What is a LIMS - a laboratory toy, or a critical IT component?

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Given the history and background of Laboratory Information Management Systems (LIMS) it is inevitable that people tend to regard them first and foremost as laboratory computers - systems which can be hard-wired to analysers, and which are rather more efficient at retrieving data than an office full of secretaries, but much less attractive. Higher management rarely bring analysts into policy discussions, and, since analytical chemists themselves are typically shy, retiring types who tend to hide in their laboratories, and view tidying up the lab data as an end in itself, they rarely bother to explain the capabilities of a LIMS or the role it can play as a key piece of the corporate IT jigsaw.

Thus the perception of a LIMS depends on one's viewpoint:

- To an analyst, LIMS is indeed the computer system which interfaces to his analyser, computes, stores, and prints results;
- To a laboratory manager, it is the system which lets him track samples, identifies their current status, audits their turnaround times, and provides better data on his customer base than he could ever have obtained from the best-organised of paper records;
- To a management information systems analyst, however, LIMS can and must be a feeder system, passing resource management data to the corporate mainframe, and
- To an accountant, it can integrate the lab costs into the client's invoice.

Four different views of LIMS, all of them correct, but each of them limited by the users' own perceptions. To appreciate the ability of a LIMS to integrate into the corporate IT ethos, one must start with an even more fundamental question - What is the role of the analytical laboratory?

The Laboratory's Function

A reasonable working definition might be that a laboratory must deliver accurate, understandable results to the originator of the request for analysis, within a suitable timescale. Such an operation entails the sequence of transferring a sample to the laboratory, analysing the sample, checking the results, (and if necessary re-analysing the sample), and issuing a report to the requester. Such a scheme is common to all analytical labs, and it is important to note that much of the cycle relates, not to analysis, but to the clerical handling of the results of analysis.

Unfortunately, manual reporting systems are neither accurate nor timely. They depend on multiple transcription of results, and they are slow - studies in the author's lab showed that clerical work in typing and issuing reports took about as long as analysis. Further, manual reporting is cumbersome and labour-intensive, data retrieval becomes a hunt across multiple locations for a single piece of paper, and retrospective data analysis is virtually impossible.

The essential concept of a basic LIMS, therefore, was, and is, that of a computer system which would automate the clerical activities associated with the processing of the analytical results, improving accuracy and turnaround times to an acceptable level. LIMS is a technique independent of discipline, and has applications in any industry where laboratory analysis is important, from Healthcare through the Food & Drink industry to Pharmaceuticals and Petrochemicals.

A more complete list of the attributes expected of a LIMS is shown below:

- To shorten turnaround time of lab tests
- To improve access to the results database
- To improve accuracy of analysis, by eliminating transcription steps
- To count and monitor resource utilisation
- To exchange data and information both with analytical equipment and corporate mainframes
- To improve productivity

Achieving the benefits

Many of these benefits arise almost automatically from the basic process of logging request data to a database, and reporting results. Studies in the author's laboratory have documented improvements in the accuracy of data following computerisation (1), and have confirmed improved turnround after installation of a LIMS (2). In all but the smallest labs, a typical LIMS computer system bridges the gap between the analysers and the company's financial and administrative mainframes. It is also an indispensable tool for both the analyst and the lab manager as it tracks samples, adds more sophisticated statistical QC/QA routines and adds data edit, display and storage facilities to the basic capability of the analysers. It documents and summarises resource utilisation within the laboratory, again as a spin-off from the basic process of recording request details on the database.

Few LIMS developments are immediately cost effective, however. On the contrary, the capital cost of the hardware, the on-cost of hiring or developing computing expertise, the maintenance costs of the system, and the general chaos of the changeover to computer reporting will almost certainly mean higher costs in the short-term. Over a period of years, however, the productivity payback in terms of cost-avoidance can be demonstrated as the lab sustains major increases in workload without requiring pro-rata increases in staff. Furthermore, as regulatory compliance and laboratory accreditation continue to demand more and more evidence of good record-keeping, a LIMS system may well become the only feasible and cost-effective way of documenting effective clerical procedures, given the readily-identifiable problems of a paper system (2).

The International LIMS Conferences

By the mid 1980's it was clear that there was a lot of re-invention of the wheel going on, as analytical chemists in lab after lab attempted piecemeal implementation of their own, or purchased LIMS systems, with variable degrees of success. A group of American LIMS enthusiasts decided that the time had come for a conference at which chemists and managers could get together in a non-commercial environment to explore the role and implementation of LIMS, and, in the company of acknowledged experts in the LIMS field, share common experiences and plan the way forward. The first two International LIMS conferences were held in Pittsburgh in 1987 and '88 (3) and were major successes, immediately attracting audiences of over two hundred delegates with a mixture of formal lectures, equipment demonstrations and social interaction. The first European LIMS Conference was held at the Anugraha Conference Centre near Windsor in 1989. The 3rd Conference was an instant hit with analytical chemists across Europe, and since then the International LIMS Conference has alternated annually between America and Europe, with close co-operation between the US and European organising committees.

I began with the question 'LIMS - a laboratory toy, or a critical IT component?' Over 30 years after the first laboratory computers were commissioned, successful LIMS systems are now, and must now be, key pieces of the corporate IT jigsaw.

References:

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