



Market Report

Smart Manufacturing In Food and Beverage

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The Evolution and Enablement of Smart Manufacturing in the Food and Beverage Industry



The landscape of the food and beverage industry has been rapidly changing, with smart manufacturing playing a pivotal role in this transformation. From traditional, labor-intensive methods, the industry is moving towards more automated, data-driven practices.



Our journey began with conventional manufacturing processes – largely manual and labor-intensive. However, as the need for efficiency, precision, flexibility and sustainability grew, so did the desire for more innovative solutions. This led us to Industry 4.0.



Digitalization is at the heart of this revolution – using digital technologies to transform business operations. This move has empowered the food and beverage industry to transition into smart manufacturing, employing a host of technologies such as the Internet of Things (IoT), Edge Computing, Artificial Intelligence (AI), Machine Learning (ML), and robotics.



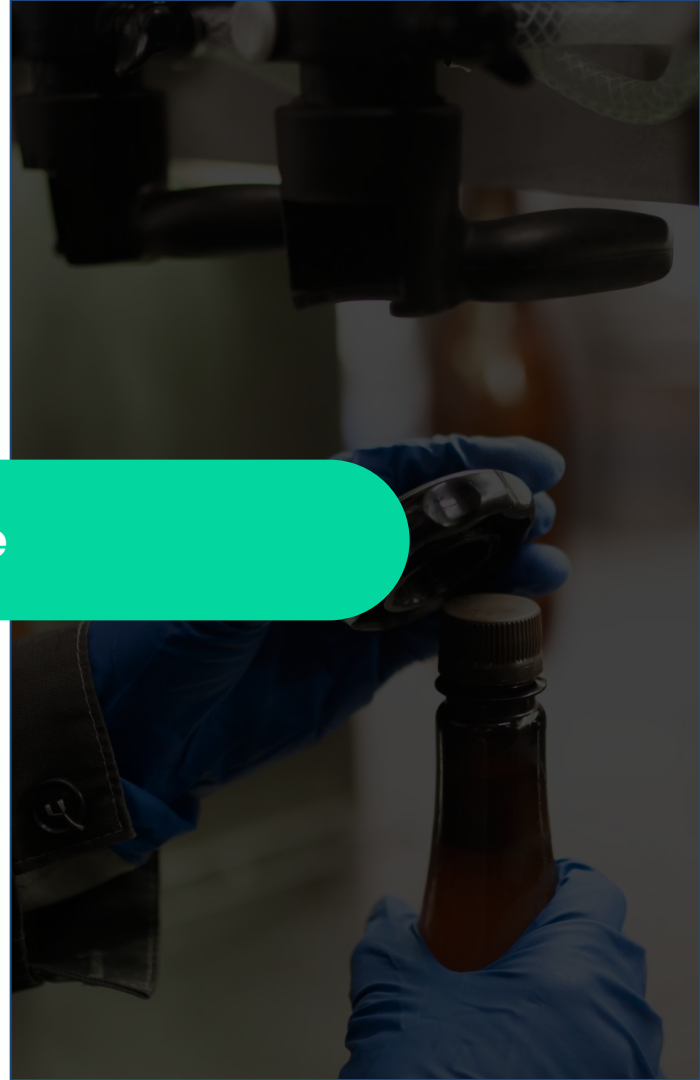
The adoption of these advanced technologies has revolutionized how we understand and operate production lines. As evidence of this transformative journey, Meticulous Research predicts that the global smart manufacturing market will reach a staggering \$506.33 billion by 2027.



This significant trend underscores a shift from conventional, labor-intensive methods to highly efficient Smart manufacturing allows us to optimize production, increase efficiency, enhance quality, and reduce waste – driving profitability and sustainability hand in hand.

Stay with us as we dive deeper into the exciting world of smart manufacturing in the food and beverage industry, where technology and innovation continually redefine possibilities.

Trends and challenges in Food & Beverage



As consumer preferences shift towards convenience and on-the-go options, F&B companies are developing innovative packaging solutions and quick-to-prepare products to meet the demands of busy lifestyles

Driven by consumer trends, the food and beverage industry is evolving. A 2020 Nielsen report highlighted the rise in sustainable product sales, up 20% since 2014. Meanwhile, according to a Meticulous Research study, the global plant-based food market could reach \$74.2 billion by 2027, emphasizing the growing demand for healthier alternatives. E-commerce is also flourishing, with online grocery sales projected to reach 20.5% of total grocery sales by 2027, according to Incisiv.

Top trends shaping Food & Beverage

Sustainability: A growing number of consumers are concerned with environmental impact. The Food and Beverage industries are transitioning to more sustainable practices, such as reducing food waste, procuring locally, utilizing recyclable or biodegradable packaging, and minimizing water use.

Plant-based Foods: The demand for plant-based foods and beverages has significantly increased. Equally, an increasing number of people are adopting vegetarian, vegan, and flexitarian diets.

Functional Foods: These are foods that provide additional health benefits beyond basic nutrition. Probiotics, foods with added vitamins and minerals, and foods marketed for specific dietary needs (like gluten-free or keto-friendly) are all part of this trend.

Direct to Consumer: With the rise of digital technology and consumer adoption, online food shopping has become more prevalent. These technologies include meal kit deliveries, online grocery shopping, and app-based food delivery services.

Health and Wellness: As consumers become more health conscious, they are seeking foods and beverages that are low in sugar, salt, and unhealthy fats.

Consumer Mindset

44%

Shoppers are now purpose-driven when it comes to making purchases.

Rising Production Costs

5X

Growth in digitally native food and beverage brands.

Growth of Private Labels

200%

Growth in plant based food products.

Demand Supply

3X

Private label food and grocery products.

Evolving market trends and sustainability concerns are catalyzing innovation and prompting F&B companies to reevaluate their strategies

- **Macro-Economic Challenges:** Changes in the global economy affect operational costs, sales, and overall market performance in the industry.
- **Sourcing and Inflation:** Difficulty procuring raw materials due to fluctuating prices, availability, and changing market conditions.
- **Batches and Lots:** Management of batch production, quality, and uniformity, as well as tracking and recall of specific lots.
- **Recipe:** Optimization and standardization of product recipes to ensure consistency and compliance with health and safety regulations.
- **Skill Gap and Tech-Savvy Workforce:** As older workers approach retirement, the risk of knowledge loss increases. In addition to this, the younger workforce wants to work for firms that leverage the latest digital technology, as it aligns with their skills.
- **Traceability:** The need to track and trace food products throughout the supply chain for safety and recall purposes.
- **Sustainability:** Meeting increasing consumer demand for environmentally friendly practices while balancing costs and operational efficiency.
- **Automation:** Integrating and managing automated technologies for increased efficiency while managing upfront costs and employee training.
- **Cybersecurity:** Protection of digital assets, production processes, and sensitive data from potential cyber threats.
- **Connectivity (IT OT Integration):** Challenges in integrating Information Technology (IT) and Operational Technology (OT) for seamless and efficient operations.

Workforce

29%

Of employees believe that labor/talent shortages will have a significant impact on F&B manufacturing.

Rising Production Costs

10X

Increase in cyber attacks on corporate assets.

Growth of Private Labels

2X

More food recalls in last 3 years.

Demand Supply

90%

Food regulations have become stricter in last 5 years.

The ever-changing consumer needs and increasing operational challenges have severe implications for F&B companies

- **Increase Efficiency:** More accurate decision-making and reduced downtime.
- **Cost Reduction:** Minimizing waste, optimizing resource use, to reduce overall costs.
- **Quality Enhancement:** Quality control and predictive maintenance help improve product consistency and reduce defects.
- **Greater Flexibility:** Enabling rapid response to changes in demand or production conditions,
- **Improved Safety:** Identify potential safety issues before they occur, leading to a safer work environment.
- **Sustainability:** Minimizing waste, and using resources more effectively contribute to more sustainable manufacturing processes.
- **Supply Chain Optimization:** Tracking and data analysis to create a more optimized and transparent supply chain.
- **Improved Customer Satisfaction:** Meeting customer demands more effectively and quickly.
- **Data-Driven Decision Making:** Harnessing the power of data analytics, AI, and machine learning for informed, strategic decision-making.

Data Management

20%

of business time is spent by employees searching for critical project information.

Sustainability

70%

Of all freshwater withdrawals are made by F&B Industries

Consumer Mindset

18%

Y-o-Y increase in input cost.

Smart Manufacturing a Key Enabler for F&B Companies



Smart Manufacturing: Revolutionizing the Food and Beverage Industry

Smart manufacturing encompasses an extensive spectrum of manufacturing approaches characterized by computer-integrated processes, heightened adaptability, swift design modifications, utilization of digital information technology, and a workforce with enhanced flexibility through advanced training methods.

Benefits of Smart Manufacturing:

Alongside cost savings and improved efficiency, smart manufacturing also offers benefits like:

- Increased productivity
- Improved product quality
- Increased flexibility and responsiveness
- Better customer satisfaction
- Enhanced Sustainability
- Improved Traceability
- Product customization and personalization
- Cost Effective

Impact on Production Costs and Efficiency:

According to the World Economic Forum, smart manufacturing could lead to a 20% reduction in production costs and enhance efficiency by 25%.

Smart Manufacturing has a significant impact on key operational KPIs

85%

Improvement in forecasting accuracy.

15%–30%

Increase in labour productivity.

30%–50%

Reduction in machine downtime.

Changing consumer preferences drives innovation and a holistic reassessment and alignment for Food & Beverage Companies

- **Internet of Things (IoT):** IoT devices collect real-time data from various parts of the manufacturing process, enabling continuous monitoring and optimization of operations.
- **Artificial Intelligence (AI) and Machine Learning (ML):** AI algorithms and ML models analyze the collected data to identify patterns, make predictions, and guide decision-making processes.
- **Automation and Robotics:** Automated machines and robots carry out repetitive tasks more efficiently and accurately, reducing human error and increasing productivity.
- **Cyber-Physical Systems:** These are integrated systems involving both computational (cyber) and physical components, allowing for dynamic interaction and collaboration between the two.
- **Advanced Analytics:** Tools for analyzing complex datasets help businesses draw insights, identify trends, and make more informed decisions.
- **Cloud Computing:** Enables remote data storage and processing, allowing for more scalable and flexible operations and facilitating real-time sharing and collaboration.
- **Digital Twins:** These are digital replicas of physical systems usable for testing and optimization without interfering with actual production.
- **Augmented Reality (AR) / Virtual Reality (VR):** These technologies are valuable for training workers, remotely monitoring operations, or simulating production process changes.
- **Cybersecurity:** Given the digital nature of smart manufacturing, strong cybersecurity measures are crucial to protect sensitive data and prevent disruptions to production.
- **Integration of IT and OT:** Seamless integration of information technology (IT) and operational technology (OT) is crucial for real-time data exchange and collaborative decision-making.

Powering Smart Manufacturing



Smart Manufacturing for Food & Beverage



Plan

Agile manufacturing
engineering

Adopt an approach to production design and operations that optimizes the performance of capital assets and delivers scale, agility, and maximum utilization.



Execute

Flexible and predictable
manufacturing

Manage the production complexity to accelerate and ensure that the design process, materials, operations, and equipment are scalable to produce high-quality products and efficiently and profitably deliver any lot size.



Optimize

Optimized, sustainable
operations

With the potential of IoT, machine learning, and analytics, food and beverage companies can achieve more optimized operations and leverage sustainable practices.

Plan: Agile Manufacturing Engineering

Agile Manufacturing is a production methodology that aims to enhance flexibility and responsiveness in manufacturing processes. The goal of Agile Manufacturing is to create an efficient and adaptable production environment that can quickly respond to changing customer demands and market conditions.

1. **Customer Centric:** An agile approach focuses on the consumer's needs and quickly adapts to evolving consumer demands.
2. **Prototyping:** Agile Manufacturing uses 3D product designs to create efficient and reliable prototypes for faster development cycles.
3. **Lean Manufacturing Practices:** Agile Manufacturing often incorporates lean principles to minimize waste, optimize production flows, and reduce lead times.
4. **Supplier Collaboration:** Agile Manufacturing improves supplier relationships, improving coordination and responsiveness across the supply chain.
5. **Information Technology Integration:** Agile Manufacturing leverages technology, such as advanced data analytics, the Internet of Things (IoT), and real-time monitoring/tracking, to improve decision-making and gain insights into production processes.

Agile Manufacturing is particularly beneficial in industries with rapidly changing customer demands, short product lifecycles, and high variability. By embracing agility, manufacturers can remain competitive, reduce time-to-market, and efficiently adapt to evolving market conditions.

Yanghe Distillery

Objective

- Visualization of the production process, intelligent scheduling and automated production control.
- Replace ageing assets with new sensor-based equipment.
- Improve production costs.

Result

- Automated production scheduling process.
- Real-time data on performance KPIs.
- Replacing spreadsheets with digital data collection.
- Improved changeover time.
- Enabled quality traceability.

“The combination of integrated MES, APS and LIMS in a collaborative platform helped Yanghe improve accounting accuracy, provide production status for each business unit and substantially improve the operational and production efficiency while increasing product quality.”

Execute: Flexible and Predictable Manufacturing

Predictive and Preventive Manufacturing aligns with the broader goals of many modern manufacturing practices, such as Industry 4.0, Smart Manufacturing, and data-driven process optimization.

1. **Cloud Computing:** Cloud computing provides a scalable and flexible infrastructure to store, process, and analyze large volumes of manufacturing data.
2. **Real-Time Monitoring:** Through IoT devices and cloud-based data storage, manufacturers can monitor their production processes in real-time.
3. **Quality Control and Defect Detection:** Predictive manufacturing uses data analytics to detect product defects, enabling real-time quality control, reducing defects, and saving costs.
4. **Process Optimization:** Data analytics can identify bottlenecks and inefficiencies in the manufacturing process. By pinpointing areas for improvement, manufacturers can optimize their production lines, reduce waste, and improve overall efficiency.
5. **Supply Chain Visibility:** Cloud-based platforms and IoT sensors provide real-time supply chain visibility, tracking raw materials, components, and finished products throughout the production and distribution stages. This process streamlines logistics and optimizes inventory levels.

By integrating cloud computing, data analytics, and IoT in predictive manufacturing, manufacturers can make data-driven decisions, enhance product quality, increase productivity, reduce waste, and stay competitive in today's dynamic manufacturing landscape.

Martell

Objective

- Reduce the time spent on activity planning during production.
- Reduce time spent on transportation.
- Streamline Barrel-to-shelf scheduling.

Result

- 12% increase in productivity.
- 30% time-saving in the tank filling process.
- Activity planning time was reduced by 20%.
- Eliminated late deliveries to assembly sites.

“We needed a tool to plan and schedule the work of our teams by minimizing the travel between the wine storehouses by optimizing the filling and the routes of the truck tanks between various sites. Most importantly, we wanted to guarantee that the eau de vie were delivered by the required deadlines.”

Lydie Bardeau, Planning Manager EDV
Martell

Case Study

Global cognac producer uses Opcenter APS to streamline barrel-to-shelf scheduling process (siemens.com)

Optimize: Optimized, Sustainable Operations

Integrating IoT, data analytics, cloud computing, and smart manufacturing can transform the Food & Beverage industry.

Here's how each technology can contribute to achieving these goals:

1. **Precision Agriculture:** In the F&B industry, IoT devices can be employed in precision agriculture practices to optimize water usage, fertilization, and pest control, reducing environmental impacts and increasing crop yield.
2. **Energy Management:** Smart manufacturing systems can intelligently control energy consumption, thereby optimizing energy usage and reducing the carbon footprint of manufacturing operations.
3. **Asset Tracking:** IoT helps optimize supply chain logistics, reducing transportation-related waste and carbon emissions. It ensures that perishable goods are handled efficiently, minimizing spoilage and wastage.
4. **Supply Chain Optimization:** Data analytics can augment the supply chain by analyzing historical data, demand patterns, and other factors, ensuring that inventory levels are optimized, which helps minimize transportation-related emissions.

Combining IoT, data analytics, cloud computing, and smart manufacturing enables the F&B industry to embrace sustainable practices, reduce waste, optimize energy usage, enhance product quality, and improve supply chain efficiency, leading to cost savings and increased competitiveness.

The Absolut Company

Objective

- 100% carbon-neutral production process, by 2030.
- Maintain a high-efficiency rate of 70%-75% via enhanced sustainability practices.
- Develop digital twins for production lines and the entire value chain.
- Achieve 100% production automation.

Result

- Increased production traceability.
- Real-time asset monitoring and production control.
- Enhanced order management capability.
- Using environmentally friendly transportation (boats).

"The solution fits us perfectly because it has been developed to cover the entire value chain, from receiving incoming materials to distribution of produced goods, including quality control, product planning and scheduling as well as reporting, trends and advanced analysis."

Emil Svärdh, Senior Automation Engineer
The Absolut Company

Case Study
The Absolut Company ([siemens.com](https://www.siemens.com))

Benefits



The complexity of running a Food & Beverage company has increased many folds. Smart Manufacturing can uncomplicate the business and deliver improvements across dimensions.

The Smart Manufacturing solution suite positively impacts production factors by achieving:

100%

Optimized manufacturing process.

25%

Cost reduction,

20%

Increase in manufacturing efficiency.

100%

Traceability and sustainability compliance.

Adoption of Smart manufacturing can transform business operations and propel business outcomes exponentially



Increase Efficiency

According to a study by Deloitte, companies that have implemented smart manufacturing techniques have seen up to a 12% gain in efficiency.



Reduce production cost

Companies using smart manufacturing and IoT technologies reported a median increase in manufacturing efficiency of 82%, leading to a cost reduction.



Improved product quality

A study from the Boston Consulting Group suggested that manufacturers implementing smart manufacturing practices have seen quality improvements of up to 50%.



Reduced time to market

Smart manufacturing can cut down product development cycles and reduce time-to-market by as much as 50%.



Energy Reduction

Energy usage can be reduced by up to 20% through practices like predictive maintenance and efficient use of resource.

Key Gaps & Future Potential



Some of the key gaps and obstacles in the adoption of smart manufacturing in the food and beverage industry include

- **Integration Difficulties:** Achieving seamless integration of the various components of a smart manufacturing setup can be challenging, mainly when dealing with legacy systems.
- **Data Management Challenges:** The vast amounts of data generated by smart manufacturing systems can be difficult to manage and analyze effectively, notably if the necessary data science skills are lacking.
- **High Initial Investment:** The cost of implementing smart manufacturing systems can increase, deterring some companies and small and medium-sized enterprises.
- **Resources:** From the initial setup of IoT devices and data analytics infrastructure to the continuous maintenance and updates of smart manufacturing systems, companies must allocate resources strategically to ensure a successful transformation. By proactively managing resources, companies can harness the transformative power of technology to achieve excellence and sustainable growth.
- **Skills Gap:** The shift to smart manufacturing requires employees to have different skills, such as data analysis and cybersecurity, creating a need for training and recruitment.
- **Cybersecurity Risks:** With increased digitization and connectivity comes greater vulnerability to cyber-attacks, emphasizing the importance of robust security measures.
- **Reluctance to Change:** As with any significant shift in operational methods, there can be resistance to change among employees and management.
- **Regulatory Challenges:** The food and beverage industry is heavily regulated, and complying with these regulations while implementing smart manufacturing technologies can be complex.
- **Uncertain ROI:** While smart manufacturing has the potential to deliver significant returns, these may not be immediate, and the exact ROI can be difficult to predict, leading to uncertainty.

The path forward for smart manufacturing in the food and beverage industry is very promising. Here are the key steps that need to be taken

- **Investment in Technology:** Food and beverage companies need to continue investing in critical technologies such as AI, machine learning, and IoT. The integration of these technologies into manufacturing processes will be central to the advancement of smart manufacturing.
- **Workforce Development:** It's crucial for businesses to focus on training their workforce to handle new technologies and to work in a more data-driven environment. Equipping the workforce with these skills will be essential to the operation and maintenance of smart manufacturing systems.
- **Collaboration:** Collaborative efforts between technology providers, manufacturers, and other stakeholders can help accelerate smart manufacturing implementation. Sharing knowledge, best practices, and innovations can quickly drive the industry forward.
- **Adaptation and Innovation:** In this rapidly evolving landscape, adapting is essential. Businesses need to be ready to adjust their strategies as new technologies and opportunities emerge. A commitment to ongoing innovation will also be crucial for keeping pace with technological advancements and industry changes.

Smart manufacturing plays a crucial role in companies' transformation into digital enterprises, and Siemens Xcelerator leads the way by streamlining the entire process, making it faster and more efficient.

Investment

55%

Of F&B Industry leaders have increased investments in sustainability.

Digital Transformation

45%–55%

Of F&B companies using digital transformations are set to see KPI improvements in the next few years.

Technology

39%

Of F&B employees consider AI to have the highest positive impact on revenue and growth in the next 5 years.

Smart Manufacturing powered by Siemens Xcelerator

Siemens Xcelerator is a unified, open digital business platform that leverages the following three pillars to tackle digitization challenges:

Portfolio – Siemens Xcelerator offers a carefully curated portfolio of software and IoT-enabled hardware solutions and services.

Ecosystem – It fosters an inclusive ecosystem that promotes co-creation among customers, Siemens, and certified partners, ranging from prominent tech companies to independent software developers.

Marketplace – Additionally, it provides access to a thoughtfully selected portfolio of connected hardware and software, a powerful network of partners, and an extensive marketplace.

The 4 design principles include

1. **Interoperability:** Xcelerator establishes digital threads throughout the product lifecycle, seamlessly integrating different communication frameworks and creating a cohesive view of the product manufacturing operations.
2. **Flexibility:** Siemens Xcelerator equips clients with pre-packaged business capabilities, enabling effortless selection, integration, and customization of components.
3. **Open:** By embracing standardized application programming interfaces (APIs), Siemens Xcelerator provides offerings that enable powerful data analytics and insights, fostering seamless interoperability.
4. **As-a-service:** Xcelerator simplifies operations and eliminates the need for significant upfront investments by offering a consumption-based subscription service, allowing clients to pay based on product usage.

Link : <https://siemens.com/xcelerator>
<https://marketplace.siemens.com/global/en/markets/food-beverage.html>

Nestle Juuka

Objective

- Digitization of the outdated factory.
- Integration of digital twin for planning and optimization.

Result

- Identify and streamline material flow.
- Increase sustainable practices, reduction of wastewater and improved chemical utilization.
- 23% improvement in median heating time.
- Raw material cost saving of 50K-100K Euros.

“The collaboration between Nestlé and Siemens ensured that both machines and people were taken on the digital journey. The project also made it possible to make best use of the abundance of data generated on the shop floor.”

Case Study

<https://www.siemens.com/global/en/markets/food-beverage/references/nestle.html>



ABOUT INCISIV

Incisiv is a peer-to-peer executive network and industry insights firm for consumer industry executives navigating digital disruption.

Incisiv offers curated executive learning, digital maturity benchmarks and prescriptive transformation insights to clients across the consumer and technology industry spectrum.

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ABOUT SIEMENS

Siemens AG is a global technology powerhouse that brings together the digital and physical worlds to benefit customers and society. The company focuses on intelligent infrastructure for buildings and decentralized energy systems, on automation and digitalization in the process and manufacturing industries, and on smart mobility solutions for rail and road transport.

To learn more, visit

<http://siemens.com/smart-manufacturing-fab>