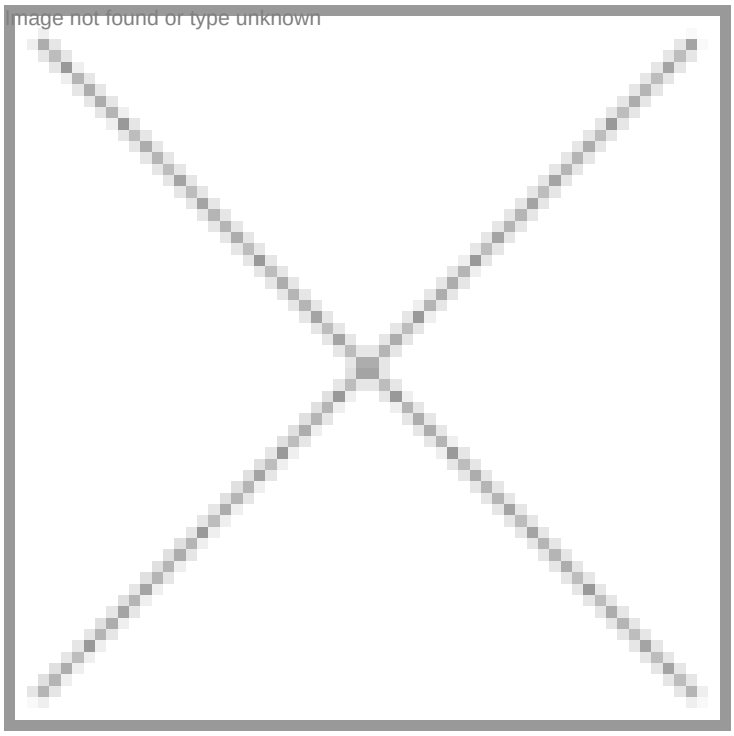

LIMS, a Comprehensive Enterprise Solution

The LIMS technology has given a new insight to scientists for conducting experiments more efficiently and providing greater lab productivity and functionality along with automated reporting capabilities.

Laboratory Information Management System (LIMS) is a computer software that is used in the laboratory for themanagement of samples, laboratory users, instruments, standards and other laboratory functions such as invoicing, plate management, work flow automation etc. LIMS are therefore the information management system designed specifically for the analytical laboratory. One of the most important aspects of LIMS is the ability to prepare and retrieve data and turn it into information quickly and easily. The LIMS has thus been able to eliminate the time consuming tasks of manual report preparation that often preclude access to the desired information.

A full-featured LIMS manages various lab data that ranges from sample log-in to reporting the results. LIMS has streamlined the data flow within organizations and has centralized the information in one primary database. The LIMS solution unifies vast and disparate volumes of biological and chemical data along with their related applications and tools, into a single, browser-based scientific interface. Built mostly on an extensible life science-based data model, the LIMS platforms function on the basis of the context of data being integrated, the relationships between associated data, and allows scientists to use the platform to query, view and analyze research data without reformatting the data-gathering methodology or changing multiple product interfaces.

Today, LIMS has become a comprehensive enterprise solution that enables research organizations to focus their time and effort on production of scientific information. Scientists are now able to leverage and utilize individual work flow within the overall process flow to meet their unique requirements. LIMS has also created a powerful environment in which scientists can interpret their results. Sample data are quickly combined with data integrated from public or proprietary databases by creating a web of information that provides a context for analysis. In addition, integration with the best technologies, platforms and

web-based search engines has enabled scientists to quickly transform data into meaningful information.

History

Originally, LIMS were developed in-house by organizations wishing to streamline their data acquisition and reporting processes. In-house LIMS, which are still being developed by many organizations, take considerable time and resources for its implementation. The need for a more immediate solution helped to drive LIMS to the next stage in the 1970s. During this time, custom-built systems became available. These early custom systems were one-off solutions designed by independent systems development companies to run in specific laboratories. Parallel to these custom-built LIMS implementations were the initial efforts to create commercial LIMS products. These extensive research efforts resulted in the first commercial solutions that were formally introduced in the early 1980s. Such commercial LIMS were proprietary systems, often developed by analytical instrument manufacturers to run on the chromatographs that the instrument manufacturer produced. These commercial systems, while typically developed for a particular industry such as the pharmaceutical industry, still required considerable

customization to meet a specific laboratory's needs. In particular, laboratories often required very specific format and reporting requirements. However, such demands for customization increased the cost of the commercial LIMS and extended the implementation time. Parallel to the rise in commercial LIMS was the increase in processing speed; the increase in third-party software capabilities; and the reduction in PC, workstation and minicomputer costs. These advantages were transferred to the laboratory and LIMS environment that resulted in a migration from proprietary commercial systems toward an open systems approach that emphasizes user-configurability rather than customization, which took place in the 1990s.

Today, LIMS tools are extensively being used in the small and large sized companies. Kim Shah, director, Global Marketing of Informatics, ThermoFisher Scientific said, "Today, there are more than a dozen companies operating in this space. LIMS first started in Europe and then in the US and gradually due to maturity of markets there and partly because the big pharma started making lesser medicines, they are now shifting their focus to emerging markets."

Technological development

Today's commercial LIMS offer a high degree of flexibility and functionality. Many of the most popular commercial LIMS take advantage of open systems architectures and platforms to offer client/server capabilities and enterprise-wide access to lab information. Web-based LIMS, or a web-based front-end to the LIMS, are also offered by many vendors. Extensible Markup Language (XML) is being incorporated into LIMS because it can enhance the information in documents, simplify web automation, and integrate applications within or between organizations. XML not only offers a more streamlined way to transmit data to web applications, but it can also be validated. XML is considered as the next generation LIMS. Informatics is redefining this field. The rise of informatics, coupled with the increasing speed and complexity of the analytical instruments, is driving more sophisticated data manipulation and warehousing tools that work together with LIMS to manage and report laboratory data with ever greater accuracy and efficiency.

Early LIMS were custom-designed and built as point solutions to meet the needs of specific laboratories. This type of in-house systems need significant effort to develop and while they may produce a very close fit to the initial requirements, they can prove difficult to change or modify in response to changing laboratory and business practices. Commercial LIMS products were initially developed in the early 1980s. At first these systems often required significant customization to meet a specific laboratory's needs as far as work flow and reporting were concerned. This increased the cost of the LIMS setup and extended the implementation time required.

Open LIMS systems

As computing technology changed, LIMS technology developed in parallel and a move towards more open and configurable COTS (Commercial off the Shelf) systems took place. This provided laboratories with greater flexibility to meet their needs within a standard commercial package.

Today's LIMS solutions offer even greater flexibility and functionality. Many popular commercial LIMS packages utilize open system architecture to offer client capabilities and enterprise-level access to lab data within a client server environment. Some vendors offer the same capability within a truly web-based LIMS using technologies such as Microsoft's .Net platform. XML enhances the data in documents, maintains data longevity by storing it in an application neutral format, simplifies automation, and integrates data and information within organizations. This, together with the adoption of technologies such as web services, allows for enhanced and simplified integration with other systems within the laboratory or organization. Combined with a fully integrated Scientific Data Management Systems (SDMS), LIMS now has the potential to bring all laboratory data together in a single unified repository.

Next level of development

The impact of informatic technology has always been a bonus for the LIMS industry. Internet, HTML, XML and hardware improvements have made data management tasks much easier to perform. Portable or wireless devices are part of these trends. Experts predict that wireless technology is on the ascendant at the same time the web-deliverable LIMS are finally gaining market acceptance. The drive to provide even more functional and productive technology results in easy to use and less expensive LIMS solutions, laboratories worldwide will be able to acquire, manage and report their data in more

interesting ways.
Anuradha Acharya, CEO of Ocimum Biosolution said, “The new wave of LIMS that we at Ocimum are developing throughour product Biotracker is to enable open methods to integrate other applications and also to act as a web-based data management service for remotely managing requests in real time. This model is a SAAS (software as a service model) and incorporates the new web 3.0 standards and allows multiple collaborators to not only exchange data but also use the LIMS in a ‘services on-demand’ model.

Latest LIMS systems
This latest generation of LIMS moves away from simple sample test and result management to provide the laboratory with a sophisticated laboratory informatics architecture. This model allows efficient management of data and information generated or used by the laboratory. Latest LIMS systems effectively manage the delivery of the laboratory product and optimize the performance of the laboratory organization. In addition, the value of historical data assets can be maintained by ensuring continued accessibility of this data in a single application.

Jahanara Parveen

Technological Upgradation Over the Years

—Anuradha Acharya, CEO, Ocimum Biosolutions

The earliest desire to develop a LIMS by organizations was taken forward by geeky scientists who wanted to streamline their data throughput and reporting processes. The fact that an in-house LIMS can take considerable time and resources to implement was learnt by the industry the hard way. The need for a more immediate solution helped to drive LIMS to the next stage in the 1970s. During this time, custom-built systems became available. These early custom systems were one-off solutions designed by independent systems development companies to run in specific laboratories.
Parallel to these, custom-built LIMS implementations were the initial efforts to create commercial LIMS products. These extensive research efforts resulted in the first commercial solutions that were formally introduced in the early 1980s but the focus was more on ‘quality control and assurance’ and subsequently production systems. These commercial systems, typically developed for a particular industry (such as the pharmaceutical industry), in spite of their ‘off the shelf’ status require a considerable customization to meet a specific laboratory’s needs, sometimes to fine-tune and other times to tune to the scientist’s formatting requirements. The desire for very specific format, reporting requirements and the restrictions of the technology made cost of the commercial LIMS to skyrocket and extended its the implementation time.
The new breed of LIMS now offer much higher configurability and allows users to implement multiple work flows and processes with ease. It doesn’t require too much intervention from the IT departments. In several cases it can be remotely monitored and managed taking off those challenges from the users and also reducing the cost of installation, customization and maintenance.
Most LIMS products allow the laboratory to automate manual processes like register work requests; print reports; monitorand communicate sample, process and resource related issues; schedule and approve requests besides data security and search ability. The real value of a LIMS is the ability to maximize sample throughput and minimize labor costs. Major players in this space are Ocimum, Thermo Fisher and Labware. Pricing models usually have two components which include license costs and some customization costs.