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Future-proofing labs through automation and immersive technologies

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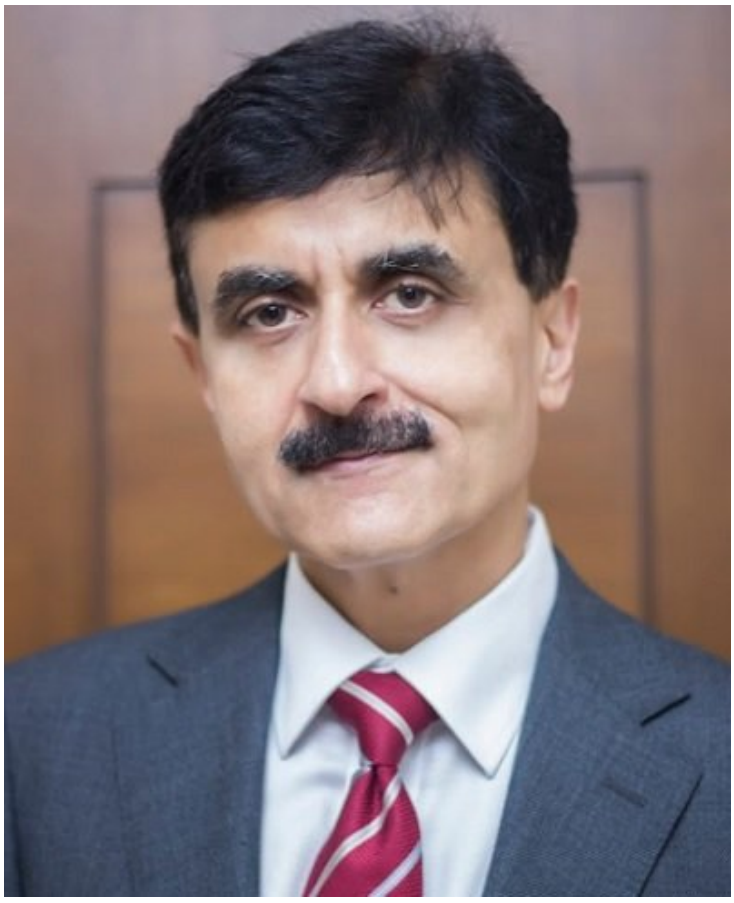
The laboratory ecosystem, today, is undergoing a massive change and transforming business and operatingmodels by leveraging digital technologies. In the last few years, the industry has witnessed a gradual shift from physical experiences to digital experiences in a steady manner. However, the pandemic has accelerated adoption of digital technologies, modernising infrastructure to support more automated, connected environments, and recruiting, retaining, and upskilling a highly experienced workforce. Let's see what the future holds for laboratories with respect to automation and digitalisation



Now more than ever, there is an escalating need to provide a modern, quality-driven digital approach to laboratory operations that offer customers unprecedented convenience, impactful innovations, and reliability. It's called Laboratory 4.0., which refers to the complete automation of lab processes using automation software, laboratory informatics, robotics, interconnectivity, big data, analytics, and machine learning to create a more holistic, better-connected, self-monitoring and smart lab environment. Automation delivers benefits including increased productivity, scalability, enhanced safety for personnel, reliability, and cost-effective operations. As a result, Laboratory Information Management Systems (LIMS) and the Internet of Laboratory Things (IoLT) have emerged as solid pillars of lab automation.

Emerging importance of automation and LIMS

Over the last decade, laboratory automation has proven to be critical, and its benefits, such as increased throughput, standardisation, and reproducibility, have been recognised by organisations worldwide. The importance of automation has especially come to light during the COVID-19 pandemic, where it has enabled laboratories to operate efficiently in a challenging climate. Initially used to allow high throughput screening in drug discovery, automation benefits are now also being recognised in other areas, for example in quality assurance (QA)/quality control (QC), production environments and precision medicine. It has many applications across different stages of the pharmaceutical industry and most recently, implementation has been rising in diagnostic testing for COVID-19.

The COVID-19 pandemic has created huge challenges for laboratories worldwide. Achieving high throughput workflows, data integrity, and traceability are game-changers in enabling diagnostic laboratories to scale up services and expand testing capabilities in response to COVID-19. The need to maintain continued operation with fewer people on site, minimising errors and managing intense pressure for increased capacity and expanded services has placed additional demands on data management systems, automation, and technology.

Expanding high throughput testing capabilities without scaling workflows in the digital space can limit the efficiencies automation offers and potentially compromise the integrity of results. Highly automated molecular diagnostic testing systems, such as the Thermo Fisher Scientific Amplitude solution, have been developed and can analyse up to 8,000 COVID-19 specimens in 24 hours with minimal user interaction. By using new systems such as this, which incorporate all three pillars of automation, including advanced data tracking via LIMS, laboratories can rapidly scale their COVID-19 testing workflows to the high volumes needed. This ultimately helps reduce the spread of disease and restore economies and communities.

LIMS have a key role to play in collecting, centralising, and managing data, automating processes, and delivering connectivity and data integrity to provide a strong foundation for artificial intelligence (AI) and machine learning (ML).

For example, LIMS manages Standard Operating Processes for analytical instruments and collects large amounts of high-quality experimental and operational data, storing it in a manageable way so that it can be analysed in deep learning. LIMS software handles data securely and comprehensively to ensure data integrity and traceability, which is crucial for complying with regulations and guaranteeing product/result quality

LIMS also allows laboratories to automate processes, such as reagent re-stocking or flagging when instrument maintenance may be required. Lab automation specific software solutions, such as Thermo Scientific Momentum workflow software, enable connection to external applications such as LIMS, electronic laboratory notebook (ELNs) and other platforms to streamline data management and tracking. This connectivity also enables users to connect and synchronise applications across multiple laboratory sites.

Furthermore, automation provides flexibility for laboratories to scale operations to meet current workflow and future capacity needs. The higher quality data generated can more easily be used for AI and ML applications to drive further insights. In fact, during the COVID-19 pandemic, laboratory automation has increasingly been viewed in a strategic way to assure business continuity.

Virtual Labs and Immersive Customer Experience Centres

The pandemic has also compelled businesses to adapt to changing market trends and customer needs. As a result, companies are committed to fueling their digital transformation efforts, encompassing the Internet of Things (IoT), extended reality, big data, AI, ML, and cybersecurity. Today, virtual reality is also emerging as a key enabler in ensuring an enhanced customer experience.

Setting a benchmark, Thermo Fisher launched Labatar — the first virtual lab in India last year using these digital drivers. Built on immersive technology, Labatar supports the customers' critical needs and offers an immersive online experience by helping them engage virtually with our state-of-the-art technologies while performing complex research. The platform seamlessly depicts a fully equipped lab environment and walks the user through each step of a workflow, using easy-to-understand instructions that simulate the experiments performed in a physical lab.

The platform hosts several workflows that offer expediency, allowing customers to learn from industry experts while performing experiments with the click of a mouse and get a first-hand, virtual experience of handling them.

The road ahead

At Thermo Fisher, we are future-proofing laboratories with new and expanded capabilities in automation and digitalisation. With the pandemic still impacting all of us, our objective is to empower customers with state-of-the-art tools and solutions that make laboratories smart, help reduce human error and enhance data traceability and integrity. The pandemic has irreversibly changed the way people interact with technology. Our objective is to support researchers, industry, and society at large and remain steadfast in our mission to enable our customers to make the world healthier, cleaner, and safer.

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