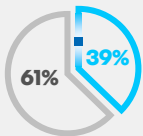


Intel Accelerates Adoption Of Pharma 4.0 Digital Transformation

Intel's hardware and software provide the power and AI-optimizing platforms needed for pharma, biopharma, cell & gene therapy companies to digitally transform their manufacturing facilities for more effective data utilization, optimized operations, and improved quality control and regulatory compliance.

190

190 of the 200 senior leaders of leading global manufacturing companies agree that digital transformation of manufacturing is essential to their company's future success.¹



Just **39%** of manufacturing executives report that they have successfully scaled data-driven use cases beyond the production process of a single product.²

Pharmaceutical Companies Are Looking to Implement Industry 4.0 Facility Standards

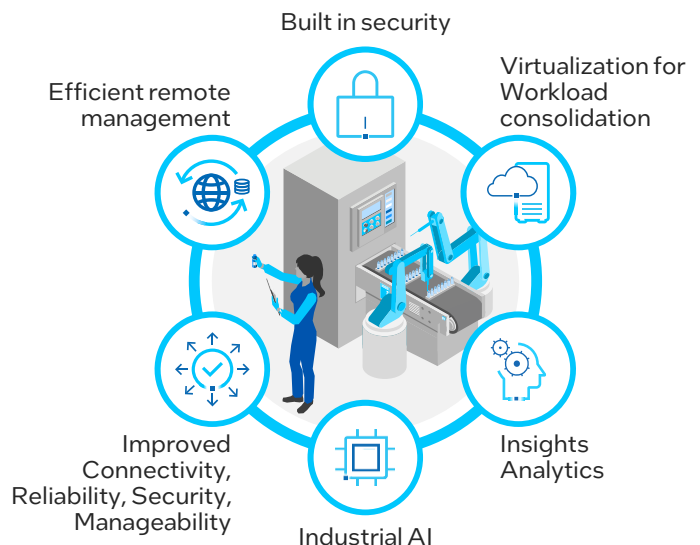
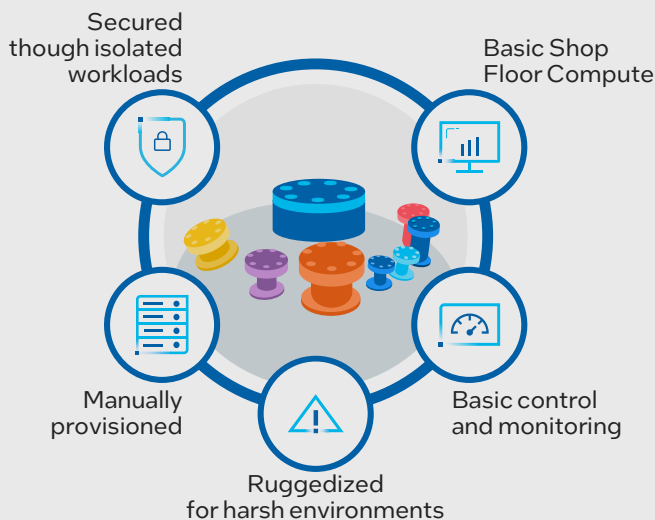
Manufacturers across all industries are transforming their facilities to implement the latest technologies in IIoT and AI to transform their facility to an inter-connected digital facility. Industry 4.0 standards can help improve processes, provide real-time monitoring and control, insights and predictive analytics, and more. However, the pharmaceutical industry faces increased levels of complexity when implementing enhanced technologies, slowing down adoption.

Due to regulations, the therapeutic developers hold stringent requirements for documentation, data integrity, and compliance process validation. However, implementing Industry 4.0 manufacturing standards to the pharmaceutical industry can help meet compliance standards with detailed data records as well as improve overall efficiency and productivity for the manufacturer.

Yesterday's Analog Production Environment



Today's Data-Operated Industry 4.0



Current Pharma Manufacturing Facilities Have an Opportunity to Improve

Current therapeutic manufacturing facility operations range from analog, paper-based processes to minimal digitalization and end-to-end network connectivity to support operations. The fact is that even though today's manufacturing processes have data collection methods from sensors, siloed or connected machines, or manually logged data, they need to develop the tools and resources to make use of that data.

Further, many biopharmaceutical companies are at earlier stages of their digital maturity and need to standardize to avoid data loss between research, validation, and production stages as well as unmask areas for process improvement.

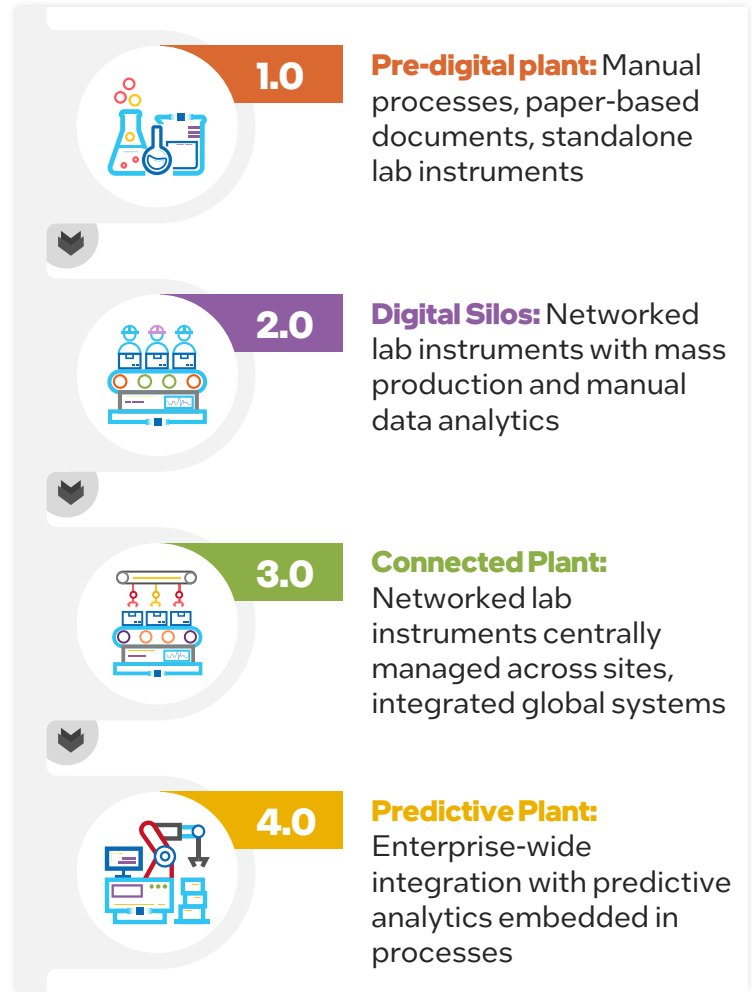
The additional overhead caused by these challenges can be resolved by Pharma 4.0 solutions that proactively catch mistakes, data errors, and manufacturing problems in real time to avoid further damages.

There is sizable potential to improve operational and process efficiencies for better workflow and greater quality control for companies at any stage of the facility's technology journey.

Pharma 4.0, a Pharmaceutical Industry Focus of Industry 4.0

The fourth industrial revolution moves from connected to predictive by utilizing big data, networking, artificial intelligence, and machine learning technologies to:





- **Access better data** – Use advanced analytics to isolate process issues and quickly respond to bottlenecks.
- **Reduce mistakes** – Automate quality assurance process to reduce the labor costs and concerns often associated with human error.
- **Evolve with the state of business** – Swiftly address changes in the manufacturing process and product variability.
- **Increase efficiency** – Using automation, optimize processes and accuracy in drug creation.



Intel Solutions Enable Pharmaceutical Manufacturers to Support Their Technology Implementation, Optimize Operations, and Maximize Performance

Intel accelerates time-to-market for therapeutic manufacturers by providing the hardware, software, and partner ecosystem solutions that fully support every aspect of the digital transformation journey toward a more connected, insightful, and controlled environment. From data center to the edge, Intel solutions enables low-power compute that can bring AI to new destinations capable of advanced analytics and ultimately enhance business results.

Use Cases

 <p>Electronic logbooks make documentation and compliance reporting a seamless part of the manufacturing process.</p> <p>Electronic Logbook</p>	 <p>IoT technology makes Pharma 4.0 more transparent.</p> <p>Line Clearance</p>	 <p>With Pharma 4.0, clean complex procedures like the cleanroom can be made clear and simple. Digital work instructions replace paper SOPs and ensure compliance.</p> <p>Clean Room Monitoring</p>	 <p>Big Data Analytics</p>	<p>Training for Regulated Environments</p> <p>Electronic Batch Records</p> <p>Process Visibility</p>
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Software

Intel® Distribution of OpenVINO™ Toolkit

helps customers further optimize deep learning and visual inference software applications to maximize performance.

Industrial Edge Insights Software (EIS)

enables integration of data, data management, and analytics for insight systems and delivers foundational AI capabilities.

Intel® Geti™ works with convolutional neural networks (CNN) to make training AI for computer vision accessible, agile, and intuitive.

Intel® Edge Controls (ECS) for Industrial integrates real-time compute, standards-based connectivity, safety, virtualization, and IT-like management to accelerate Industrial Control Systems transformation towards software defined and autonomous systems.

Hardware

Intel® Processors – Intel® Xeon® Scalable processors, Intel® Core™ processors, and Intel Atom® processors deliver the power bandwidth for facility needs such as considerations for environmental factors such as water resistance, chemical/sanitization compliance, and clean rooms.

Intel® Xeon® includes breakthrough memory and I/O capabilities with the introduction of DDR5 memory, PCIe 5.0, CXL 1.1, and new engine in Intel® Deep Learning Boost (Intel® DL Boost), called Intel® Advanced Matrix Extensions (Intel® AMX).

With Intel processors, pharmaceutical manufacturers can accelerate advanced workloads, help protect data with built-in security technology, and more flexibly deploy across existing devices.



Intel® Deep Learning Boost (Intel® DL Boost) with Intel® Advanced Matrix Extensions (Intel® AMX)

accelerates AI training and inference performance to integrate emerging machine vision and deep learning workloads into current infrastructure with x86 CPUs while avoiding expensive GPUs with high cost, thermal, and power requirements.

Intel® Smart Edge

is a Kubernetes-based, edge computing platform for deploying edge networks and delivering multi-access edge computing (MEC) for applications, containers, and virtual machines. The platform is optimized for performance, secure, user-friendly, and energy intelligent.

Intel® Time Coordinated Computing

augments the compute performance of Intel processors to address the stringent temporal requirements of real-time applications, helping improve performance for latency sensitive applications.

Conclusion

Today's industrial manufacturing trends are shaping pharmaceutical production into the future. Intel's hardware, software, and partner solution ecosystem can help streamline the transition to Pharma 4.0. Through a unique suite of Intel offerings, customers can discover new innovative ways to help improve regulatory compliance, optimize operations, streamline processes, solidify data integrity, and create new efficiencies.

Learn More

Find more information by contacting health.lifesciences@intel.com or through the links below:

- [Intel® Xeon® Processors Product Page](#)
- [Intel® Time Coordinated Computing Tools \(Intel® TCC Tools\) Web Page](#)
- [Intel® Deep Learning Boost \(Intel® DL Boost\) Web Page](#)
- [Intel Internet of Things Web Page](#)
- [Healthcare and Life Sciences Home Page](#)
- [Intel® Distribution of OpenVINO™ toolkit Product Page](#)
- [Intel® Geti™ Platform Web Page](#)
- [Intel® Edge Insights for Industrial Web Page](#)
- [Intel® Edge Controls for Industrial Web Page](#)
- [5G Industrial Automation Web Page](#)

Sources

1. Forbes, "[2021 State Of Manufacturing: Digital Transformation Is The Key To Winning In The "Next Normal"](#)", 2021
2. World Economic Forum, "[The future of manufacturing is powered by data and analytics. Here's why](#)", 2022



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