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The Possibility of using Robot as one of the Artificial Intelligence Techniques in the Food and Beverage Department in Five-star Hotels: Managers' Perspective

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الملخص:

يتم استخدام الروبوتات بشكل متزايد في صناعة الفنادق في شكل روبوت طاهٍ، وروبوت نادل، وروبوت مضيف، وروبوت توصيل، وروبوت مسؤول عن خدمات الضيوف، وروبوت موظف استقبال، وروبوت حامل للحقائب، الأمر الذي يتطلب معرفة شاملة بكيفية تطبيق تكنولوجيا الروبوتات في الفنادق بالمستقبل. يهدف هذا البحث إلى دراسة وجهة نظر وتصورات المديرين حول مدى قدرة واستعداد الفنادق المصرية لاستخدام الروبوتات في قسم الأغذية والمشروبات. لتحقيق هذا الهدف، اعتمد البحث الحالي نهجًا استنتاجيًا باستخدام المقابلات الشخصية مع المديرين العاملين في فنادق خمس نجوم في القاهرة وشرم الشيخ كعينة من البحث. تم إجراء (30) مقابلة شخصية مع المديرين، وهو ما يمثل عينة من البحث. وأظهرت نتائج الدراسة الميدانية أن مستوى وعي المديرين بتكنولوجيا الروبوتات ضعيف ولا توجد رؤية استراتيجية من إدارة الفنادق لاستخدام تقنيات الذكاء الاصطناعي. كما أظهرت النتائج أن التكلفة العالية لتقنية الروبوتات قد تعيق تطبيقها. تتمثل إحدى التوصيات الرئيسية في أن الدعم الحكومي يجب أن يشجع المنظمات على اعتماد الذكاء الاصطناعي وتكنولوجيا الروبوتات، حيث يجب تثقيف مالكي

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الفنادق والمديرين لتبني فكرة استخدام الروبوتات في أقسام
الفنادق المختلفة. من خلال اتباع خطى وتوصيات رؤية مصر
2030، والتي تركز جهودها واستثماراتها على تطبيق التقنيات
الجديدة في الصناعات المختلفة. وعليه، يجب التوجه نحو تطبيق
هذه التقنيات في الصناعة الفندقية وإصدار قرارات إلزامية في
هذا الشأن لمواكبة المتغيرات العالمية، ووجودها ضمن توجهات
الدولة في خطتها لمواجهة الأزمات (مثل Covid – 19) الحفاظ
على العملاء في مؤسسات الضيافة، ومواكبة التطور التكنولوجي
حول العالم.

الكلمات الرئيسية: الذكاء الاصطناعي، علم الروبوتات، الأغذية
والمشروبات، صناعة الفنادق، وجهة نظر المديرين.

Abstract:

*Robots are increasingly being used in the hotel industry in
the form of a chef robot, waiter robot, host robot, delivery
robot, concierge robot, receptionist robot, and bellboy
robot, which requires comprehensive knowledge of how
robotics technology will be applied in the future in hotels.
This research aims to study the viewpoint and perceptions
of managers about the extent of the ability and readiness of
Egyptian hotels to use robots in the food and beverage*

department. To achieve this goal, the current research adopted a deductive approach using personal interviews with managers working in five-star hotels in Cairo and Sharm el-Sheikh as a sample of the research. A total of 30 personal interviews were conducted with the managers, which represents a sample of the research. The results of the field study showed that the level of managers' awareness of robotics technology is weak and there is no strategic vision from hotel management to use artificial intelligence techniques. The results also showed that the high cost of robotics technology may hinder its application. One of the main recommendations is, Government support must encourage organizations to adopt AI and Robotics Technology, where hotel owners and managers should be educated to adopt the idea of using robots in different hotel departments. by following in the footsteps and recommendations of Egypt vision 2030, which focuses its efforts and investments on applying new technologies in different industries. Accordingly, it should head towards applying these technologies in the hotel's industry and issuing mandatory decisions in this regard to make them keep pace with global changes, and their presence within the state's directions in its plan to confront crises (such as Covid -19) to preserve customers in hospitality institutions, keeping pace with technological development around the world.

Keywords: Artificial Intelligence, Robotics, Food and Beverage, smart Hotel, managers' Perspective.

Introduction:

Artificial intelligence and robotics can provide structured automated services and experiences that improve the service provided from the customer's perspective. From a corporate perspective, it supports customer engagement, rich service delivery, secure data acquisition, and employee productivity and efficiency (Alt, 2021). From a governance perspective, Artificial intelligence expands the scope of work, allows the adoption of new governance models, and drives efficiency to new levels. As such, they help advance smart hospitality agendas with their important focus on sustainability, resilience, and improved wellbeing. Thus, there are good reasons to emphasize smart hospitality and artificial intelligence as a leading topic in the future (Xiang, 2021). According to Reis *et al.* (2020), The opening of *"Henn-na"* Hotel in Japan in 2015 was a turning point for the application of service robots in hospitality, *"Henn-na"* is the world's fully automated hotel, where service is mainly provided by robots. Since then, robotics has been widely adopted by hospitality and tourism and are increasingly being deployed as different service providers- (Hou *et al*. 2021). Despite this (Reis et al. 2020), he argued that there is still no academic consensus on the use of robots in hospitality and that there are indeed significant challenges for machines to deliver 'sympathetic intelligence' in frontline service roles.

The research's problem is to know the attitudes of managers and owners to use service robots in hotels, and studying the

challenges that prevent the organizational application of artificial intelligence and robotics in the hotel industry in the study community and raising awareness among managers to apply robotic techniques in all its forms to most of the hotel services provided in the food and beverage department in hotels (Kuo et al., 2017; Lee et al., 2018; Li et al., 2019; Tuomi et al., 2019, 2020b; Xu et al. 2020). The opinion of hotel managers is important when making decisions to introduce robots into hotel services. And if they don't see the benefits of using robots in hotels, it won't be adopted as a practice in the food and beverage department. So, the application of artificial intelligence and robotics in the food and beverage industry is very important, and most of it is in restaurant service and food preparation. In some restaurants, food orders are arranged by robots (Curtis, 2016). Pizza Hut in Japan hires a humanoid robot called "Pepper" to take food orders from customers by voice. "Pepper" is equipped with a voice recognition system and an artificial intelligence system and talks with customers. Additionally, Pizza Hut has partnered with "MasterCard" to program Pepper using a payment app. In other words, Pepper not only takes food orders from customers and sends them to the restaurant kitchen but also processes orders for customers saving time for both rants and customers. There is also a fully automated "Eatsa" restaurant, which serves quinoa dishes, its first location in San Francisco. Customers place their orders through an iPad in the lobby, and their name will appear on one of the

clear *LCD* screen boxes. In less than two minutes, customers can retrieve their bowl of quinoa from the box. Similarly, Tipsy Robot, a new bar in Las Vegas, employs two robot bar tenders who mix and serve drinks (Stapleton, 2017). Guests only need to order their drinks on their iPad, choose from 18 specialty cocktails or make their own. The two automated bar tenders will prepare a drink for customers in 60 to 90 seconds. In their spare time, the robots will slice fruit or dance to entertain customers. All these robots utilized in the restaurant mitigate the customer's waiting time and eliminates human waiters and cashiers. Robotics technology helps the food and beverage industry save labor cost and keep food quality consistent (Smith, 2021).

Research Questions:

- What are the opinions and attitudes of managers towards the use of the robot as one of the artificial intelligence techniques in the food and beverage department in five-star hotels in Cairo and Sharm el-Sheikh?

- How does the analysis of the "*SWOT*" model (Strengths - Weaknesses - Opportunities - Threats) contribute to the proposals for using the robot as one of the artificial intelligence techniques in the food and beverage department?

- What are the benefits of using the robot as one of the artificial intelligence techniques in the food and beverage department?
- What technological, regulatory, and environmental factors influence the intention of hotel managers to adopt robotic technologies?

Aims of the Research

- Assessing the readiness of hotel managers to use robots in the food and beverage department in Egyptian hotels and getting to know their opinions and attitudes towards the Applicability them.
- Study "*SWOT*" analysis model to evaluation of the expected effects of service robots on the functional areas of the food and beverage department.
- Study the benefits of using the robot as one of the artificial intelligence techniques in the food and beverage department.
- Study the Challenges of using the robot as one of the artificial intelligence techniques in the food and beverage department.

Literature review:

Robots in hospitality:

According to the International Federation of Robotics (2020), a service robot is a type of autonomous robot that performs useful tasks for humans based on the situation it is dealing with through sensing without human intervention.

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In a more specific sense, service robots are described as social agents that can replace human service providers in service trials (Van Doorn *et al.,* 2017).

Robots are becoming an important part of society, with robotic technologies being valued in various types of hospitality and tourism businesses, such as hotels, restaurants, events, theme parks, airports, car rental companies, museums, and travel agencies. Robotics innovation has the potential to make hotel guest experiences more enjoyable and efficient (Ivanov *et al.,* 2017). According to Kuo *et al*. (2017) explained that service robots are more prevalent in hospitality and tourism studies, where he conducted a *SWOT* analysis of robot hotel by adopting a mixed method after asking robotics experts and hotel owners, and the result confirmed that service robots can be used in the hotel industry in Taiwan as a strategic approach to the supply and demand perspective.

Experts predict that by **2030**, robots will make up about 25% of the hotel industry workforce (Bowen *et al.,* 2018). Physical service bots are now prominently featured in the properties of leading hotel brands. Service experiences can significantly influence the consumption of these tourism services (Kar *et al.,* 2021). In cooperation with IBM, *Hilton* has launched a robot called Connie, which is able to inform guests of nearby places of interest, provide dining recommendations, and provide travelers with as much

information they need. *"InterContinental"* Hotels has purchased a bot named *"Dash"* to deliver snacks and toiletries with a greater focus on enhancing the guest experience. What surprises hotel guests is that Dash can calculate its own battery usage and return to the charging point if necessary (Wang, 2022).

Benefits of adopting robots in the hospitality industry:

The use of robots in the hospitality and tourism industry is one of the modern, innovative, and most advanced things ever. The use of service bots ranges from basic AI chatbots to assist in the service process to complex assistant bots to improve guest experience and satisfaction. As the number of companies using service robots grows, it is important to understand what they will bring to the business in terms of the business itself and customer satisfaction (Belanche *et al.,* 2020). The rapid growth of robotic automation is seen when software systems use automation, easy operation of routine tasks, structured data, and analysis of internal systems that are directly compared to human activities (Aguirre and Rodriguez, 2017). The effects of bots on business and the economy have brought massive and unstoppable changes with the new way to take advantage of business opportunities and challenges with service bots (Dirican, 2015). Service robots are automating and transforming the current hospitality industry through their smart and advanced technological innovations (Tuomi *et al.*

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2020). The use of robots in hospitality facilities creates a competitive advantage for companies in the future due to changing consumer markets and the growth of technology (Ivanov and Webster, 2017). Robots consist of different complexity functions and service scopes that are important to this service-based industry where the basic interactions and activities of robots differ (Murphy *et al.,* 2020). For service organizations, it is important to recognize and understand the role that robots will play and how it will affect businesses and their customers to ensure everyone is satisfied during this emerging trend (Lukanova and Ilieva, 2019). Hospitality consumers' acceptance of AI provides a more user-friendly system with interactive technology and applicability to the hospitality industry business model (Go *et al.*, 2020). The concept of service robots has been applied in the hotel, food and beverage, and meeting and conference sectors impacting businesses, workforces, and customers with their current applications and future trends (Yang *et al.*, 2020). The increasing implementation of service robots in hotels is providing a unique customer experience unparalleled anywhere else by combining human communication and artificial intelligence into one component (Fuentes-Moraleda *et al.,* 2020). The use of service robots in hotels is reviewed based on their performance, operations, purpose, trust, and intent with the utmost importance of high service performance (Park, 2020). Service robots serve as a tool to improve the quality of service provided to travelers as they give an extra reason

to return to visit to use advanced technology systems in the rapidly growing age of technology (Cakar and Aykol, 2020).

According to, Lee *et al.*, (2021), explained that hotel guests expect a high level of technical performance and facilitation terms. Moreover, analysis of innovation and optimism for technological readiness are critical factors in smart hotels where guests enjoy the performance of robots and their services and how this technology creates a positive experience for them during their stay (Kim *et al.,* 2020). With the COVID-19 pandemic strategies to flatten the curve, many drastic and rapid changes have been introduced such as lockdowns, social distancing, stay-at-home orders, and travel restrictions affecting the hospitality industry. However, the use of service robots in the hospitality industry is a critical factor for both physical and psychological factors of device acceptance and service delivery (Gursoy and Chi, 2020). During the COVID-19 pandemic, service robot use in hotels has created a positive attitude and response from customers compared to pre-pandemic outcomes with growing fear of human contact and social distancing (Kim *et al.*, 2021; Wu *et al.,* 2021). With the increasing presence to help manage the spread of COVID-19 and reduce the spread, service robots can perform delivery, sterilization, safety, and security tasks using AI programming and functionality (Zeng *et al.,* 2020).

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Robotics Technologies in the Food and Beverage Department in Hotels:

According to Samala *et al.* (2020) Robotic technologies are the most common application of artificial intelligence techniques in the hotel industry, where robotics are prominent as pioneering technologies, their use is becoming widespread, and they are seen as emerging technologies in the hotel industry. Hotels can take advantage of smart robots in the food and beverage department, save money and people, enrich menus, reduce errors, reduce food waste, and work 24/7 without boredom or downtime. In this context, the following are application examples of robotic technologies in the hotel industry in the food and beverage department (Feller, 2021).
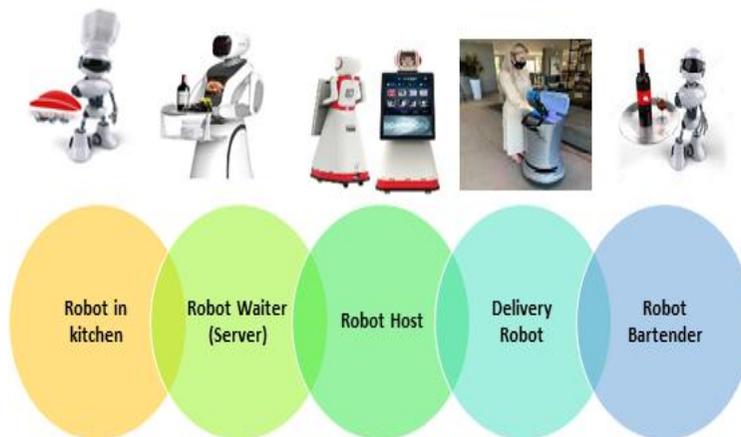
Figure. 1: Robotics Technologies in the Food and Beverage Department in Hotels.

Source: The Researcher

Robot in kitchen: There are many robotic innovations used in the food industry such as salad robot, automatic pizza robots, fast food makers, bread maker robot, virtual dark kitchen robot (Feller, 2021). M Social Singapore introduced the robotic chef named "Ausca" in 2017. It is reported that this robotic chef can cook sunny side and omelette and can improve himself by learning more different egg cooking techniques (Cavallo, 2017). Moreover, there are also robot chefs who can cook sushi (Sushirobo, 2022), pasta called "Foxbot" (Elkins, 2015), sausage called "BratWurst Bot" (Filloon, 2016), and burgers (Troitino, 2018).

Robot Waiter (Server)/Robot Busser: According to *"Keenon Robotics"* (2022), a leading company in the field of intelligent robotics, which launched a group of reliable and effective robots in the hospitality field, due to the continued shortage of employees and high labor costs caused by the outbreak of epidemics, accordingly, the server robot is one of the applications provided by the company, which It is specially designed to serve food to customers and carry used plates and cups and is equipped with the latest artificial intelligence technology including *" GPS "* technology which results in a more efficient guests service experience. The use of robots as waiters in the

hotel's food and beverage department service industry is an increasingly common practice. It has been suggested that restaurateurs are looking for automated waiters to help serve guests in cases where staff cannot keep up with orders or the number of waiters is limited (Cheong *et al.,* 2016). Automated waiters and robots can assist restaurant staff when restaurants are busy; However, excessive use of robots may lead to the dismissal of some employees (Ivanov and Webster, 2020). A robot in a red plaza holding a tray meets guests at a seafood restaurant called Rong Heng in Singapore; Guests' orders are brought in by two robots named "Lucy" and "Mary" with elegant scarfs around their necks (Ang, 2016).

Robot Host/Hostess: According to Prideaux (2019) that robots are used to encourage sales, Tanuki Restaurant in Dubai uses a host robot to welcome the guests as they enter the restaurant. The robot host can communicate with the guests and give them discount coupons and convince the guests to visit the restaurant again (Ivanov and Webster, 2020). Robot hosts can be considered as an alternative to human hosts for tech-savvy restaurants or those targeting younger customers. Communicating with such robots can be a future experience for tech-savvy customers and allow these customers to have fun while they visit the restaurant (Berezina *et al.,* 2019).

Delivery Robot/Robotic Butler: According to Staff (2022), a robotic butler/delivery robot called the "*Relay*

Robot" is being used at the *" Radisson Hotel Sunnyvale - Silicon Valley*", California, designed by *"Savioke*". Robots are used to deliver orders to rooms instead of human staff (Park, 2020). And there's another delivery robot named "Wally" at the Residence Inn Marriott LAX Hotel (Tung and Au, 2018). Additionally, Jen in Tanglin employs two delivery robots, named "*Jeno*" and "*Gina*". They are in the lobby area, they are in uniform, they leave to the rooms at an average speed of 2.5 km, slower than the walking speed of a person, and they submit to guest requests (Lin, 2017). These robots can roam the hotel, use the elevator, communicate with the room upon arrival at the guest's door, and deliver orders to the guest (Ivanov *et al.,* 2017). Additionally, if a guest requests something, such as an extra toothbrush or towel, the hotel staff uploads those requests to the delivery bot, calls the room, and sends the requests to the guest's room (Crook, 2014).

Robot Bartender: The robot Bartender can be in the form of a robotic arm or in human form (Tussyadiah *et al.,* 2020). It has two robotic arms located in the center of the bar below the bottles (Berezina *et al.,* 2019,). In general, it has the ability to perceive guests as human beings, to receive and deliver their beverage orders in hotel (Giuliani *et al*., 2013). According to Smith (2021), Swiss bartender "*Barney*" was revealed by "*F&P Robotics AG"*, a fully-programmed robotic bartender machine capable of blending dozens of cocktails to exact standards, sterilizing itself and

even telling jokes about the order, and serving customers their orders via Their mobile phones, then the robot will be able to mix 16 different spirits and eight different sodas, in addition to offerings of beer and Prosecco, a version of the barista robot has also been created capable of making different varieties of coffee, and it can serve all beverages for 24 hours An hour and automatically sterilize itself without getting bored, and the cost of the robot is 120 thousand Swiss francs.

Perceptions of Managers Towards the Use of Robots in the Food and Beverage Department:

According to Pizam *et al.,* (2022), a study was conducted of 1077 hotel managers in 11 countries in North and South America, Europe, Asia, and the Middle East, to determine the effects of technological, regulatory, and environmental factors "*TOE*" (Technology- Organization- Environment) on hotel managers' intentions to adopt robotic technologies in their hotels. Structural Equation Modeling "*SEM*" was used to test the study hypotheses. Results indicated that the intent of hotel managers to adopt robotic technologies was positively affected by their perceived comparative advantages, competitive pressure and top management support and was negatively affected by the perceived complexity of the technology. The results of the study further showed that the effects of comparative advantage

complexity, senior management support, and competitive advantage over intention to adopt were innovatively moderated. The current study also examined the theoretical and practical implications of current knowledge and practice in the hotel industry.

According to **Ivanov** *et al.*, (2020), a study conducted in Bulgaria on hotel managers to know their opinions about the use of robots in hotels, the study included 79 survey forms and 20 personal interviews to measure managers' attitudes. The results indicate that managers feel that repetitive, dirty, boring, and dangerous tasks in hotels will be more suitable for robots, while managers prefer Hotels use employees for tasks that require social skills and emotional intelligence. Respondents' individual characteristics and the organizational characteristics of the hotels in which they currently work played little role in their perceptions of service robots. Managers considered that bots would reduce the quality of service and would generally not be willing to use bots. Additionally, interviewees indicated that skilled and well-trained employees were more valuable and more convenient than robots in the hospitality and tourism industry.

According to Zhong *et al.,* (2022), a study conducted in China on 15 hotels in different cities (Shanghai, Nanjing, Suzhou, Xi'an and Hanzhong) about the views of hotel guests, managers and employees and the impacts in terms of costs and benefits of adopting and accepting the

introduction of hotel service robots, the study included a system of questionnaires for guests and interviews Personal with managers and employees. The results indicate that there are different perspectives, with hotel guests noticing more benefits than expenses while management opinions were more focused on costs and technical aspects. Primarily financial managers and administrators had a return-on-investment perspective on the use of a hotel robot. Negative attitudes of hotel managers toward service bots were related to implementation costs and concerns that these costs could not be compensated. The Technology Readiness Index, Service Robot Acceptance Model, and Technology Organization Environment (*TOE*) framework were applied to examine guest perceptions and adoption attitudes.

Challenges of Robotics in Hotels Industry:

According to Goel *et al.,* (2022), Reported unexplained access to guests' data jeopardizes their privacy. Also, Customers reported incidents when they found AI algorithms biased and opaque (Grundner and Neuhofer, 2021). Customers feel that artificial intelligence and robotics (*AIR*) is not a replacement for human staff, and they experienced a lack of social intelligence, particularly in service robots during their face-to-face interactions (Wirtz, *et al.,* 2018). Also, Customers miss the human touch, interaction, and personal attention in a robot-service environment (Hwang *et al.,* 2020). Sometimes, Customers

behave anxiously while interacting with these high-end technological solutions as they feel chased every time (Ivanov and Webster, 2019a). Artificial intelligence is one of the most advanced and renewable technologies. Hence, hotel guests note a lot of flaws in it. Guests see AI and robotics as ineffective in providing appropriate solutions to their own problems and not adaptable in a dynamic environment (Go *et al.,* 2020; Tussyadiah, *2020;* Burgard *et al.,* 1999). Consumers are also aware of the risks related to robot failure, automation, or loss of control. Moreover, due to the limited availability of training data, machine algorithms may not work with high accuracy. It is difficult for machines to predict accurately due to insufficient data (Grundner and Neuhofer, 2021). Adopting AI and robotics requires good network infrastructure, and in many geographies, people are having connectivity issues (Mazilescu, 2019). Moreover, most AI-enabled devices are trained in common languages such as English, German, or Mandarin, making them unable to receive instructions in other languages (Grundner and Neuhofer, 2021).

According to Xu *et al.,* (2020), robotics is expected to increase the efficiency and productivity of hotel services, but there are many challenges that may pose a hindrance to the application of AI and robotics such as high costs, lack of skills, and significant changes in organizational structure and hotel culture. Therefore, applications the prospect and integration of robotic technology will require future

managers and owners to carefully consider the balance between the roles of service robots and human employees in the guest experience and nurture a work environment that embraces openness and change. There are many factors that affect the intention of managers to adopt robotics and artificial intelligence technology in hotels, and these factors are represented in, the cost of adoption, maintenance, and leasing, environmental factors, which are competitive pressure and comparative advantage, organizational practices, and application infrastructure as well as ethical challenges (Ivanov *et al.*, 2020; Jabeen *et al.* 2021). Since managers' intent to adopt robotic technologies depends on their innovation or desire for change, marketing campaigns that specifically appeal to innovative hotel leadership must be created to target organizations that are likely candidates to adopt robotic technology. Given the long-term implementation, technology vendors must also work alongside educational institutions in the hospitality industry to encourage future generations of hotel management to be more innovative through educational initiatives and programs (Pizam *et al.,* 2022).

Research Methodology:

Sample
The current study aimed at investigating the applicability of Robotics as one of the Artificial Intelligence Techniques in the Food and Beverage Department in Five-star Hotels in Egypt. To establish suitable standards for selecting hotels,

the researchers selected 15 hotels from several international chains. On the other hand, the researchers chose 15 hotel brands from international chain companies such as Marriott Bonvoy (Marriott and Sheraton), Accor Hotels (Sofitel and Movenpick), Concorde El Salam Hotels, Fairmont Nile City Hotels, and Intercontinental Cairo Semiramis. Accordingly, the geographical distribution of hotels was taken into consideration, including Cairo and Sharm El-Sheikh. The selected sample is hotel brands around the world. In conclusion, the study relied on the hotels mentioned above because the probability of applying robotic technologies in such companies is greater than any other hotel brand in Egypt.

The present study collected data from 23 *IT* managers and *IT* assistant managers and 7 managers from the Food and Beverage Department as a director and assistants. IT managers and IT assistant managers are the best-qualified employees in hotels to answer questions about the applications of Robotics, the possibilities, the circumstances of applying Robotics technologies, and the advantages and disadvantages of such new technologies. After the thirty interviews, no additional themes manifested. As such, saturation was considered to have been achieved, and data collection was stopped (Saunders, Lewis, & Thornhill, 2016). Most of respondents were male (95%), and most of them were IT managers (72%) with more than 11 years of experience in the position (60%).

Data Collection and Analysis:

To achieve the objectives of the current study, the researchers adopted a qualitative approach based on in-depth interviews. An interview is an important method of collecting qualitative data that is used to extract more detailed information or a deeper understanding of a topic or concept. Participants in an in-depth interview are encouraged and promoted to speak in depth on the topic under study (Alshenqeeti, 2014; Brönnimann, 2021). Face-to-face interviews were conducted in five-star hotels in Greater Cairo, and others by phone calls in five-star hotels in Sharm El-Sheikh, as the interview is not mandatory for the meeting, but can be conducted via phone calls, or through various forms of voice-supported applications only or both by audio and video Without a physical presence (Saunders *et al.,* 2019). The current study collected data by conducting 30 in-depth face-to-face and telephone interviews, from December 2021 to February 2022, and the researchers recorded the interviews after verbal agreement from the respondents. The duration of the interviews ranged between 10:35 minutes, the duration of calls ranged between 15:55 minutes, and the average duration of the interviews ranged from 17:43 minutes.

The researchers conducted semi-structured interviews, by dividing the interview questions into three parts: The first

part consists of three questions aimed at evaluating the readiness of hotel managers to use robots in the food and beverage department in Egyptian hotels and identifying their opinions and attitudes towards its applicability. The second part, consisting of four questions, aimed to study the administration responsible for adopting robotic technologies in hotels. The third part, consisting of three questions, it was related to the study of *SWOT* analysis and the benefits of using robotic technologies in the food and beverage department in five-star hotels and the study of the perceived obstacles facing the use and application of robotic technologies. It is likely that robotics technologies will be adopted in the Egyptian hotel industry soon, in addition to the impact of robots on food and beverage department practices.

After collecting all opinions and interviewer comments, qualitative data from interviews were analyzed by qualitative analysis. Qualitative analysis means analyzing the interview to identify the main themes that emerge from the respondents' answers. The study identifies and analyzes the responses of the interviewees, summarizes the data to draw conclusions, and acknowledges the objectives of the study.

Results:

The researchers referred to the managers of information technology, food and beverages, and their assistants in the hotels under study, such as **R1, R2, R3… R30.** Comments and responses to them are explained as follows:

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The results of the interviews confirmed, in terms of evaluating the readiness of hotel managers to use robots in the food and beverage department in Egyptian hotels and identifying their views and attitudes towards the possibility of its application. The high level of application and the lack of a specialized human cadre to deal with these technologies of robots, but at the present time, both R1, R2, R3 and R4 mentioned that an advanced robot service has been activated within the city of Sharm El-Sheikh during the World Youth Forum in its fourth edition, where it works to sterilize the halls, and another robot that measures the temperatures of the participants and distributes sterilization tools to the attendees, as well as providing information about the halls and event venues, in addition to a robot that distributes food and drinks to the attendees, as mentioned by R1, R5 and R7 that it is located in the New Administrative Capital Two hotels are under completion and work will start soon. Both hotels are competing for robust infrastructure and facilities design that will enable them to offer modern hospitality services backed by new technologies such as robotics. They added that these hotels will move the Egyptian hospitality industry to a new, advanced stage that will allow the Egyptian hospitality industry to keep pace with the changes taking place around the world.

The results of the interviews also confirmed, by studying the "*SWOT*" analysis model to assess the expected effects of service robots on the functional areas of the food and

beverage department, as shown by R1, R6, R, R9, R11, R12, R13, R14, R15, R16 and R17. and R18, the factors affecting the development of service robots in the Egyptian hotel industry, where the *"SWOT"* analysis on the possibility of applying service robots in the Egyptian hotel industry is shown in "Table 1".

Strengths	*Weaknesses*
1. Government Egyptian supports the robotics industry.	1. Government has focused on industrial robots rather than service robots.
2. Government has offered a variety of preferential subsidies and development programs.	2. Government policy has lacked a strategic action plan, resulting in no execution.
3. Government Egyptian has been continuing to support collaboration between academia and industry for research and development of robotics technology.	3. There is a lack of a broad technological strategy in Egyptian hotels; emphasis is on the manufacturing industry.
4. Reducing employment costs.	4. Small-to-medium-sized companies cannot easily gain a large amount of funding support for their technology development because of preferential subsidies allocated by the government.
5. Higher productivity.	
6. High accuracy.	
7. Working in a lot of sites with different environmental conditions.	
8. Implement complex Processes.	

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9. Safer and less risk. 10. Multi- tasking.	
Opportunities	*Threat*
1. Working with Corona virus pandemic. 2. Creating competitiveness among Egyptian hotel companies. 3. Opening markets to a global industry is the hotel service robot's industry.	1. There is no good application of service robots in hotels Egyptian, so guests do not understand the benefits. This creates a big gap between expectation and reality. 2. Increasing unemployment and laying off many workers in Egyptian hotels. 3. Economic constraints on hoteliers because the adoption of robots requires a high cost of implementation. 4. Service robot design does not match the needs of guests, which makes them unwilling to use service robots. 5. The difficulty of legislation and laws regulating the use of

	technology.
	6. Some hotels and stakeholders are not interested in implementing bots.

Also, as confirmed by the results of the interviews, by studying the benefits of using the robot as one of the artificial intelligence techniques in the food and beverage department. As the advantages of the robot over human

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employees, R18, R19, and R20 of the managers interviewed
stated that "Robots will be faster, smarter, and more
accurate…", "They can work at any time" and "Served by
robots will be an exciting experience for guests" which is It
will provide a competitive advantage for the hotel. At the
same time, R10, R21, and R30 from managers
acknowledged that robots increase the quality of hospitality
services provided, improve performance and productivity,
enable hotel management to control operations, reduce
human errors and mistakes, and reduce the problem that
occurs according to the mindset. And the psychological
state of employees, long-term cost savings. R13, R27, and
R28 stated that robots are good for customers who do not
need personal or human contact, especially in the Covid-19
pandemic and the need for social distancing. They also
predicted that it would be mandatory for hotel managers to
implement robotic technologies that enable social
distancing. Moreover, R4 and R29 emphasized that
reducing the number of hotel staff is one of the advantages
that help departments reduce payroll costs.

Finally, regarding studying the challenges of using the
robot as one of the artificial intelligence techniques in the
food and beverage department in the Egyptian hotel
industry, R5 and R20 said that the application of robots
requires huge investments that represent a huge burden on
hotel management in Egypt. In the same context, R 13, and
R 14 announced that the absence of local employees who
can operate and maintain robots, will force managers to hire

foreign specialists with the experience to deal with these new technologies, and hiring them will cost hotel management additional expenses. At the same time, interviewed managers R10, R17, and R22 acknowledged that "robots cannot understand human emotions… differentiate between right and wrong… and carry out special requests…" and "they have a hard time understanding people's desires. Unlike robots, "people have appropriate judgment and appropriate approach to diverse situations". High installation and maintenance costs, errors by robots, and difficulties communicating and understanding guests were identified as disadvantages of using robots in hotels as well. The interviewees believed that well-trained and skilled employees were more valuable than robots and believed that employees are more suitable for the hotel sector because the industry is mostly associated with service and behavior which are important in terms of guest satisfaction and experience. For example, R23, R24 and R25 stated that "In my opinion", the most important thing in the hotel business is the service and attitude towards the guests. The guest wants to be special. He has invested a large amount of money to go to a place where he can indulge and relax… Human More convenient because the robot can't take many factors into account." Another participant R26 said that "Tourist service is an experience. Guests not only want to remember the place they visit, but also the people and hotel staff they meet... The attention and attitude the staff gives to the guests

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would not be the same if the robots took their places."
Therefore, "social bots are for short interactions".

Discussion:

The results show an enrichment of knowledge about
understanding the status of the possibility of applying
robots in Egyptian hotels. First, assessing the readiness of
hotel managers to use robots in the food and beverage
department of Egyptian hotels and getting to know their
opinions and attitudes towards their applicability; The
interviewees emphasized that there are no robots'
applications in the hotel sector. These results indicate that
hotels need more management support to implement
existing certified robotics applications. This finding is in
context - Ivanov *et al.* (2020), where they recommended
that the future of robotics in hotels is promising, and the
number of robotic units being manufactured and applied in
various places is expected to increase.

Second, with regard to the study of the "*SWOT*" analysis
model to assess the expected effects of service robots on the
functional areas of the food and beverage department.,
robust infrastructure and facility design is essential for
effective robotics implementation. The results indicated that
hotels in Egypt have good infrastructure and facilities
design that help them implement robots. However, the old
buildings that were built for five years or more suffer from
poor infrastructure that cannot support the adoption of such
new technologies and they need huge investments to make
improvements, and the results also from the third table

indicate that the hospitality industry in Egypt has good potentials for implementing service robots, as the robotics industry is an important industry supported and funded by the government. Thus, the success of robotics solutions will depend on the strategic position that hotels intend to take in the business market, and accordingly this can include the trend of implementing robots aimed at increasing customer satisfaction, strengthening relationships between them, and expanding into new markets.

Third, regarding studying the benefits of using the robot as one of the artificial intelligence techniques in the food and beverage department. The results showed several advantages while implementing robotics. The most important advantages of robots are increasing the quality of services provided, improving performance and productivity, enhancing marketing, reducing human errors, overcoming some problems related to the mental and psychological state of employees, and reducing the number of hotels. Personnel and personnel costs. This result is consistent with (Ivanov *et al.* 2020; Drexler *et al.* 2019) as they assert that robots reduce errors, enable portion control and thus control costs, work long hours, no time off, no time off, require no sick days, and reduce labor costs which account for about 33% of total expenditures, and thus will Robots help lower the overall cost. In addition, robotics technologies are suitable for customers who do not need personal or human contact, especially in the Covid-19 pandemic and the need for social distance. It is expected that it will be mandatory

for hotel managers in Egypt to implement basic robotics technologies that enable social distancing.

Fourth, regarding studying the challenges of using the robot as one of the artificial intelligence technologies in the food and beverage department in smart hotels, many challenges and obstacles must be addressed and overcome. The results recommended the following: 1) Cost: The technology is expensive and needs constant upgrade to design infrastructure and facilities, procure, operate, and maintain robots. 2) Lack of skilled and qualified human resources that can use robotics applications is one of the main challenges. 3) Customer Requirements and Desires: Most of the customers who come to Egypt for leisure or entertainment purposes (especially the Red Sea) prefer human contact with the Egyptian employees who are famous for their hospitality. In addition, many of them have concerns about booking and purchasing the tour electronically. Accordingly, from the point of view of hotel management in some Egyptian destinations, there is no need to adopt advanced robotic technologies that can reduce or reduce direct contacts and relationships with customers. However, the situation is different in downtown hotels as the types of clients, their needs and desires are different. In short, cost, absence of qualified personnel and desires of customers are the most important conditions to be overcome and overcome. So, the managers emphasized that hotel customers prefer to be served by hotel staff rather than using innovative technology.

Conclusion:

When considering the application of smart robots in the Egyptian hotel sector, the challenges facing the application of these robotic technologies must be studied and overcome. The study provides suitable pathways for hotel companies to assess and reflect on the use of current smart technology. The aim of this study is to know the factors that affect the possibility of using robots in the food and beverage department in the five-star hotels in Cairo and Sharm El Sheikh. This is done by measuring the perceptions and opinions of managers in the IT department and the food and beverage department and knowing their awareness of artificial intelligence and robotics through interviews. In-depth personal face-to-face and through audio and video phone calls, regarding the analysis of managers' opinions through personal interviews towards the application of robots in hotels, it was found that IT managers are almost sufficiently aware of robotic techniques, and they expressed their opinion that this modern technology of robotics has a promising future because it contributes significantly to improving services, productivity and hotel performance in accordance with the direction of the Egyptian state and simulating global changes, but there are some obstacles that are the high cost of application, the absence of qualified personnel to operate and maintain these new technologies, and customer preferences in direct communications between customers and employees. As for food and beverage managers, they

have shown Some objection for fear that this technology will replace the human element They also added that the well-trained human element, especially in the food and beverage department, is much better than the application of these robotic technologies. Finally, there is a significant impact of the dimensions of the application of robotic technologies in terms of infrastructure, high-cost investments, and digital restructuring requirements for hotel administrations, and this represents a great burden on hotels for their potential to apply artificial intelligence and robotics in the future, which requires state cooperation with these companies to advance the hospitality industry and simulate change.

Limitations and Future Research:

The current study represents a strong relationship between robotic technology and the behavior of managers, the focus of the research. It cannot be claimed that its results are generalizable and represent the entire hotel industry within Egypt, which means that there are fruitful opportunities for future studies, for example, investigating the perceptions of hotel owners interested in robots, guests, and managers. Frontline employees can provide additional important insights. Moreover, since the information provided to the subject of this study prior to their opinion was limited, some subjects were unable to express their support or objection to the issue of intent to adopt robotic technologies in the food and beverage department of Egyptian hotels. Accordingly, at this point in theoretical development and

empirical evidence, we are only able to partially predict the factors influencing managers' adoption intent and actual adoption behavior in a longitudinal framework to provide a deeper understanding of how the actual adoption decision shapes robots. For future research, investigate the role of rating (e.g., star rating) and hotel size in Egyptian hotel owners and managers' perceptions of the use of service robots. Furthermore, case studies of leading organizations that have implemented robotic technology can be used to gain qualitative insights into the implications of using service robots. Future research may also take a welfare perspective and explore how robots reduce employee fatigue associated with performing repetitive tasks. These topics point to a rich source of experimental research opportunities for hotel robotics.

Recommendations for the application of robots in Egyptian hotels:

According to the literature review and the results extracted from the field study, the following recommendations could be suggested:

1) Government support must encourage organizations to adopt AI and Robotics Technology was that hotel owners and managers should be educated to adopt the idea of using robots in different hotel departments.by following in the footsteps and recommendations of Egypt vision 2030, focuses its efforts and investments on applying new technologies in different industries. Accordingly, it should head towards applying these

technologies in the hotels industry and issuing mandatory decisions in this regard to make them keep pace with global changes.

2) Encouraging hotels to take action to enhance the usability of robots in the food and beverage department, especially in restaurants such as robot host, robot waiter and robot Butler and some kitchen tasks, such as chef robots.

3) International hotel chains in Egypt can cooperate with technology companies and specialized professional institutions to provide training courses in robotics and machine learning, considering the work to reduce labor turnover and maintain a fixed number of employees, as well as training in the use of artificial intelligence.

4) The work in the concerned departments must be restructured and developed in terms of digital transformation, digitization, and service automation in terms of speed, goal achievement, ease of use, prices, and the institutional and intellectual readiness of department managers to provide their services in this context. Employees in the hotels industry should receive training in entrepreneurship, business administration, and innovation to link changes in technology to the international hotel industry.

5) Encouraging businesses to take action to promote smart technology and assist Egypt's hotels sector with relevant tourism infrastructure in developing strategies for their

policies and practices based on effective artificial intelligence and robotics planning and implementation.

References:

❖ **Aguirre, S., and Rodriguez, A., (2017).** "Automation of a business process using robotic process automation (RPA): a case study", In: Figueroa-García, JC., López-Santana, ER., Villa-Ramírez, JL., Ferro-Escobar, R., (eds) WEA (2017), (742), CCIS. *Springer*, Cham, pp. 65–71, https://doi. org/10.1007/978-3-319-66963-2_7.

❖ **Alshenqeeti, H., (2014).** "Interviewing as a Data Collection Method: A Critical Review", *English Linguistics Research*, 3(1), https://doi.org/10.5430/elr.v3n1p39 .

❖ **Alt, R., (2021).** "Digital transformation in the restaurant industry: Current developments and implications", *Journal of Smart Tourism,* 1(1), PP. 69–74. https://doi.org/10.52255/smarttourism.2021.1.1.9**.**

❖ **Ang, B., (2016).** " Robot Lucy at your service at newly opened Rong Heng Seafood", Available online, https://www.straitstimes.com/lifestyle/food/robot-lucy-at-your-service-at-newly-opened-rong-heng-seafood [Accessed on 23 January 2022].

❖ **Belanche, D., Casaló, L.V., and Flavián, C., (2020),** " Frontline robots in tourism and hospitality: service enhancement or cost reduction?", *Electronic Markets*, 31(3), PP. 477–492, https://doi.org/10.1007/ s12525-020-00432-5.

❖ **Berezina, K., Ciftci, O., and Cobanoglu, C., (2019).** "Robots, Artificial Intelligence, and Service Automation in Restaurants", *Emerald Publishing*

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Techniques in the Food and Beverage Department in Five-star
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Limited, In S. Ivanov & C. Webster (Eds.), Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality, pp. 185–219, https://doi.org/10.1108/978-1-78756-687-320191010.

❖ **Bowen, J., Morosan, C., (2018),** " Beware hospitality industry: the robots are coming " , *Worldwide Hospitality and Tourism Themes*, 10 (6), pp. 726-733 https://doi.org/10.1108/WHATT-07-2018-0045.

❖ **Brönnimann, A., (2021).** "How to phrase critical realist interview questions in applied social science research", *Journal of Critical Realism*, (1) 21, PP. 1-24, https://doi.org/10.1080/14767430.2021.1966719

❖ **Burgard, W., Cremers, A.B., Fox, D., Ha¨hnel, D., Lakemeyer, G., Schulz, D., Steiner, W., Thrun, S., (1999)**. "Experiences with an interactive museum tour-guide robot", *Artificial Intelligence*, Vol. 114 Nos 1/2, pp. 3-55, https://doi.org/10.1016/S0004-3702(99)00070-3.

❖ **Cakar, K., and Aykol, S., (2020),** " Understanding travellers' reactions to robotic services: a multiple case study approach of robotic hotels", *J Hosp Tour Technol*., ahead-of-print (ahead-of-print), https://doi.org/10.1108/JHTT-01-2020-0015.

❖ **Cavallo, C., (2017).** Will Your Eggs Taste Better if They're Made by a Robot? Available online, https://www.saveur.com/egg-robot-machine-ausca-singapore/ [Accessed on 20 January 2022].

❖ **Cheong, A., Lau, M. W. S., Foo, E., Hedley, J., and Bo, J. W., (2016), "** Development of a robotic waiter

system", *IFAC-Papers Online*, 49 (21), P.P 681–686. https://doi.org/10.1016/j.ifacol.2016.10.679.

❖ **Crook, J. (2014).** " Starwood introduces robotic butlers at aloft hotel in Cupertino, ,Available online,https://techcrunch.com/2014/08/13/starwood-introduces-robotic-butlers-at-aloft-hotel-in-palo alto/#:%7E:text=Starwood%2C%20one%20of%20the%20world's,around%20guests%20and%20use%20elevators [Accessed on 22 January 2022].

❖ **Curtis, S., (2016),** "Pizza Hut hires ROBOT waiters to take orders and process payments at its fast-food restaurants", *Mirror*, Available online, https://www.mirror.co.uk/tech/pizza-hut-hires-robot-waiters-8045172 [Accessed on 2 Feb 2022].

❖ **Dirican, C., (2015),** "The impacts of robotics, artificial intelligence on business and economics", Procedia Soc Behav Sci, 195, PP. 564–573. https://doi.org/10.1016/j.sbspro.2015.06.134.

❖ **Drexler, N., Lapré, V. B., and Group, F. (2019).** For better or for worse: Shaping the hospitality industry through robotics and artificial intelligence, 3534, https://doi.org/10.1080/22243534.2019.1689701.

❖ **Elkins, K., (2015).** "This restaurant has a new secret weapon: A robot that slices the perfect noodle faster than any human", Available online, https://www.businessinsider.in/This-restaurant-has-a-new-secret-weapon-a-robot-that-slices-the-perfect-noodle-faster-than-any-human/articleshow/47188856.cms [Accessed on 21 January 2022].

❖ **Feller, C., (2021).** " 10 robots automating the restaurant industry", *fast casual*, Available online https://www.fastcasual.com/blogs/10-robots-automating-the-restaurant-industry/ [Accessed on 22 January 2022].

❖ **Filloon, W., (2016).** "Bratwurst-cooking robot is a feat of German engineering", Available online,https://www.eater.com/2016/7/19/12227128/bratwurst-robot-sausage-cooking-germany [Accessed on 21 January 2022].

❖ **Fuentes-Moraleda, L., Díaz-Pérez, P., Orea-Giner, A., Muñoz-Mazón, A., and Villacé-Molinero, T., (2020),** "Interaction between hotel service robots and humans: a hotel-specific service robot acceptance model (sRAM), *Tourism Management Perspectives*, 36, PP. 100751. https://doi.org/10.1016/j.tmp.2020.100751.

❖ **Giuliani, M., Petrick, R. P. A., Foster, M. E., Gaschler, A., Isard, A., Pateraki, M., and Sigalas, M. (2013).** "Comparing task-based and socially intelligent behavior in a robot bartender", Paper presented at the ICMI 2013 – 2013 ACM International Conference on Multimodal Interaction, pp. 263–270, doi: 10.1145/2522848.2522869

❖ **Go, H., Kang, M., and Suh, S.C., (2020),** "Machine learning of robots in tourism and hospitality: Interactive technology acceptance model (iTAM) – cutting edge", *Tour Rev,* 75(4), PP. 625–636, https://doi. org/10.1108/TR-02-2019-0062.

❖ **Goel, P., Kaushik., N., Sivathanu, B., Pillai, R., and Vikas, J., (2022).** " Consumers' adoption of artificial

intelligence and robotics in hospitality and tourism sector: literature review and future research agenda", *Tourism Review*, *Emerald*, doi: 10.1108/TR-03-2021-0138.

❖ **Grundner, L., and Neuhofer, B., (2021).** "The bright and dark sides of artificial intelligence: a futures perspective on tourist destination experiences", *Journal of Destination Marketing & Management*, 19, PP. 1-12, https://doi.org/10.1016/j.jdmm.2020.100511.

❖ **Gursoy, D., and Chi, C.G., (2020),** "Effects of COVID-19 pandemic on hospitality industry: Review of the current situations and a research agenda", *J Hosp Mark Manag*, 29(5), PP. 527–529, https://doi.org/ 10.1080/19368623.2020.1788231.

❖ **Hou, Y., Zhang, K., and Li, G., (2021),** " Service robots or human staff: How social crowding shapes tourist preferences", *Tourism Management,* (83) 104242*,* PP. 1-15, https://doi.org/10.1016/j.tourman.2020.104242.

❖ **Hwang, J., Park, S. and Kim, I. (2020),** "Understanding motivated consumer innovativeness in the context of a robotic restaurant: the moderating role of product knowledge", *Journal of Hospitality and Tourism Management*, Vol. 44, pp. 272-282, https://doi.org/10.1016/j.jhtm.2020.06.003.

❖ **Insider Intelligence (2021).** Chatbot market in 2021: Stats, trends, and companies in the growing AI chatbot industry. Insider. https://www.businessinsider.com/chatbot-ma rket-stats-trends, [Accessed on 2 Feb 2022].

❖ **International Federation of Robotics (2020),** "Service robots", Available online https://ifr.org/service-robots [Accessed on 16 January 2022].

❖ **Ivanov, S. and Webster, C. (2019a).** "Conceptual framework of the use of robots, artificial intelligence and service automation in travel, tourism, and hospitality companies", in Ivanov, S. and Webster, C. (Eds), Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality, *Emerald Publishing Limited*, pp. 7-37, https://doi.org/10.1108/978-1-78756-687-320191001.

❖ **Ivanov, S., and Webster, C., (2020).** "Robots in tourism: A research agenda for tourism economics". *Tourism Economics*, 26 (7), P.P 1065−1085. https://doi.org/10.1177/1354816619879583.

❖ **Ivanov, S., Seyitoğlu, F., and Markova, M., (2020),** "Hotel managers' perceptions towards the use of robots: a mixed-methods approach **",** *Information Technology & Tourism*, 22, PP. 505−535**,** https://doi.org/10.1007/s40558-020-00187-x.

❖ **Ivanov, S., Webster, C., and Berezina, K., (2017).** "Adoption of robots and service automation by tourism and hospitality companies", *Revista Turismo & Desenvolvimento,* 27(28), PP. 1501−1517, https://ssrn.com/abstract=2964308.

❖ **Jabeen, F., Zaidi, S.A., and Dhaheri, M.H.A., (2021).** "Automation and artificial intelligence in hospitality and tourism", *Emerald Publishing Limited*, 28, https://doi.org/10.1108/TR-09-2019-0360

❖ **Kar, A.K., Kumar, S., and Ilavarasan, P.V., (2021),**" Modelling the service experience encounters using user-generated content: a text mining approach", *Global J. Flex. Syst. Manga.*, 22 (4), pp. 267-288, doi: 10.1007/s40171-021-00279-5.

❖ **Keenon Robotics (2022),** " KEENON Robotics Showcases Full Line-Up of Service Robots at CES 2022 ", *PRNewswire*, Las Vegas, Available online https://www.prnewswire.com/news-releases/keenon-robotics-showcases-full-line-up-of-service-robots-at-ces-2022-301455410.html [Accessed on 18 January 2022].

❖ **Kim, J.J., Lee, M.J., and Han, H., (2020),** "Smart hotels and sustainable consumer behavior: testing the effect of perceived performance, attitude, and technology readiness on word-of-mouth", *Int J Environ Res Public Health*, 17(20),7455, https://doi.org/10.3390/ijerph17207455.

❖ **Kim, S (Sam)., Kim, J., Badu-Baiden, F., Giroux, M., and Choi, Y., (2021).** "Preference for robot service or human service in hotels? Impacts of the COVID-19 pandemic", *International Journal of Hospitality Management*, 93,102795, https://doi.org/10.1016/j.ijhm.2020.102795.

❖ **Kuo, C. M., Chen, L. C., and Tseng, C. Y., (2017).** " Investigating an innovative service with hospitality robots", *International Journal of Contemporary Hospitality Management*, 29(5), PP. 1305–1321, doi: 10.1108/IJCHM-08-2015-0414.

❖ **Lee, W.H., Lin, C.W., and Shih, K.H., (2018),** "A technology acceptance model for the perception of restaurant service robots for trust, interactivity, and output quality", *International Journal of Mobile Communications*,16(4), PP. 361–376, **doi**: 10.1504/IJMC.2018.092666.

❖ **Lee, Y., Lee, S., and Kim. D-Y., (2021),** "Exploring hotel guests' perception of using robot assistants", *Tourism Management Perspectives*, 37,100781, https://doi.org/10.1016/j.tmp.2020.100781.

❖ **Li, J.J., Bonn, M.A., and Ye, B.H (2019),** "Hotel employee's artificial intelligence and robotics awareness and its impact on turnover intention: the moderating roles of perceived organizational support and competitive psychological climate", *Tour Manag*, 73, PP. 172–181, https://doi.org/10.1016/j.tourman.2019.02.006.

❖ **Lin, J., (2017),"** Robots are taking Singapore's hotel industry by storm – here's where to go for some robot hospitality", Available online, https://www.businessinsider.com/robots-are-taking-singapores-hotel-industry-by-storm-heres-where-to-go-for-some-robot-hospitality [Accessed on 21 January 2022].

❖ **Lukanova, G., and Ilieva, G., (2019),** " Robots, artificial intelligence, and service automation in hotels, In: Ivanov, S., Webster, C., (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality*, Emerald Publishing Limited*, pp. 157–

183, https://doi.org/10.1108/ 978-1-78756-687-320191009.

❖ **Mazilescu, V., (2019).**"Tourism and travel can effectively benefit from technologies associated with industry 4.0", pp. 53-63, International Conference "*Risk in Contemporary Economy*", doi https://doi.org/10.35219/rce206705327.

❖ **Murphy, R.R., Adams, J., and Gandudi, V.B.M.,** (2020), " How robots are on the frontlines in the battle against COVID-19", Available online, https://www.smithsonianmag.com/innovation/how-robots-are-on-front-linesbattle against-covid-19-180974720/, [Accessed on 2 Feb 2022].

❖ **Park, S., (2020),** "Multifaceted trust in tourism service robots", *Annals of Tourism Research,* 81, PP. 1-12, 102888. https://doi.org/10.1016/j.annals.2020.102888.

❖ **Pizam, A., Ozturk, A.B., Balderas-Cejudo, A., Buhalis, D., Fuchs, G., Hara, T., Meira, J., Revilla, M. R.G., Sethi, D., Shen, Y., State, O., Hacikara, A., and Chaulagain, S., (2022),** " Factors affecting hotel managers' intentions to adopt robotic technologies: A global study", *International Journal of Hospitality Management*, (102) 103139, PP. 1-15, https://doi.org/10.1016/j.ijhm.2022.103139.

❖ **Prideaux, S., (2019),** "Robot host welcomes guests at new Dubai Mall restaurant", Available online, https://www.thenationalnews.com/lifestyle/food/robot-host-welcomes-guests-at-new-dubai-mall-restaurant-1.813177 [Accessed on 24 January 2022].

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Techniques in the Food and Beverage Department in Five-star
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❖ **Reis, J., Melão, N., Salvadorinho, J., Soares, B., and Rosete, A., (2020),** " Service robots in the hospitality industry: The case of Henn-na hotel, Japan", *Technology in Society,* (63) 101423, PP. 1- 12, https://doi.org/10.1016/j.techsoc.2020.101423.

❖ **Samala, N., Katkam, B. S., Bellamkonda, R. S., and Rodriguez, R. V. (2020).** "Impact of AI and robotics in the tourism sector: A critical insight", *Journal of Tourism Futures*, https://doi.org/10.1108/JTF-07-2019- 0065

❖ **Saunders, M., Lewis, P., & Thornhill, A. (2019).** "Research Methods for Business Students" Chapter 4: Understanding research philosophy and approaches to theory development, In book: Research Methods for Business Students, Edition: 8, https://www.researchgate.net/publication/330760964 .

❖ **Smith, C., (2021),** "Barney' the Swiss robot bartender can mix dozens of cocktails, tell jokes and sanitise itself ", Available online, https://www.thedrinksbusiness.com/2021/04/barney-the-swiss-robot-bartender-can-mix-dozens-of-cocktails-tell-jokes-and-sanitise-itself/ [Accessed on 24 January 2022].

❖ **Staff, K., (2022).** " Robots deployed to some hotels amid staffing shortage", *CNN Newsource*, Available online, https://www.weau.com/2022/01/04/robots-deployed-some-hotels-amid-staffing-shortage/, [Accessed on 2 Feb 2022].

❖ **Stapleton, B., (2017),** "Go on a Bender at the new Tipsy Robot, Available online, from

https://vegas.eater.com/2017/6/30/15898204/tipsy-robot-now-open, [Accessed on 2 Feb 2022].

❖ **Sushirobo (2022),** "Sushi Machines", Available online, https://www.sushirobo.com/ [Accessed on 16 January 2022].

❖ **Troitino, C., (2018)**. "Meet the world's first fully automated burger robot: Creator debuts the big mac killer", Forbes, Available online, https://www.forbes.com/sites/christinatroitino/2018/06/21/meet-the-worlds-first-fully-automated-burger-robot-creator-debuts-the-big-mackiller/?sh=3dfd79016a89 [Accessed on 21 January 2022].

❖ **Tung, V. W. S., and Au, N., (2018). "**Exploring customer experiences with robotics in hospitality", *International Journal of Contemporary Hospitality Management*, 30(7), PP, 2680–2697. https://doi.org/10.1108/IJCHM06-2017-032.

❖ **Tuomi, A., Tussyadiah, I., and Stienmetz, J., (2019)**, Service robots and the changing roles of employees in restaurants: a cross cultural study. e-Rev Tour Res 17(5):662–673.

❖ **Tuomi, A., Tussyadiah, I., Ling, EC., Miller, G., and Lee, G., (2020a),** " x=(tourism work) y=(sdg8) while y= true: automate (x), Ann Tour Res, 84:102978, doi: 10.1016/j.annals.2020.102978.

❖ **Tuomi, A., Tussyadiah, IP., and Stienmetz, J., (2020b),** " Applications and implications of service robots in hospitality", Cornell Hosp Q, https://doi.org/10.1177/1938965520923961.

**The Possibility of using Robot as one of the Artificial Intelligence
Techniques in the Food and Beverage Department in Five-star
Hotels: Managers' Perspective**

❖ **Tussyadiah, I., (2020),** "A review of research into automation in tourism: Launching the annals of tourism research curated collection on artificial intelligence and robotics in tourism", *Annals of Tourism Research*, 81, 102883, https://doi.org/10.1016/j.annals.2020.102883.

❖ **Van Doorn, J., Mende, M., Noble, S.M., Hulland, J., Ostrom, A.L., Grewal, D. and Petersen, J.A. (2017),** "Domo arigato Mr. Roboto: emergence of automated social presence in organizational frontlines and customers' service experiences", Journal of Service Research, Vol. 20 No. 1, pp. 43-58, doi: 10.1177/ 1094670516679272.

❖ **Wang, N., (2022).** " Application of DASH client optimization and artificial intelligence in the management and operation of big data tourism hotels", *Alexandria Engineering Journal*, 61, PP. 81-90, https://doi.org/10.1016/j.aej.2021.04.080 .

❖ **Wirtz, J., Patterson, P.G., Kunz, W.H., Gruber, T., Lu, V.N., Paluch, S. and Martins, A. (2018**). "Brave new world: service robots in the frontline", Journal of Service Management, Vol. 29 No. 5, pp. 907-931, doi: 10.1108/JOSM-04-2018-0119.

❖ **Wu, J., Zhang, X., Zhu, Y., and Yu-Buck, G.F, (2021),** "Get close to the robot: the effect of risk perception of COVID-19 pandemic on customer-robot engagement", *Int J Environ Public Health*, 18 (12), PP. 1–17, https://doi.org/10.3390/ijerph18126314.

❖ **Xiang, Z., (2021).** " Journal of smart tourism: A new platform to support and define an emerging field".

Journal of Smart Tourism, 1(1), 1–2. https://doi.org/10.52255/smarttourism.2021.1.1.

❖ **Xu, S., Stienmetz, J., and Ashton, M., (2020)**,"How will service robots redefine leadership in hotel management? A Delphi approach", *International Journal of Contemporary Hospitality Management*, 32 (6), PP. 2217–2237, doi: 10.1108/IJCHM-05-2019-0505

❖ **Yang, L., Henthorne, T.L., and George, B., (2020),** "Artificial intelligence and robotics technology in the hospitality industry: current applications and future trends", In: George, B., Paul, J., (eds) Digital transformation in business and society, *Springer*, Cham, pp. 211–228. https://doi.org/10.1007/ 978-3-030-08277-2_13.

❖ **Zeng, Z., Chen, P-J., and Lew, A.A., (2020),** From high-touch to high-tech: COVID-19 drives robotics adoption", *Tour Geogr*, 22(3), PP. 724–734. https://doi.org/10.1080/14616688.2020.1762118.

Zhong, L., Verma, R., Wei, W., Morrsion, M.A., and Yang, L., (2022). "Multi-stakeholder perspectives on the impacts of service robots in urban hotel rooms**",** *Technology in Society*, (68) 101846, PP. 1- 10, https://doi.org/10.1016/j.techsoc.2021.101846.