



CONSUMER PACKAGED GOODS

Unlock the Digital Enterprise:

Move Faster
from Idea to Market and
from Data to Value

SIEMENS

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Meeting Customer Needs: How the Challenges Facing the CPG Industry Continue to Grow

Consider the number and diversity of products a person uses on a typical morning. Everything from textiles to personal hygiene products, food, transportation and smart-phones. And all of them depend on vast, global supply networks made up of production machinery, robotics, building infrastructure and more that consumers indirectly rely on to conduct their daily lives.

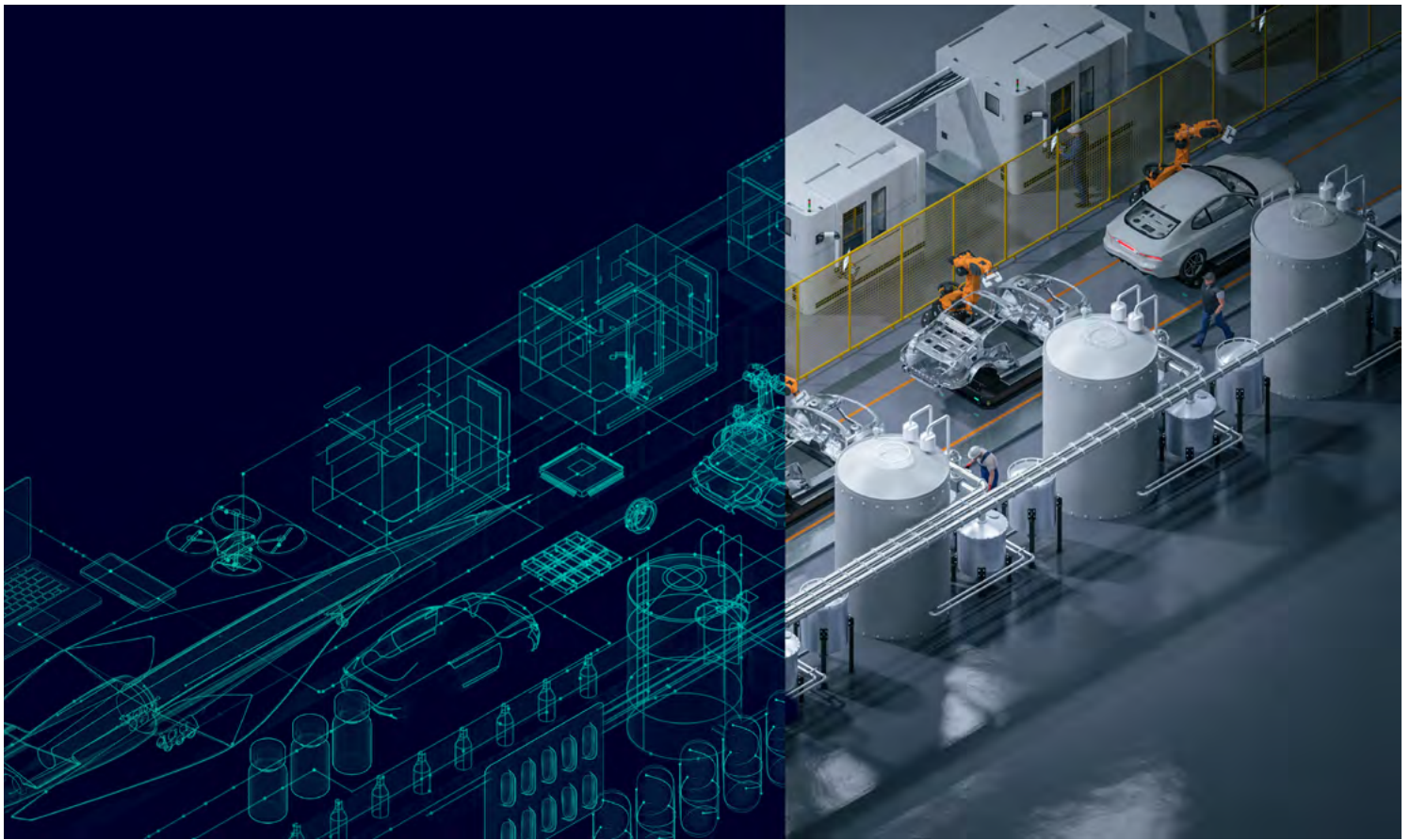
The question industries face is how to address growing demand, both in terms of volume and novelty, while using resources more efficiently and accelerating both development and production timelines.

Companies that aim to scale successfully must combine higher production volumes with greater efficiency and faster innovation to stave off competition.

Managing the complexity, speed and scale of a modern industrial enterprise demands a smarter approach. Companies that attempt to address the problems of tomorrow through familiar processes will fall behind competitors that embrace the opportunity to transform. The key is to unlock the power and value stored within the data already available within the organization.

CPG companies face an increasingly complex situation due to the enormous variety of products and consumers' increasingly personalized preferences.





As a Digital Enterprise, companies can unlock the full power of data for confident decisions that are driven by fully integrated and digitalized workflows.

How Digital Transformation Unlocks Organizational Data

To overcome these challenges, companies must embrace digital transformation to combine the real and digital worlds, managing product and production lifecycles through a unified digital ecosystem. Now, through the synthesis of industrial software and automation in the Siemens Xcelerator portfolio, companies can build such a unified ecosystem of tools, assets and systems, both real and digital.

By doing so, companies can become Digital Enterprises in which everything is connected, and data and information is gathered and exchanged quickly between product and

production development, testing, maintenance and operation.

This seamless flow of data in a Digital Enterprise enables a holistic digital-first approach built on a single digital backbone. Such a unified digital backbone enables companies to parallelize development work across teams and domains, and supports continuous optimization across the lifecycle. In a Digital Enterprise, insights from the real world are transferred into the digital world for analysis, driving recursive optimizations in real world processes, products and systems.

Digital Enterprise – Technology lays the Foundation

The transformation into a Digital Enterprise occurs through the adoption of four core technologies: the comprehensive Digital Twin, Software-Defined Systems, Connected Automation and Industrial Artificial Intelligence (AI). And there is ample opportunity

today for companies that embrace digital transformation. While leaders have a head-start on transformation projects, much of the industrial landscape is still in the early stages of digitalization. Each of these key technologies is examined below.

Comprehensive Digital Twin

The comprehensive Digital Twin is the foundational technology, providing physics-based modeling for data in the virtual world. Through the comprehensive Digital Twin of both product and production, a modern Digital Enterprise can collect and

synthesize data from throughout the product and production lifecycle. This leads to greater transparency, tracking capabilities and the ability to create a closed loop of product development, production and optimization.



The comprehensive Digital Twin generates tremendous value by running “what if” scenarios and predicting future performance and behavior, e.g. the filling process can be optimized to achieve faster filling with less splashing.

Software-Defined Systems

Next, industries are engaging in a large-scale shift towards Software-Defined Systems and software-driven product development and industrial automation. Software-Defined Systems will serve as the bridge from the digital world to the products, systems and assets in the real world. Critically, live usage data is gathered from these modern systems and supplied to centralized compute and control systems. Engineers, operators or, in some cases, even end users can use this data to monitor system performance. In the other direction, automation and security updates can be accomplished en masse, pushing new code to multiple assets at once.



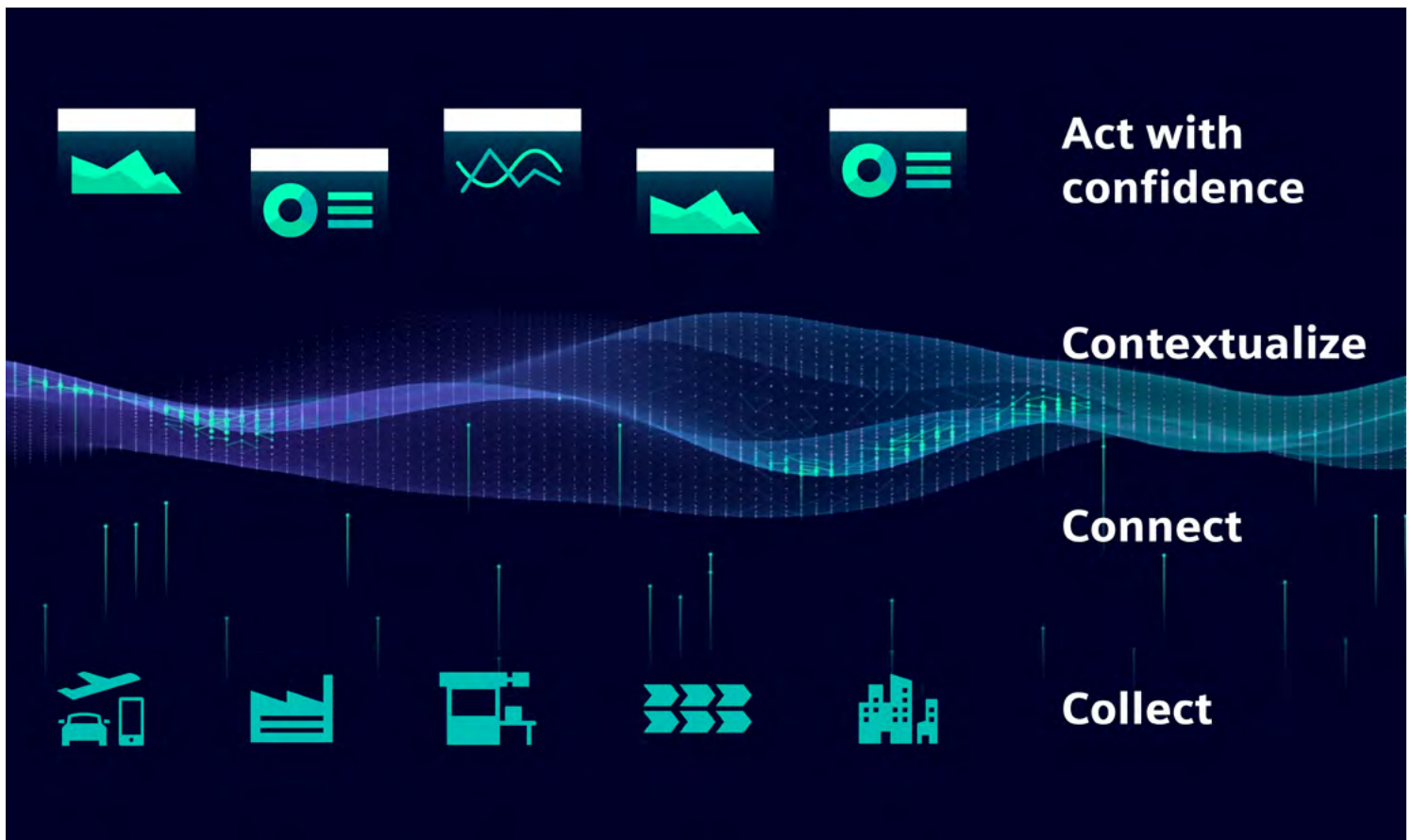
Software takes hardware-based systems to the next level.

Connected Automation



Connected Automation allows CPG companies to use shop floor data in the best possible way.

Then, on the shop floor, Connected Automation ensures that all automation components communicate and work together seamlessly. These components deliver real-world data and react to data from the digital world, translating data into real-world action. Connected Automation provides high performance, availability and connectivity, giving companies the ideal foundation for an AI-powered Digital Enterprise.



Connecting and contextualizing data from a wide variety of sources creates a unified data fabric. Industrial AI embedded directly in the Siemens Xcelerator turns insights into confident actions.

Industrial Artificial Intelligence

Fourth is artificial intelligence. AI is expected to transform industry, ushering in a new era of industrial technology. Yet this transformation is just beginning, and the technology is still developing. For industrial leaders, it is necessary that Industrial AI systems can speak the language of engineering and manufacturing. These AI systems must prioritize precision, reliability and security while managing complexity even in highly technical environments.

Industrial AI systems will also support the seamless data flow that powers a Digital Enterprise. Data from various systems and teams throughout an organization need to be collected, connected and contextualized to produce deeper insights and better decisions. This flow of connected data forms a unified “data fabric,” a contextual digital layer that turns multiple data streams into actionable intelligence rather than overwhelming decisionmakers with fragmented information.

Bringing the Digital Enterprise to life in the CPG Industry

The Digital Enterprise concept, and the technologies that make up the foundation of a Digital Enterprise, are applicable across various industry verticals from highly discrete to continuous process orientations. By removing data silos and establishing connections across the lifecycle, businesses can derive deeper insights into operational characteristics.

To further explore Digital Enterprise technologies and their application, the following sections will detail how companies in the Consumer Packaged Goods (CPG) industry can leverage data and apply the comprehensive Digital Twin, Software-Defined Systems and Industrial AI to improve efficiency and productivity.

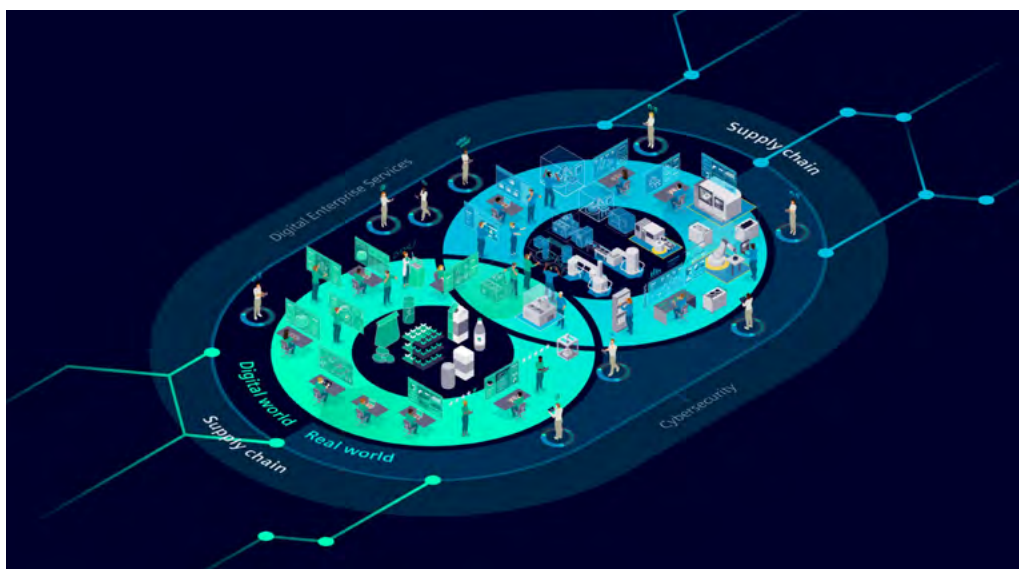
Building the Data Foundation

To develop new products, CPG companies first capture and analyze data from consumer feedback, sales performance of existing products, market trends, previous product recipes, production metrics and other sources. This data is integrated into the Digital Twin, becoming part of the data fabric

that connects a Digital Enterprise and acts as a single source of truth.

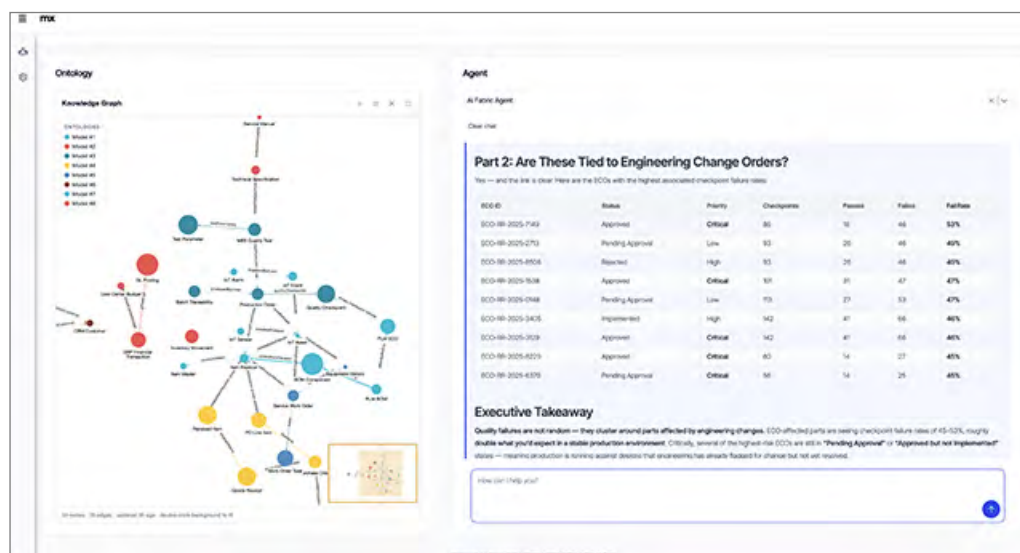
Today, knowledge graph solutions help companies apply this data by contextualizing sources, revealing interrelationships and mapping how changes ripple across domains. For example, an unexpected shortage from a vendor can impact many facilities and product lines across complex global supply chains. A knowledge graph solution can instantly show the bills-of-materials, bills-of-process, recipes and production plants impacted by the ingredient shortage. With this understanding, the CPG company can act quickly to locate a new source for the key ingredient and minimize or avoid the disruption to their own operations.

With this data foundation in place, companies can speed up the design and verification of products. Integrated Industrial AI assistants produce additional gains in speed, helping users locate key information, extract insights from simulation results and automate routine tasks, such as the configuration of simulation test cases.



The Digital Enterprise enables CPG companies to combine the real and the digital worlds across the value chain.

Knowledge graph software helps give data meaning in a unified data fabric woven from contextualized data.



Accelerating recipe development

Next, companies need to connect the product specifications with recipe design and execution, and product specifications must be translated into a recipe. This translation requires the management of complex ingredient interactions, assessment of raw material availability and production capacity, and an accounting of regulatory differences across global markets.

CPG companies can virtualize the recipe under development with the Digital Twin to accelerate formula development by fostering collaboration and ensuring traceability and consistency across research and development, quality assurance and manufacturing. The result is quicker formula development cycles, better integration between lab and formulation work, and stronger regulatory compliance baked into the workflow.

By fully virtualizing the recipe, the Digital Twin establishes a platform for continuous testing, optimization and validation. Scientists and engineers can take advantage of these optimization cycles to dial in ingredient ratios or production characteristics like volume, temperature or mixing speed without incurring multiple rounds of costly physical experiments.

And the Digital Twin ensures that this optimization can be completed for smaller lab batches all the way up to industrial scale. For example, instead of "black boxes", production machines can be modeled in high-fidelity and simulated to analyze behavior. These simulations allow engineers to test and optimize recipes with high precision entirely in the digital world. And Industrial AI will further accelerate recipe testing and development by reducing the number of simulations required to deliver a high-quality product.



Multiphysics simulation software accelerates the time from lab to manufacturing by enabling recipes to be tested in the digital world to ensure viability for manufacturing at scale.

Moving from recipe to production

The transfer of a developed recipe to large scale production has often represented the largest bottleneck in the development of a new product in the CPG industry. For a Digital Enterprise, with all aspects of the recipe and production equipment in the data fabric, this transition becomes much easier.

Feasibility checks can be completed based on real plant capabilities rather than estimates and assumptions. Once appropriate production facilities are identified, the recipe is transformed into the correct format and sent directly to the facilities around the world, all automatically. If ingredients, processes or physical equipment change, the master recipe can be updated and propagated to all affected sites immediately. This creates a closed-loop flow of data from the production

floor to research and development teams, ensuring maximum flexibility and adaptability even when production has already begun.

In a Digital Enterprise, production design and engineering can begin in parallel with recipe development. Plants, machines and buildings are designed, simulated, optimized and validated with the comprehensive Digital Twin for fast and first-time-right execution. Meanwhile, the Digital Twin combines recipe data, process data and data from the physical equipment and automation systems to virtually test, adapt and optimize production processes early. Again, Industrial AI assistants support this process by helping engineers to create, optimize and debug complex automation code.

Digitalizing Production Execution

With machines, production and infrastructure engineered and commissioned, companies can move into actual production execution. Only a well-planned production process runs smoothly, but manufacturers often struggle to create optimal production schedules while maintaining flexibility and quality.

Manual optimizations may work for individual lines but are incapable of scaling to address adaptive and flexible optimization of multiple production lines. The comprehensive Digital Twin and Software-Defined Automation enable advanced planning and scheduling solutions that automate the planning process with live data from the shop floor. With dynamic production scheduling, companies can optimize all lines, save time, effort and cost, while ensuring consistent quality and in-time delivery.

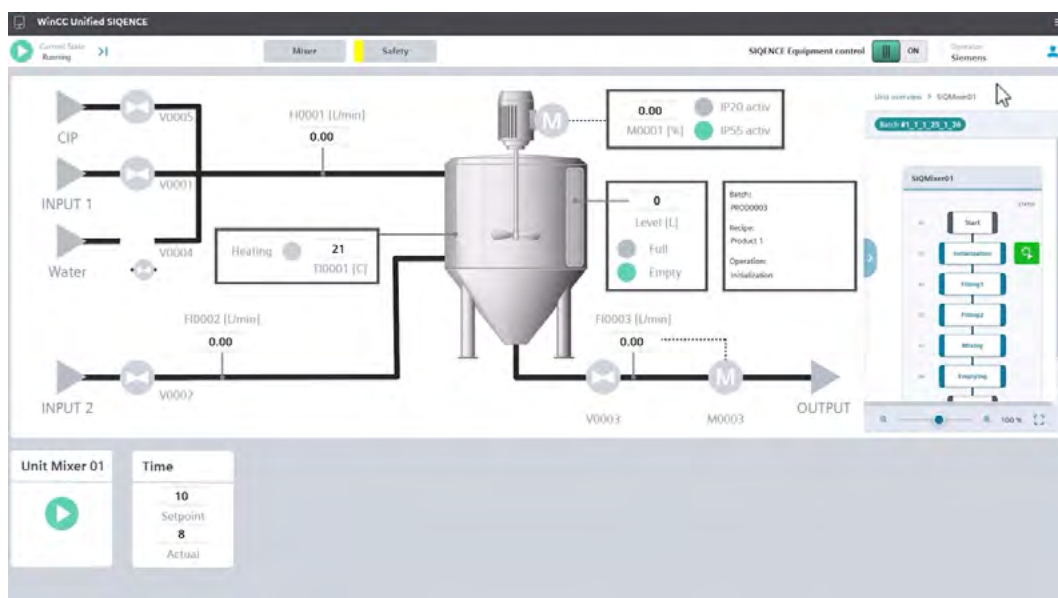
Managing live production

Digitalization transforms production into a fully connected, data-driven process by integrating software, automation and Industrial AI, enabling manufacturers to accelerate operations, improve overall equipment effectiveness through real-time insights, and adapt flexibly to changes such as staffing, conditions, ingredients and product variants.

Building on the unified data fabric, digital tools and Connected Automation facilitate flexible and high-quality production. One example is Siemens' new SIMATIC WinCC Unified SIQENCE, which lets operators create and run recipes directly at the machine through a graphical interface, requiring no manipulation of automation code. The solution also provides runtime batch monitoring, easy parameter adjustments and detailed reporting in a web-based SCADA environment. The result is reduced engineering effort, improved consistency, faster changeovers and high-quality production and batch execution.

Filling and packaging processes are a crucial part of production systems in the CPG industry, preparing products for shipping and stocking on store shelves. Filling processes are sensitive to minor variations in flow rate or the alignment of the container with the machine. Even small variations can cause splashing or waste, reducing quality and the speed of the process.

An Industrial AI-powered Digital Twin and Connected Automation ensure optimum filling and packaging accuracy, quality and availability at high speed. For liquids, the Industrial AI-assisted Digital Twin simulates fluid dynamics with virtual copies of the real machines and bottles. The result is cleaner filling, reduced waste and faster cycle times.



The new SIMATIC WinCC Unified SIQENCE software lets operators create and run recipes directly at the machine through a visual interface, without reprogramming.



A flexible AI-based quality inspection with Visual Inspection Cockpit enables continuous monitoring of the production process for highest quality

AI-enhanced production ensures quality, throughput

Digitalizing production operations and lifecycle optimization involves deploying automated systems and data-driven controls to maintain quality, maximize throughput and ensure traceability. Crucially, intelligent operations require a scalable, AI-ready and secure IT/OT infrastructure that can leverage real-time monitoring and analytics to enable proactive adjustments that meet efficiency, cost and sustainability targets. This infrastructure must be paired with connected automation and software-defined systems to enable real-time data capture and optimization.

Such a system enhances equipment performance through AI-enabled predictive maintenance, lifecycle management and real-time condition monitoring, while also supporting the agile and adaptive production systems needed for the future. An AI-based visual inspection solution integrated directly into automation, rather than running in the cloud, can process up to 2,400 images per minute to detect defects, trigger real-time alerts, and visualize live metrics. Such a system can, for instance, evaluate bread roll size and slicing, with results fed back into automation for early deviation detection and continuous optimization.

Up to

2,400

images per minute to detect defects, trigger real-time alerts, and visualize live metrics.



From raw dough to rock-solid data: The digital transformation of a Pringles factory resulted in tangible benefits.

Digital Enterprise Technology Delivers Immediate Value

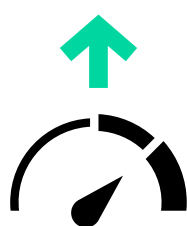
Collaborations with customers in the CPG industry are already yielding impressive results.

Imagine producing more than 100 million tons of Pringles chips a year. Your production is perfectly automated, your operators are seasoned experts, and everything runs like clockwork. But demand shifts unpredictably, energy costs climb, and climate change disrupts raw materials. That's exactly the situation the Pringles factory in Kutno, Poland, faced.

By unlocking the power of data, the factory could push past the boundaries of automation. Traditional dough making once relied on operators' instincts. Digital

transformation changed the game. Now, sensors feed temperature, humidity, protein, and data into an edge-based AI model. It calculates the ideal recipe in real time, adapting to raw material uncertainties. Operators get precise recommendations to tweak formulation and keep production flowing without waste, stops, or yield losses.

The Digital Twin of the dough was just the start. Pringles also boosted energy efficiency with our energy management system and cut costs with our AI-powered predictive maintenance. Smart recommendations prevent downtime. Aiming for broader transparency, Pringles created value from the first steps.



10%

higher capacity



13%

less waste



7%

less energy



Our customers consistently achieve proven results and get smarter from data to value and, most of all, faster from idea to the consumer.

Digital Transformation Becomes a Strategic Imperative

The transformation into a Digital Enterprise is an imperative for manufacturers seeking to remain competitive in an increasingly complex and demanding global marketplace. The convergence of the comprehensive Digital Twin, Software-Defined Systems, Connected Automation and Industrial AI creates a powerful foundation that transforms how companies design, produce and optimize products across their entire life-cycle.

Progress is already being made in the CPG industry. These examples illustrate that Digital Enterprise technologies deliver tangible, measurable results today. Yet the true power of the Digital Enterprise extends beyond individual process optimizations or isolated efficiency gains.

The future of industry is already being built—one connected dataset, one optimized process and one intelligent decision at a time. The question is not whether to transform, but how quickly your organization can begin.

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