



Medlab Middle East

By Informa Markets

Digital and AI: Lab Automation and Digitalisation

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Overview of Lab Automation and Digitalisation

Advancements in electronics and robotics have significantly accelerated laboratory automation, with digitalisation emerging as a major driver in lab diagnostic sciences in recent years. As per Precedence Research, the global automation market was valued at USD 7.35 billion in 2023, estimated to reach USD 7.84 billion in 2024 and is projected to grow to around USD 14.78 billion by 2034, expanding at a CAGR of 6.55% from 2024 to 2034.

Various automation equipment components are included in robotic systems based on the needs of the process. One such component is the Total Laboratory Automation (TLA). It connects the four major steps of analytic processing: pre-analytical, analytic, post-analytic, and reporting phases. With little to no human intervention, this fully automated machine-based analyser determines the biological plus chemical components. It comprises stages to prepare as well as treat specimens, measure reagents, phases of chemical reactions, process signals along with data handling. By implementation of TLA, a laboratory production capacity can be increased greatly. TLA has gained popularity as a result of its successful application in clinical chemistry and hematology. However, its application in diagnostic microbiology along with histology has been significantly delayed due to additional manual operations in the overall process.

Exploring the Transformative Power of Total Lab Automation

The healthcare sector is leveraging automation and digital transformation to reduce its carbon footprint and achieve the United Nations' 2030 Sustainable Development Goals. According to Data Bridge Market Research, the Middle East and Africa Lab Automation Market is expected to grow at a CAGR of 4.8%, reaching a market size of USD 376.55 million by 2029. TLA is a sustainable model of practice in the management of laboratory services. It utilises automation for tasks such as activity-based expenses, LEAN design, plus carbon footprint strategies to achieve the best solution to provide viable and timely results. This approach fits into the brain-to-brain (B2B) loop concept for laboratory tests, increasing patient safety together with service quality. Middleware assisted medical decision-making, plus the paperless environment is also

relevant in TLA and contingently affects clinical procedures, validation, data management, along with analysis.

The Lundberg loop, a B2B loop for laboratory tests, validates the entire testing process, from pre-preparation to post-examination. The need for digitalisation to overcome the supply-demand imbalance drives automation in the sector. The impact of the COVID-19 pandemic suggests that worthy objectives should prioritise closing the supply-demand gap. Involvements include various levels of expenditure, prominent short-term initiatives, and long-term efforts to promote progressive improvements in diagnostic care.

Expert systems and evidence-based guidelines help calculate the risk stratification score for laboratory plus clinical data. The novel clinical decision support system can address the issue of variability in hospitals through utilisation of informatics and change management techniques. The use of TLA in laboratory digital transformation has led to improved revenues, patient needs guidance, enhanced quality, preparedness for standard guidelines, as well as better interpretation of tests. It has encouraged standardised care by flagging patient risks, better interpretation of data, improved patient satisfaction, and alignment with international guidelines.

Key Trends in the Lab Automation Market

In vitro diagnostic (IVD) is a key component of modern healthcare as it provides essential information for illness diagnosis and treatment choices. Innovation plus resource allocation have driven the adoption of specialised technological policies to develop the IVD industry. Surgeons with advanced skills in the domain are in high demand as the usage of robotic surgery continues to move from open to laparoscopic operations. Robotic ultrasonography tests are conducted in remote clinics plus virtual operating rooms. The Department of Health - Abu Dhabi has introduced the Robotic Process Automation (RPA) tool to boost workforce productivity as well as improve sector outcomes.

The tool automates processes like healthcare professional audits and license requests, aims to increase service quality by over 80% along with the reduction of completion time by 90%.



• **Robotic arms are more often used in research labs** due to the device's flexibility, compact size, and ease of integration with other laboratory equipment. This surge in popularity has increased the demand for lab automation. The UAE fosters talent through AI education as well as research, with institutions such as Khalifa University and MBZUAI who offers specialised courses in robotics. **The UAE's commitment to cutting-edge research is also evident in its participation in international competitions such as A2RL together with MBZIRC.**

• **Labor-saving, as well as productivity-enhances tasks** such as pick-and-place or machine tending are common laboratory activities that use robotics extensively. With modular equipment advancements, automation can be beneficial even for small labs. **Emirates Health Services (EHS) has launched four robotic pharmacies to automate pharmaceutical service delivery. The project was implemented in Al Qassimi Hospital, Al Qassimi Women's & Children's Hospital, Ibrahim Bin Hamad Obaidullah Hospital, along with Abdullah Bin Omran Hospital for Obstetrics & Gynecology.** EHS also launched a self-dispenser system linked to robots, which enables smart electronic applications to order and obtain medicines directly through smart self-exchange outlets. The robotic pharmacy features a built-in smart alert mechanism to measure temperatures plus humidity that ensures the quality of medicines. It also operates advanced software to prepare reports as well as carry out inventory operations in seconds. **The robots use AI technology to locate and identify medicines to dispense prescriptions automatically in less than a minute. The technology can handle a storage capacity of more than 45,000 medicine boxes in one location.**

• **Demand for speedy findings** has led to an increase in the usage of automated lab equipment. Lab automation achieves higher throughput and accuracy while providing precision, better data management, fewer repetitive tasks, along with reduced human interference. For instance, utilisation of a robotic arm to sort blood samples guarantees patient safety and reduces stress on hospital staff.

• **IoT-enabled systems** enhance efficiency by managing servers as well as monitoring sensors. The systems can easily be

configured to communicate with the cloud by the usage of additional hardware. This link boosts overall performance which helps labs keep accurate and secure data. **PureHealth has launched PureNet, a digital health service platform that uses cloud computing technologies. The platform connects healthcare providers, enables operational efficiencies and aligns with the UAE's Forward Society pillar of We the UAE 2031.** It aims to accelerate socio-economic growth plus development over the next 50 years, enhancing patient care in the UAE.

Advantages of Lab Automation and Digitalisation

Lab automation involves using tools to perform tests, experiments, and data analysis with minimal human involvement. Automation is essential to contemporary research plus diagnosis, offering increased efficiency, precision, repeatability, as well as the capacity to handle large sample volumes. Key features and advantages include:

• **Laboratory automation streamlines and accelerates experimental processes by mechanised repetitive tasks** like precise pipetting. This accelerates the rate of completion and allows researchers to achieve higher throughput in less time. Additionally, researchers experience minimum to zero downtime as laboratory automation systems are productive 24/7. **Medtronic Plc has introduced the Hugo RAS system, a robotic-assisted surgery platform with advanced automation features, aimed to improve surgical precision.** Additionally, Siemens AG has acquired a healthcare automation software firm to enhance its digital health solutions, which focuses on clinical workflow automation and patient data management.

• **Automation in microbiology reduces human error** which ensures precise measurements and leads to improved reproducibility plus high-quality results. This reduces variability introduced by manual intervention, confirms consistent and reliable outcomes in experiments. **The Emirates Health Services Foundation is the first regional institution to use a "blood drawing robot," saving 80% of the staff's time as well as 50% of delays for patients.**

• **Lab activities automation can drastically lower costs** by optimisation of resource utilisation and staffing levels, a



crucial part of laboratory operations. It can cut labour costs by limiting the need for physical labour, allowing institutions to focus on more sophisticated and value-added tasks.

• **Automation optimises resource use by wastage minimisation**, such as in liquid handling, and to ensure that the correct amount of reagent is used. This leads to significant savings and contributes to environmental sustainability by reduction of waste along with material costs over time.

• **Lab automation enhances data management and analysis** ensures safety as well as transparency in daily laboratory routines. Automated systems enable seamless data collection, guarantees meticulous recording, timestamped storage, and scrupulous labeling, which forms a foundation for meaningful analysis. Automation equipment often includes tools for real-time data analysis that allow lab automation software to process large datasets, perform detailed statistical analyses, and predict trends with minimal intervention. **Laboratory information management systems (LIMS) enable researchers to gain deeper insights and make informed decisions**

Lab Automation and Digitalisation Market Dynamics

Market Growth Drivers

a. Population Growth and Increased Consumption: The expansion of population plus heightened consumption patterns significantly contribute to the growth of the lab automation market.

b. Technological Advancements and Innovation: Ongoing technological advancements as well as innovations play a pivotal role by driving market growth and fostering continuous development.

c. Rising Disposable Income: An increase in disposable income among consumers positively impacts market growth, which drives demand for lab automation products.

d. Growing Awareness of Product Benefits: Rise in awareness of the benefits associated with lab automation further propels market expansion with consumer preferences.

e. Increase in Investment and Strategic Initiatives by Market Players: The market for laboratory automation expands due to high demand for specialised automated services that eliminate human errors. Market players focus to provide a variety of tools, equipment, machines, and techniques to support the development of automated laboratory infrastructure. To capture the global market share, such players invest more in advanced technologies. The emphasis reduces manual efforts and hands-on time for traditionally labor-intensive processes.

f. Government Initiatives to Strengthen Laboratory Infrastructures: Government organisations play a significant role to strengthen the healthcare sector plus laboratory infrastructure. Government funds and initiatives to expand laboratory automation is expected to help market growth while increases the number of market players. Collaborations along with agreements between the government as well as key market players are expected to further enhance laboratory infrastructure.

g. Growth in Expenditure on Lab Automation Tools and Equipment: The expenditure on lab automation tools / equipment is growing due to an increase in the demand for laboratory diagnostic tests. Factors such as an aging population, the growth of chronic diseases, the discovery of new biomarkers, and an increase in preventive health awareness contribute to this trend.

h. Reduction in Human Efforts and Elimination of Human Error: Traditional methods exist to reduce human errors, but develop advanced systems that mitigate the risk in an integrated manner. Manufacturing facilities are focused on building systems that utilise artificial intelligence (AI) to anticipate, recognise and rectify potential issues.

Market Restraints

a. Economic Downturns and Reduced Consumer Spending: Economic downturns plus a decrease in consumer expenses pose challenges to market growth, which impacts demand for lab automation products.

b. Intensified Competition and Market Saturation: Heightened competition plus market saturation requires innovative strategies to sustain growth.



c. Stringent Regulatory Frameworks: Stringent regulatory requirements present hurdles for market players that necessitate compliance efforts that may impact operational flexibility.

d. Emergence of Alternative Products: The introduction of alternative products diverts consumer attention, affecting demand for lab automation products.

e. Technological Obsolescence: The risk of technological obsolescence necessitates constant adaptation to new technologies to remain competitive.

f. Analysing Novel Complex Products: Novel products in automated laboratories are often complex, require early engagement between staff and device manufacturers to ensure smooth operation. Limitations to detect plus analyse such products hamper the installation as well as the functionality of automated labs.

g. High Cost of Installation and Setup: The installation plus the setup of lab automation systems is a complex endeavour, which requires significant time, effort, planning, as well as regulatory approvals. The high cost of advanced machines, tools, and equipment necessitates substantial investment in infrastructure.

h. Upgradation, Maintenance, and Periodic Checkups: Efficient lab operation requires regular maintenance, upgrades, and periodic checkups of equipment. The expenses are significant restraining factors for market players. Regulatory or quality control mandates also compel laboratory holders to test products.

Market Opportunities

Investment in cutting-edge technology and adoption of a holistic approach to laboratory operations, healthcare providers can unlock the full potential of lab automation as well as digitalisation.

a. Rising Healthcare Expenditure: Healthcare expenditure has increased due to several factors, which include a rise in drug prices, healthcare service costs, and administrative expenses. In 2020, healthcare spending reached its highest level, primarily due to the COVID-19 pandemic. It led to the fastest growth rate in healthcare expenditure since 2002.

b. Strategic Initiatives by Key Players: Leading pharmaceutical and healthcare companies have undertaken various initiatives to automate laboratories, which aims to deliver advanced healthcare services more efficiently. The growth in healthcare demand has intensified competition among companies to



improve lab automation worldwide. As a result, such strategic initiatives are expected to create opportunities for growth in the lab automation market.

c. Increase in the Number of Pharmaceutical Companies: The pharmaceutical industry has seen significant growth over the past two decades. **Factors such as rise in disposable incomes, increased access to healthcare facilities, greater health consciousness among people, and increased penetration of medical services have driven the growth of pharmaceutical companies.** This rise in the number of companies is a response to the increase in demand for healthcare products and services.

Conclusion

Integration of automation system has become a strategic priority as laboratories strive to manage rising demand for diagnostic testing, drug discovery, and research. The capacity to effectively manage greater workloads and complicated data sets while preserving precision distinguishes laboratory automation as a standalone solution. As a result, increased demand for high throughput and operational efficiency is boosting the laboratory automation industry.





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