Beware hospitality industry: the robots are coming

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Abstract
Purpose – The purpose of this study is to provide an overview of how artificial intelligence (AI) and robotics can and will be utilized by the hospitality industry, providing a glimpse of what their use will look like in 2030.

Design/methodology/approach – The paper reviewed both academic and trade literature to provide an overview of how robots will affect the hospitality industry during the 2030s.

Findings – Experts predict that by 2030, robots will make up about 25 per cent of the “workforce” in the hospitality industry. The paper also explains the industry challenges the robots will solve, as well as other benefits they provide. One of the findings is that the adoption of robots by the industry will be a disruptive paradigm shift. It will create successful new hospitality companies while putting others out of business. Finally, this paper discusses how to keep the hospitality in hospitality businesses, when machines replace employees.

Originality/value – This paper is one of the first to discuss the disruption that robots will cause in the industry. One of the findings is service delivery systems will need to be redesigned to maximize the benefits of robots, while still maintaining the hospitality of a customer service orientation.

Keywords Restaurant, Technology, Disruption, Robotics, Hotel, Service delivery, Artificial intelligence, International tourism, Robots, Labour shortage

Paper type Literature review

Introduction
The hospitality industry is facing a number of challenges, including labor shortages, an increase in the number of international travelers, and large volumes of consumer data. Managers of hospitality firms in Britain have warned that they could face a shortage of up to 60,000 workers if immigration from the European Union is too tightly controlled (Ahmed, 2017). In the USA, Federal Reserve officials forecast a 3.6 per cent unemployment rate, which would be the lowest rate in over 50 years. As a result, labor shortages have become a major concern in the USA (Harrison and Raice, 2018). Taiwan is experiencing a labor shortage owing to the aging population and low birth rate (Kuo et al., 2017). There are a growing number of international travelers from Asia and Southeast Asia. Many hospitality workers in Europe speak multiple languages, but this often does not include Mandarin or other languages used in Asia. In the USA most hospitality workers are not bilingual, and if they are, it is commonly English and Spanish. This creates communication challenges as guests from the east interact with service providers from the West. Providers of travel products have volumes of data available on their customers as well as prospective customers, but they often lack the human and financial resources to effectively use this information. Robotics and artificial intelligence (AI) can provide a solution to these challenges. By 2030, we predict that multiunit organizations that effectively plan and implement the use of robotics and AI in their service delivery systems will have a competitive advantage over those who do not.

There has been a gradual introduction of robotics in the hospitality industry. Some industry experts predict this slow introduction is about to turn into an explosion.
PricewaterhouseCoopers estimates that one-quarter of the hospitality jobs in the USA will be automated by the 2030s (Gupta, 2018). The CEO of H.I.S., the company that introduced the first staffed front desk by robots in its Henn-na Hotel in Japan, states that robots are a way to staff hospitality operations in Japan where the unemployment rate is below 3 per cent; he forecasts that over half of the jobs at Japan’s hotels will be done by machines (Semuels, 2018). The McKinsey Global Institute estimates that between 400 million and 800 million of today’s jobs will be automated by 2030 (Meyer, 2017).

The purpose of this study is to provide an overview of how AI and robotics can and will be utilized by the hospitality industry, providing a glimpse of what their use will look like in 2030.

First, a definition of robots and AI: Accenture (2018) defines AI as “a collection of multiple technologies – from machine learning to natural language processing – that allows machines to sense, comprehend, act, and learn.” We use the definition of robots provided by Professor Dragan: “A robot is a physically embodied artificially intelligent agent that can take actions that have effects on the physical world” (Simon, 2017). Two key parts of her definition are that a robot is embodied and that it is artificially intelligent. The robot has physical qualities that differentiate it from an AI-based software program. Tung and Law (2017) discuss the different forms of embodiment. A robot can be in the form of a human (anthropomorphic); can be in the form of an animal (zoomorphic); can be in the form of an object that is representational, such as a wine bottle on a restaurant table (caricatured); or it can be in the form of an object that is functional, such as an autonomous car (functional). Simon (2017) discusses the second key part of Dragan’s definition: intelligence. He states that a robot should be able to sense its environment, and, based on what it senses, think about what its next action should be and then take that action (Simon, 2017).

In organizing this paper, we first discuss the adoption of robots by hospitality organizations, followed by a discussion on how robotics will create a disruptive paradigm. We then discuss the benefits of using robots. This will be followed by a discussion on how we maintain hospitality with robots, and finally, we will discuss segmentation factors that will affect the use of robotics.

Adoption

One of the critical aspects of this field is the rate of adoption by individual and institutional users. Given the prediction that robots will be rapidly adopted over the next 20 years, it is not surprising that this is one of the most prolific areas of academic research (Rizzuto et al., 2014). The current literature overwhelmingly supports the notion that a system’s perceived usefulness and performance (i.e. the ability of the system to complete a task) is the main driver of user adoption, in both mandatory and voluntary settings (Morosan and DeFranco, 2016). Additionally, the literature recognizes the role of other factors, such as ease of use, subjective norms, facilitating conditions, hedonic motivations, heuristics, emotions, convenience and sociodemographic profiles of users (Ozturk et al., 2016).

Based on these insights, system designers are likely to approach the design of robotics and AI from this multifaceted adoption angle. To create value, the robot must perform a given task better than rival systems (Consortium of Cognitive Science Instruction, 2018; Russell and Norvig, 2010). In addition, the systems must be:

- designed with user interfaces that are attractive for entire segments of users simultaneously in order to facilitate first impressions and emotions;
- similar in their utilization with other contemporary platforms to stimulate heuristics; and
- sufficiently customizable to be appealing to a variety of different user segments (e.g. adaptation based on organizational goals, strategies, marketing approaches, consumers’ sociodemographic or psychographic characteristics, etc.).
It is expected that using robotics and AI will not be different from the psychological processes that eventually drive users to follow the normal course of system utilization: contemplating, exploring, using and talking about systems. However, this requires systems to be able to integrate seamlessly with the service environment and address tasks that are critical to the service delivery. For example, one should expect to see front-of-the-house robots that respond to voice commands – are accurate in understanding various languages and accents, recognizing users to recall analytics from previous service episodes, and then engaging in behaviors that are consistent with an analytic view of a particular user’s stay experience. Other examples may include robotic back-of-the-house applications, with robots learning and adapting to the work habits of individual employees. Specifically, a robot can learn the natural employees’ idiosyncrasies that result in work-efficiency variations throughout the workday and help facilitate his or her tasks by taking advantage of the most efficient periods for that employee. For example, tasks that require maximum concentration and effort may be sent to the employee during a time of high efficiency, while heuristic and automated tasks can be addressed during a period of lower efficiency.

Paradigm shift
Hospitality employees and customers are both involved in the service delivery process, creating a high level of interaction between them. Employees are part of the hospitality product, and companies look for customer-facing employees that have a positive attitude and a passion for serving customers. The robot revolution will disrupt the present service delivery systems as humans are replaced by machines. This will call for the creation of new systems. Although some companies will replace certain positions with robots, forward-thinking companies will create new service delivery systems designed to incorporate robots. For example, a combination of robots and other forms of technology will potentially reduce the need for a front desk. This creates a challenge for hotel management to maintain a feeling of hospitality within the hotel and design this into the new service delivery system. For example, it could be human greeter in the lobby to welcome guests and be available to those who are more comfortable conversing with a human than a robot.

Some restaurants have replaced certain positions with a robot. For example, Caliburger created a robot that can cook hamburgers, sensing when they are done and picking them up and placing them on a tray, where humans take over finishing the product (Graham, 2018). Compare this with a restaurant developed by Creator, which has designed a service delivery system around using a robot. The robot grinds the meat to order, forms and places the patty on the grill. Creator claims only a robot would have the dexterity to hold the freshly ground patty together during cooking. For cheeseburgers it grates cheese on top of the patty. The robot slices and butters the bun before toasting it. After the buns are toasted the robot places them in a paper serving tray. Tomatoes and onions are sliced to order and placed on the bun, next condiments which the guest has specified are placed on the bun and finally the patty is placed on the bun. The freshly cut vegetables are more consistent than those cut by a human and fresher than produce purchased pre-cut. Creator claims the labor savings is passed on to the customer through the use of quality ingredients like pasture-raised beef, that is not normally used for $6 hamburgers. Another benefit is the smoke from the cooking process is contained and filtered by the robot. Finally, humans still interact with the customer to explain the different choices available to the customer and answer questions (Peters, 2018). As the cost of robotics is reduced, companies that can create service delivery systems designed to use robots will have a competitive advantage, to the point where this disruptive technology could be the demise of multi-unit operators who fail to adopt it or fail to redesign their service delivery systems.
When designing and implementing new systems, organizations must remember that customers are part of the service delivery system; just as employees are trained, so too must customers be trained. With the changes in service delivery systems called for by the use of robotics, both customers and employees will need to be trained by humans in using the system.

**Benefits of robotics**

AI will effectively manage the consumer information companies have available to them. The travel industry faces two challenges with information: what to use and how to use it. The capability and applications of information in well-managed customer relationship-management systems are so massive that the only way to extract the true value of the information is through AI applied to software programs or machines. This information is then passed on to robots or humans that can use this information to cocreate a great experience for the guests – doing so in a way that ensures the guests’ information is used discreetly and securely. For example, if the customer is traveling with a companion, it may not be the same partner they had on their last trip. Any customization specifically mentioning the last trip can result in a memorable experience, but this type of negative memorable experience is not the type we want to create. AI will be able to give suggestions on how to create or cocreate a good customer experience while not revealing any private information. If we know from our database that the person likes a certain red wine, a robot server could mention three wines with that wine being one of them, rather than saying, “Would you like the same wine you had when you were here two weeks ago”.

Robotics will allow hotels to offer services that previously were cost prohibitive. Autonomous cars, a type of robot, will pick up guests at the airport. If they have not checked into the hotel, the car can check them in and set up their smartphone to use as a key. Based on the customer information available on the guest, the car can make suggestions regarding restaurants near the hotel. It will be able to ask questions, and based on the responses, the car can make reservations for the guest. As they head toward the hotel, the guest may see a large stadium on the other side of the river and ask about it. The car can recognize the building and then provide information on the stadium. The robot serves as an airport pick-up, front desk clerk, concierge and tour guide. The robot not only creates a great initial experience for the customer on behalf of the hotel but also creates additional value by saving the customer money and/or time. The robot has created a much more engaging experience than the ride from the airport with most taxi drivers.

There are intangible factors that, once tangible, offer rewarding experiences to consumers (e.g. finding a popular dining spot at a destination that offers overwhelming dining options, making sense of multiple marketing offers, etc.) (Torres et al., 2015). Robots can provide recommendations that are aligned with users’ communication habits (e.g. a guest does not manifest any preference for a high- vs low-floor room in a hotel), known preferences (e.g. a guest expresses certain preferences and becomes unhappy when such preferences are not addressed), decision-making patterns (e.g. a consumer always makes a hotel reservation within a week of arrival), or stated goals (e.g. a consumer wants to accrue maximum reward points) (Bowen and Chen McCain, 2015).

Hospitality technology has traditionally been plagued by the lack of interfacing among various systems. This is due to the fragmented nature of programs that are designed for specific tasks. The particularities of hotel and restaurant ownership include changing brands, and management companies acquiring brands with different systems (Morosan and Bowen, 2018). In such cases, certain legacy systems become outdated, and new systems capable of replacing those outdated systems become available on the market. While the
latest generation of systems has started to address interfacing, the newest service models do not necessarily incorporate enough interfacing between old and new systems. As a result, the industry remains inefficient and is prone to error. To address both the inefficiency and the error potential, the new robots must be based on well-designed interfaces that work with all the other systems in an organization. Newer hotels are already moving in the direction of utilizing the infrastructure much more efficiently by designing unique buses and allowing the various systems to “talk” to one another. When deploying robots at the top of this well-integrated infrastructure, the systems are likely to be in a better position to learn about the operations in the hotel and restaurant, deploy the most efficient remedy tools in case of errors and provide better suggestions to decision-makers.

Most robotics and AI tools have been developed for use by commercial entities (Meike and Ribickis, 2011). However, over the past 10-15 years, there have been many systems based on robotics and AI that are used seamlessly by consumers to help them make better economic decisions and engage in a seamless hospitality experience (e.g. shopping assistants, chatbots, etc.) (Kolodny, 2016). Some of these have a physical embodiment (robots), while others may be AI-empowered software programs on their computer. Similar approaches are likely to be seen in the future, as consumers will have at their disposal intelligent agents that could make decisions on their behalf. For example, apps can synchronize consumers’ calendars, send reminders, make payments and eventually learn guests’ travel routines to respond better to the variety of subdecisions that are inherent in hospitality; these sub decisions are integral to newer, interactive approaches to services that are designed according to the principles of service-dominant logic (Zhang et al., 2018). Moreover, there will be integration between the users’ own hardware and software, creating an environment characterized by continuous human-machine interaction and learning. By 2030, an increasing amount of travel products will be reserved and purchased by machines, without the need for human interaction, that represent the traveler and the travel industry company. The cocreation of the travel product will be created by machines and AI software representing the guest and the hospitality organization; both systems will understand their client’s needs.

**Blend between hospitality and technology**

One important challenge to be addressed by robotics and AI systems is the blend between hospitality and technology. It is very difficult to make any predictions about any proportion of blending between the two concepts. “Hospitality” services are grounded in human-to-human interaction. Yet such legacy services are likely to undergo transformations as:

- guests become attracted to robotics and AI in day-to-day life settings and transfer such behaviors to hospitality settings; and
- guests may also be attracted to the efficiency provided by such systems, which will facilitate exploratory use and adoption.

For example, while the front desk may take different forms (e.g. staff walking through the lobby with tablets to help guests to check-in, self-service technologies, etc.), in some service models, the front desk functions (e.g. guest authentication, security protocols, payment, etc.) will be done by a robot. It is likely that the new service models will adapt to incorporate automation and consumers’ responses without necessarily becoming deficient in hospitality, though hospitality will be defined differently in the future as a result.

If there is something that IT vendors have learned over and over again during the past 50 years, it is the indubitable fact that any technology will be difficult to adopt in the absence of a very good user interface. The success of the user interfaces designed by
companies such as Apple, Zingle or Google has created a mentality that systems are not worth spending time to learn and that the winning technologies, standards or formats should be based on very successful and intuitive user interfaces. This logic has dominated the design of most contemporary systems. While the technologies represented at the foundation of such interfaces have changed, there is still progress to be made in ensuring that such systems work consistently; the user interface will remain critical. To this end, one is likely to see robots that respond to voice commands but can read the user’s face to gauge various emotional responses. As the voice-recognition algorithms improve, coupled with developing systems with the ability to capture the sound of the human voice and sample it into a digital format, one should expect to see systems that are accurate and can respond to thoughts, gestures and user behaviors, thereby reducing the skills and the learning curves that are necessary for the utilization of new systems. As a result, service models based on a blending of consumption-related tasks with potentially routine tasks will seem natural for guests to use. In the future, through a front desk or lobby robot, a guest will be able to ask questions in their native language and receive responses back in their language. The robot will be able to cognize and converse in most known languages, creating an environment that helps put customers at ease.

**Segmentation**

The emergence of analytic techniques based on the data that are voluntarily and involuntarily disclosed by consumers has created a new wave of system developments that analyze and engage the consumers. However, not all the consumers have the same innovativeness (response to new things) (Slade et al., 2015), and therefore, the future service delivery systems using robots will be based on segmentation schemes that take into account the consumers’ various and gradual responses to such systems.

Two types of segmentations affecting the use of robotics, especially those involving customer interfacing tasks, will be generational and dependent on the class of the service (economy, luxury, etc.). Millennials have been called the digital generation, as they grew up with technology. Millennials and the generations following them should readily adapt to robotics as part of the service delivery system. Boomers, however, are a mixed group regarding their confidence and competence in using and interfacing with technology. Hospitality firms focusing on boomers will need to staff robots supplemented with humans to help the consumer interact with the service delivery system. Relating to the class of service, those who are value-conscious – focusing on price – will appreciate limited-service hotels and restaurants that have cut costs by using robots and have passed some of those cost savings to the consumer. These companies will be able to deliver a good product at a low price. Guests of luxury properties view value as being able to get what they want when they want it. They are used to being pampered by humans. Luxury properties will still have to feature this human-to-human interaction in the front of the house. As hospitality companies move into robotics, it is important they understand their customers and how they will or will not interact with robots.

**Summary**

Robots will become an important asset of many hospitality organizations by the 2030s. The demand for robots will be driven in part by labor shortages, the need to communicate with an increasing number of international travelers and the cocreation of a memorable guest experience through effectively using the data available on the customer. The introduction of robotics will be a major disruption to the industry. Success in this period of disruption will require a redesign of the service delivery system so that the robots create customer value in
terms of a better product, lower price or both. The service delivery redesign will also include ways to maintain a high level of customer service. Different customer segments will be more comfortable with machines delivering all or part of the service product. Understanding the willingness of your customer segment(s) to accept robots, especially in the front of the house will be an important part of the service system redesign. Finally, there will be a place in the market for owner operated restaurants and boutique hotels to differentiate themselves by continuing to use an all human staff.

References


**Further reading**


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