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## **The Impact of Artificial Intelligence on the Restaurant Industry**

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# **The Impact of Artificial Intelligence on the Restaurant Industry**

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## **Abstract**

Stated will be the collection of several studies conducted to observe and understand the development of artificial intelligence (AI). The software developed within these robots will be explored to clarify different functions, followed by studies conducted to observe guests' satisfaction experiences and satisfaction rates. Further qualitative research is recommended due to the rapid growth and popularity of the usage of artificial intelligence within the restaurant industry.

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## **Introduction**

The development of Artificial Intelligence (AI) has been impressive since its introduction during the initial stages of Google, and GPS advancements have been transforming multiple fields and industries with their rapid advancements, such as apps, chatbots, and robotic intelligence. It opens up new opportunities for career growth across various sectors. In the restaurant industry, AI-enabled machines and devices can analyze their surroundings, make informed decisions, and offer customized services to customers. These services are tailored to the responsibilities of restaurants, from cooking and serving to greeting guests. Customers are getting their first taste of robotic services in place of human interactions, and their feedback is being collected and discussed. We can expect more exciting and innovative applications across different industries with AI's evolution.

During the process of observations and data collection, the Appreciative Inquiry Hospitality Method was implemented as a well-structured approach. As Maier (2009) stated, this method fortifies and enriches the hospitality framework, enhancing communication and a supportive work atmosphere. Furthermore, adopting this method creates a shared vision and objectives that benefit everyone within the company. This method fosters an inclusive environment for guests from all backgrounds and demographics. Consequently, the restaurant industry has experienced more intense competition, revenue fluctuations, individualistic pressures, and an augmented necessity for security.

## **Literature Review**

According to a study by Altman in 2023, digital technology has evolved in less than a generation faster than biological evolution, which occurs over thousands of years. This rapid progress means that improvements in digital technology occur constantly, and every individual

uses various forms of artificial intelligence daily. According to AI | Oxford Cyber Academy, Oscar Hengxuan Chi and his team (2020) outlined that artificial intelligence comprises various technologies that enable machines to perceive, comprehend, behave, acquire knowledge, and display some aspects of human intelligence. These frameworks can range from “low AI” categories to fully functional anthropomorphic robots. “Low AI” consists of applications for self-service kiosks and fully functional anthropomorphic robots that can detect emotions and relate to humans interactively (Chi et al., 2020, pp. 757-759).

### **Development and Implementation of Robotic Systems**

As the hospitality industry focuses on artificial intelligence development, businesses increasingly adopt robotics to enhance customer experiences. In restaurants, these technologies automate tasks, streamline processes, and provide guests with personalized services. Customers can use robotic servers and even cooks to request and customize meals, order drinks, and even check out. These personalized services are integrated into the robots' software, allowing them to assist with any possible customer request, navigate the restaurant's layout changes, and suggest menu improvements. Thanks to advanced navigation systems, robots can efficiently move around the restaurant without collisions (Cheong et al., 2016).

Cheong et al. (2016) present the Robotic Operating System (ROS), a comprehensive framework that enables designers to create various software applications for robots. One such application is the waiter robot, composed of a sturdy base and an automatic dumbwaiter featuring three levels for trays. These trays are designed to keep the food clean and warm during transportation from the kitchen to the customer. Once the robot reaches the assigned table, a drawbridge door is lowered, and the specific tray is lifted and rolled out for the customer, ensuring a seamless dining experience.

Two 24V lithium-polymer batteries power the robot, providing enough energy to keep it running smoothly throughout the day. The robot also features a motorized lifting table that can be adjusted to accommodate tables of different heights in the restaurant, making it a versatile solution for various customer needs. With these advanced features, the waiter robot is an innovation that enhances the dining experience and provides a glimpse into the future of robotics in the food industry.

In 2019, Hamdany et al. introduced an innovative Autonomous Servicing Robot (ASR) that revolutionized the traditional way of ordering food and serving customers. The ASR is a sophisticated technology designed to minimize costs, streamline the process of collecting customer orders, and enhance the interaction between people and machines. With the help of this advanced technology, the need for human involvement in café or restaurant systems can be significantly reduced. The robot has cutting-edge features like an e-menu, a keypad for order selection, a Liquid Crystal Display (LCD), Bluetooth wireless, and Arduino. The LCD and keypad simultaneously utilize Arduino technology, offering guests an easy and interactive way to view the e-menus on the screen and place their orders using the keypad. As soon as the order is placed on the table, the Bluetooth wireless software immediately sends it to the kitchen and reception, ensuring it is prepared accurately and delivered promptly. The ASR is a reliable and efficient way of taking orders and serving customers, making it a welcome addition to any café or restaurant.

In a research paper published in 2023, Daradkeh and his team delve into the impact of digital technology on the restaurant industry. Specifically, they explore the adoption of self-ordering machines at self-service kiosks and terminals. These kiosks have large touch-screen monitors that enable customers to access digital menus, place orders, customize their meals, and

pay their bills without human interaction. As Daradkeh et al. (2023) state, implementing this digital transformation can disrupt the industry and compel businesses to respond strategically to remain relevant and add value to their services.

A remarkable breakthrough in robotics took place in 2020 when Tim Kelly and Akira Tomoshige documented the creation of Japan's first robot bartender. This innovative robot has been put to the test at a Tokyo pub. With its success, there is a strong potential for a significant increase in the application of artificial intelligence (AI) in restaurants and shops worldwide. Developed by QBIT Robotics, this robot can pour a beer in just 40 seconds and mix cocktails within a minute. It has four cameras to monitor customers and analyze their expressions using sophisticated AI software.

### **Consumer Responses to Artificial Intelligence**

In 2022, Nozawa and colleagues conducted extensive research examining how artificial intelligence (AI) affects people's choices between luxury and non-luxury restaurants. The first study examined consumers' general perceptions and attitudes toward goods and services provided by AI and humans. The second and third studies investigated participants' food preferences for luxury and non-luxury restaurants. The dependent variable used in these studies was the intention to eat, which was associated with consumers' preferences for restaurant settings. The fourth study focused on the impact of AI cooking staff on consumers' preferences for luxury and non-luxury restaurants while also considering the mediating role of restaurant quality, including food, service, and ambiance quality. The study's main focus was to evaluate consumers' intentions towards restaurants. The results of this research provide valuable information regarding how AI can impact consumer preferences and influence the design of future restaurant experiences.



The findings of study one aligned with Nozawa et al.'s predictions regarding the perceived desirability of AI-provided products and services, particularly in luxury restaurants. Study two highlighted the primary impact of service staff and restaurant category and identified a significant interaction between the two variables. Specifically, human service staff were found to increase the intention to visit both luxury and fast-food restaurants. In contrast, study three found that the presence of AI staff decreased participants' intention to eat at luxury and fast-food establishments. Additionally, the study indicated that food prepared by human chefs was viewed as more desirable in luxury restaurants compared to fast-food ones. Finally, the fourth study revealed a notable interaction between the service staff and restaurant type regarding visit intention. The results demonstrated that human service staff positively impacted visit intention and perceived food and service quality in luxury and non-luxury restaurants (Nozawa et al., 2022).

To understand the impact of automation on specific areas within the hospitality industry, including the restaurant industry, Tussyadiah and colleagues thoroughly analyzed contrasting groups of food service technology experts. Their study, published in 2022, aimed to address the need for more knowledge regarding the factors that drive the adoption of automation by organizations. To fill this gap, the researchers worked closely with practitioners to identify a comprehensive set of factors influencing the implementation and adoption of automation in hospitality jobs, including the restaurant industry. Through their research, Tussyadiah et al. shed light on the importance of automation in improving the efficiency and overall success of the hospitality industry. Results proposed a need to understand how automation influences specific areas within hospitality jobs after analyzing contrasts of focused groups of food service technology experts.

In a study by Catherine Prentice et al. 2020, the researchers aimed to evaluate customer satisfaction with the service provided by artificial intelligence. The study found that AI has become an integral part of the services offered by various providers to influence customer experience, attitudes, purchases, and loyalty. However, the results revealed that the service provided by AI received a significant amount of adverse and insignificant feedback from customers. The standard of AI services is required to be upgraded to fulfill customers' expectations and enhance their satisfaction.

### **Expectation Gaps**

Gaps within artificial intelligence give limited resources, but rapid growth has proven to secure profit and service exchange with hospitality companies (Mengxi, Chen, et al., 2023). Chun Liu and Kam Hung (2022) challenged the view of guests who experienced self-served performance with the advantages of technological advances during their customer experience. These findings concluded that there were enriched differences between customers with expressed experiences and hoteliers' perceptions of customer experiences. Artificial intelligent devices use acceptance theory and create a framework to better narrow motivation possibilities. The influence of social, hedonic, anthropomorphism, performance, effort, and emotions all take some play within the openness of this development (Hongzia Lin et al., 2020).

With artificial intelligence being a rapidly growing aspect of the hospitality industry, there will be learning curves and concerns with new technology within the workforce. An article written by Michael Redbord (2021) explained 14 different ways in which technology will affect customer service. Most relevant to these studies will be the customers' expectation gaps that will form, artificial intelligence will replace the need for human workers, customer support will change e-commerce, self-service will become an absolute necessity, customer success will

become a competitive differentiator, decisions will be more data-driven, and social media will become a customer service tool, (Micheal Redbord, 2022).

### **Research Methodology**

In this working paper, a comprehensive analysis is conducted to investigate the development and implications of artificial intelligence technology in the restaurant industry. Valuable insights into the current trends and potential future outcomes of utilizing artificial intelligence in the industry are obtained through a comprehensive review of the literature underlying the research. The study offers a qualitative analysis of secondary research data, providing an overview of the impact of AI on the restaurant industry.

### **Analysis**

As businesses continue to evolve, the impact of artificial intelligence (AI) has been a game-changer. AI technology has revolutionized how businesses operate, offering customized customer experiences, automating routine tasks to help managers focus on essential matters, and improving recruitment and onboarding procedures for increased staffing efficiency. Assistants can provide valuable insights by analyzing real-time data to optimize business operations. Companies can enhance overall efficiency by streamlining processes with AI. Over the past few years, there has been a significant reduction in the number of individuals willing or able to work in specific industries, leading to a shortage of workers. Restaurant companies, in particular, have been hit hard by this trend, as they rely heavily on human labor to provide high-quality customer service (Kelly & Tomoshige, 2020).

Cheong and his team conducted a detailed study in 2016, focusing on developing and implementing restaurant robotic systems. These systems were designed to automate taking orders, delivering food, and handling payments. The team's goal was to streamline restaurant

processes and provide personalized services to customers. The team developed a comprehensive framework that enables designers to create various software applications for waiter robots. The framework includes a sturdy base, which ensures the robot's stability while moving around the restaurant, and an automatic dumbwaiter with three tray levels. The dumbwaiter can carry dishes and drinks from the kitchen to the customers' tables, reducing the need for human servers.

In 2019, Hamdany conducted a study that focused on the use of chatbots in the restaurant industry. The chatbots are advanced software that can provide customers personalized recommendations for their orders, handle complaints, and process orders. The chatbots use natural language processing and machine learning algorithms to understand customers' requests and provide them with relevant information. Hamdany's study aimed to minimize staffing needs and increase customer satisfaction through streamlined service and reduced wait times. The chatbots can assist in providing a more efficient and personalized experience for customers, which can increase their satisfaction levels. Furthermore, the chatbots can collect customer feedback and provide valuable insights to restaurant owners, which can help them improve their services.

Tim Kelly and Akira Tomoshige (2020) explore the use of AI in restaurant management, while Daradkeh's (2023) study focuses on the impact of AI on guest satisfaction in restaurants. Both sides are crucial to discuss. AI can help restaurant managers make informed menu offerings, pricing, and inventory management decisions. Unfortunately, many of these businesses cannot relocate their operations overseas for more available labor. As a result, they have had to get creative to keep up with customer demands (Kelly & Tomoshige, 2020). This is where AI technology comes in. Darakeh (2023) found that AI-enabled machines and devices can improve the speed and accuracy of order processing, reduce wait times, and increase customer

satisfaction. By utilizing AI-powered systems and tools, service companies can streamline operations and offer faster, more efficient customer service. Waiter robots, for example, can provide instant responses to customer inquiries, freeing human employees to focus on more complex tasks. Digital sensing identifies transformation opportunities for increased customer value within fast-food restaurants by looking into external environment trends and implementing changes to meet customer desires. All of these AI-driven solutions are helping service companies maintain high customer satisfaction levels, even in the face of a shrinking workforce.

The restaurant industry has been subject to extensive research on the impact of artificial intelligence, with several studies providing valuable insights. Nozawa et al. (2022) conducted a study that found human service staff positively influence the intention to visit both luxury and fast-food restaurants for the first time, while the presence of AI staff has the opposite effect. Additionally, their research revealed that customers prefer human-prepared food in luxury restaurants compared to fast-food establishments. Tussyadiah et al. (2022) emphasized the importance of AI technology in improving efficiency and overall success in the restaurant industry. The study detailed the potential benefits of AI, including streamlining operations, optimizing staffing levels, and providing personalized recommendations to customers. They highlighted that AI technology can improve the customer experience by reducing wait times, improving order accuracy, and providing efficient service. However, Prentice et al. (2020) conducted research that echoed the findings of Nozawa and colleagues (2022) regarding the negative feedback AI service receives from customers. Their study found that customers often perceive AI-powered service as impersonal and less responsive to individual needs.

Furthermore, customers often value the human element of the restaurant experience, such as friendly interactions with staff and the art of human-prepared food. These studies provide a

comprehensive view of the role of AI in the restaurant industry and highlight the importance of human service staff and human-prepared food in enhancing the customer experience. While AI technology can improve efficiency, restaurants must balance the benefits of technology with the value of human interaction.

Artificial Intelligence (AI) has limitations but has proven profitable for hospitality companies. Advancements in technology have led to a difference in customer experiences between expressed and perceived, with AI devices using acceptance theory to narrow down motivational possibilities (Hongzia Lin et al., 2020). Though AI is increasingly adopted in the hospitality industry, it poses challenges such as forming customer expectation gaps, replacing human workers, and requiring self-service. While AI may not be a perfect solution, it is undoubtedly helping businesses adapt to a changing economic landscape and stay competitive in an increasingly challenging market (Redbord, 2021).

### **Limitations**

Cheong et al. (2016) and Hamdany et al. (2019) conducted studies on artificial intelligence software designed to help guests and facilitate interactions. Both studies found that the software's accuracy could have been faster and more accurate, with location and set-up time restrictions causing inaccuracies in guest flow. The waiter robotics system's ecosystem still needs to be fully developed. Daradkeh et al. (2023) had 20 participants; 13 were males, and 7 were females, with demographics of 11 restaurants being international, five unknown, and four locals.

Customer feedback varied across different geographic locations. Kelly Tomoshige (2020) and Nozawa et al. (2022) conducted studies in Japan and collected demographic data. Participants' average age ranged from 41.30 to 43.25 years old, with more men than women in each study. In Kelly & Tomoshige's study, demographic data was not collected, but random

customer feedback was. Tussyadiah et al. (2022) and Prentice (2020) only conducted customer viewings in Portugal with generalizability within the results. AI service quality scales were based on non-academic resources and perceptions, causing this scale to be cross-validated for further applications. Locations for these studies varied in size, ranking, and ownership (local and international). Hongzia Lin et al. (2020) and Redbord (2021) spoke of AI through general perspectives and not specifically for the restaurant industry but instead as an overview of artificial intelligent growth through all branches of the hospitality industry.

### **Conclusion**

The restaurant industry is experiencing a transformation with the implementation of Artificial Intelligence (AI) and robotic systems. These technologies automate tasks and provide personalized services to customers. By developing AI-enabled machines and devices, restaurants can offer customized services to their customers, from cooking and serving to greeting guests. This paper highlights the various studies conducted to observe and understand the development of AI in the restaurant industry. The literature review explains the different categories of AI, from "low AI" applications to fully functional anthropomorphic robots. The research methodology used in this paper involved a thorough review of existing literature to gather valuable insights into the current trends and possible future outcomes of leveraging artificial intelligence in the industry. The conclusion recommends further qualitative research due to the rapid growth and popularity of the usage of AI within the restaurant industry. AI is transforming the restaurant industry, enhancing customer experiences and streamlining processes, increasing efficiency and revenue.

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