# Transforming the laboratory

**SOPHIA KTORI DISCUSSES THE NEED FOR DIGITAL TRANSFORMATION IN THE LABORATORY**

Specialist consultancy firm Astrix Technology Group works with life science organisations to identify and implement systems for scientific informatics and laboratory operations, to maximise value from scientific data, improve product and experimental quality, and aid safety, security and regulatory compliance.

Dale Curtis, Astrix president, said: 'We're not a technology company and we don't make software, but that's a big advantage for us because we can take a vendor-neutral stance and really help companies to look at their operations and workflows, and identify just how they can start to approach digital transformation.'

Sometimes that transformation will start from a very basic position of an initial move away from pen and paper, and sometimes from the point of acknowledging that their legacy informatics systems are no longer viable.

**Review and be realistic**

Whatever the ultimate aim, any attempt at digital transformation should start with a review of existing processes, and consider what the organisation hopes to realistically achieve, in terms of optimising those processes.

'The goal may be to remove the need for manual data entry, but to do that you have to understand your processes and your process flow, to understand the end-to-end workflow,' Curtis said. 'Organisations need to take a tactical approach based on need, rather than just focus on the software that's out in the marketplace.'

Astrix has built its expertise on many years of researching laboratory best practices and implementing solutions for scientific and laboratory-based organisations. 'One starting point can be to measure just how much time scientists spend on activities such as the manual transcription of data from one system to another, data review verification, reports preparation, extraction of data,' Curtis noted. 'Digitising some of all of these activities can dramatically improve efficiency and productivity, as well as help to ensure data integrity and improve downstream quality. But you have to go through your processes to understand how that digitisation needs to be implemented.'

In reality, companies are often quick to flood laboratories with software, he suggested. 'They may have a dozen or more informatics systems, including multiple LIMS and ELNS from different vendors, which don't talk to each other. That causes another set of problems.'

**Consider bite-size chunks**

Companies commonly approach Astrix because they want to understand how digitalisation can deliver value back to their organisations in a commercially reasonable timeframe, Curtis suggested.

'They may have been told by vendors that digital transformation will eventually transform the way that business is done, but that it will be a three-year initiative and cost however many million dollars. That's just not tenable for most organisations.'

It's likely that the most successful projects won't be those that promise an all-encompassing, enterprise-wide outcome, he added. 'It is generally more manageable to structure digital projects in bite-sized chunks that can be achieved in a realistic timeframe, rather than trying to boil the ocean.'

Take this approach and its possible to address end-to-end processes within a lab operation one at a time, however small a portion of overall workflow those processes are. 'We could start looking at the beginning, or we could start in the middle,' depending on where the major sticking points are,' Curtis noted.

Astrix's approach is to help companies define their processes, then use its expertise and technology selection process – which over the years has encompassed potentially hundreds of thousands of requirements – to understand those processes and define potential solutions. 'Then we can also start working with the vendors themselves, to demonstrate how their product or platform can deliver against specified objectives.'

**Beaten by complexity?**

Astrix is vendor-independent but, as Curtis pointed out, the company is frequently called in because a vendor hasn't been able to deliver on a promise. 'We carry out upwards of 200 projects a year, and more than half are rescue projects, perhaps because the vendor has started an implementation and realised that it's a lot more complex than they thought, or the solution isn't really addressing the finer details.' And as technology becomes more 'capable', then the differentiation between acronym-led decisions, 'Do we need a LIMS, ELN, SDMS?' starts to disappear, he continued. 'Companies shouldn't just think about platform 'names'.'

'Once there is an indication of how the different steps can be digitised, and what that digitalisation will achieve, we can bring in the architectural elements, and look at the systems or platforms that might achieve that architecture, and how they can be used to improve and streamline

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defined processes, for example to improve security, compliance, reduce manual errors or save time.'

Then it is possible to look at how software can do that in a commercially reasonable timeframe. 'No one wants to sit around and look at projections and implementation plan PowerPoint slides for a year or more. They want to see progress in the short term, and demonstrate real value driver points in three to six months.'

**Change and cultural challenges**

Another major consideration is the change in working practices that digitalisation will inevitably engender. Whether that's moving away from the reliance on paper, pen and excel spreadsheets, or replacing existing, but outdated legacy systems with modern platforms. 'In fact, some of the biggest challenges aren't technical at all, but cultural,' Curtis noted.

'You're asking a lab scientist who has been trained to execute a method, design an experiment, or write a report in the same way for potentially decades, to change their working practice from the ground up. That's quite an expectation. Even if you have technical and supervisory support, it's important to clearly define a value-engineered roadmap that shows each individual how, by changing their behaviour, they are going to impact on their own working practices, and the overall process.' But again, do it in bite-sized chunks, and it becomes less daunting. 'Everyone needs to understand the benefits in the long run, and people are just as much part of that transformation and journey as the software.'

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Not trying to change everything in one go – like the entire analytical operation of an organisation – also makes the process less intimidating from a user perspective.

'Maybe start with a single laboratory that is part of that analytical engine in an organisation. Take this one step further back and you may even want to identify an analytical step within that lab, perhaps.

'For example, how does a chemist submit essential material for characterisation? There you have that easy-to-manage chunk but it's still a workflow and you can map it out from end to end. How do the samples come in? How do the materials go through the workflow? What do we produce to then send on to the next group? By looking at these processes in stages, we can define what each package of data actually looks like, and that's a really digestible piece of a problem … you're not trying to eat the whole elephant.'

And this user experience leads to the issue of training, Curtis said. 'It's all very well implementing a new system, but how do you ensure that everyone knows how to use it and is comfortable doing so? One thing that the pandemic has demonstrated is that there is no longer the need to bring everyone into a classroom over multiple days and try to teach by rote in an external environment,' he suggested.

People need to be confident in their own workspace, he continued. 'Smart companies are investing in learning management systems, so the people using a new software or informatics platform can continue to learn as they are using it, and become confident in the workplace, which is, after all, where they are using it from day to day.' →

→ **What works, and what doesn't?**
Life science enterprise laboratory informatics provider Benchling also notes that companies looking to either initiate or update their digital transformation journey should start by taking stock of their existing infrastructure. Michael Schwartz, head of product marketing, said: 'Organisations must be honest about what's working and what isn't, and also about what they want to achieve, rather than focus on specific categories of software. It really has to do with their workflows and R&D goals.'

Complexity aside, companies are still concerned about some of the fundamentals, such as security. Every organisation is in a different spot in their transition into the cloud, Schwartz noted. 'Most companies will still need assurance that their data will be as secure, if not more, in the cloud than it is on-premise.' Connectivity is another key consideration, according to Schwartz, and the ability to integrate platforms from different vendors comes high on the list of requirements.

'Organisations are aware that they will, if they don't already, implement multiple platforms across their organisation – not just in their R&D.'

So while their existing processes may have little connectivity, that ability to integrate different platforms – whether those already in place or those yet to be purchased – is also high on the list of digital requirements. 'Organisations know that if their data doesn't aggregate in a very clean and structured manner, they are going to have challenges. They want to make sure that they have that connectivity, so that they can integrate across applications and data repositories.'

**Outdated platforms**
A willingness to look at existing software objectively will highlight problem areas with possibly outdated platforms, Schwartz noted. 'Early generation ELNs, for example, offered a fairly narrow field of data capture. They were designed primarily to capture unstructured data, and to document intellectual property.' But the software was not well connected as part of a holistic R&D operation.

In fact, such platforms were not much different than a paper notebook, he suggested. 'Individual scientists received access to an ELN for instance, but there was no connectivity, so any experimental data that was put in the ELN wasn't readily accessible for sharing and scientific decision support.

'That's not the way science works now. There may be multiple specialised teams all working around one common endpoint,


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and they need to organise around data generated by multiple individuals and different teams to drive them to that endpoint.'

**Flexibility and connectivity**
Since Benchling was founded eight years ago, Schwartz said it has developed a flexible, unified, cloud-based informatics solution for life science R&D organisations, ranging from the largest enterprise pharma companies to the most cutting-edge biotech startups.

'Our modern approach and scientific expertise has allowed us to build a highly flexible platform which can be easily configured to support a diverse set of R&D functions in this space, which are all linked through a connected platform. We can now address some of the mission-critical pain points in life science R&D. Individual organisations all have their own distinct challenges', Schwartz said.

'These may centre on managing inventory, or on tracking samples, or on centralising and standardising data capture, but the important thing is that we can address all of these different use cases on one unified platform.'

Companies in the biotech and pharma industry are at various points on their digital transformation journey, Schwartz stated. 'In life sciences, it often starts with the need to document molecular and experimental design in the same location, and how their scientists can achieve individual productivity gains.

'Then companies typically want to address operational inefficiencies, which usually involves rethinking how they standardise their database of biological and chemical entities, and how they co-ordinate requests and workflows.

'Lastly, companies will then seek to drive smarter program-level decision making, which involves aggregating their data for analysis and visualisation. Often these different functions are addressed holistically at the same time, but it's possible to solve for these acute needs in phases, as part of a broader transformation process.'

Benchling believes two key factors set it apart from some other platform providers in the same field. The first is that all the implementation teams that work with clients have deep domain expertise in the life sciences, enterprise software, and data modelling, so they understand the scientific needs of biotech and pharma organisations, as well as the IT and business requirements.

'Whether an organisation is focused on small molecule R&D, or is involved in the biologics arena, they will work with a Benchling team that has carried out multiple implementations in their area of specialisation, from traditional chemical drug discovery, to vaccine research, gene therapy or synthetic biology and industrial applications,' said Schwartz.

The second hallmark of the Benchling solutions is that the platform can be implemented without code. This makes the platform fast to configure and easy to deploy. 'We run an agile implementation process, and iterate very quickly with our customers, so we can get a prototype up and running quickly. This can then be fine-tuned so that customers get maximum benefit, without complex customisation processes.'

The company has developed a mature set of Rest APIs, so connecting the Benchling platform to existing systems should not be problematic. 'But we also have partnerships with instrument vendors, and have developed templates for common laboratory instrumentation, so most clients can get up and running, and connect with almost any instrument very quickly,' said Schwartz.

'As the aim is to automate those manual processes as much as we can, we have a lab automation module that sends run instructions to robotic liquid handlers and analytical instrumentation, then digests the output data in a structured, actionable format.'