

Total Lab Automation

Category: Digital Excellence

Focus Area: Automation in pharmacy, laboratory, and diagnostic services

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Problem Statement / Digital Challenge

The key operational and clinical challenge was managing an increasing patient load that demanded faster turnaround times (TAT). Manual processes were prone to pre-analytical and analytical errors, lacked standardization across diagnostic disciplines, and struggled to meet the demand for high-throughput testing with minimal sample volumes.

A digital solution was required to automate workflows, minimize manual intervention, and provide real-time monitoring and proactive quality management. Intelligent automation was necessary to eliminate manual touchpoints, optimize sample processing, and ensure absolute sample integrity with complete traceability.

The primary stakeholders affected by these challenges included:

â€¢ Patients: Faced potential delays in diagnosis, larger pediatric sample volume requirements, and the risk of repeat sampling due to manual errors.

â€¢ Laboratory and Technical Staff: Had to manage heavy workloads manually without centralized workflow visibility, decision support, or real-time tracking.

â€¢ Clinicians and Management: Lacked a unified reporting platform and real-time actionable insights to make fast, proactive clinical and operational decisions.

The digital gap directly impacted key National Accreditation Board for Hospitals & Healthcare Providers (NABH) quality indicators. It specifically constrained Patient Safety Goals (COP.3) due to manual error risks, Access, Assessment & Continuity of Care (ACC.1) by slowing down report delivery, and Laboratory Services (MOM.4)

regarding standardization, validated methods, and quality control compliance. It also

affected overall operational metrics like sample recollection rates, instrument downtime tracking, and data integrity.

Digital Tool / Solution Implemented

The hospital deployed Rajagiri Smart Lab, an outsourced, end-to-end total laboratory automation ecosystem. It is powered by Roche Diagnostics advanced robotics, conveyor track networks, and high-throughput analytical modules.

The digital engine is the Digital Command Center, which runs the navify® Lab Operations and Monitoring software. This middleware provides unified, multi-disciplinary IT integration across clinical biochemistry, immunoassays, infectious serology, and hematology.

Key features include:

- Centralized Dashboards: Offers real-time visibility into operational sample statuses.

- Patient Safety Tracking: Features automated laser barcode routing, high-definition camera fluid checks, and auto-flagging to ensure near-zero pre-analytical errors.

- KPI Reporting: Delivers proactive turnaround time (TAT) alerts, automated quality control tracking, and digital pathology sample life cycle.

- Automated Archiving: Uses the cobas p 501 unit for automated refrigeration storage and reflex retrieval.

Digital Implementation Highlight

The full deployment of the Rajagiri Smart Lab was executed through a highly collaborative and structured rollout. The transformation involved the multi-disciplinary connectivity and integration of four major diagnostic domains:

â€¢ Clinical Biochemistry

â€¢ Immunoassay

â€¢ Infectious Serology

â€¢ Hematology

The implementation required comprehensive training for the on-ground technical team and laboratory technicians to master advanced robotics, ergonomic technician workstations, and touchscreen operations. Technicians were trained to utilize real-time workflow controls, automated result verification systems, and digital pathology monitoring.

This major operational pivot was driven directly under the strategic oversight and vision of the hospital's executive leadership, led by Fr. Johnson Vazhappilly CMI, Executive Director & CEO. The initiative was championed internally by a dedicated joint task force consisting of the hospital's clinical laboratory management, technical team leaders, and specialized automation specialists from Roche Diagnostics. Together, they successfully bridged advanced digital pathology infrastructure with the core Hospital Information System (HIS) to establish a future-ready diagnostic ecosystem.

Digital Impact

The transition to total laboratory automation has dramatically elevated clinical operations and safety standards:

â€¢ Operational Improvements: The solution significantly reduced Turnaround Time (TAT) across all test categories, driving faster clinical decisions and timely treatment initiation. Operational efficiency lowered costsâ€”making care more affordableâ€”while seamless Hospital Information System (HIS) integration provided 100% automated documentation compliance.

â€¢ Quality & Safety Improvements: High-definition cameras and laser technology achieved a near-zero pre-analytical error rate (target <0.1%). Automated quality checks minimized sample recollections and repeat test runs, while the system's complete sample lifecycle tracking ensured flawless audit readiness.

â€¢ NABH Digital Health Support: The implementation maps perfectly to core NABH standards. It fulfills Patient Safety Goals (COP.3) through automated error flagging and Laboratory Services (MOM.4) via standardized, validated methods. Continuous quality tracking through the navifyÂ® dashboard drives compliance with Quality Assurance (FMS.4), while digital integration protects data integrity for Information Management (HIC.1).

Key Enablers / Innovations

The successful deployment of total laboratory automation was driven by distinct technological enablers and the mitigation of complex integration challenges:

Key Enablers:

â€¢ Intelligent Robotics & Conveyors: Advanced robotic track systems automated sample handling, identification, and routing, drastically reducing manual intervention.

â€¢ High-Definition Pre-Analytical Features: HD cameras and laser barcode readers automated initial quality and sample sufficiency checks.

â€¢ The Digital Command Center: The integration of navify® Lab Operations and Monitoring provided the technical and management teams with centralized workflow management, real-time tracking, decision support, and proactive turnaround time (TAT) alerts.

â€¢ Scalable cobas® Modules: Future-ready modules (pro, e 801, ISE neo) enabled high-throughput testing utilizing the lowest required pediatric-friendly sample volumes.

Overcoming Challenges:

The primary hurdles involved standardizing diverse diagnostic protocols across separate disciplines (biochemistry, immunoassay, serology, and hematology) into a single entry track. The hospital overcame this by building a unified reporting platform

and establishing seamless, bidirectional data integration with the core Hospital

Information System (HIS), eliminating traditional operational siloes and decision

barriers.

Key Learnings & Sustainability

Top Learnings & Guidance for Other Hospitals:

1. Prioritise Patient Safety Over Speed: Technology investments must directly advance patient care. Automation is a strategic vehicle to achieve near-zero error rates, not just high throughput.
2. Eliminate Operational Siloes: Hospitals adopting total lab automation should look for modular, interconnected platforms. Standardising clinical biochemistry, immunoassay, serology, and haematology into a single entry track is essential to eliminate traditional decision barriers.
3. Build Multi-Disciplinary Digital Command Centres: Real-time visibility is vital. Command dashboards are required to balance technical alerts for on-ground staff with consolidated performance overviews for executive management.

Supporting Visuals & Dashboards:

• navify® Lab Monitoring Dashboard: Displays critical results, instrument distribution, and active turn-around-time (TAT) delays.

• cobas p 501 Analytics Interface: Tracks complete sample lifecycles and automated storage archiving.

Reference Sources (If Applicable)

navify® Lab Operations & Monitoring interface and the cobas® automation suite

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