**Artificial Intelligence in Food Industry**

Introduction

The food industry is an eminent sector that deals with our basic need - food. From packaging to the production of food, the industry employs various technological equipment to keep up with its day-to-day tasks. Thanks to technology and the importance of the food industry, this sector has advanced at every forefront in terms of quality, efficiency, and speed. The way it has emerged from a comparatively slower industry has made the food industry and its evolution quite commendable. The day-to-day tasks in the industry vary from the segregation of food ingredients to the packaging of them in order to deliver them to their customers. This requires technological aid at every step of the way. As more automated processes have emerged in the industry, the regulation of the industry has become more efficient. However, the total absence of manual labor is impossible as technicians and quality managers are required to evaluate the production process at every step of the way. This makes us curious as to how various technologies like AI, machine learning, or [big data analytics](https://www.analyticssteps.com/blogs/what-big-data-analytics-definition-advantages-and-types) can be employed in the food industry. Many scholars have argued that the total replacement of humans with machines can lead to a catastrophe that might eventually push humans towards famine. Yet, years of experience have only pointed to the direction that machines and automated equipment can substantially improve the way the industry operates.

 **“As it is in many industries, artificial intelligence (AI) is making huge waves in the world of food and beverage. More and more organizations within the industry are recognizing the potential of AI to drive greater efficiency and profits, reduce wastage and provide protection against supply chain disruptions. “**

- Growth of AI in Industrial Sector

 This wave of transformation can be witnessed in the upcoming segment that talks about the applications and uses of AI in the food industry.

## **What is Artificial Intelligence**

Artificial Intelligence is an area of computer science. It demonstrates or models human intelligence in machines. It is also a process for making machines think intelligently.AI is developed by studying human behavior and thinking processes. It takes note of how people learn, make decisions, and collaborate when solving a problem. The findings of these numerous investigations serve as a foundation. It is then used for the development of associated intelligent software and systems.

 **Artificial Intelligence in Food Industry**

Artificial Intelligence will play a critical role in food production in the future. Companies in the food and beverage industry are rapidly using technology. The aim is to improve operational and logistical efficiencies and meet customer demands. To retain great empathy with their audience, the industry’s leading players have embraced Artificial Intelligence.

For many sectors, Artificial Intelligence and Machine Learning technologies offer several opportunities. AI helps to streamline and automate processes, save money, and eliminate human error. Restaurants, bars, cafes, and food manufacturers, can profit from AI and machine learning. These two divisions offer a lot of frequent application cases for AI in the food industry.

[**Applications of Artificial Intelligence in the Food Industry**](https://www.knowledgenile.com/blogs/artificial-intelligence-applications-in-the-food-industry#ApplicationsofAIintheFoodIndustry)

* [Sorting Packages and Products](https://www.knowledgenile.com/blogs/artificial-intelligence-applications-in-the-food-industry#SortingPackagesandProducts)
* [Food Safety Compliance](https://www.knowledgenile.com/blogs/artificial-intelligence-applications-in-the-food-industry#FoodSafetyCompliance)
* [Maintaining Cleanliness](https://www.knowledgenile.com/blogs/artificial-intelligence-applications-in-the-food-industry#MaintainingCleanliness)
* [Developing Products](https://www.knowledgenile.com/blogs/artificial-intelligence-applications-in-the-food-industry#DevelopingProducts)
* [Assisting Customers With Decision Making](https://www.knowledgenile.com/blogs/artificial-intelligence-applications-in-the-food-industry#AssistingCustomersWithDecisionMaking)

 Food processing is a challenging industry. It includes sorting food or raw materials from the farm and maintaining machines and various sorts of equipment. Finally, when the final product is ready to ship, it is inspected for quality and determined whether it is ready to send. However, AI automates this procedure in many food processing facilities.

The top 5 Artificial Intelligence applications are listed below. These directly impact food processing firms. These processes help companies generate revenue and improve customer experience.

### **Sorting Packages and Products**

The sorting of feedstock is the first operational difficulty that food processing companies encounter. Every potato, tomato, orange, and apple is unique, necessitating meticulous sorting. Every food processing company must maintain a particular level of quality to be competitive. This procedure involves a lot of human effort if it isn’t automated with AI and other new technologies like IoT.

According to TOMRA, humans sorted 90% of the food until the end of the twentieth century. TOMRA is a major sorting and collection software solutions provider. It is situated in Norway. TOMRA uses X-ray, NIR (Near Infrared) spectroscopy, LASER, cameras. It combines this tech with a unique machine-learning algorithm. This algorithm examines numerous features of a fruit or vegetable for sorting. It is different from the existing food sorting robots that only sort imperfect quality fruits and vegetables from the good ones.

A Japanese food processing firm, Kewpie Corporation, developed an AI-based machine. It detects irregularities in agricultural produce. Corporations such as TORMA and Kewpie are assisting the food processing industries. Thus helping in increasing their revenue while also improving yields.

#### **Food Safety Compliance**

In the food processing industry, safety is a significant problem. Even the tiniest contamination in food can be fatal. Factories have begun to use AI-based cameras to identify whether or not an employee dresses appropriately. It is, however, a large-scale application of what the Shanghai municipal health agency did in Shanghai restaurants. The agency has installed AI-enabled cameras in more than 200 eateries. In conjunction with Remark Holding, it plans to expand to more than 2000 outlets.

The AI-enabled cameras assist restaurant management in keeping an eye on their employees. This is to see if they are wearing suitable food protection gear following food safety rules. It also aids them in detecting any form of indiscipline in real-time.

##### **Maintaining Cleanliness**

Cleanliness is a significant problem in food processing plants. Many businesses claim to be clean since all of their processes are automated and unaffected by human intervention. What happens if the machines and equipment become contaminated? Customers have also evolved, and they understand that just because a procedure is automated does not mean the product is safe to eat.

The University of Nottingham found that equipment cleaning consumes over 30% of a food processing plant’s energy and water. They estimate that their AI-based sensor system can save almost $133 million per year. This will also reduce cleaning time by 50%. It will also reduce electricity and water use.

Traditional cleaning systems lacked sensors. This resulted in the presence of food particles in equipment vessels. The old system couldn’t clear minute food particles, but the new self-optimizing cleaning system could. It delivers data to the Machine Learning algorithm. To do this, it uses optical fluorescence imaging and ultrasonic sensing technologies. This will also aid in the monitoring of microbiological waste and food particles in the equipment.

###### **Developing Products**

The food processing sector is unique in that a single company can produce a wide range of products. Coca-Cola, for example, has purchased over 500 brands and offers over 3500 different drinks to its clients. However, the question of how the corporation chooses which flavor to make next arises. Prior to AI, the company performed surveys and advertising to learn about their consumers’ preferences.

Coca-Cola currently maintains a number of self-serving soda fountains. These soda fountains allow consumers to build their own customized drink by mixing a selection of Coca-Cola liquids. Thousands of these fountains were installed around the United States. Hundreds of consumers created their own beverages at each of these fountains. They also investigated using artificial intelligence. It was discovered that the majority of customers blend cherry-flavored Coke with Sprite. Coca-Cola used this information to develop Cherry Sprite, a new product.

###### **Assisting Customers With Decision Making**

AI, like food processing firms, aids customers in making more intelligent purchasing decisions. Kellogg’s is the world’s largest food company. It debuted Bear Naked Custom, which allowed customers to make their own unique granola using more than 50 ingredients. The system made use of IBM’s Chef Watson. Chef Watson stores hundreds of possible recipes. These recipes are then fed into an AI algorithm. This helped users figure out if the items would work well together. This technology assisted customers in creating little personalized quantities of granola. It also helped the corporation in determining what their next line of product should be, comparable to Coca-Cola.

Despite its infancy, artificial intelligence is transforming the food processing and handling industry. It will completely transform the Food Processing & Handling sector in the following years. AI will also assist these businesses in increasing revenue by speeding up the manufacturing process. AI will help in reducing maintenance time and thus reduce production downtime. It will also lower the risk of failure by automating almost every operation. AI will also play a significant role in providing an excellent customer experience by anticipating their likes, dislikes, and desires.

###  **Trend Analysis**

  The very first use of AI in the food industry is that it helps FMCG businesses to analyze the

 prevalent customer demands and desires.

On the basis of big data analytics and [machine learning models](https://www.analyticssteps.com/blogs/top-8-machine-learning-models), AI can extract useful insights pertaining to the needs and desires of the customers that lead to product development.

This stage is very essential as businesses must choose a product that is most likely to become a success in the consumer market. AI is the force of change that gives businesses the confidence to launch a certain product with various characteristics.

Using the technique of trend analysis, food businesses can serve the customer needs efficiently and correctly target the right audience present across the market.

### **Efficient Speed**

One of the biggest benefits of AI in the food industry is that it induces a speedy process in the production process. Unlike earlier when humans had to perform all the

 processes by hand, the food industry witnessed numerous mishaps and a slow production rate across the year.

However, with the coming of AI and automated machines, machines can rapidly produce greater outcomes and produce more products at the same time. This, in turn, benefits the business houses and generates more [revenue](https://www.analyticssteps.com/blogs/types-examples-revenue-economics).

**“By using such types of systems, industries gained some advantages such as faster production rate, high-quality yielding, and labor cost cutting.”**

- [AI in Speedy Production](https://www.hindawi.com/journals/jfq/2021/4535567/)

### **Quality Inspection**

Another tedious task that was earlier handled by humans is quality inspection. The food industry is all about quality and maintaining the right standard as prescribed by the regulatory authorities.

However, with the mass production of food items and products, quality can seldom be hampered and ignored. But, this is not a drawback when the production process runs in compliance with AI-empowered machines.

That said, [AI algorithms](https://www.analyticssteps.com/blogs/top-10-ai-algorithms-models) and tools can be trained and customized to check for various parameters so that quality is ensured. This particular task can also be done with minimal errors as machines only accept a certain range of quality.

### **Controlled Cultivation**

Even though the process of cultivation is not entirely a part of the food industry, it still largely impacts the finished product and its quality. Cultivation requires growing food crops to use them in the production process afterward.

Owing to weather changes and alternate conditions, sometimes crops can fail and lead to a poor quality yield. This can be managed and ‘controlled’ using controlled cultivation.

By employing AI in food science and technology, controlled cultivation can be performed. This leads to a controlled quality that is predetermined by the cultivator to prevent any crop damage under controlled environmental conditions.

### **Smart Sensors**

How would you feel if every time a machine failed to work, you could get an alert or a notification? Satisfying, right? With the help of smart sensors driven by AI, the food industry and its processes can be timely monitored and managed.

From the very beginning to the final stage of producing and packaging the finished product, smart sensors keep an eye throughout the clock in order to report if something wrong or unusual happens. This can refer to anything and everything including quality defaults or electric cutoffs.

The use of AI in the food industry with regard to smart sensors is particularly a boon for all food industries as they not only help in the detection of unusual activities but also negate the idea of quality inspectors throughout the production chain.

### **Investigative Exploration**

Faults are inevitable in any type of industry. Be it in the food industry or a clothing manufacturing plant, problems can occur at any point in time. However, it is possible that the causes for these defects might be unknown.

Using AI, food industries can investigate such cases and explore the hidden reasons behind any mishaps. By studying past data records and evaluating them, [AI applications](https://www.analyticssteps.com/blogs/top-10-artificial-intelligence-ai-applications) can perform investigative exploration and yield results rapidly.

This saves substantial time for dedicating resources to other processes and leaving no stone unturned.

### **Segregation**

One of the most important steps to getting started with food production is food segregation. Separating and sorting food ingredients is required for an efficient and organized production process.

Earlier to segregate, humans were employed to perform the task manually. On the contrary, customized machines using AI algorithms are used today to segregate food materials that are later mixed to produce products.

The task of segregation was a time-taking process in the past. But, today it requires lesser time and lesser efforts which has led to substantial preservation in resources of the industries dealing with food production.

### **Tracking Food Supply Chain**

Ever wondered how tracking a courier takes place? Even though you have been doing it for a while, artificial intelligence introduced this technology long before anyone knew about it.

Similar to the task of tracking a courier or a parcel, food businesses can track the supply chain to ensure that their raw material is moving in the right direction and at the right speed.

A lot of times, raw materials get displaced or dispatched to other locations. This can severely affect the production process by delaying the final outcome. From packaging material to production ingredients, food manufacturers can now track food supply chains with the help of customized AI applications and portals.

### **Automated Packaging**

As we move towards the latter part of the production process, we must discuss how AI has transformed the packaging process in the food industry.

Today, automated machines are aware of the exact quantities that they have to release in the packaging container and take less than a quarter of a minute to pack a set of items.

That said, automated packaging machines are another one of the biggest advantages that AI has provided to the industry. With the help of fast and efficient machines, packaging has become a lot more smooth and speedy.

### **Predictive Management**

Predictive analytics using [AI technologies](https://www.analyticssteps.com/blogs/top-10-ai-technologies-you-should-know) in the industry cannot be left out when its impact is being discussed. For ages, food industries have suffered huge losses only because they were unaware of the future consequences of certain practices.

From crop failure to electricity cut-offs, food industries can be affected in many ways. To prevent such crises, predictive analytics helps food industries to employ predictive measures in order to forecast possible outcomes.

This has helped many such industries to prepare themselves for otherwise unforeseen circumstances.

The power of [predictive analytics](https://www.analyticssteps.com/blogs/predictive-analytics-techniques-and-applications) can take the food industry a long way as it is empowered with the ability to foresee and predict numerous possible situations.

## **Exploring the Benefits of AI in the Food Industry**

The food industry is constantly evolving, and the integration of artificial intelligence (AI) has brought significant changes to the sector. AI offers a solution to many of the challenges faced by the food industry, including food safety, sustainability, and waste reduction. AI technology has enabled more efficient management of these problems, resulting in a better customer and business experience.

### AI-Driven Customer Service

One of the most significant ways AI changes the food industry is through customer service. Many companies now use chatbots, automated systems to answer queries and place orders. These conversational assistants work 24/7 and reduce wait times significantly, improving customer satisfaction. They can also learn as they interact with users, making them more effective at providing customer information and solutions.

AI-driven customer service has enabled companies to provide customers with personalized recommendations based on their previous orders and preferences. This has resulted in an enhanced customer experience, as customers feel that their needs are being catered to more efficiently and effectively.

### Menu Personalization and AI

AI can also help personalize menus based on dietary preferences, restrictions, and past ordering data. With this technology, menus are tailored to fit the customer's needs, improving the dining experience. This also reduces food wastage as customers are more likely to order what they like and are more likely to finish their meals.

Moreover, AI-powered menu personalization has enabled restaurants to offer more diverse and inclusive options for customers with specific dietary requirements. This has created a more inclusive and welcoming dining experience for all customers.

### Efficient Inventory Management

AI technology can help track and manage inventory more efficiently. It can predict demand and reorder supplies when needed, reducing food spoilage and waste. This improves the profitability of restaurants, as they can adjust supply and demand accordingly.

Moreover, AI-powered inventory management has enabled businesses to reduce their carbon footprint by minimizing food wastage. This has resulted in a more sustainable and environmentally friendly approach to the food industry.

### AI-Powered Marketing Strategies

AI can help marketers personalize advertising and promotional campaigns to target specific audiences. This makes advertising more efficient, and the targeted approach can build stronger customer relationships. Companies can also use AI to analyze social media interactions and customer feedback to make informed decisions about future promotions and campaigns.

AI-powered marketing strategies have enabled businesses to reach a wider audience and enhance their brand image. This has resulted in increased customer engagement and loyalty.

### Automated Food Preparation and Delivery

AI has revolutionized the way food is prepared and delivered. Robots can prepare food and beverages, reducing human error and ensuring consistency in portions and taste. This technology can also speed up the preparation and delivery time, improving the customer's experience.

AI-powered food preparation and delivery has enabled businesses to offer customers a more efficient and convenient service. This has resulted in increased customer satisfaction and loyalty.

AI has brought significant changes to the food industry, enabling businesses to provide a better experience for customers and themselves. With the integration of AI technology, the food industry has become more efficient, sustainable, and customer-focused, resulting in a more enjoyable and inclusive dining experience for all.

## **AI and Food Safety**

Food safety is a critical issue for the food industry, and AI can help regulate this issue. AI can help monitor food production and distribution, detect contamination, and prevent disease outbreaks. Analyzing data can predict potential hazards and offer measures to mitigate them.

One of the ways AI can help with food safety is by monitoring the temperature of food during transportation. Temperature control is crucial when it comes to food safety, as bacteria can grow rapidly in food that is not stored at the correct temperature. AI sensors can be placed in food transport vehicles to monitor the temperature and alert drivers if there is a deviation from the recommended temperature range. This can help prevent food spoilage and contamination, ensuring that food is safe for consumers.

Another way AI can help with food safety is by detecting contaminants in food. AI can analyze images of food samples and detect any abnormalities or foreign objects that may be present. This can help identify contaminated food before it reaches consumers, preventing the spread of foodborne illnesses. Additionally, AI can help identify the source of contamination, allowing for a more targeted response and quicker resolution of the issue.

AI can also assist with food safety by predicting potential hazards. By analyzing food production and distribution data, AI can identify patterns and trends that may indicate a potential hazard. For example, suppose there is a sudden increase in cases of a particular foodborne illness. In that case, AI can analyze the data to identify the outbreak's source and recommend measures to prevent further spread. This can help prevent disease outbreaks and keep consumers safe.

AI has the potential to revolutionize the food industry by improving food safety. By monitoring temperature, detecting contaminants, and predicting potential hazards, AI can help ensure that food is safe for consumers to eat. As AI technology continues to evolve, it will likely play an even greater role in ensuring food safety.

## **Challenges and Ethical Considerations**

While AI has numerous benefits, there are some ethical considerations to consider. Many are concerned about the implications of AI on the labor market, as automation reduces the need for human labor.

One of the biggest challenges of AI is job displacement. As AI technology advances, it is predicted that many jobs may become automated over time, significantly reducing the demand for human labor. This could lead to a rise in unemployment rates, particularly for low-skilled workers who may need the necessary skills to transition into new jobs. Governments and businesses must work together to address these challenges and find ways to retrain and reskill workers for new job opportunities.

Additionally, there is a valid concern about the impact of AI on privacy and data protection. Companies must ensure proper data protection measures and transparency when implementing AI systems.

Data privacy is a major concern when it comes to AI. AI systems rely heavily on data; companies must ensure they collect and use data ethically and transparently. This includes obtaining proper consent from individuals before collecting their data and ensuring that the data is stored and used securely. Companies must also be transparent about how they use the data and allow individuals to control it.

Another ethical consideration when it comes to AI is the potential for bias. AI systems are only as unbiased as the data they are trained on; if the data is biased, the AI system will also be biased. This could lead to unintended outcomes and potentially harm the brand. Companies should make a significant effort to use unbiased data and regularly audit their AI systems for bias as part of their regular evaluation process once these systems are deployed.

## **AI and Sustainability**

The food industry is one of the largest consumers of resources worldwide. AI can help promote sustainability practices by reducing food waste and optimizing resource allocation. AI can predict demand and adjust production accordingly to reduce environmental impact.

### AI-Driven Food Waste Reduction: A Greener Future

Food waste is a significant social, economic, and environmental issue. AI-driven food waste reduction solutions optimize supply chains by forecasting demand and managing inventory in real-time. Additionally, AI can track expiration dates and help companies implement effective waste reduction measures.

One of the most significant challenges facing the food industry is the amount of waste generated throughout the supply chain. In the United States alone, it is estimated that up to 40% of all food produced is wasted. This waste represents a significant economic loss and contributes to greenhouse gas emissions and other environmental impacts.

AI-driven food waste reduction solutions can help mitigate these issues by providing real-time data on inventory levels, demand forecasts, and expiration dates. By analyzing this data, AI algorithms can help optimize supply chains, reducing waste and promoting sustainability practices.

For example, AI can help identify patterns in consumer behavior, such as seasonal fluctuations in demand for certain products. By analyzing this data, companies can adjust production accordingly, reducing the excess inventory that goes to waste.

AI can also help companies track expiration dates more effectively, ensuring that products are sold before expiration. This reduces waste and improves food safety, as consumers are less likely to purchase expired products.

AI-driven solutions have the potential to revolutionize the food industry, promoting sustainability practices and reducing waste throughout the supply chain. As AI technology continues to evolve, we will likely see even more innovative solutions emerge, helping to create a greener, more sustainable future.

## How AI Is Changing Restaurants

When we talk about AI in restaurants, we’re usually not talking about AI-powered robots or large-scale automations. Most restaurants don’t have the kind of large manufacturing needs that would require mechanized interventions. It’s much more likely that AI will be used to streamline some of the day-to-day tasks of the restaurant, both in the [front of house](https://www.escoffier.edu/blog/culinary-pastry-careers/5-effective-ways-chefs-can-communicate-with-wait-staff/) and [back of house](https://www.escoffier.edu/blog/culinary-pastry-careers/retaining-and-training-in-the-back-of-house/), as well as improve restaurant marketing. Here are some of the improvements we’re seeing due to this new technology.

### 1. Personalized Menu Recommendations for Guests

AI can power analytic tools that make personalized recommendations to customers based on past behavior. For example, AI-powered engines can assess a customer’s past orders and reviews, determine days they may be more likely to place an order, and choose events that they may be interested in. This kind of personalized analysis will let AI make custom suggestions to the customer. For example, if a customer has only ordered vegetarian items, the AI could infer that the customer eats a [plant-based diet](https://www.escoffier.edu/blog/world-food-drink/what-exactly-is-a-plant-based-diet-and-is-it-right-for-you/), and can make recommendations that are relevant to that guest.

### 2. Predictive Analytics for Smarter Forecasting

Using predictive analytics, artificial intelligence can analyze sales data, weather patterns, and local events to estimate future sales. This may help to take the guesswork out of forecasting, so chefs can make more accurate employee schedules, estimate their inventory needs, and improve their long-term financial outlook.

### 3. Chatbots to Answer Questions, Take Orders, and Set Reservations

Today, most reservations are taken on sites like [OpenTable](https://www.opentable.com/) or [Resy](https://resy.com/). And online orders often go through platforms like [Toast](http://pos.toasttab.com) or [ChowNow](https://get.chownow.com/).

AI-powered chatbots can streamline these processes into a single platform. How about instead of navigating a complicated interface of checkboxes and customizations in an online ordering platform, the customer could have an easy “conversation” with an AI chatbot? The bot could ask all the questions a server would, like “Would you like fries with that?” for easy upsells. Domino’s Pizza, for example, uses a chatbot on Facebook Messenger to take orders and provide order updates.

### 4. Improved Cost Tracking and Menu Pricing

Historically, calculating the cost of each plate has been a painstaking process that requires spreadsheets and formulas. And since the cost of ingredients can fluctuate, those spreadsheets have to be updated often with up-to-date costs.

AI programs can make the process faster and easier. [xtraCHEF](https://xtrachef.com/), for example, can easily calculate the cost of each plate and update those costs automatically based on scanned invoices from suppliers. It can also factor in unique labor costs for more time-consuming items, instead of applying the same labor percentage across the entire menu.

This can give chefs a real-time understanding of the [cost of each menu item](https://www.escoffier.edu/blog/food-entrepreneurship/menu-design-best-practices/), so they can see at a glance if their margins are shrinking.

### 5. AI-Integrated Inventory & Purchasing To Save Time

Inventory and purchasing are two chores that can take up a lot of time in the kitchen. What could a cook or chef accomplish if they got some of that time back?

AI-integrated inventory tools can track stock levels in real time and automatically create purchase orders when quantities run low. They may also be able to analyze vendor performance and pricing so chefs can decide whether to keep a supplier or try a new one. With these tools, restaurants may be able to cut costs and streamline their inventory management process.

### 6. Robotic Food Delivery

If you live in a major city, you may have seen a small unmanned cart zipping around the sidewalk. These [autonomous vehicles](https://www.forbes.com/sites/bernardmarr/2021/11/05/the-future-of-delivery-robots/?sh=18638e873375) have been used to [deliver food from restaurants](https://www.escoffier.edu/blog/food-entrepreneurship/building-a-delivery-friendly-menu/) and supermarkets right to consumers. They are run by AI that can learn routes and assess obstacles in their way. While this hasn’t caught on at a large scale yet, we don’t know what the future holds. These autonomous vehicles could help to reduce the cost of [third-party delivery services](https://www.escoffier.edu/blog/food-entrepreneurship/the-pros-and-cons-of-becoming-an-uber-eats-restaurant-partner/), since there would no longer be a need to pay a human driver.

And beyond the restaurant industry, this could have major implications for seniors or those with disabilities that make it hard to run errands. A service that could deliver groceries or medicines at a low cost could make life much easier for those who have difficulty leaving their homes.

AI in the food industry isn’t limited to restaurants. The entire supply chain, from agriculture to distribution, could see substantial improvements with AI tools!

### 7. More Efficient Food Production

Much of the food chain is already automated, with robotic components completing [repetitive tasks like food sorting and packaging](https://www.analyticssteps.com/blogs/10-applications-ai-food-industry). These machines can be sterilized for cleanliness and can run 24/7 (minus some maintenance time).

While they’re already efficient, the addition of AI can help them to do even more, like making value judgments about the quality of produce.

The addition of AI can make these processes both faster and safer. AI can guide the robotic components to react to changes or troubleshoot problems before they take the entire manufacturing process down.

### 8. Developing a Stronger and Safer Supply Chain

Feeding a growing population has been a focus of scientific research for centuries. At the recently-formed [AI Institute for Next Generation Food Systems](https://aifs.ucdavis.edu/), scientists and researchers from five top American universities are getting help from AI. The institute uses AI learning to develop better food production, from breeding plants for higher yield to better agricultural methods to more efficient processing and distribution.

One of their current projects aims to use AI to predict [food safety](https://www.escoffier.edu/blog/food-entrepreneurship/visible-sanitation-is-now-an-unspoken-marketing-requirement-for-restaurants/) risks at the consumption end of the supply chain. A project like this could raise red flags about possible contaminations before consumers get ill.

### 9. Predicting Consumer Response To New Products

Food manufacturers considering a new product or new version of an existing product often have to do extensive market research and consumer surveys to identify trends and assess tastes. What if that process could be automated with AI?

The AI at [Gastrograph](https://www.gastrograph.com/) gathers data on products and consumer preferences in specific markets. It then recommends product changes and predicts how the target consumer will respond to them. With a tool like this, manufacturers may be able to reduce the lead time on getting their products to market and create more successful products for specific demographics.

Some uses of technology in food production include the following:

* **Genetically modified organisms.** GMOs are inserted in a plant's genes to help it become disease resistant and grow in areas not favorable for production. GMOs are used in large crops such as rice, wheat and corn.
* **Drones.** Drones can provide satellite imagery to monitor crop growth and deal with problem areas.
* **Meat industry technology.** AI is effective in poultry production where it helps detect health issues with birds by the sounds they make. AI robots can work at poultry farms to collect eggs or assist with butchering.
* **Crop monitoring.** Along with the use of drones, AI can detect pests and diseases in crops. Digital apps -- such as AgroPestAlert, Farm Scout Pro and IPM Toolkit -- can help detect pest infestation and changing soil conditions to prevent large losses.
* **3D food printer.** Food printers can create food -- such as pizza, snacks and candy -- at a faster pace. AI helps design the layers and structure of the food by placing one ingredient at a time. This could eliminate waste, as leftover ingredients can be reused.
* Food processing requires a lot of time, efficiency, and effort to produce good quality and safe food for the consumer. To ensure this, food manufacturers track many factors, such as raw materials, machinery used in production, packaging, quality, and much more. All these processes require time, effort, and skilled employees. Some of the largest food processing companies use Artificial Intelligence (AI) to optimize production processes.
* AI has been transforming the food processing industry in many ways. Right from predicting consumer demand to optimizing supply chain management, AI is enhancing efficiency and driving innovation in the food processing industry. The application of AI in the food processing industry can help reduce contamination in food production, leading to a better end product. Let's see how AI is revolutionizing the food processing industry.
* **Sorting.**Food sorting is a necessary step in food processing. Traditionally sorting was done by hundreds of workers who used to sort manually good food from bad. This process, if done manually, can be time-consuming and monotonous. No matter how skilled the worker is, there is a chance that some low-quality foods will slip from sight and reach consumers. However, this process can be automated with the help of ML and AI.
* The best part is that AI will do most of the work automatically. AI-driven food machines can accurately sort foods based on size, color, and weight with the help of advanced X-ray scanners, lasers, cameras, and robots that all work together to analyze food quality and sort it according to your specific quality requirements. This will speed up the sorting process and eliminate any errors caused by humans.
* **Food safety compliance and quality control**
* AI is used to improve the quality of food products. For example, AI technology can analyze images of food products, such as fruits and vegetables, to identify defects and imperfections. This information can be used to optimize production processes to reduce the likelihood of faults occurring in the first place. AI can also be used to analyze data from sensors that monitor the quality of food products during storage and transport, allowing for early detection of any issues that may affect the quality of the product.
* AI is making a significant impact on food safety. AI-enabled cameras ensure safety compliance among food workers in food processing plants. This employs facial and object-recognition software to determine whether workers comply with good personal hygiene practices as food safety law requires. If the violation is found, it extracts the screen images for review, which can be rectified in real-time. AI can also analyze data from food safety inspections to identify potential risks and hazards, allowing corrective action to be taken before any harm occurs.
* **Improved cleanliness**
* Clean-in-place (CIP) is an efficient and effective way to clean the equipment but it uses huge amounts of water. The cleaning-in-place system is programmed to clean equipment in timed cycles. However, AI-enabled technologies (self-optimizing clean-in-place system (SOCIP)) can measure food residue and microbial debris on the equipment and optimize the cleaning process. This leads to savings on water, time, and energy.
* **Predictive maintenance**
* One of the applications of AI in the food processing industry is predictive maintenance. Predictive maintenance is a program of continuously monitoring equipment and developing a performance profile that indicates when it is likely to need attention. It's a step forward from preventive maintenance, which involves servicing or replacing equipment according to a predetermined schedule. AI can also predict when equipment is likely to fail, allowing maintenance to occur before a breakdown occurs.
* **New product development**
* AI is used to develop new food products and flavors. For example, AI algorithms can analyze consumer preferences and trends to create new products likely to be popular with consumers. AI can also be used to analyze the chemical composition of foods to identify new flavor combinations that are both delicious and healthy.
* **Supply chain management**
* Supply chain management is the top priority for all food companies, with the increasing need for transparency. AI improves the efficiency of supply chains through food safety monitoring and testing products at every step of the supply chain to ensure compliance with industry and consumer specifications—more accurate forecasting to managing pricing and inventory. AI also helps in efficient and transparent tracking of produce from the farm to the end consumer, increasing consumer confidence.

**Challenges to the adoption of artificial intelligence**

* Despite AI's numerous benefits to the food processing industry, some challenges remain constant. One of the most significant challenges is the need for standardized data. While AI thrives on large amounts of data, the data in the food processing industry is often scattered and inconsistent, making it difficult for AI to make accurate predictions for analysis.
* AI technology requires increased transparency and more involvement of consumers in decision-making. AI technology is still in the infancy stage; there is a demand for specialized skill sets around gathering and analyzing data. As a new technology, many companies are only willing to invest once AI's actual value or delivery capability is well known.
* Also, the cost of AI deployment is one of the biggest challenges. While the benefits of using AI in the food processing industry are significant, the initial investment can be substantial. Food processors may need help to justify the cost of implementing AI, mainly if they are small or medium-sized enterprises.

**Future of AI**

* Artificial intelligence makes the food industry more efficient and promises to yield many more changes soon. AI's role in the food processing industry is becoming increasingly significant due to its ability to reduce waste, predict markets for products, efficient and effective monitoring, augment sanitation, manage costs, and increase revenue.
* AI is transforming the food processing industry, from improving quality control and food safety to optimizing supply chain management and creating new products. We can expect to see huge innovation in this area. While challenges remain, the benefits of using AI in the food processing industry are significant and will likely drive further innovation. Companies that embrace AI while also understanding the system's loopholes will be able to stay ahead of the competition, reducing costs, increasing efficiency, and delivering products that meet consumers' evolving needs!
* Within that ecosystem are three exciting start-ups: Eggmented Reality, which is developing egg-alternatives from naturally-occurring proteins, Imagindairy, which is developing animal-free dairy proteins that have the same taste, texture, functionality, and nutritional benefits as their bovine counterparts, and Alteco.AI, which uses AI to manage the food industry’s energy usage. Eggmented and Alteco.AI are both start-ups within Fresh Start, a food-tech incubator and leader in the agri-food tech cluster in Galilee.
* With capabilities vastly beyond any human endeavor, AI is poised to become an essential tool to not only streamline the F&B sector, but reshape human livelihoods by freeing up the workforce.
* **FoodIngredientsFirst** speaks with Dr. Eyal Afergan, co-founder and CEO of Imagindairy, Jon Rathauser, CEO and co-founder of protein Eggmented Reality and Alon Mashkovich, CEO of Alteco.AI, about the latest developments, ideas, and strategies in the Israeli AI space.
* **Israeli start-ups are increasingly turning to AI to solve issues of food production.Breaking the cost barrier**

Afergan at Imagindairy details his view of how AI technologies can secure sustainable food production, particularly for dairy-based products.

* “The demand for protein is forecasted to be doubled by 2050, with the need to feed 10 billion people. The food industry must convert to more sustainable and efficient production methods to answer this need. AI-powered technologies can ensure the efficiency, quality and safety of food systems, which is much needed,” he explained.
* Imagindairy develops animal-free dairy proteins, aiming to provide the same taste, texture, functionality and nutritional benefits as their bovine counterparts.
* “Our core technology is based on AI models that amplify protein expression, making precision fermentation commercially viable to produce these proteins while tackling the biggest hurdle in this space: reaching cost-effectiveness,” says Afergan.
* This commercial viability is the wall that has held back mass fermentation processes, although Afergan feels AI is the “force needed to break through this wall.”
* He details that AI is an enabling technology that can push food production systems forward when applied wisely. Precision fermentation is a well-known process in the industry, yet AI is needed to pass the cost barrier currently present for edible proteins.
* “We realized that we must solve the production cost issue to produce edible proteins in large quantities by precision fermentation. We found the solution in a lab at Tel Aviv University, where one of our co-founders, Prof. Tamir Tuller, is developing an innovative AI technology that enables high protein production by our protein-producing microorganisms. From this moment on, we had all the pieces of the puzzle,” concludes Afergan.
* **Imagination without limits**
AI could be a pathway to a “utopian vision” of food production and how Eggmented Reality is navigating that road, Rathauser underscores.
* Eggmented Reality has developed a protein platformed that has leveraged bioinformatics to create their first product: an egg and  methylcellulose-functional alternative.AI technology is capable of analysing and producing ingredients more efficiently than any human.
* “The uniqueness of Eggmented’s technology platform is to ‘ask’ nature [utilizing bioinformatics] for the right non-genetically modified organism protein that would provide improved functionality, reduced allergenicity, increased stability to processing, and more,” he says.
* Rathauser’s approach is less about solving existing problems and more about imagining a production process with no restraints, then leveraging AI to enable that vision.
* “We’re having conversations with food manufacturers that force them to consider: What would you make if you didn’t have the constraints of today’s ingredients? What new product lines would you pursue, how could you tailor compositions, and who else can you reach with your product offerings?” he says.
* **Unlocking new livelihoods**
Using AI to solve the complex challenges of our food industry may also stand to create opportunities that didn’t previously exist, Rathauser stresses.
* For Eggmented Reality, such progress will hopefully beget even further improvement.
* “I prefer to think of technology in food as an enabler – such as, if we can free someone from the farm who would rather spend their waking hours as an artist, or if we can make certain food products available to more people if we neutralize an allergen,” says Rathauser.
* He continues to detail that if we can unlock the creative potential of chefs or bakers, it may lead to new culinary experiences and greater nutritional health, and ultimately solve the challenges of feeding more people healthy food without destroying our environment.
* “Technology alone will not solve all these challenges, but it is indispensable if we wish to have the chance.”
* Such a future may be far away, but Rathauser is keen to point out developments in the present.
* “As technology has made it possible to analyze the entirety of an entity’s financial records instead of only sampling and spot-checking, so will we see these benefits in food safety. We can more quickly, less expensively, and comprehensively assess food for consumption and reduce the risk of contamination that used to be commonplace,” explains Rathauser.
* “As in other disciplines, I don’t see this trend going backward.”
* AI also has the potential of providing new livelihoods.Whereas many leaders tout the potential of AI, [others warn of its dangers](https://www.foodingredientsfirst.com/news/ais-agri-food-takeover-analysis-warns-growing-tech-to-table-trend-in-farming-is-not-without-huge-risks.html), such as presenting new hacking vulnerabilities.
* Despite such warnings, large scale ingredient specialists such as ICL and Protera biosciences have [made moves to integrate AI-based solutions](https://www.nutritioninsight.com/news/icl-and-protera-biosciences-form-plant-based-partnership-for-ai-powered-solutions.html) fully.
* **Lowering energy prices**
During a historic time of global inflation and supply cutbacks, Mashkovich tells us about how AI can unshackle the food industry from rising energy prices.
* “The food industry is well known for its high consumption of energy. We are developing a unique technology capable of identifying the machinery connected to a single metering point without any additional hardware installed.”
* He continues to argue that AI and deep learning is the only way to analyze a dynamic list of power quality parameters.
* “The producer’s pricing model needs to consider electricity bills as part of the production line, as they cannot tell how much energy is consumed for the whole process. AI is crucial in the food industry to take energy consumed into account while calculating the total cost of the product.”

#### Machine learning applications in the restaurant business

**Analytical solutions for a better customer experience**

Currently, there are several applications in the foodservice space that may help to foresee visitor traffic on different seasons and events, food orders and relevant inventory needs to predict the number of orders for a certain period/date. Such applications and solutions collect previous data to engage customers more through examining their habits and preferences: it brings more repeat visits and orders in the result. These are Cloud Big Data solutions, restaurant management platforms to make the paying process easier, applications that allow connecting and pre-order a table in advance.

**Food-selling site and applications**

Once you have defined what to produce, the next step is to make the best online service system for your Food Beverage business for people who discovered your existence through the Internet or decided to examine your menu/order takeaway online. Say, it will be an online site that gives the best recommendations/makes the order process really quick or a mobile application with a convenient and smart AI foods system. E-commerce is getting more popular in the digital world so it is a bad thing to forget the promotion of your goods on the Internet. Automated customer service and customer segmentation can significantly increase the accuracy and efficiency of administrative functions such as creating reports, placing orders, dispatching crews, formulating new tasks and etc.

**AIs for online restaurant search**

Restaurants, cafes, and bars are also dependent on their ratings and feedback on the Internet. Nowadays many customers get to know about their existence through Google maps/searches. In these cases, an AI in foodservice solution offers to unite the data from various food delivery programs to give the user a hint for a café or a restaurant that might appeal to his tastes and be relevant to the location. There are also AI agents that notify clients about any sales and events in their favorite restaurants via their most used platforms like Twitter or Slack.

**Voice searches**

As people begin to prefer voice search over typing anything into the Google address (around 27% of the population), voice commerce seems to gain more significance. Restaurants can create tools such as Amazon Alexa to allow their customers to make an immediate order without even an ordinary “click”. In such a way you can place orders quickly and hands-free.

**Self-serving system**

Self-serving (point-of-sell systems) are being massively taken up by restaurants as long as they enable customers to control the ordering process, carefully examining their choice, sometimes even checking the number of flavors and spices put into the dish. It is believed that this technology should be available for all size restaurant businesses, not only for big ones. Applications and terminals allowing to make a self-order reduce customer wait time, make orders more accurate and increases customer experience, being highly engaging.

**Innovations in robotics for the food industry**

Some of the most complicated and brightest AI-based solutions like robotics have popped up recently, but are only a privilege for big food businesses and fabrics, still unavailable for small-to-medium. These are drones to deliver orders or robotic hands that can manage many processes in food manufacturing and even cooking. However, these devices can get popular due to the exponential rise of human talent wages and can save more costs in a long-term run. The International chain of convenience stores **7-Eleven** already uses drones and street boots in its delivery service while **Walmart** claims that it will soon use drones in warehouses. Another curious robotics implementation is the **“Flippy” robot** which actually consists of two mechanical hands, able to take and turn over fried burger patties and put them into buns along with other ingredients for burgers.

#### Artificial Intelligence in food waste

The United States Department of Agriculture claims that: “In the United States, food waste is estimated at between 30-40 percent of the food supply. This estimate, based on estimates from USDA’s Economic Research Service of 31 percent food loss at the retail and consumer levels, corresponded to approximately 133 billion pounds and $161 billion worth of food in 2010. This amount of waste has far-reaching impacts on society.”

According to McKinsey Artificial Intelligence can solve this problem and unlock a $127 billion opportunity by reducing food waste in 2030! Such astonishing numbers could be achieved by introducing more regenerative recreational agricultural practices. What does that mean? It means that humans currently don’t use their resources wisely and mono-cropping, the blanket application of synthetic chemical fertilizers and intensive land use can be replaced with “smarter” methods. Information gathered from sensors, drones, and satellites, as well as other equipment, could help farmers to make better decisions faster. Here are some ways to reduce food waste with AI:

* While some solutions analyze the ripeness of the fruits, another figure out what microbes could increase crop growth without the involvement of synthetic fertilizers.
* Farmers could get rid of field trials, benefiting from advantages of the AI, which will significantly save money.
* If farm-based food supply chains will use visual imagery technology, the food inspection process will be much easier.
* AI food tracking will enable us to sell food before it becomes a waste, connecting farmers with restaurants or people buying food more efficient.

The main challenge, to make these ideas a reality can’t be delivered by one company. The whole industry needs to be changed. The entire network of partners is required to help these changes to make a significant impact on the world.

This problem is getting more attention worldwide. Since 2011, more people are searching for “Food Waste” In Google:

#### Future application of AI in food

We already know that among the investments in AI technology, there are significant investments in the Food Manufacturing sector. AI could easily predict many issues in agriculture, for example, then people could, and investors begin to notice it.

Switzerland-based agricultural tech firm Gayama raised over $3.2 million in funding AI project. They use drones with hyperspectral cameras that detect changes in water, fertilizer, pests, and crop yields. Then the AI algorithms can find potential threats and alert farmers. AI algorithms can also suggest certain actions the human must take to make the best out of their resources. Harvesting is also an interesting case of usage Machine Learning in analyzing satellite data on the Earth’s surface. The purpose is to find the places that could use some help from investors or the government for improvement and providing more food as a result.

If we talk about the agricultural industry in the context of the food industry there is a lot of room to grow. Farming is still outdated in many parts of our planet. Britain’s Institution of Mechanical Engineers claims that they are 550 billion liters of water wasted annually in the crop production process. Artificial Intelligence has a chance to solve this problem somehow in the future and reduce this number. Successfully solving this problem could raise the production of food by 60% or even more. Machine Learning and AI are nascent, but there will be plenty of solutions to eliminate waste in food production and raising their effectiveness.

The 77 Lab, for example, already introduced smart bots that could pick food straight from the plant, eliminating the ineffectiveness of human farm labor. There were automated pickers in the past, but these robots are using Machine Learning and could tell the level of ripeness of the fruit, distinct the fruits from other plants better and handle fruits more careful. What will happen if this will be more adopted? This is just one way for the Food Industry to benefit from ML. Iron Ox, have built entire farms based on robotics, that don’t even suppose to be handled with the help of humans. How fast we will get such innovations worldwide? Time will only tell.

#### AI in food and beverage statistics

During the 2019-2024 period, the Food and Beverage market is expected to register a CAGR of over 65.3%. The leaders of the industry are already transforming their businesses by enabling cutting-edge technologies in their processes. North America is expected to be a significant part of this explosion.

* The United States of America is a leading region in its area. In 2017, the USA was the second biggest region of the AI food industry market in the world, with a 29.1% market share.
* North America has a really high level of readiness for AI adoption, that’s why it has high automation potential that expected to occur at the regional level in the period between 2019 and 2030.
* According to the United States Department of Agriculture, 16% of shipment value in the USA is coming from food processing plants.

Increasing the Application of Artificial Intelligence in the Food Industry in this region is inevitable because is a low-margin and high volume industry. Even the slightest increase in efficiency can make a significant impact on the success of the companies.

#### Benefits of AI in food

1. Recently there are more and more companies are trusting Artificial Intelligence with improving supply chain management thorough logistics, predictive analytics and also adding transparency.
2. Digitization of the supply chain ultimately drives revenue and provides a better understanding of the situation. AI can analyze the enormous amount of data that is beyond human capability.
3. Artificial Intelligence helps businesses to reduce time to market and better dealing with uncertainties.
4. Automated sorting will definitely reduce labor costs, increase the speed of the process and improve the quality of yields.

The AI food industry will ultimately be better in the area of safety standards.

Here are just a few of the benefits of using AI in an independent restaurant:

* Cut costs: AI technology can be used to automate a lot of simple and rote tasks (like taking reservations or entering orders into the POS). This means less money spent on staffing your restaurant, and lower costs overall.
* Reduce errors: Human error accounts for a lot of things that can go wrong in a restaurant. For example, a server in a busy dining room might mishear a guest's order, resulting in the guest receiving the wrong dish. When guests order via AI, there's less opportunity for human error.
* Customize orders: AI gives more control to guests during the ordering process. This allows them to customize their orders (and their overall experience) to fit their needs.
* Improve guest service: By embracing AI's ability to perform simple and rote tasks in your restaurant, you can free up employees to do what they're best at (and what AI can't just yet): Focus on your guests and provide them with the best possible experience. For all the talk about robots being poised to take over restaurant kitchens, there's one thing they definitely can't do yet: Mimic the human touch that can make a restaurant experience so special.
* Find new customers: AI technology can supercharge your restaurant's marketing efforts, allowing you to identify what kinds of customers might love your food, reach out to them, and encourage them to pay you a visit. AI can also help with retaining guests—remarketing efforts can encourage them to make a repeat visit after coming to your restaurant.

## Ways AI in Restaurants is Becoming More Common

In recent years, the restaurant industry has been changing rapidly, particularly when it comes to technology.

AI has been one area where technology has created changes for restaurants that look straight out of a sci-fi novel. For example, take Flippy, the [burger-flipping robot](https://www.livescience.com/61994-flippy-burger-flipping-robot-flops.html) at a CaliBurger franchise in Pasadena. Or the [delivery drone used by Domino's](https://www.cnbc.com/2016/11/16/dominos-has-delivered-the-worlds-first-ever-pizza-by-drone-to-a-new-zealand-couple.html) to drop off a pizza order in New Zealand. These big, quick-service restaurant chains have enough capital to invest in AI technologies that come with high up-front costs, but this is the exception for the restaurant industry, not the rule.

While advances in technology have made AI more accessible than ever before, robots that do the food preparation and cooking or deliver orders to guests are still out of reach for the vast majority of restaurants. In the foodservice industry, AI is becoming more common, but in smaller ways, often behind the scenes.

### AI in the Front of House

#### **AI Phone Answering**

Missed phone calls can have a disastrous effect on a restaurant business. A recent survey conducted by Popmenu found that a staggering 83 percent of customers will move on and find another restaurant if they try to call and get voicemail more than once.

That's why many restaurants are adopting technology that helps them avoid missing customers' calls. AI phone answering technology can take messages, make reservations, [add a guest to the waitlist](https://get.popmenu.com/post/waitlist-me-alternatives), or even answer commonly asked questions (for example, if a guest asks, "Can I bring my dog on the patio," and AI phone answering service can be programmed to pick out keywords like "dog" and "patio" and respond, "Our patio is dog-friendly.").

This technology is similar to the AI chatbots that have been common online for a few years now. They can handle many simple guest queries, which frees up your front-of-house staff for on-premise service—and ensures you no longer miss phone calls from guests.

#### **Voice Ordering**

27 percent of [all online people](https://www.forbes.com/sites/tjmccue/2018/08/28/okay-google-voice-search-technology-and-the-rise-of-voice-commerce/#4d7feb3a4e29) now use voice search, and nearly 40 percent [prefer voice search](https://www.fastcasual.com/news/study-1-in-4-consumers-who-get-a-restaurant-result-in-voice-search-visit-that-restaurant/) over their smartphones when searching for nearby restaurants. As voice assistants have become more popular—Amazon Alexa, Google Home, and Siri, just to name a few—the tasks they can help users accomplish have become more complex and far-ranging.

Guests have been using virtual assistants to search for restaurants for a while now. But a new technology that's gaining popularity is voice ordering—where guests can use their smart devices to place restaurant orders on the go or while multitasking.

But this technology has even more applications than just ordering on guests' personal devices. Voice ordering could be implemented at self-service kiosks or in drive-thrus, allowing guests to place orders conversationally—and without touching anything, a great safety measure in the pandemic age.

#### **Self-Serve Options**

Self-serve technology goes hand-in-hand with voice ordering. This encompasses all the different ways guests are being given the power to control and customize their own dining experience through self-service.

Customizing menu items while ordering from kiosks. Splitting the check and paying from tableside tablets—or even their own devices. More and more guests are embracing self-service technology in a variety of ways—and from all kinds of restaurants, from fast food to sit-down dining.

#### **Kiosks that Personalize Customer Experiences**

While ordering kiosks have become fairly common in a variety of restaurants, there are some eateries that are taking that experience a step further. Take KFC, for example, which is experimenting with kiosks with facial recognition technology that can recognize repeat visitors and tailor their experience based on their past orders and preferences.

While facial recognition might not be accessible for all restaurants, there are many ways you can use AI to help personalize the dining experience for your guests. Online ordering and digital marketing are two places where restaurants are more commonly collecting guest data, and then using that data to provide personalized service, from dish recommendations to targeted marketing.

### **AI in the Back of House**

#### **Integrated Inventory and Purchasing**

One area of restaurant operations where AI can have a major impact is by integrating inventory and purchasing systems with your point of sale (POS systems). AI-enabled software can track historical inventory and purchasing data, looking for trends and making real-time recommendations for how many ingredients and supplies to buy.

Not only does this ensure your restaurant has enough inventory on hand to avoid having the 86 a popular dish, but it can help cut down on food waste by tailoring purchasing to only meet inventory needs, without buying excess that your restaurant won't be able to use before it expires.

#### **Smarter Staffing and Scheduling**

Staffing your restaurant and scheduling employees can be one of the trickiest parts of restaurant management. That's why it's an area where AI technology is becoming more and more popular.

Using AI-enabled software, restaurants can track staffing and sales data to determine any trends or patterns in busy times (and less busy times). Then, they can staff the restaurant appropriately for the traffic and sales that are expected during each shift.

#### **Optimized Delivery Processes**

Food delivery exploded in popularity during the COVID-19 pandemic, and that trend doesn't look like it's slowing down any time soon. That's why many restaurants are turning to AI technology to help them optimize their delivery processes.

AI can help delivery drivers find the best and fastest routes for making multiple deliveries in one trip, utilizing map data to avoid traffic and other hazards. AI can also keep guests in the loop about their orders—like how delivery platforms like DoorDash and Uber Eats allow customers to follow along on a map, and send them texts when their order status is updated.

#### **Data-Based Insights and Predictions**

In 2019, McDonald's started using predictive AI technologies and forecasting orders made in its drive-thrus. By analyzing historical data about what customers ordered and when, McDonald's stores were able to anticipate rushes and even predict what dish would be most popular during a given time of day. By anticipating orders, the stores using this technology were able to reduce wait times by 30 seconds on average—quite a feat when you consider that drive-thru ordering experiences typically only last a few minutes.

This kind of predictive technology can be used by restaurants in so many ways: To manage inventory, staffing, [menu pricing](https://get.popmenu.com/post/menu-engineering), and more.

#### **Automated Marketing and Remarketing**

One place where most restaurants can implement AI today is in their digital marketing plans. There are many tools available now that use automation to [send out marketing emails](https://get.popmenu.com/post/restaurant-newsletter), social media posts, and targeted ads to the right people at the right times to maximize views, click-through rates, and more.

AI marketing can also be used to retarget recent visitors to your restaurant, encouraging them to become repeat guests. It can help identify [promotions](https://get.popmenu.com/post/restaurant-promotions) that might help you upsell guests. All you need is the right automated marketing tools (which are included in every [Popmenu](https://get.popmenu.com/) package).

While AI might seem like an intimidating subject to many less tech-savvy restaurateurs, the bottom line is that it's earned its place in the restaurant industry's future. AI is here to stay, and along with it, many benefits for independent restaurants that embrace the trend.

## **AI in Food & Beverages Market Analysis**

The AI in Food & Beverages Market size is expected to grow from USD 7.00 billion in 2023 to USD 35.42 billion by 2028, at a CAGR of 38.30% during the forecast period (2023-2028).

Changes in consumer demands toward preferring fast, affordable, and easily accessible food options have transformed the food and beverage industry. Market leaders are leveraging advanced technologies, such as artificial intelligence and machine learning to scale operations and help companies stay relevant in a dynamic market environment.

* AI actively gained prominence over the last few years, with many companies actively investing in exploring the technology potential in the industry. This emerging AI technology is helping F&B companies with supply chain management through logistics, predictive analytics, and transparency. For instance, in August this year, Rockwell Automation released cost-effective photoelectric sensors ideal for material handling, packaging, and assembly applications to address the small form factor needs of industries like food and beverage and household. The 42EA RightSight S18 line of sensors offers the performance of more comprehensive solutions in a smaller, more versatile package to deliver excellent detection capabilities where size and shape matter.
* Organizations are rapidly digitizing their supply chain to differentiate and drive revenue growth, improving efficiency across the supply chain. Supply chains are generating massive amounts of data, and AI is helping the organization to analyze this data and better understand variables in the supply chain by anticipating future scenarios.
* AI in supply chains is helping businesses to innovate rapidly by reducing the time to market and establishing an agile supply chain capable of foreseeing and dealing with uncertainties. It is driving AI growth in the food and beverage sector.
* AI provides many benefits to the F&B industry, but the high cost of large-scale deployment in the sector restricts market growth. One of the challenges of the food processing industry is its feedstock, which can only be found to be uniform. It is seen that food storage is done with the help of manual labor. But with AI, this sorting process can be automated, ultimately reducing labor costs, increasing speed, and improving yields. For instance, in July last year, SORTEX A GlowVision launched recently in London and is available in three to five chute models on a five-module frame. It features a custom-built inspection system explicitly designed for PET sorting. It will be of great interest to PET processors looking to reduce contamination levels on key color and polymer defects, providing one of the most comprehensive solutions on the market.
* Companies with the fortune of established data analytics capabilities and a team of competent developers can safely build their own AI platforms. F&B players without such resources seek solutions and providers with clearly defined goals, needs, and budgets.

## AI in Food & Beverages Industry segmentation

Artificial Intelligence (AI) is a process of making intelligent machines that work and react like humans. The aim is to teach machines to think intelligently, as humans do. The machines have been doing what they were told to do till today. But with AI, machines will think and behave like human beings. The food processing industry is leveraging AI to enhance various offerings, optimize operations, and deliver better customer experience. The Artificial Intelligence (AI) in Food & Beverages Market is segmented by application (food sorting, consumer engagement, quality control, and safety compliance, production and packaging, maintenance, and other applications), end user (hotels and restaurants, food processing industry, and other end users), and geography(North America, Europe, Asia Pacific, Latin America, and Middle East and Africa).

## AI in Food & Beverages Market Trends

This section covers the major market trends shaping the AI in Food & Beverages Market according to our research experts:

### **Consumer Engagement is Expected to Register a Significant Growth**

* The investment made by the former chairman of Tata Sons in Techbin Solutions Pvt Ltd’s Niki.ai is depicting the investments and growth of chatbot usage. It is an AI-fueled chatbot that conducts conversations with consumers to assist them in ordering a wide range of services with the help of a chat interface).
* AI is being applied to understand consumer behavior, which is expected to lead to more accurate predictions. It can further enable marketers and organizations to reach out to customers personally, engage in deeper interactions, and enhance their overall experience with the brand.
* Furthermore, many consumers are adopting chatbots, as they can effectively work offline. An American Express report stated that more than 50% of customers are willing to spend more in companies that provide superior customer service. It opens up a tremendous opportunity for AI, likely to fuel AI growth in the food and beverage market. For instance, in August last year, Jio Haptik Technologies Limited (Haptik) partnered with Zoop, an IRCTC partner, for food delivery on trains to enable railway passengers to seamless food ordering and delivery on train journeys. This WhatsApp-based self-service food delivery platform allows passengers to place food orders and get their deliveries straight to their seats with real-time order tracking, feedback, and support.
* AI can also help to analyze, monitor, and deduce customer behavior and sentiments across various social media channels. Therefore, when AI builds an in-depth customer profile, it matches their social experiences about the product. With the help of such powerful insights, firms can now aim to improve the customer experience and make it more productive, thereby leading to market growth.

## **Food waste management**

As AI technology continues to evolve and advance, we can expect to see even more innovative solutions for food waste management. Some of the key areas of focus for future AI food waste management technologies include:

### **Advanced Analytics and Data Integration**

With the growing availability of data and the increasing sophistication of analytics tools, we can expect to see more advanced AI algorithms that can process and analyze large volumes of data from various sources, providing more accurate and comprehensive insights into food waste generation and prevention.

### **Integration with Other Technologies**

AI food waste management technologies can be integrated with other technologies such as [blockchain](https://www.cronj.com/blog/what-is-blockchain-technology-and-what-are-benefits-of-blockchain/) and IoT to enable more seamless and efficient tracking of food waste throughout the supply chain. This can enhance transparency and traceability while also improving waste reduction strategies.

### **Increased Use of Robotics**

Robotics technology can be used to automate certain processes such as food sorting, reducing the need for human intervention and improving efficiency. AI algorithms can be used to optimize these processes, improving overall performance.

### **Expansion of Food Waste Reduction Programs**

As public awareness of food waste continues to grow, we can expect to see an expansion of food waste reduction programs at the local, national, and international levels. AI-based technologies can play a key role in supporting these initiatives, providing data-driven insights into food waste generation and prevention.

### **Adoption of Circular Economy Principles**

The adoption of circular economy principles can help businesses and organizations reduce waste and optimize resource utilization. AI-based technologies can help facilitate this transition by providing data-driven insights and enabling more efficient and effective waste reduction strategies.

### **Increased Collaboration and Partnerships**

Collaboration and partnerships between businesses, organizations, and governments can help drive the development and adoption of AI food waste management technologies. These collaborations can enable the sharing of data, resources, and expertise, resulting in more effective and sustainable solutions.

As AI food waste management technologies continue to evolve and improve, we can expect to see significant advancements in the way we manage food waste. With the potential to improve efficiency, reduce costs, and promote sustainability, these technologies will play a critical role in creating a more sustainable and resilient food system.

## **Future of AI**

The future of artificial intelligence is expansive as it has so much to develop into. Yet, the kind of evolution it has triggered in various sectors is the real determinant as to how prominent it can become in the coming years or decades.

With the rise of the metaverse and other technological advancements, AI and machine learning will likely take over the human ability to determine, develop, and dedicate resources in the right direction.

To sum up, AI has its own set of pros and cons. But, it is an unsaid fact that it has fastened the way technology serves us and satisfies our desires for the time being.

Even if we only consider the food sector, this technology has achieved a milestone in kickstarting the process of automation, adaptation, and autonomy. Gone are the days when humans had to stay around to keep an eye on the machines.

Thanks to AI, machines are capable of monitoring themselves and other machines too which has drastically changed the nature of workload on us.

Despite the lump sum employment of machines in the industrial sector, humans are still required to keep up with the day-to-day challenges which proves that AI has a long way to go in order to fully replace us as the leaders.