Selecting Laboratory Automation

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The case for automation

Clinical laboratories face escalating pressures to reduce costs, increase the test menu, reduce turnaround time, and improve productivity. Simultaneously, there is a shortage of trained professionals in clinical laboratory science. The average age of a medical technologist in the US is approaching 50 and there are 56 percent fewer graduates than 20 years ago.[1]

As a result, everyone is being asked to do more with less, and labs are looking for new ways to reduce turnaround times and expand services without adding full-time employees. They need to improve lab processes, eliminating manual steps so staff can focus on critical, value-added tasks. Laboratory automation can be a powerful means to achieve these goals.

Lab automation choices

Automation enhances lab productivity by targeting manual, labor-intensive activities. Automation solutions are diverse, ranging from total laboratory automation (TLA) to highly focused islands of automation. A detailed analysis of current laboratory processes and business needs is a critical first step toward selecting the best automation solution.

Total lab automation

TLA solutions are comprehensive, complex systems whose goal is to automate the entire sample handling and analytical process. These systems have features such as auto–sample retrieval for rerun/reflex testing, a reduced need for technologist intervention with samples, and information consolidation and integration. Among the most touted benefits are a reduction in reporting-time fluctuations for consistent result reporting. (See Figure 1.)

By completely automating lab processes, a TLA solution can increase productivity over the long term. It requires a large up-front investment, however, and the ability to make changes as business evolves is limited. Standardizing on a single manufacturer offers some efficiency, but the lab should make sure that it has a flexible solution. If quality declines or prices rise, the lab needs the ability to change to another vendor.

Islands of automation

Islands of automation offer focused functionality by automating the processes with greatest impact on labor reduction. This solution provides flexibility in system configuration, footprint, and choice of vendors. Because automation is implemented in targeted areas, islands of automation require a lower initial capital outlay than TLA. (See Figure 2.)

Rather than a comprehensive "all or nothing" solution, labs can streamline existing processes, identifying tasks where automation will have immediate benefits. The lab may select "best-of-breed" for each platform and introduce automation in steps.

The islands of automation solution does not require extensive track systems. Samples may be delivered to various areas by less skilled staff (the "sneaker net") while the experienced technologist focuses on laboratory testing. This modular approach makes it easy to modify work area design. It is a scalable solution that adapts to accommodate growth and change, and it integrates into existing systems.

Realizing the benefits of lab automation

To realize return on investment (ROI) and productivity gains from automation, labs should select the solution that fits current and future business directions. It is also important to select a vendor as a business partner who will collaborate to support and energize the automation initiative.

Preparing for automation

Healthcare organizations are beginning to apply the principles of Lean and Six Sigma to improve quality and performance.[2,3] Dwindling workforce and budget constraints are forcing labs to streamline processes, consolidate sample handling, and reduce activities that do not generate billable results. Before deploying automation, the laboratory should conduct a cost–benefit analysis and set measurable business goals and success metrics. Areas often overlooked that the laboratory should keep in mind include workplace safety, improved patient care, and overall work environment.

The laboratory should start by evaluating and streamlining existing processes to identify areas where automation will have the greatest impact. For example, existing manual processes

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Figure 1. An example of total laboratory automation (TLA) is the DPC LabStation (not available in all countries). It is expandable by design, allowing the lab to add various systems and multiple components to the track-based system as needs change.

Figure 2. An example of an island of automation is the DPC Immunoassay Workcell. Here the Sample Management System (SMS) connects two IMMULITE 2500 systems, providing the lab with a single sample-entry point and access to 48 different analytes.

such as sample transport may be efficient, while other preanalytical activities such as sample sorting, decapping and recapping may hold the highest potential for automation.

The concept of Lean

Leading healthcare organizations throughout the world are beginning to implement a manufacturing principle called Lean in their organizations to eliminate waste, streamline processes and cut costs. This is an important undertaking when considering laboratory automation. Lean is an integrated set of industrial principles designed to eliminate waste by removing unnecessary processes and redirecting human effort toward value-added business operations. This reduces production time, decreases costs and improves customer satisfaction.

A laboratory embarking on a Lean program must expect that it will take time and bring challenges. Keeping the following considerations in mind will help the program succeed.[4]

- Management must lead the way by fully supporting the Lean concepts.
- Identify, analyze and lay out your current processes, both the effective and the wasteful, using Lean "value stream mapping" or another mapping technique.
- Use this "snapshot" of your current organization to map its future state.
- Remove or consolidate steps that do not contribute value to the process, to create a more efficient work flow.
- If desired, consult a Lean expert from the manufacturing industry or visit an organization with an established Lean program, for insight and direction.
- Anticipate skepticism. It may be helpful to determine benchmarks before inaugurating the Lean program for comparison later. Share findings with management and employees.
- Persevere; results are sometimes years in the making.

Successful deployment

Successful deployment of an automation product depends on how well the automation solution satisfies the laboratory's needs. The "Automation Considerations" section of the table presents lab-specific factors to assist with the selection of TLA or islands of automation. The "General Considerations" section lists factors to evaluate when making vendor selections.

Automation success factors

Labs in a stable business environment that can make large, initial investments are candidates for TLA if their physical and IT infrastructure supports deployment. TLA infrastructure considerations include evaluating its compatibility with the current lab layout and the LIS, as well as the importance of multivendor capabilities.

Labs operating in a dynamic, changing environment that may not be able to support a large initial investment benefit from an islands of automation approach. This solution fits with any footprint, automates high-payoff functions, and offers a choice of "best-of-breed" solutions.

Return on investment

Projections for ROI include increased quality and productivity, with decreasing labor costs. Installing automation, especially TLA, creates upheaval in most laboratories. Labs should avoid the temptation to promise a short timeline for ROI, as well as a timetable that commits to reducing labor costs before the system is fully functional. To fully realize ROI, the lab must be prepared to reevaluate and change lab processes to take advantage of automation.

TLA is a dramatic change for most laboratories, so they must plan for the long term to realize ROI. With islands of automation, the laboratory implements moderate change in phases, and targeted ROI is realized more quickly in specific functional areas.

Additional considerations

Implicit in the investment in automation is the expectation of improved productivity. Innovative manufacturers add value by incorporating additional features into their products that further enhance productivity. Real-time monitoring and proactive support of systems by the manufacturer, informatics tools that turn instrument data into useful information for managing laboratory workflow, and the ability to monitor multiple systems from a single location are all features that improve productivity.

Factor	Automation Considerations	
	Islands of Automation	Total Lab Automation
Budget	Do budget constraints require a phased investment?	Is the lab able to make a large upfront capital investment?
Business Trends	Is the lab operating in a dynamic, changing environment requiring flexible expansion?	Is the lab seeing stable, predictable demand that allows for a single long-term solution?
Footprint	Is the lab in different rooms, on different floors, or in different buildings?	Is the lab located in a large, open area that can accommodate the linking of all instruments to a single track?
Multivendor Compatibility	Does the lab use several vendors and embrace the "best-of-breed" instrument philosophy?	Has the lab standardized on a vendor that markets TLA?

Factor	General Considerations
Sample Tube Requirements	Does the lab receive varied sample tubes, including capillary samples, and can the vendor accommodate the lab's sample tube specifications?
Lab Processes	Does the automation solution impact the existing processes requiring improved turnaround time and productivity?
LIS Integration	Will the automation solution integrate with the existing LIS, and can the LIS manage the information traffic flowing from the automation solution?
Partnership	Is the automation vendor willing to partner and help the lab develop the new processes and activities necessary for successful implementation?

Manufacturers with a proven track record of offering these features will likely continue to enhance their systems in the future.

Summary

Selecting the right automation system begins with understanding existing processes and selecting the automation model that meets the lab's long-term business needs. The lab must prioritize the "must-have" features and consider budget, business environment, space restrictions, selection of "best-of-breed" for each platform, sample tube requirements, and LIS integration.

In addition, the lab should seek out a manufacturer with a history of innovative product design and outstanding service and support that includes real-time monitoring for superior uptime and productivity.

Finally, the lab should avoid the temptation to predict early ROI. Instead, it should look ten years into the future and select the automation process that can most easily adapt to change and expansion.

References

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