MAHENG/2009/33944
Vol 18 Issue 02 • Pages 78 • Mumbai • ISSN: 2456-7418
July 1, 2026 • Rs. 300 •

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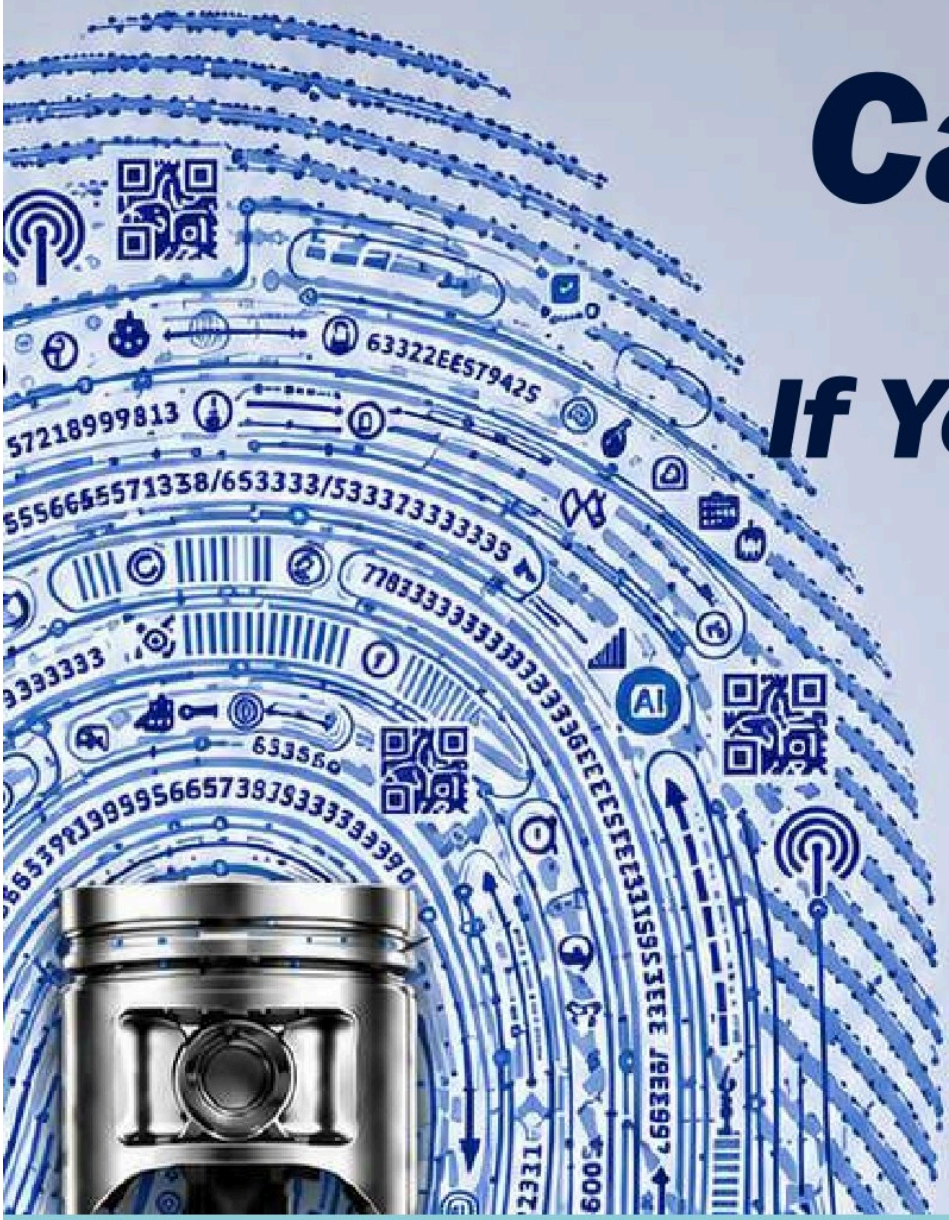

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Automation Reshaping Pharmaceutical manufacturing in 2026

Industry experts believe the sector is moving rapidly from conventional batch-based manufacturing toward connected, data-driven, and highly automated

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The pharmaceutical manufacturing industry in 2026 is witnessing a major technological transformation as automation, artificial intelligence (AI), robotics, Industrial Internet of Things (IIoT), and smart manufacturing systems redefine production ecosystems. Across biologics, sterile injectables, packaging, formulation manufacturing, and APIs, pharmaceutical companies are increasingly investing in intelligent manufacturing infrastructure to improve efficiency, strengthen regulatory compliance, and ensure product quality with greater precision.

Industry experts believe the sector is moving rapidly from conventional batch-based manufacturing toward connected, data-driven, and highly automated "Pharma 4.0" environments capable of real-time monitoring, predictive maintenance, and adaptive compliance management.

Automation driving intelligent manufacturing ecosystems

According to Dr Sanjay Agrawal, a pharmaceutical consultant, the pharmaceutical manufacturing landscape is undergoing a major transformation through automation and digital integration.

"The pharmaceutical manufacturing landscape in 2026 is undergoing a major transformation through automation and digital integration. Modern pharma plants are increasingly adopting robotics, AI-driven analytics, IoT-enabled systems, and continuous manufacturing technologies to enhance productivity, precision, and quality assurance. Automation is not merely replacing manual processes; it is enabling intelligent manufacturing ecosystems capable of predictive maintenance, real-time monitoring, and data-driven decision-making. This shift is helping pharmaceutical companies improve operational efficiency while maintaining stringent regulatory standards," he said.

Dr Komal Saini, Assistant Professor, Chandigarh College of Pharmacy, noted that automation is reshaping pharmaceutical

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manufacturing by shifting the industry from fragmented batch processing to orchestrated continuous production systems. "These automated smart facilities are powered by AI and IoT, reducing production time, scaling delivery of personalised medicines, and lowering operational costs while maintaining strict regulatory compliance. Automation is revolutionising how drugs are produced, stored, and distributed through automated filling lines, robotic packaging, and intelligent cleaning systems integrated with PLC/SCADA systems," she explained.

Dr Parina Kumari, Assistant Professor, MM College of Pharmacy, highlighted that the industry is moving beyond conventional mechanisation toward fully integrated AI-driven manufacturing ecosystems.

"In 2026, the industry is moving toward Pharma 4.0 through technologies such as AI, machine learning, robotics, Industrial Internet of Things, digital twins, and cloud-connected Manufacturing Execution Systems (MES). These technologies allow manufacturers to monitor, optimise, and control production processes in real time, thereby improving consistency, reducing human intervention, and minimising batch failures," she said.

Akshansh Chaudhary, Executive Director & Chief Technical Officer, Venus Remedies Limited, stated that automation in pharmaceuticals is evolving beyond traditional Pharma 4.0 frameworks. "Automation in the pharma sector is evolving beyond conventional Pharma 4.0 frameworks toward more resilient, connected, and human-centric manufacturing ecosystems, where intelligent automation drives real-time quality oversight, faster decision-making, operational agility, adaptive compliance, and overall manufacturing resilience," he said.

According to Chaudhary, pharmaceutical companies are increasingly adopting integrated strategies that combine infrastructure modernisation, such as robotics, aseptic automation, and advanced filling systems, with digital transformation initiatives including AI-enabled analytics, smart compliance systems, and connected data environments. "This shift is enabling faster decision-making, improved product quality, reduced contamination risks, and scalable production capabilities for sterile injectables, oncology products, and other highly regulated formulations where precision, aseptic integrity, and traceability are critical," he added.

Biologics and packaging lead automation investments

Industry experts unanimously agree that biologics, sterile injectables, and pharmaceutical packaging are currently attracting the highest automation investments.

Dr Agrawal said biologics manufacturing demands extremely precise environmental control, contamination prevention, and process consistency, making automation indispensable.

Dr Parina Kumari stated that biologics and sterile injectables are leading automation investments because of their highly sensitive production environments.

"Biopharmaceutical manufacturing requires stringent environmental control, real-time monitoring, and high precision, making automation indispensable. examples including WuXi Biologics' AI-powered "PatroLab" digital twin platform, AstraZeneca's expansion of digital twins and agentic AI across manufacturing sites, and Cipla's adoption of digital twin technology at its Goa manufacturing facility to improve formulation efficiency and continuous manufacturing capabilities" she said.

Chaudhary emphasised that automation investments vary depending on a company's operational focus and manufacturing maturity."Some of the strongest automation investments are being witnessed across sterile formulations, injectable manufacturing, packaging operations, and digitally integrated warehousing infrastructure. These segments operate under highly regulated environments where precision, contamination control, serialisation, and real-time traceability have become critical operational priorities," he said.

Regulatory compliance accelerating automation adoption

Experts identified regulatory compliance, operational efficiency, contamination control, and real-time quality assurance as the primary drivers behind automation adoption.

Dr Agrawal outlined key factors accelerating automation adoption, including increasing GMP and FDA expectations, the need for production efficiency and cost optimisation, reduction of human error, enhanced data integrity, and growing demand for biologics and personalised medicines.

Dr Saini explained that automation helps pharmaceutical plants eliminate manual errors, improve safety, and accelerate product commercialisation.

Dr Parina Kumari added that post-pandemic supply chain disruptions further accelerated the need for resilient and flexible manufacturing systems capable of rapid scale-up. "Regulatory agencies such as the US FDA and EMA increasingly emphasise traceability, electronic documentation, and real-time quality assurance, compelling pharmaceutical companies to modernise their operations".

Chaudhary observed that compliance is no longer managed as a standalone quality function but is now embedded directly into manufacturing operations and enterprise-wide digital systems.

The pharmaceutical manufacturing landscape is undergoing a major transformation through automation and digital integration.

▶ *Dr Sanjay Agrawal,*
Pharmaceutical consultant

Industry is moving beyond conventional mechanisation toward fully integrated AI-driven manufacturing ecosystems.

▶ *Dr Parina Kumari,*
Assistant Professor,
MM College of Pharmacy

Automation in pharmaceuticals is evolving beyond traditional Pharma 4.0 frameworks.

▶ *Akshansh Chaudhary*
Executive Director & Chief Technical Officer
Venus Remedies Limited.

Venus Remedies' initiatives such as Project Hyperlink and Project Archival, which are focused on digitising compliance ecosystems, electronic documentation systems, and audit-ready operational environments.

Smart factories redefining pharmaceutical production

The emergence of smart factories is significantly improving production efficiency across pharmaceutical manufacturing. Dr Agrawal described smart factories as unified digital ecosystems integrating connected machines, AI-based process controls, robotics, MES platforms, and IoT sensors. "These facilities help manufacturers achieve reduced downtime, faster batch release cycles, lower wastage, and improved equipment utilisation".

Dr Parina Kumari explained that smart factories facilitate real-time communication between machines and centralised systems, enabling predictive maintenance, optimised resource utilisation, and faster process adjustments. "Smart manufacturing significantly reduces downtime, improves Overall Equipment Effectiveness (OEE), enhances batch consistency, and shortens production cycles".

She cited AstraZeneca's use of digital twins and AI-enabled manufacturing simulations, along with Pfizer's fully digitalised HighCon smart manufacturing facility in Freiburg, Germany, which reportedly increased production capacity substantially while improving sustainability and manufacturing speed.

Automation strengthening GMP and FDA compliance

Experts believe automation is becoming indispensable for maintaining GMP and FDA compliance in highly regulated pharmaceutical environments.

Dr Agrawal explained that automated systems improve accuracy, traceability, documentation, and process consistency through electronic batch records, audit trails, deviation tracking, and real-time validation systems. "As regulatory frameworks continue evolving globally, automation has become a strategic necessity rather than an optional technological upgrade," he said.

Dr Saini highlighted that automation helps pharmaceutical manufacturers comply with FDA 21 CFR Part 11 requirements through secure electronic records, tamper-proof audit trails, and automated documentation systems.

"Automation simplifies standard maintenance requirements and reduces potential errors by verifying manufacturing processes against GMP standards," she explained.

Dr Parina Kumari stated that automation minimises manual intervention and significantly improves data integrity and regulatory readiness. "AI-powered manufacturing platforms are increasingly functioning as real-time compliance layers, continuously validating operations against GMP requirements and enabling faster corrective actions" .

Chaudhary concluded that intelligent compliance infrastructure is becoming a defining trend in pharmaceutical manufacturing. "Real-time data systems strengthen traceability and data integrity through secure electronic records, automated documentation workflows, and continuously updated operational visibility".