

Published by:
Siemens AG

Life Sciences industry
Oestliche Rheinbrueckenstr. 50
76187 Karlsruhe, Germany

For further information:
siemens.com/pharma

Image sources: Siemens
Printed in Germany

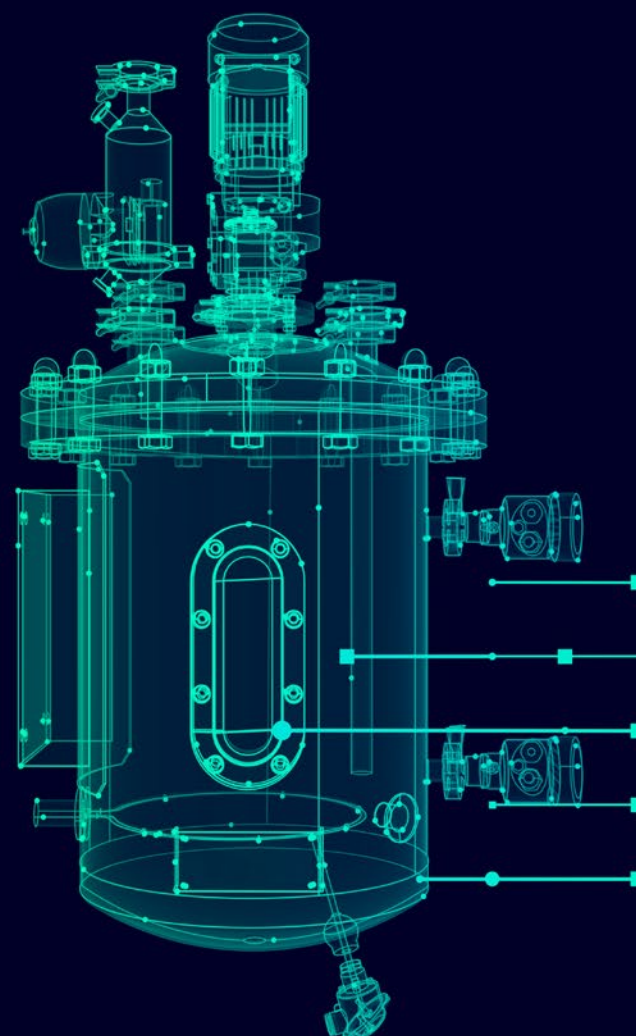
© Siemens AG 2026

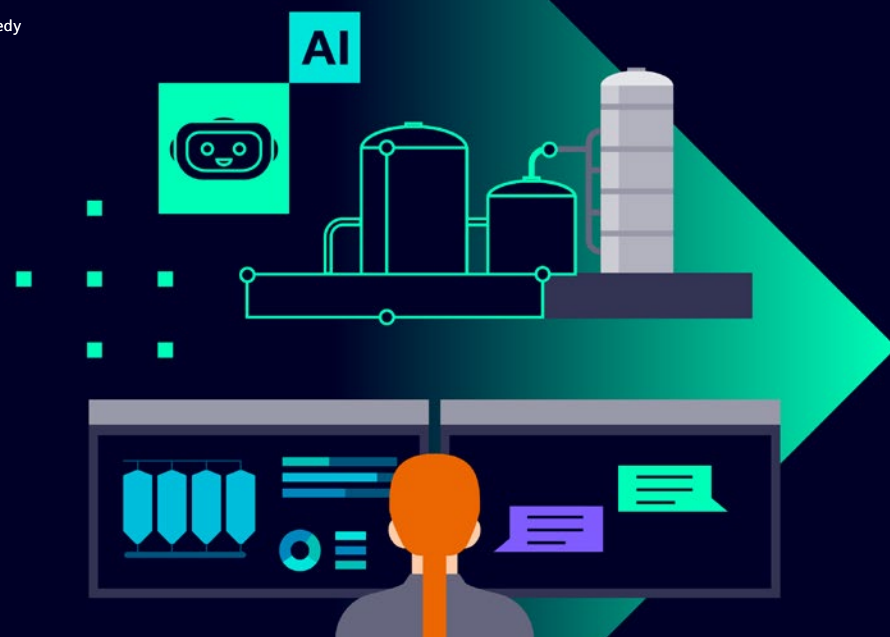
The information provided in this brochure contains merely general descriptions or performance characteristics, which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract. Availability and technical specifications are subject to change without notice. All product designations may be trademarks or product names of Siemens AG or supplier companies whose use by third parties for their own purposes could violate the rights of the owners.

A highly effective remedy

How AI is already shaping the future of the pharmaceutical business today

[siemens.com/pharma](https://www.siemens.com/pharma)





The pharmaceutical industry is under relentless pressure – tighter regulations, increasingly complex manufacturing, rising cost constraints, and the race to accelerate time-to-market. In this high-stakes environment, AI isn't just a nice-to-have – it's a strategic imperative. From R&D to tech transfer to production, AI-powered solutions are already transforming operations by streamlining processes, maximizing resource efficiency, and enabling faster, more sustainable drug development. For pharma leaders, the message is clear: those who harness AI now will define the future of medicine tomorrow. And when it comes to industrializing AI at scale, Siemens stands as a global leader – combining deep expertise in industrial automation, software, and AI to bring intelligence directly into pharma production.

Within the broader Life Sciences sector, the pharmaceutical industry stands out as one of the most innovation-intensive segments. Growth is driven by an aging population, increasing demand for advanced therapies, and rapid progress in biopharmaceutical technologies. At the same time, the industry is under enormous pressure. Research and development involve higher costs than ever before, regulatory requirements are growing, and there's increasing competition due to new market players focusing on biotechnology and the production of generic medicines. "As a result, higher levels of efficiency, faster development cycles, and resource-friendly production methods aren't just technological imperatives – they're also vital from an economic perspective," says Maria Grahm, Vice President Life Sciences at Siemens. So how can pharmaceutical production become more intelligent, flexible, and efficient?

Research and development – the role of digital twins

Digitalization and AI are already delivering tangible value across Life Sciences – starting right in the laboratory. The future is no longer defined by conventional lab environments, but by connected, intelligent digital labs that are flexible, modular, and data-driven. Beyond physical design elements such as modular ceilings and advanced fume hoods, these labs rely on integrated digital ecosystems. A network of sensors, instruments, and systems feeds data into platforms such as Siemens Xcelerator, enabling seamless connectivity across research and development processes. This shift fundamentally changes how innovation happens. Traditional formulation and process development have long been constrained by trial-and-error approaches and siloed data. New recipes required extensive testing cycles, consuming time and resources while delaying results. Today, digital twins and AI-powered tools are transforming this paradigm.

For example, bio solutions company **Novonesis** leveraged the cloud-based software Riffyn X from Siemens to reduce its experimental data acquisition and processing time from hours to minutes while increasing employee efficiency by as much as 50 percent. Riffyn X has been designed to record, contextualize, and integrate data at every stage of the development process so that experiments can be designed, planned, and conducted digitally.

J&J Innovative Medicine has leveraged Siemens solutions to optimize its manufacturing process. gPROMS in combination with SIPAT captures deep process knowledge in the form of high-fidelity predictive process models and has driven down total costs at the company by 35 percent.

But why not go one step further? At the **Medicines Manufacturing Innovation Centre in Glasgow**, a network of partners uses Siemens Tecnomatix not just to create digital twins, but also to enhance throughput. By leveraging real data to simulate production systems and logistics processes, the partners can run experiments, identify potential problems and optimize performance.

Novonesis

Cloud-based software Riffyn X

Reducing experimental data acquisition and processing time from hours to minutes

Increasing employee efficiency by as much as 50 percent

J&J Innovative Medicine

gPROMS in combination with SIPAT

Optimizing manufacturing process

Capturing deep process knowledge in the form of high-fidelity predictive process models

Driving down total costs at the company by 35 percent

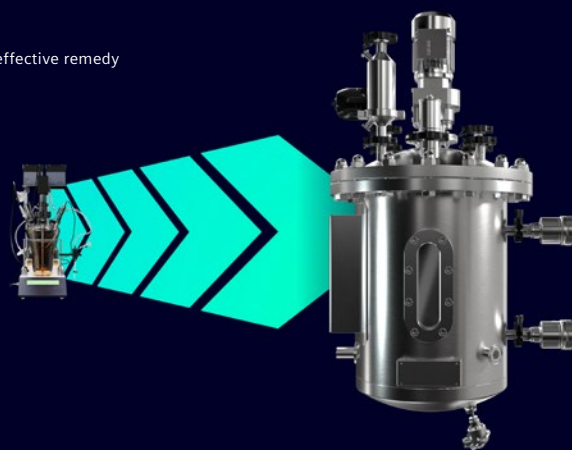
Medicines Manufacturing Innovation Centre in Glasgow

Siemens Tecnomatix

Digital twins

Enhancing throughput

Running experiments, identify potential problems and optimize performance



From molecule to production – with automation as the key

Pharmaceutical companies then need to transfer their process know-how from research and development to a pilot or commercial-scale plant. “However, the average tech transfer takes around 20 months and involves nearly 3 cross-functional experts. Why take so much time when you can speed up recipe engineering and scale up from molecule to production faster and more efficiently?” asks Grahm. By leveraging the Enterprise Recipe Management approach – a digital backbone for data-driven knowledge sharing – the recipe can be transformed and process know-how seamlessly transferred from lab to production.

AI can support automation engineers during this process, too. For instance, it can generate control code, answer engineering-related questions, and create visualizations for the user interface. “By integrating generative AI into the Siemens

Industrial Copilots to optimize workflows and improve collaboration between people and AI, we are boosting innovation and productivity in the pharmaceutical industry,” Grahm explains. This means faster knowledge transfer, quicker modifications to production systems for new active ingredients, less manual programming work, and manufacturing that is more flexible overall.



“By integrating generative AI into the Siemens Industrial Copilots to optimize workflows and improve collaboration between people and AI, we are boosting innovation and productivity in the pharmaceutical industry.”

Maria Grahm, Vice President
Life Sciences at Siemens

Sanofi

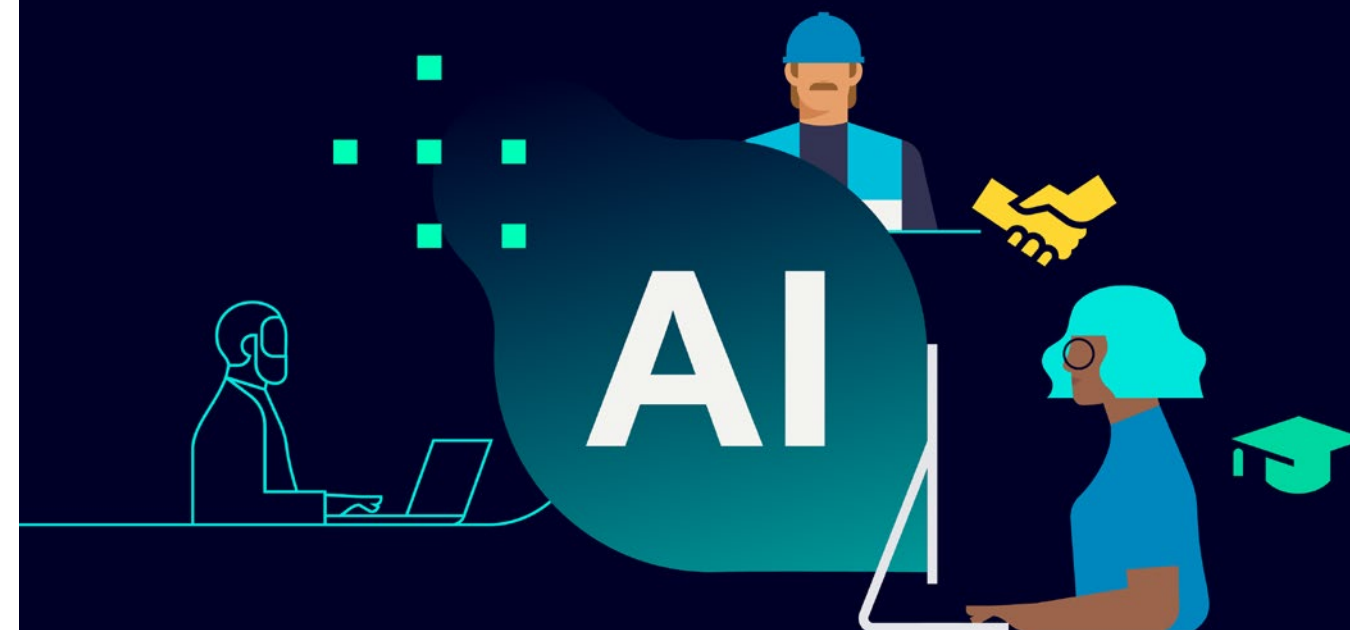
Integrating generative AI into the Siemens Industrial Copilots

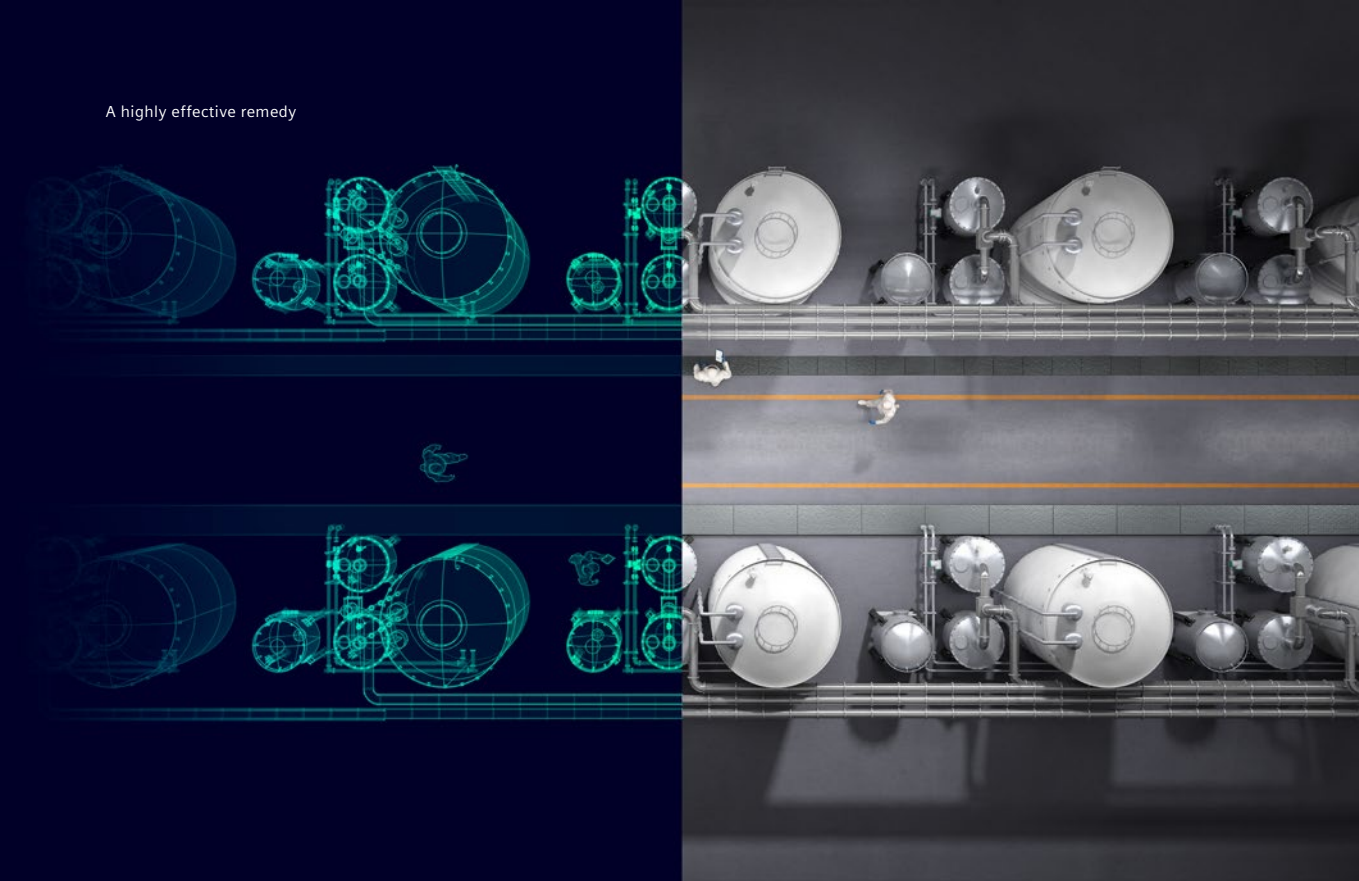
50 percent expected acceleration for MES deployment

Stronger together Industrial AI as a driver of innovation and collaboration

At Siemens, industrial AI is a vital component of existing solutions, enabling companies to make faster, smarter decisions while simultaneously boosting the efficiency of their processes. This is precisely where Siemens Xcelerator comes in – an open, flexible, and interoperable system that invites partners, customers, and developers to join forces to work on AI innovations. There is a particular focus on reliability, trust, and safety.

Behind Siemens Xcelerator is the acknowledgment that we cannot tackle the major challenges of our times successfully by going it alone. We need brilliant minds, companies, developers, and innovators to work in a way that transcends all boundaries and borders. An ecosystem approach can then become a nerve center for innovation and make it possible for the synergies and interoperability of industrial AI to be used for other technologies, too.





Building the foundation for AI-powered production

Industrial AI is only as powerful as the manufacturing data behind it.

As pharmaceutical manufacturers accelerate their adoption of Industrial AI, one reality is becoming increasingly clear: AI can only create value when built on trusted, contextualized, and accessible operational data. Connected production environments are therefore becoming the foundation for the next generation of pharmaceutical manufacturing.

Octapharma



Turning operational data into predictive intelligence



Up to 50% less unplanned downtime;
10% higher OEE/performance through
company-wide transparency

Leading pharmaceutical companies are investing in digital infrastructures that provide real-time visibility into operations, improve traceability, and transform manufacturing data into actionable insights. The objective is not only to optimize performance today, but also to create the conditions required for scaling AI across manufacturing networks.

Octapharma exemplifies this approach. Together with Siemens, the company established secure access to production data and implemented real-time OEE and KPI monitoring across manufacturing operations. By leveraging Siemens Industrial Edge as a scalable IT/OT integration layer, Octapharma created greater operational transparency and a trusted data foundation for future AI-driven applications.

Building on this digital backbone, solutions such as Performance Insight and Senseye Predictive Maintenance help transform operational data into actionable intelligence. In pharmaceutical

manufacturing, where unplanned downtime can put productivity and security of supply on risk, AI-powered analytics continuously evaluate equipment conditions, identify emerging risks, and provide actionable recommendations before failures occur. The result is improved asset availability, reduced downtime, and more resilient production operations.

To further simplify access to operational knowledge, the AI-powered SIMATIC eaSie assistant enables operators and maintenance teams to retrieve relevant plant information through natural language interactions. Complementing these capabilities, Siemens Predictive Analytics (SiePA) combines machine learning with process expertise to detect anomalies earlier and support more informed operational decisions.



More than paperless manufacturing thanks to AI

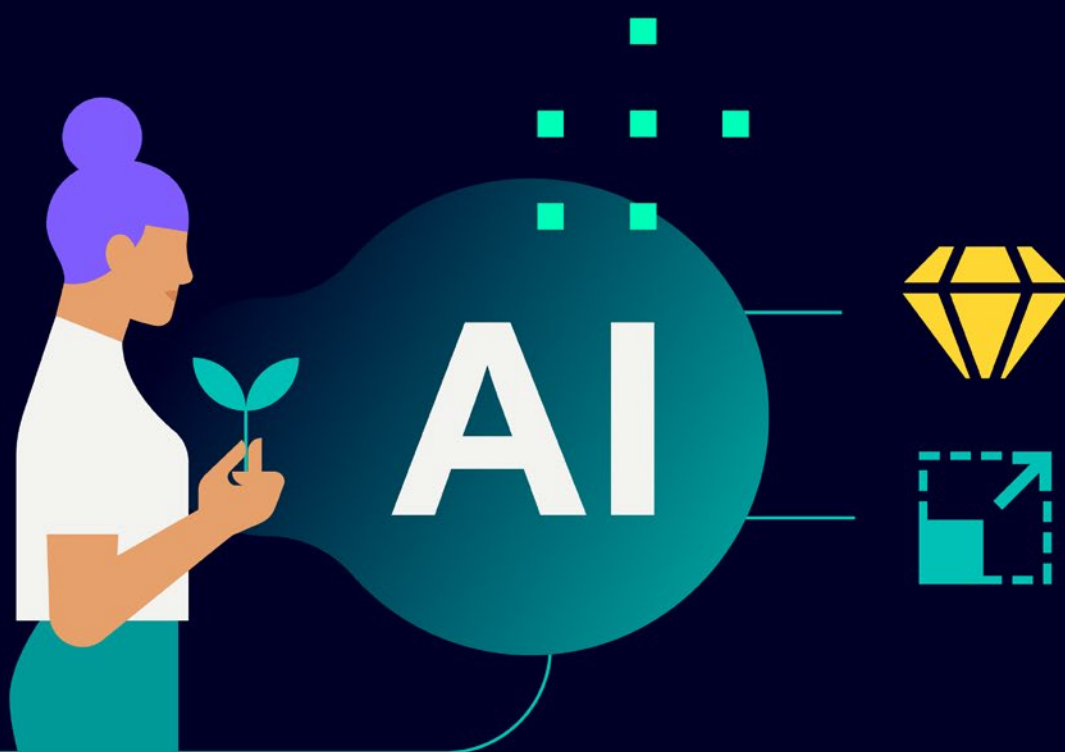
Seamless documentation and precise traceability are essential requirements in pharmaceutical manufacturing. By integrating generative AI into Opcenter Execution Pharma, Siemens simplifies recipe engineering and provides intuitive access to engineering, production, and audit-related information. Through natural language interactions,

users can retrieve relevant manufacturing data faster, streamline documentation activities, and improve operational transparency. The result goes beyond traditional paperless manufacturing, helping pharmaceutical companies strengthen compliance, improve traceability, and transform production data into actionable insights.

Acquisition of Dotmatics

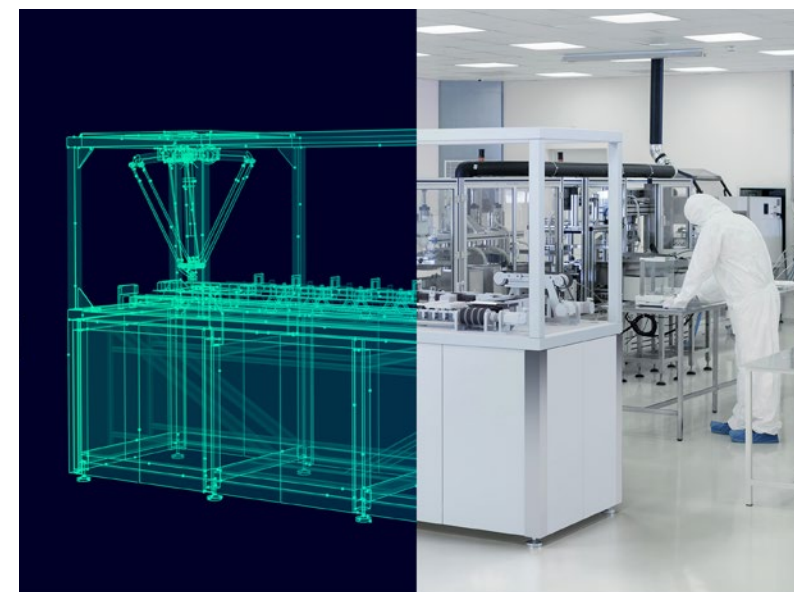
Siemens strengthens its AI-powered software portfolio in life sciences

Siemens is expanding its AI-powered product lifecycle management (PLM) portfolio in the life sciences sector to seamlessly connect research and development (R&D) with production, thereby strengthening its market-leading position in industrial software. Dotmatics is a leading supplier of scientific R&D software connecting science, data, and decision-making. This acquisition means Siemens can combine its comprehensive production know-how and industrial simulation and AI skills with the complementary Dotmatics applications.



Faster development of machine concepts

Production of the active ingredient is followed by the next production stage, which is known as secondary manufacturing. In this step, the active ingredients are converted into products suitable for administration. These can be tablets, capsules, or injections. This step focuses on pressing or filling, finishing, and packaging. Why rely on conventional engineering methods when it's possible to design and build digitally enabled equipment to support operations? "We work closely with pharmaceutical equipment manufacturers to accelerate engineering and deployment. This helps them achieve sustainability goals with smart, digitally enabled equipment through design and engineering, commissioning and training, operations and maintenance, and connectivity and optimization," Grahm explains.



How AI will shape the pharmaceutical industry

Artificial intelligence streamlines processes and optimizes the use of resources at every step of production – from recipe design and production operations to active ingredient quality control. In this way, AI is driving a whole range of trends that are shaping the pharmaceutical industry of the present and future.

1. Faster innovations

Drugs will be available for patients sooner

2. More flexible production processes

Companies will respond to new requirements with greater speed

3. Improved sustainability

Lower energy consumption, reduced consumption of materials, optimized use of resources.

Siemens is leading in industrial AI for manufacturing and the development of foundational models for industry and ideal when it comes to bridging the critical gap between recipe engineering in the lab and the mass production that follows. "We're proud of the fact that Siemens AI solutions are already being used in practice and, figuratively speaking, are proving to be a highly effective remedy for persistent inefficiencies," Grahm concludes.