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Biotech's Next Leap: Building the Automation Backbone for Scale

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Building scale requires a unified automation architecture that can connect people, processes and facilities



India stands at the threshold of a new industrial era, one in which biotechnology is becoming not just a field of scientific discovery, but a powerful engine of manufacturing and economic growth. From precision fermentation and advanced therapeutics to next-generation biomaterials, innovation is emerging across healthcare, agriculture, food, materials, chemicals and sustainability.

The opportunity ahead is immense. Realising it, however, will depend on our ability to reproduce these innovations consistently, efficiently and economically at an industrial scale. This requires technology infrastructure that can deliver greater speed, control and flexibility. Automation will be a cornerstone of this transformation, helping India advance the ambitions of its BioE3 (Biotechnology for Economy, Environment and Employment) Policy by enabling a competitive biomanufacturing ecosystem and bringing innovations to market faster.

Unlike conventional manufacturing environments, biological systems can be highly sensitive to variations in critical process parameters. While these variables may be managed effectively at laboratory or pilot scale, commercial biomanufacturing requires tight control of process variables, equipment assets and input/output (I/O) points across the facility. With processes often running continuously, even small deviations can affect stability, productivity or product quality. Automation provides the visibility and precision needed to manage this complexity, enabling consistent and repeatable manufacturing outcomes.

The Case for 'One Plant, One System'

As biotech companies expand, they often evolve from single production blocks into integrated manufacturing campuses spanning fermentation, active pharmaceutical ingredient (API) manufacturing, bioreaction systems, utilities, warehousing and support infrastructure. Managing these assets through separate automation systems can create operational silos, fragmented data and complexity. This has led some large biomanufacturing facilities to adopt a 'One Plant, One System' approach, providing plant-wide visibility across production, utilities and support systems.

At its core, "One Plant, One System" is an automation architecture that scales with the manufacturing footprint without creating silos. A unified platform simplifies operations, compliance and expansion by providing a common foundation across the plant. In highly regulated environments, compliance with regulations such as FDA 21 CFR Part 11 is critical, requiring secure electronic records, electronic signatures and time-stamped audit trails. The "One Plant, One System" model supports these requirements through built-in capabilities for system security, secure data management, reporting, electronic records and signatures, and automated audit trails. This helps manufacturers maintain data integrity, ensure traceability and remain audit-ready.

Integrated architecture also reduces maintenance costs, simplifies upgrades, and removes the need for training teams on multiple automation platforms. By standardising operations on one system, manufacturers can accelerate onboarding, improve workforce flexibility, and maintain consistency across sites. The architecture can then scale seamlessly from new production lines to thousands of additional input/output (I/O) points without adding operational complexity.

In one large-scale deployment, an automation environment grew from approximately 4,000 to 45,000 I/O points across nine manufacturing facilities. What began with a couple of production units and a fermentation block evolved into a common control environment spanning fermentation, API production, bioreactions, continuous-flow chemistry and building management. The significance lies not simply in managing more I/O points or connecting more facilities, but in extending a common automation architecture across increasingly diverse and complex operations while maintaining consistency, visibility and control.

As India seeks to establish itself as a global biomanufacturing hub, success will depend on the ability to industrialise innovation at scale. Building that scale requires a unified automation architecture that can connect people, processes and facilities while preserving consistency, compliance and process knowledge. Such a robust foundation enables manufacturers to accelerate the journey from discovery to commercial production and unlock the full promise of biotechnology.

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