The Role of Artificial Intelligence in Restaurants

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Executive Summary

As prolonged wait times, production mistakes, supply chain challenges, and labor shortages continue, restaurants are turning to artificial intelligence (AI) to alleviate and correct problem areas. While the popular thought of AI in restaurants congers up images of kitchens staffed by trained robots, this by no means captures the realities of the technology. The most common ways AI is changing restaurant operations is by reducing human errors, containing escalating costs, enhancing production accuracy, adherence to safety standards, and redefining the customer experience. Restaurant operators can benefit from AI processes designed to increase capacity, advance forecasting precision, and accelerate production, while enabling growth. Additionally, AI-enabled machines and virtual assistants can be assigned to effectively conduct customer communications, reservations, and recommendations while providing adapted ordering.

The International Data Corporation (IDC), a global provider of information technology and publisher of the report, 'AI Strategies View 2021 Survey' identified the primary business objectives of AI as accelerating innovation, improving operational efficiency, and enhancing customer experiences. Survey results basically established AI as the key to sustainable competitive advantage. Lightspeed analytics' 2021 Global State of the Hospitality Industry Report', projected the growth of AI in US restaurants at a steady pace for the foreseeable future. The study noted that at least fifty percent of operators were planning to implement some form of AI technology in the near term and revealed forty-seven percent of full-service restaurant (FSR) operators and thirty-seven percent of quick service restaurant (QSR) operators credited AI with the ability to streamline operations and help survive the pandemic.

AI can be divided into three main disciplines: machine learning, computer vision, and natural language processing. Machine learning involves mathematical algorithms that are capable of drawing conclusions from processed data, over time. For example, the ability to accurately forecast sales volumes based on historical observations. Computer vision involves acquiring high-level understanding based on digital images or videos. For example, developing visual authentication using facial recognition. Natural language processing is concerned with the interactions between computers and human language. For example, the process of transcribing voicemail into text. Suffice it to say, the restaurant industry is finding credible ways to apply artificial intelligence though insights and expectations gained via data processing.

AI Life Cycle

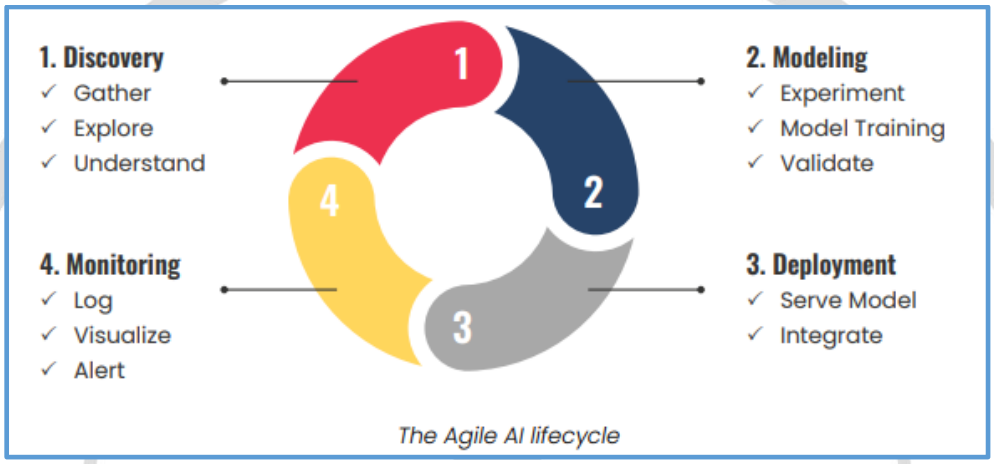
In the phData guidebook 'How to Implement a Successful AI strategy', the authors point to the stages of an AI project life cycle. The four project stages being: discovery, modeling, deployment, and monitoring.

Stage 1: Discovery – collecting relevant information that can guide strategic decisions is critical to a successful AI solution. Discovery centers on use-case situations. Subcategories include gathering, exploring, and understanding.

Stage 2: Modeling - operationalizing AI solutions require identifying infrastructure components that support a restaurant application. Subcategories include experimenting, model training, and validating.

Stage 3: Deployment – selecting the most appropriate AI and ML applications can be difficult given the increasing number of suppliers in the space. It is important to identify workable and feasible solutions. Subcategories include serve modeling and integrating.

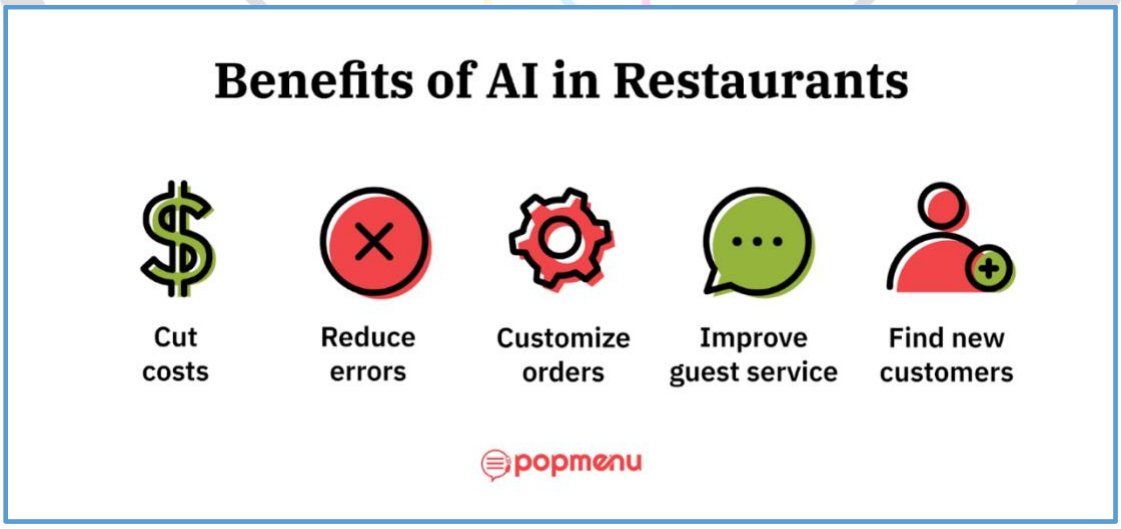
Stage 4: Monitoring – probably is no restaurant that is completely prepared to pursue an AI initiative without experiencing gaps and oversights prior to reaching a fully deployable solution. Subcategories include logging, visualizing, and alerting.



Source: offers.phdata.io

AI Benefits

Artificial Intelligence combines multiple concepts of mathematics, statistics, physics, and computer science in a way that formulates a feasible solution. AI enables a computerized device to mimic human behavior and perform tasks that normally require human intellect. AI captures data from a surrounding environment and reacts to it in a way that enables multi-tasking with minimal resource displacement. AI applications include learning, reasoning, and perceiving using machine learning, computer vision, and natural language processing. The objective of AI is to drive business processes with creativity and innovation.



Source: get.popmenu.com

AI technology applied in restaurants can interact with customers, take orders, interface with point of sale (POS) systems, cycle production to service, and perform many other functions. A few of the broad benefits of applying AI in restaurants, include cutting costs, reducing errors, customizing orders, improving customer service, and identifying new customers:

- Cost containment - AI technology can be used to automate repetitious tasks, such as taking reservations or entering orders into a POS terminal. Efficient order capture, forecasting, and job streamlining can result in less money being spent on operations, thereby leading to lower overall expenses.

- Error reduction - human error is attributable to many things that can go wrong in a foodservice business. For example, a server might misunderstand a customer's order, resulting in production of an incorrect menu item. Given AI order capture and placement is digital, there are fewer errors.

- Customized orders - AI provides enhanced customer control during the ordering process thereby providing a platform for more personalized ordering.

- Improved customer service - by embracing AI's ability to perform specific tasks, employees are free to focus on providing exceptional customer service.

- Identifying new customers - AI technology can improve marketing efforts that allow the development of customer profiles to identify new target markets. In addition, AI can help with retaining customers through remarketing efforts that incentivize repeat visits.

AI Genres

AI can be divided into at least three distinct genres: 1- machine learning (ML), 2- computer vision (CV), and 3- natural language processing (NLP).

Machine learning takes AI to the next level. ML technology allows computers to not only retain data but also to apply complex formulas to generate predictions about events or human behavior based on historical patterns. Machine learning is a field of inquiry devoted to understanding and building methods that leverage information to improve task performance. It is a part of artificial intelligence that is able to learn and adapt without following explicit instructions. ML relies on algorithms and statistical models to analyze and draw inferences from data patterns. Machine learning is used by platforms like YouTube TV, Netflix, and Spotify that suggest new content based on a user's personal preferences. Similarly, restaurant AI applications can promote menu specials and upselling to candidate customers given ordering history.

Computer vision is an interdisciplinary scientific field that deals with how computers can gain understanding from digital images or video. Computer vision is a field of AI that enables systems to derive meaningful information from digital, visual inputs and, in turn, to take actions based on the information. Different types of computer vision include image segmentation, object detection, facial recognition, edge detection, pattern detection, image classification, and feature matching. The goal of CV is to enable computing devices to correctly identify an object or person and to take appropriate action.

Natural language processing (NLP) refers to the branch of AI that enables computers to understand text and spoken words in much the same way human beings do. NLP is concerned with programming computers to process and analyze large amounts of data. Apple's Siri, Google's Hey Google, Microsoft's Cortana, and Amazon's Alexa are examples of personal digital assistants (PDAs) capable of recognizing a user's voice and applying AI in response to queries. Additionally, spell check, autocomplete, and spam filtering are examples of other NLP in action.

AI in Restaurants

With respect to restaurants, many AI solutions are intended to automate rote tasks or job functions. Equally important are related cost savings and marketing strategies. Note: the following twenty foodservice use cases are representative, but not assumed exhaustive.

Integrated Inventory and Purchasing–tracking historical inventory and purchasing data in search of trends leading to real-time recommendations

Demand Forecasting – menu item sales projections emanating from transactional data, bundling campaigns, digital marketing, cross-selling, and upselling.

Predictive Maintenance – embedded scheduling benchmarks enabling enhanced maintenance of operational and transactional procedures.

Task Automation – the reduction or elimination of repetitive tasks based on the redesign of functions through automated processes.

Virtual Assistant – customer use of smart device to search for restaurants, locate reviews, menus, and placing ordered and payment via a smart device.

Proactive Ordering – machine learning-based decision technology to predict what menu offerings are most likely to be preferred by customers.

Voice Recognition – phone answering technology capable of taking messages, booking reservations, building waitlists, and voice ordering with POS integration.

Facial Recognition -- recognizes customer at the drive-thru, displays past orders, and allows for payment via face identification.

Order Clarity – AI platform capable of handling complex, multilingual, multi-accent, and multi-item conversational ordering.

Robotics – the role of robots performing hosting, production, and service processes in restaurants. Also, implementation of drone devices.

Loyalty Programming – monitoring and management of marketing strategies designed to encourage, reward, and incentivize business

Automated Marketing -- AI tools available for digital marketing campaigns, emails and social media posts aimed at maximizing views and click-throughs.

Chatbots – similar to online chatbot adjustments can be made for restaurant assistance in handling guest queries and avoiding unanswered contacts.

Staff Scheduling -- AI-enabled software can correlate staffing and sales data to determine trends and patterns in peak and slow time traffic requirements.

Self-Service Kiosks – devices that increase capacity and accelerate ordering, preparation, and payment while providing the power to control and customize.

Personalized Service – customer data collection from online ordering and digital marketing can lead to personalized services.

Waste Reduction -- reducing food waste by fine tuning purchases to meet inventory needs and thereby avoiding expiration dates and excessive buying.

Customer-facing -- conversational AI apps can greet customers, take orders, transfer orders to point of sale (POS) systems and perform related functions.

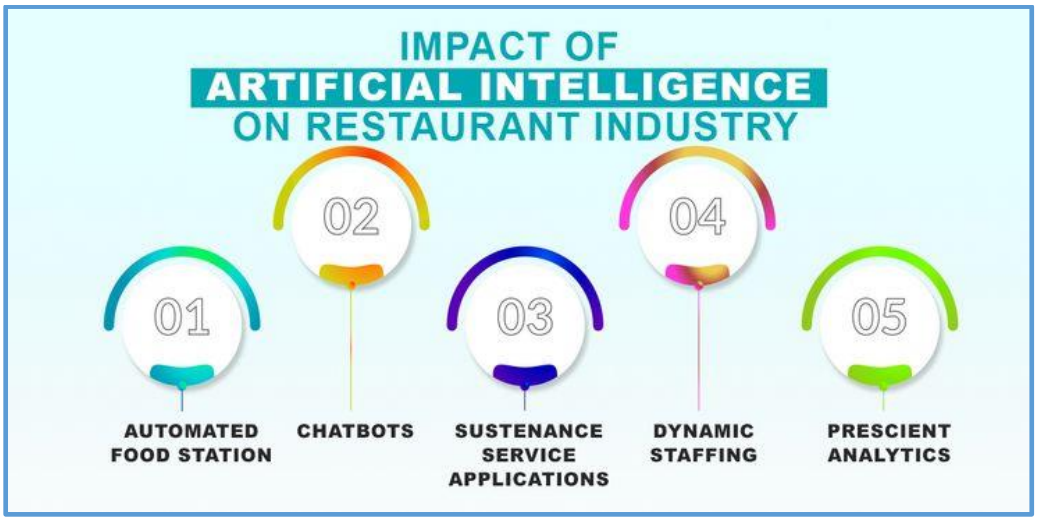
Optimized Delivery -- AI can assist delivery drivers locate the most efficient routes, utilizing real-time map data, for multiple deliveries in a single trip

Delivery Tracking – enables awareness of progress by delivery services by allowing customers to view a tracking map with text message updates.

Industry Experiences

Briefly, Checkers & Rally's found that an AI voice assistant had nearly one-hundred percent accuracy in taking drive-thru orders, all without staff intervention. Domino's Pizza successfully uses drone delivery to deliver pizza orders, while Marco's Pizza employed proprietary voice-to-text ordering using conversational AI. Cali-Burger employed Flippy the burger-flipping robot to prepare orders. The RoboBurger vending machine relies on a robo-chef platform to grill patties, toast buns, dispense condiments, plate the item, and deliver it piping hot in about six minutes. Chick-fil-A restaurants are testing AI-enabled self-driving autonomous vehicles for delivery. KFC and Wendy's have both implemented smart kiosks to customize customer experiences and inter-activities.

In more detailed examples, the experiences of McDonalds, Sodexo, Coca-Cola, and Uber Eats represent important, and different, AI models for industry development.



Source: pinterest.com

McDonalds Example

McDonald's created McD Tech Labs after its 2019 acquisition of Apprente, a voice technology firm, which in turn followed its earlier acquisition of Dynamic Yield, a firm that specialized in personalization and decision logic technology. In 2020, McDonald's announced its Accelerating the Arches growth strategy, which included an emphasis on the 3 D's: Digital, Delivery and Drive-Thru and integration with AI technologies. The Apprente technology, for example, uses AI to understand drive-thru orders in a way that would automate drive-thru lanes with the potential of replacing drive-thru staff members.

As of December 2021, McDonald's offers drive-thru service in more than 25,000 locations, including 95% of all US operations, representing 70% of sales in top markets. In addition to implementing drive-thru innovations like express pick-up, express drive-thru, and smaller on-the-go locations, McDonald's is also looking to improve ordering and payment functions. Apprente technology has been described as a voice-based platform for complex, multilingual, multi-accent, and multi-item conversational ordering. McDonald's hopes that using the solution's natural language processing and machine learning capabilities have created a faster, simpler, and more accurate drive-thru order-taking process. Reported results include reducing the time it takes to serve drive-thru customers by thirty seconds with increased customer satisfaction. Accompanying such success if the fact that automated order-taking scores an 85% accuracy rating with close to 20% of orders requiring human intervention.

McDonalds is also focused on order prediction based on digitization embedded into smart digital displays. As part of its Accelerating the Arches effort to make the drive thru as efficient and convenient,

McDonald's purchased Dynamic Yield to leverage its decision technology to add personalization and modernize the customer experience. Dynamic Yield is a machine-learning solution that captures customer purchases and links them to presentations on digital ordering displays. In other words, the application digitized the point-of-sale process. Tracking such variables as time of day, order selections, traffic velocity, item popularity, and weather conditions. As a result, McDonald's can offer digital displays that suggest popular items by weather or specific day part. Measuring traffic can also lead to the displays suggesting faster-to-prepare items to alleviate drive-thru slowdowns. In late 2021, McDonalds sold Dynamic Yield to Mastercard, which plans to continue to work with the fast-food company. McDonalds has stated a preference for investing in the 3D's: digital, delivery, and drive thru.

Source: engadget.com

Sodexo Example

Sodexo is one of the largest foodservice contractors in the US and continues to focus attention on increasing the convenience of its offerings. By leveraging digital and technological innovation, the company is striving to gain a competitive advantage over its competitors on college campuses. Digital engagement by younger consumers and density have made college campuses a target for delivery innovation. As a result, the company will add virtual brands, ramen vending machines, and checkout-free grocery stores at several campuses. It will deploy three delivery-only virtual brands in partnership with Virtual Dining Concepts, which offers brands like MrBeast Burger, Mariah's Cookies, and Buddy V's Cake Slice, on a mobile app. Virtual brand meals will be delivered via robot. In addition, the company recently announced a partnership to bring 1,000 delivery robots to college campuses. Perceiving its customers as having three important concerns (convenience, choice, and quality) making innovation, digital, and social media promotions take on a unique role. An autonomous vending machine manufacturer is partnering with Sodexo to deploy ramen and udon noodle machines to several campuses. These machines will offer meals after campus dining halls close, bridging a common gap in university foodservice offerings. In addition, the company will offer Eat>NOW autonomous campus grocery stores to its high-tech vending and virtual dining concepts with robot delivery services. Sodexo's new offerings and partnerships with delivery and restaurant tech companies highlight the blurring lines between institutional foodservice and changing restaurant offerings.

Coca-Cola Freestyle Example

Throughout its value chain, Coca-Cola creates and collects a significant quantity of data, including sourcing, production, distribution, sales, and consumer feedback. As a result, Coca-Cola is continuously faced with the challenge of effectively leveraging aggregated data. Coca-Cola Freestyle is an innovative fountain drink dispenser (released in 2008) that allows customers to combine beverages

and flavors via an interactive touch-screen display. These fountain drink dispensers are popular, with more than 50,000 units in operation, dispensing 14 million beverages per day.
In order to use the Coca-Cola Freestyle mobile app, consumers need to register using an established social media account. Coca-Cola then applies AI to analyze the social media content of its customers, generating insights on where, when, and how its products are consumed. Based on the consumer behavior and demographics analysis, Coca-Cola can identify which products are popular in which geographic areas. Coca-Cola's ability to leverage such detailed and comprehensive data provides ways to better serve its customers.

Source: thecarcollection.com

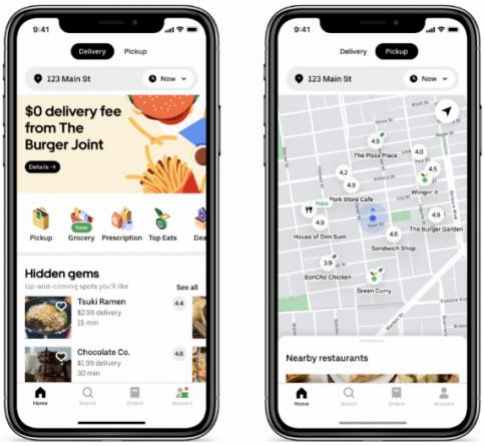
Coca-Cola can use the network of Freestyle machines to acquire a knowledge of how tastes and beverage preferences differ among its customers thanks to AI algorithms in its machines. The data is critical in determining when, where, and how to manufacture and sell new products. For example, collected data from these self-service machines, enabled Coca-Cola to uncover valuable information on client preferences. This research resulted in the launch of at least two new products: Sprite Lymonade and Orange Vanilla Coke. Freestyle machines continue to provide on-demand access to more than 200 sparkling and still beverages, including more than 117 low- and no-calorie options, as well as more than 100 unique variations exclusively offered through these dispensers.

Uber Eats

Uber Eats' picked up ordering at various stadiums, piloting test autonomous delivery, launching voice ordering and expanding its vouchers program to general consumers to use at events like weddings, food ordering, or rides. Uber Eats is currently testing and implementing voice ordering, starting with English-language capabilities before bringing additional languages online. The service integrates with Google, allowing customers to say a phrase like "OK Google, order food from Sweetgreen," which would trigger the Uber Eats app. When the app pulls up, the customer can place an order with the requested restaurant via voice. Google Assistant will confirm the order details, and the customer can change or submit the order hands-free through the app. Initially, the Uber Eats' voice ordering function will be available only on Android devices with other devices launching in the future.

Grubhub added voice ordering through Amazon Alexa in 2017, but it doesn't appear to be an Alexa skill anymore, according to Amazon's website. Diners were able to use various Amazon devices to ask about the past three orders and reorder from their favorite restaurants. While DoorDash doesn't currently support voice ordering. Its products do work with screen readers and other assistive technology, however.

Uber Eats' is offering in-venue mobile ordering to select stadiums, allowing guests to order and pick up food or merchandise without waiting in line. Additionally, the app will be able to identify the stadium and provide a list of specific foods available. Uber Eats will also identify the proximity of each concession to the individual.



Source: uber.com

AI Disadvantages

From a cost-benefit perspective, AI solutions are not without disadvantages. Such things as expense, inflexibility, intimidation, not-productivity, and inelastic decisions should be considered. Briefly, these five items deserve consideration:

- Expense – an application simulating intelligence can be complex and costly.
- Inflexibility - solution becomes fixed, without innovation or creativity iterations.
- Unemployment – potential loss of jobs can create a fear in workplace staffers.
- Non-productivity – solutions may lead to unmotivated staff member performance.
- Inelastic – AI algorithmic solutions lack ethics and morality capabilities.

Summary

Artificial intelligence has the potential to transform the restaurant business by unlocking powerful insights and predictions .It is important to note that without taking a strategic approach, most AI projects and initiatives are likely to fail to create value. While AI seems like a complex and inappropriate solution to many restaurants operating problems, it has been shown to present many beneficial outcomes. Industry practitioners foresee AI as having long-term applicability given its many characteristics and features. For example, AI predictive technology can be used to manage inventory, staffing, menu pricing, sales forecasting, and more. AI in restaurants is more than a trend; it's likely the future of the industry as it can streamline operations, reduce costs, and improve profitability.

Appendix A

Will Artificial Intelligence Be Taking Your Next Drive-Thru Order?

Lana Bandoim, Contributor
forbes.com

Many people have experienced ordering fast food in a drive-thru and opening the bag later to find their French fries are missing, or their burgers are covered in ketchup they did not want. Artificial intelligence (AI) may make ordering food through a talking box easier, faster and more accurate.

You may not have to wait long for AI to take your next drive-thru order. Checkers & Rally's are joining McDonald's MCD on the list of fast-food restaurants that are testing voice-ordering bots in their drive-thru's. Through a partnership with Presto, the company plans to install the AI-based voice assistant in 267 restaurants. For now, only the corporate-owned restaurants will get the new technology.

The Bot Will Take Your Order Now

Presto's AI voice assistant automates speech recognition in restaurants and can be used in drive-thru's, kiosks, pay-at-table systems, and other places. Presto shares that it has an accuracy of over 95% and improves labor productivity by as much as three times. The conversational AI technology can greet customers, take orders, transfer orders to point of sale (POS) systems and do other functions.

In a pilot program last year, Checkers & Rally's found that the AI voice assistant had 98% accuracy in taking drive-thru orders and did not need restaurant employees to intervene. The system was even able to handle different customer accents.
Checkers & Rally's are not the first company to test or use AI-powered drive-thru's. McDonald's used Dynamic Yield to personalize the drive-thru experience through machine learning and AI. Last year, McDonald's successfully tested voice-ordering technology in Chicago.

Bot vs. Human or a New Collaboration?

Several forces are driving the growth of AI-powered voice assistants in drive-thru's. The first is the Covid-19 pandemic, which has encouraged more customers to use drive-thru's instead of going inside of restaurants because of fears about exposure to the virus. Customers feel more comfortable ordering through a talking box than a breathing human who may be sick.

Although drive-thru's now add up to 41% of all off-premise orders in restaurants, they are slower and less accurate than in previous years. Part of this is caused by the larger number of people who are using them, and part of this is because of the labor shortage, which is another driving force.
A survey from the National Restaurant Association found 78% of restaurant operators did not have enough employees, and 61% of fast-food restaurants closed their dining rooms because they did not have enough staff.

As wait times, mistakes and labor shortages climb, restaurants are turning to AI to fix the problems. However, there is concern about replacing human workers with bots, even if it is only in the drive thru. Some restaurants are starting to view AI as a necessity and an opportunity for workers and machines to collaborate instead of replacing each other. There are not enough workers to handle all the current tasks, and AI offers a solution.