Digitisation versus Digitalisation – Understanding the Difference and the Role of LIMS in Achieving Both

Communication can be a problem. A few misplaced letters in a word can have a huge impact on the meaning. Tony Abbott, the former Australian Prime Minister, is reported to have said that no one "is the suppository of all knowledge",[1] while Bertie Ahern a former Prime Minister (Taoiseach) of Ireland is supposed to have warned against 'upsetting the apple tart'.[2] Combine this with an industry like the IT industry, that revels in three letter acronyms, and where the use of jargon* is compounded by imprecise definition of the jargon itself, and you have a recipe for confusion. Within the context of laboratory informatics this can be frustrating to those for whom IT is a means to an end and not the end in itself. It obscures and confuses the benefits of what can be worthwhile technology driven initiatives.

Such is the case with a current hot topic in laboratory informatics, namely laboratory digitisation or digitalisation. This article will show that those two letters do make a difference, that it is important to understand that difference, and that once the difference is understood significant benefits can be gained through implementing these initiatives. The role of a Laboratory Information Management System (LIMS) in supporting this will be covered.

Digitisation in the Laboratory Environment

Starting with digitisation; this is the transformation of currently manual or paper-based operations to a digital format, generally enabled by one or more database applications. Within the laboratory there are many examples of how digitisation improves laboratory efficiency and helps ensure data integrity.

Looking at a simplified non-digitised sample workflow, samples arrive at a laboratory reception area accompanied by a handwritten test request form. Sample details and testing requirements are written into a laboratory notebook or logbook based on the submitted form. Once testing is to start a hard copy worklist may be created for a specific analyst or instrument. Before the test can be run the instrument logbook must be checked to ensure that it is in service and not awaiting maintenance or calibration. Instrument results are entered manually onto the work list or lab notebook and may require approval by another analyst or supervisor. In addition, they may require checking against applicable specifications or limits. Once the testing has been completed, the sample may need approval before the results are collated and a report created and sent to the sample submitter. During this process the submitter has been calling the lab to find out where their results are, while their colleague grumbles about late delivery of results for a sample the lab has no record of and threatens to formally complain about poor laboratory service.

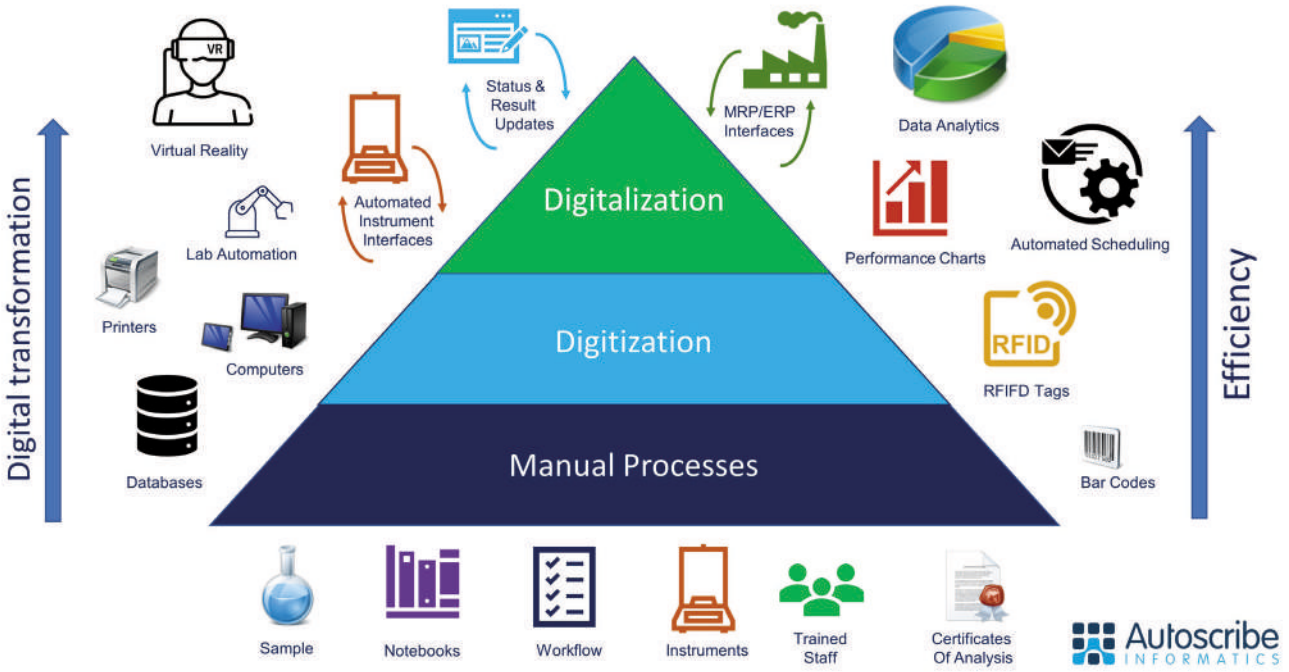
This simplified example shows how digitisation through the use of a LIMS provides substantial benefits. Allowing test requests to be submitted electronically through a LIMS portal removes potential issues with unreadable test requests, ensures only relevant tests are available and allows the requestor to print a barcoded label for the sample. Reading the barcode when the sample arrives allows the date and time of receipt to be automatically recorded. Samples that have been requested but not received are easily identified. Worklists can be automatically created based on samples and tests waiting to be tested. If QA/QC run-sheets are required these can be built automatically based on predefined rules for the placement of the QC samples. If instruments allow bidirectional communication run-sheets can be automatically uploaded. Even if this is not possible most modern instruments can be integrated unidirectionally with a LIMS to allow automatic result capture. Transcription errors are therefore eliminated, as may be the need for result verification by another analyst. Results can also be automatically checked against specifications and limits. As LIMS can manage both instrument calibration and maintenance, and analyst competencies, it can prevent tests being run on instruments that are not in service, or by analysts not competent in the technique.

Once testing has been completed sample approval can be recorded in the LIMS and reports automatically generated and sent to the submitter. The lab hasn't been called by the submitter to check progress because this can be done through the LIMS portal. Their complaining colleague has been told that the sample has never been delivered and that the key performance indicators available from the LIMS show the laboratory achieving their agreed targets for sample turnaround times.

Digitisation of the laboratory in this way through the use of computerised database systems such as LIMS has been taking place for many years. Experience shows that many organisations have gone at least some way down this path, however, few have implemented it fully and a surprising number still use paper-based systems. In addition, beware a feeling of complacency if you are running your laboratory using electronic spreadsheets, this is not an electronic database system (try running the question 'Is Excel a database' through a search engine).

Digitalisation, the Next Step

Digitalisation is perhaps more difficult to define precisely, partly because it is as much a concept as anything else. However, we can look at it as how the digital environment, as enabled by the process of digitisation, will impact how we work and how we do business. One relatively simple example can be seen in laboratory stock control. Electronic stock records combined with defined reorder levels and the modelling of projected usage can support just in time ordering of laboratory supplies and reagents, while automated reordering and Business to Business (B2B) ecommerce removes the needs for time consuming manual purchase order and invoicing tasks. In effect digitalisation is the process of using the data we have, or could generate, to change, and hopefully improve our business.



This is not necessarily a new idea but has been given added impetus lately by concepts such as industry 4.0 and laboratory 4.0, and specific tools including business analytics and business intelligence software. Increased connectivity throughout the laboratory (unfortunately sometimes referred to as the Internet of Laboratory Things or IoLT)) can provide more of the data needed. Increased automation and the use of robotics also have their part to play. Getting it right opens the way to potentially game changing technology such as machine learning and artificial intelligence. To some extent what can be achieved through digitalisation and how an organisation will benefit depends on the corporate imagination. However, it is also dependant on having the right data available in a suitable electronic format.

Once again to take a simple example, certain laboratories have always been concerned with how many samples they can process and what the impact of having an increased workload would be. These may be high throughput laboratories wondering what the impact of a new screening project would be, or commercial testing laboratories needing to know if they can cope with a new contract. This has gained increased importance during the pandemic where testing laboratories that may already be handling hundreds of thousands of samples a week need to know if they can cope with increased throughput based on changing infection levels. This is dependent on many different variables within the laboratory, from the time it takes to unpack and receive samples through the capacity of liquid handling robots and other equipment, to how samples are approved, and results released. With data driven tools and applications, together with increased access to relevant data, modelling the process and changes to the process becomes easier. The concept of Digital Twin software has grown up around the ability to model a physical process in order to optimise it and predict the impact of changes on the process. This is a prime example of digitalisation. However, the ability to do this effectively is dependent on having the right digital data available, and in the laboratory setting, much of this will come from digitisation and a well implemented LIMS.

Getting the foundations right

The aim of this article has been to differentiate digitisation from digitalisation in what is hoped is a clear and reasonably jargon freeway. The aim is to prevent laboratory organisations being led down a blind alley when it comes to process improvement. Embarking on a digitalisation project because it is the hot new concept is unlikely to be a success if the basic process of digitisation has not been completed. The system infrastructure for the creation, storage and management of electronic data has to be in place. If this isn't the case, then completing a digitisation project using well accepted and proven solutions such as LIMS will provide considerable process benefits and form the foundations on which the concepts of digitalisation can be built.

*Jargon – the technical terminology or characteristic idiom of a special activity or group OR obscure and often pretentious language marked bycircumlocutionsand long words.[3]

REFERENCES

1. Liberals squirm as Abbott refers to 'the suppository of wisdom – Sydney Morning herald August 12, 2013
2. https://en.wikipedia.org/wiki/Malapropism
3. https://www.merriam-webster.com/dictionary/jargon

Simon Wood

Simon Wood PhD, Product Manager at Autoscribe Informatics, has 30 years' experience in the commercial LIMS environment. He is an acknowledged expert in the field of scientific and laboratory informatics. With a degree in Plant Biology from Newcastle University and a PhD in Mycology from the University of Sheffield, Simon successfully moved into the field of laboratory informatics.

Email: swood@autoscribeinformatics.com