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Service System Design and Automation in the Hospitality Sector

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Abstract
Service system design and customer experience mapping are useful tools capable of improving focus on guest satisfaction and service processes. This integrative-narrative literature review paper (INRP) investigated the technological automations (robots, artificial intelligence and augmented reality) in the hospitality sector for the purpose of gaining the attention of operations managers, hotel chains and academics alike. The INRP investigated how service system design and blueprinting can be utilized to roadmap technology innovations in hotel and restaurant customer experiences. The research is intended to guide hospitality practitioners into new lines of inquiry and facilitating the direction of academic research by determining what needs to be done to narrow the gap among practitioners and academics with respect to how implementation in of technological advancements in the hospitality sector can best be approached. A guided framework of key decision points in technological adoption is presented.

Key words: Service system design, automation, augmented reality, hotel operations

1. Introduction

One of the key competitive differentiators in the hospitality industry is the customer service experience. Accordingly, hotel companies consistently strive to capture new customers and retain loyal customers for future visits by offering unique and consistent service delivery. In particular Pine and Gilmore, (2011) emphasize the importance of creating competitive service advantages through various experience realms: (1) educational, (2) entertaining, (3) escapist, and (4) aesthetically pleasing. Secondarily, facility design and ambience are important factors in determining satisfactory customer experiences (Ivanov & Webster, 2017a; Oh, Fiore & Jeoung, 2007).

More recently, automation, artificial intelligence and robotic adoption in service delivery programming has gained more attention as a means of creating unique customer experiences and labor efficiencies (Agah, Cabibihan, Howard, Salichs, & He, 2016; Ivanov & Webster, 2017a). Additionally, empirical research studies have indicated advances in robotics and artificial intelligence will continue to accelerate as service related jobs become harder to fill and human-robotic integrations become more acceptable by consumers (Mizuta, 2014; Pagliarini & Lund, 2017).

The purpose of this paper is to define robotic, artificial intelligence and augmented reality technological advancements in order to provide further insight and understanding for hotel industry practitioners to better understand the impact robots, artificial intelligence and service automation (RAIS) can have on customer experiences (Naumov, 2019). The paper also discusses and integrates the influence of automation on workforce development and operational effectiveness through service system blueprinting and offer a decision framework to consider certain technology applications and adoptions.

2. Methods

This narrative literature review paper was designed to identify current research in the area of service design, artificial intelligence and augmented reality. Narrative reviews, sometimes referred to as overviews or standard/traditional reviews of the literature, critically appraise and summarize the literature relevant to an identified topic (Rhodes, 2011). According to Yorks, (2008) an integrative literature review in and of itself, may be considered a form of research that can stand alone. Although not empirical per se, an integrative literature review does a systematic and replicable study of the literature. The diverse nature of this literature review was purposeful, drawing from key concepts and underlying theories surrounding the application of service system design to the hospitality sector from a wide variety of industries. Also, to determine what was known and unknown in the subject area of automation and artificial intelligence to better inform professional practice involving the adaption of technology across various hospitality industries.

The review of literature for this paper was conducted using the following data bases and sources (e.g. Web of Science, SCOPUS, Scholar Google, Industry reports and TRID). Key search words developed for the literature review were based on subjective criteria, brainstorming with professional hospitality experts, personal knowledge, extensive research in the area of service blueprinting, automation and technology, and other open-ended approaches to search the following topics; (1) service design, (2) service systems (3) hospitality service, (4) customer experience, (5) augmented reality, (6) technology and innovation, (7) artificial intelligence-service design, and (8) robotics and artificial intelligence. Additionally, backward snowballing methods were implemented to find relevant citations desirous of the topical focus and relevant literature discovered from the initial data base searches (VanWee & Bannister, 2012).

Since gaps in the hospitality literature existed surrounding artificial intelligence and robotics, alternative peer-reviewed journal sources and industry reports were identified to weave together the current state of automation in the service industries. The literature review for this paper was conducted from June 20, 2019 until January 6, 2020. The logic used to select the papers for exploratory review were; (1) the descriptive nature and relevance to the hospitality industry, (2) total citations, (3) overall quality, (4) technical efficacy, and (5) explanatory nature. Exceptions to the time specific relevancy were made for the purposes of illustrating the underlying theory of customer experience realms and service system foundations.

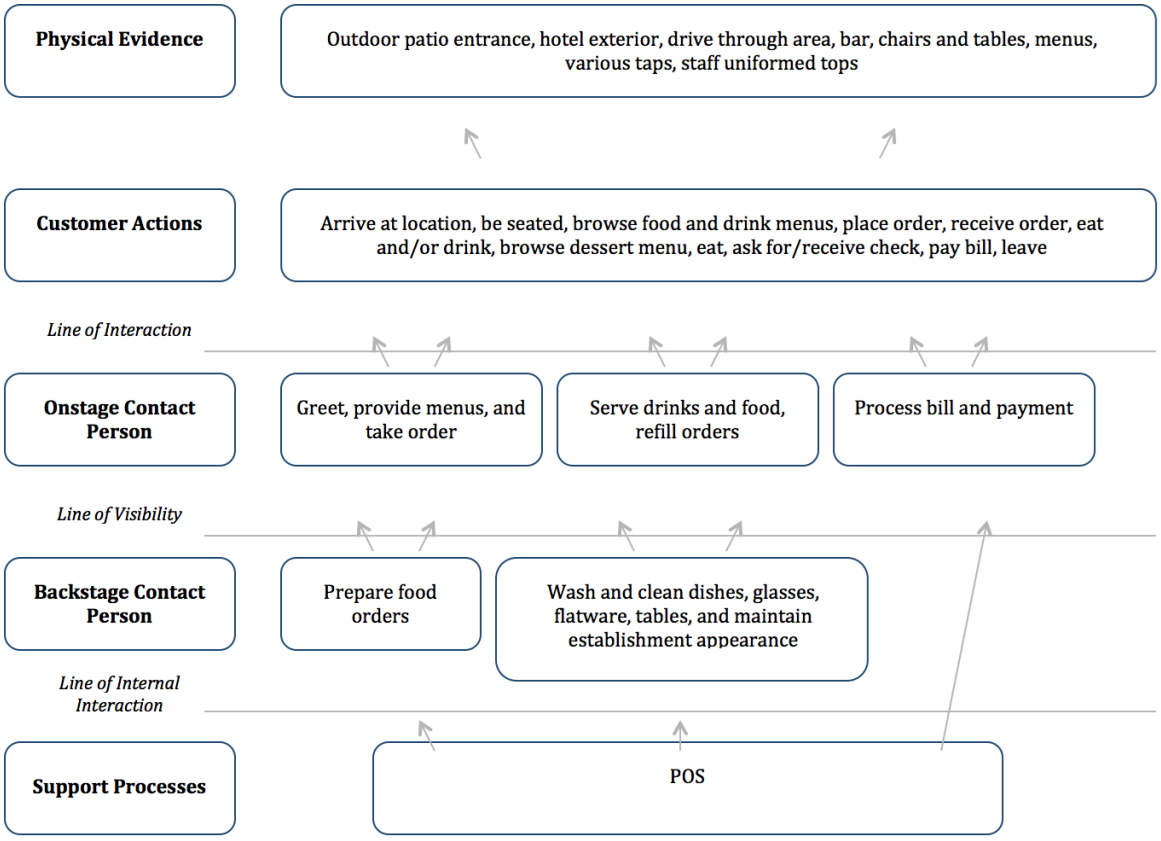
3. Narrative Literature Review

3.1 Service system design

Service system design taxonomy finds its roots in the customer service encounter and contact touchpoints of various service personnel along with thoughtful and detailed consideration of behind the scene service production processes. The blueprinting process or structural operational components associated with service system design can be useful in assisting hotel operators with the necessary insights required to ensure both direct and indirect customer contact points align with customer expectations (Wemmerlov, 1990).

Customer contact service modeling or service blueprinting considers the key interactions between service personnel and the customer (figure 1). Theoretical underpinnings associated with customer service call attention to the importance of two main components; (1) labor intensity and (2) customer interaction (co-creation). The former involving high input costs associated with employee time, effort and cost while the latter involves the degree in which the customer interacts with the service personnel and the level of personalization they require.

Figure 1. Hotel restaurant service system design blueprint



In the literature, researchers have found a direct relationship between personalization and higher levels of service personnel interaction. Typically, hotels are known for high service contact and touch points between service personnel and customers (Schmenner, 1986).

According to Mersha, 1990, a majority of service encounters take place in the presence of the customer. Similarly, Pine and Gilmore, 2011 advocated for more pronounced customer interaction and co-creation of service experiences (Mehmetoglu & Engen, 2011). They argued these interactions within the service system and customer involvement in the production process are critical elements in the service system blueprint. Both Mersha, 1990; Pine and Gilmore, 2011 argued within the service system design customer touch points and key interactions may be defined and engineered as either active or passive in nature.

As figure 1 depicts, hotel-based customer interactions involve the initial arrival and check-in experience and onstage line of interaction delineating the front and back of house processes. Customer contact activities

considered front of the house, while back of house (backstage) processes involve staging and support roles of service personnel.

Earlier research surrounding service system design focused on the structural components of an organization to articulate customer contact points within a service system (Chase &Tansik 1983). The descriptive nature of said service design advocating for reconfiguration of the service system as a response to the variability in customer interactions between low and high contact points. Accordingly, the theoretical basis of customer contact approaches to service system design are grounded in the degree in which the service personnel contact with customers formulates the service product.

At the core of service system structural designs are the degrees in which customers require interaction with service personnel to complete the service transaction or experience (Buzacott, 2000). When considering the service system structure, operations managers are often confronted with trade-offs between speed and quality of service related to the cost of production. This cost of production linked can be directly related to task requirements assigned within the service system for both front and back of house activities (FOH/BOH).

More recently, utilizing the service blueprint as a service experience design process has been linked with multi-service interfaces found in other customer facing industries such as banking, retail and healthcare. These multifaceted customer experiences often requiring different service requirements for different customers. Therefore, the service experience blueprint offers operators strategic perspectives and multiple decision points designed to allocate service tasks best suited to optimize service interfaces (Patricio, Fisk, & Cunha, 2008). Specific to the hospitality industry, (Victorino, Verma, Plaschka & Dev, 2005) contended service innovation has a significant impact on customer choices when seleting accommodations. Particularly across different hotel classifications and customer segments. In their study, they found service innovation does matter when guests are selecting a hotel. More so for customers preferring to stay at economy hotels and leisure customers in general. With respect to customer segmentation, they also believe understanding customers' choices allows managers the opportunity to better design service systems and formulate corresponding operational strategies to target those specific segmented customer preferences.
Given the importance of service innovation Victorino et. al, supported the notion that service system design can be an excellent tool for hotel managers deciding on which service innovations to implement for competitive advantages. Kandampully and Duddy, (2001) also supported the importance of service design as a means to strategically empower service personnel to meet customer satisfaction guarantees and establish competitive advantages in the market.

As an example of BOH production efficiency in service system design, Wang, Lee and Trappey, (2017) found noticeable benefits of utilizing service system blueprinting in concert with quality functional deployment (QFD) for a cloud-based, meal self-service ordering system in the quick-service restaurant sector. Recent advancements in artificial intelligence and augmented reality technologies may offer opportunities for improvements in both front of house (FOH) service encounters and back of house (BOH) support-production processes.

3.2 Artificial intelligence (AI)

Artificial intelligence (AI) refers to a number of different technologies. AI is an umbrella term that is used to refer to a number of different technologies (Davenport, 2018). AI technologies may be classified as physical AI technologies like robots and autonomous vehicles or cognitive technologies that perform “thinking” tasks. In both cases, the essence of AI is that it uses data to predict an outcome.

AI is growing exponentially in terms of its capabilities and applications. As a result, it is already impacting the way human resources (HR) professionals perform their jobs and can be expected to have an even greater impact on human development in the hospitality sector over decades to come. The robot evolution will disrupt current service delivery systems as humans are replaced by machines calling for the re-design of current service systems (Bowen & Morosan, 2018).

Table 1. AI based technologies and integrated business solutions

Technology	**Application-Use (FOH/BOH)**
Computer vison	BOH-Acquiring, processing and analyzing images
Video analytics integrated with surveillance cameras	BOH-Provides situational awareness mitigating risk and also tracks consumer behavioral patterns
Audio processing	FOH-Identifying and recognizing sounds and speech to profile users
Natural language processing	FOH-Understanding the meaning of what a person is saying
Knowledge representation	BOH-Capability to link search content to other relevant content for behavior mapping
Inference engines deriving answers from statistical knowledge	BOH-Expeditated decision making i.e. job applications
Expert systems	BOH-Emulating decision-making capability to solve complex problems sifting through massive data sets in rapid time frames
Machine learning	BOH/FOH-Altering the decision process based on experiences to improve productivity and other desired outcomes

When considering technological adoption in service system design, Bowen and Morosan, (2018) emphasized the importance of hotel property service systems and operating structural capabilities integrating automation seamlessly with customer service experiences. The aforementioned integration of front of house systems with customers and back of house applications with fellow service personnel. According to (Neuhofer et.al., 2012) the role of artificial intelligence in service design innovation is synonymous with the evolution of the more static Web 1.0 to the transformative interactive, user-generated, co-created Web 2.0 platform found today. In this regard, they contended the customer is the co-creator or producer of their own experience similar to Pine and Gilmore's, (2011) with emphasis on co-creation of customer experience realms.

For customer co-creation and other service system design elements involving AI, Bowen and Morosan, (2018) believed customer segmentation and hotel classification may be a major factor in the implementation of robots in the service delivery process. For instance, Millennial customers are more likely to be digitally driven and receptive to AI driven experiences, conversely, Baby boomers may lack confidence and competence in using AI driven technology. This divergence in customer expectations will further exacerbate the need for service blueprinting to map the desired service experience and ensure proper alignment with generationally diverse

customer segments. AI is not just about robotics, more importantly, it involves all sorts of data and interconnectivity.

Other applications in the hospitality space involves using business intelligence to generate scenarios that enhance revenue management performance through interconnectivity and interoperability with existing software systems (Buhalis & Leung, 2017). From a back of house support process perspective, automated robotic systems are finding their way into the production process flow. For instance, utilizing a cost-effective bartending robotic system which is capable of patrolling a bar and serving beer when signaled to by a customer. From a front of house perspective, the use of robots as servers in restaurants is said to be gaining more frequent attention. Restaurateurs have been evaluating robots to assist with table service. When autonomous navigation is achieved and perfected, mobile robot servers will be capable of traveling to and docking at targeted tables in the dining room and rolling out serving trays of food and beverages (Cheong, Efoo, Hedley & Wenbo, 2016).

Advanced artificial intelligence solutions are not only limited to robotics and FOH/BOH applications. AI is increasingly becoming more prominent in human resource management and human capital performance applications.

3.3 AI-Managing human capital resources

Engaged hospitality employees remains a key to successfull customer-driven service enterprises. With the explosion of data analytics and rapidly developing IoT (internet of things), management processes are expected to be the next breakthrough disruption. With AI tools to manage talent, monitor effectiveness, measure productivity, evaluate performance, facilitate capability building, predict trends, and red-flag potential problems. Human interactions in the workplace are poised for technological disruption with both robotic replacement, advanced performance intelligence and human-robotic interfaces (Agrawal, Gans, & Goldfarb, 2018).

Since hiring in the hospitality industry has become highly competitive, using applicant metadata (micro-detailed data) housed in the AI assisted HR programming can link job candidate preferences with future career growth within the organization. Not only can AI based programming align future career trajectory it can also identify the likelihood of future performance on the job. That performance can be aligned with a job applicant personality traits and rank considered for promotion.
Typical programmatic use of AI in human capital resources includes: (1) applicant screening; analyzing candidate profiles and determining their fit for a job opening, (2) profile enrichment; automatically sourcing additional information about a candidate from publicly available data across the web, (3) candidate sourcing; surfacing qualified candidates from internal and external talent pools for current vacancies, (4) personalized assessments; training, tailoring solutions that adapt to each candidate skills and abilities, (5) candidate matching; identifying and evaluating the strongest active or passive candidates for an open position based on their relevant skills, experience, or other defined criteria, (6) chatbots; conversational UI for candidates or prospects for pre-screening, Q&A, and scheduling (Kharkovyna, 2018).
Additional adaptations of AI in human resources involves programming performance management benchmarks by learning to predict future job performance. Using data and predictive analytics as a tool to measure engagement levels, collating relevant results and providing employment options is gaining traction among HR professional (Marr, 2017). Advanced data analytics and machine learning tools can simplify running engagement programs. With facilitated predictive analysis using historical/current data across job category and applicant variables, will open up and advance the adoption of efficient, customized technology solutions.

Technology advancements are not only limited to human to human or human to machine interactions. Technology advancements are already integrated into the physical space and configuration of service systems and building envelope design configurations.

3.4 AI-hotel facility design

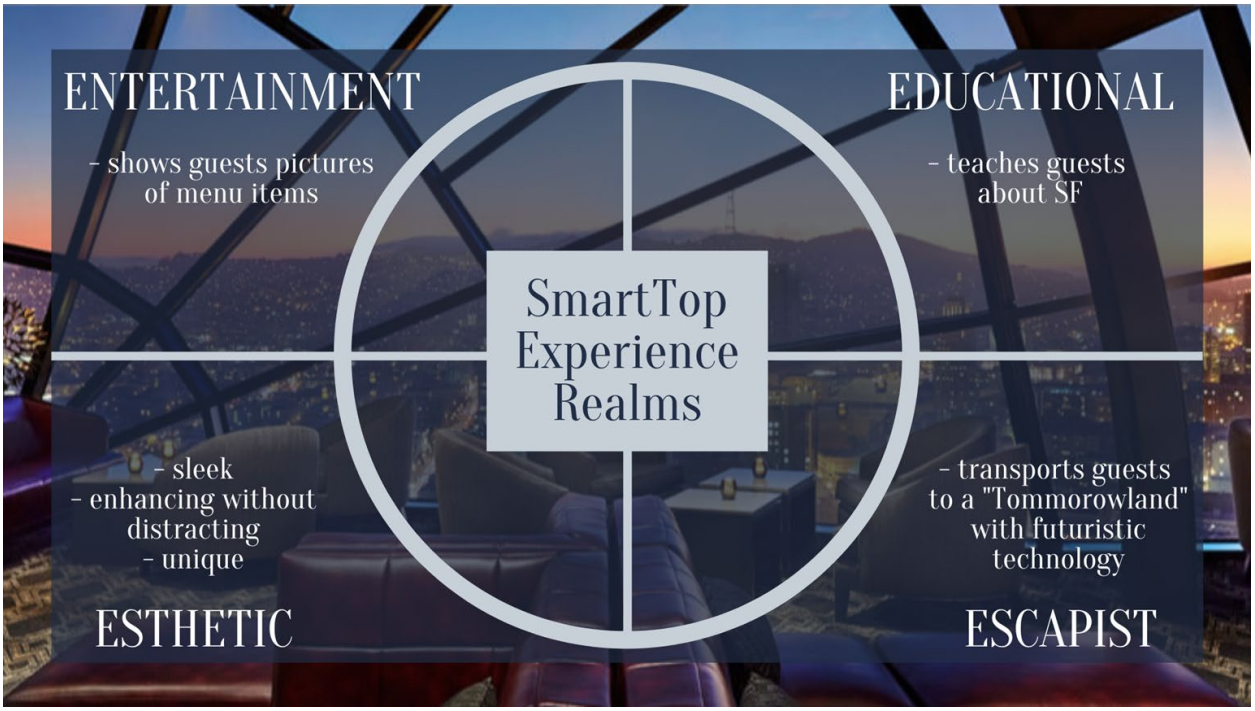
An emerging area of physical AI application in the hospitality industry is facility design. To incorporate the functional aspect of human-robotic interactions key considerations in robot-friendly hospitality facilities consider the following components: (1) floor surfaces, (2) corridor width, (3) stairs, (4) elevator landings/elevators, (5) doors, (6) doorsteps, (7) artificial and natural landmarks, (8) back of house product storage systems and (9) strategic placement of charging stations and robot storage bays.
For instance, corridors need to be wide enough to allow the movement of people and robots. Niechwiadowicz and Khan (2008) pointed out that artificial landmarks (i.e. specially designed signs and objects) facilitate a robot's navigation within the premises they move around, although in some cases like hospitals, it is preferable to avoid the installation of artificial landmarks and to rely on natural ones like walls, lamps, and corners. Using smart technologies and installing sensors in a building helps the robot navigate because it does not need to rely only on its on-board sensors only, rather, it receives data regarding its location off the sensors strategically installed around the facility (Sprute, Pörtner, Rasch, Battermann & König, 2017).
Consequently, architects and designers need to select materials that will not be removed by the rotating brushes of the robot. The same will likely be true for those robots involved in cleaning bathroom with regard to corners and angles that a robot can properly service. The future design of hotels will have to consider how robots will be powered and recharged. Hotels and restaurants will have to design spaces for repairing and staging robots. There may be separate facilities for in-house repair of hotel-owned robots and services for the repair of robots for guests in the hotel.
Considering the high costs of acquiring and maintaining service robots (Ivanov & Webster, 2017a), believed it is likely that many robots used by hospitality companies will actually be rented from robot-leasing companies. This means that their maintenance would be the responsibility of their owners, i.e. the robot-leasing companies, and the hospitality companies themselves would not need to finance (full) repair facilities for robots.
In addition to AI driven technologies that may be utilized in BOH staging, human resource management and customer interfacing activities, augmented reality offers a unique opportunity for hotel and restaurant operators to construct more active, co-created customer experience exchanges.

3.5 Augmented reality

Augmented reality (AR) allows guests to have immersive experiences through the integration of technological interfaces. These experiences can positively influence a hotel or restaurants brand, deepen trust through personalized experiences and elicit loyal return guests.

When evaluating the application of augmented reality in the service scape Pine and Gilmore's, 2011, customer experience realms provided a unique alignment and fit for hospitality operators desirous of implementing augmented reality into their service system design. Their four primary customer experience realms included: (1) entertaining, (2) educational, (3) aesthetic, and (4) escapist. Depending on the level of active participation in the service experience can be dictated by the adoption of technology.

Figure 2. AR enhanced service system design



For instance, figure 2 depicts a FOH-hotel bar service delivery system incorporating “smart table” augmented reality applications. AR apps can support service system re-designs by delivering immersive experiences to potential customers. The smart table application depicted in figure 2 addresses all four customer experience realms with active participation from customers. By incorporating the ordering process into the smart- table design guests can entertain themselves with interactive pictures of menu items and featured product specials that “come to life” through augmented reality. With respect to educational experience realms, the smart-table allows guests to learn more about the destination sites and activities surrounding the history and culture of a local environment. For instance, AR can entertain and assist customers in visualizing different menu items even before they enter the hotel restaurant or bar. Information about where the ingredients come from and an idea of the portion size and nutritional composition can be delivered to customers in a seamless manner.

AR can also help to increase profitability by improving BOH processes. For instance, a specified AR app can support maintenance crews by storing instructions for repairs, information about part supplies and repair history in order to automatically dispatch preventative maintenance requests.
Moreover, AR can be incorporated into BOH processes to ensure sanitation codes and food storage rules are constantly communicated to all employees by interactively reminding employees to store food items at the correct temperature. Since culinary managers often struggle with staff turnover, AR can improve training programs by visualizing food preparation or cooking techniques as part of the onboarding process for new hires or as a quality control mechanism for food plate presentations.

4. Discussion

4.1 Adopting AI to current operations

The adoption of AI driven service robots by both hospitality companies and customers raises many questions regarding how organizations will adapt to this new technology. Due to the enormity of data collected and consumer behavioral information, the hospitality industry faces future challenges surrounding: (1) the adoption of AI driven automation, (2) AI applied to software programs or machines, and (3) human capital workplace disruptions.

Key stakeholder groups included in automation adaption in the hospitality sector in table 2. include: (1) hotel owners, (2) chains-brands, (3) asset management companies, (4) operations managers, and (5) front-line service employees. The degree in which key adoption decisions are made may be determined by the primary or secondary role of each stakeholder group. Depending on the approval protocols certain stakeholder groups may have more autonomy in disrupting the workforce with advanced technology than others.

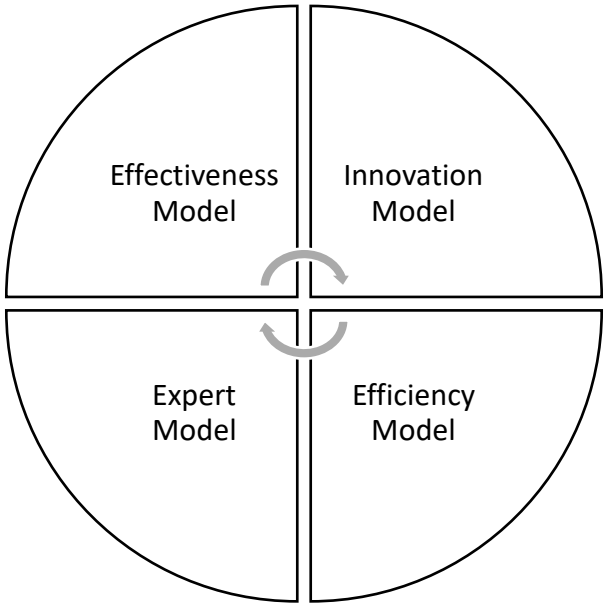
Table 2. Key hotel stakeholder groups

Key hospitality Stakeholder groups	Primary decision maker	Secondary decision maker
Owner/Investor	○	
Franchise Chain i.e. Marriott	○	
Management Company	○	○
Hotel GM	○	○
Hotel Rooms Division Mgr.		○
Hotel Director Housekeeping		○
3rd party Services		○
Unions		○
Service Employees		○

For instance, stakeholder groups exhibited in table 2 may have dissimilar interests. For instance, owners are ultimately interested in return on investment and are less likely to intervene in front- line service blueprinting, however, if those investments require significant capital, investors may become the primary decision makers or have significant influence over those decisions.

While there are not many studies specifically devoted to the impact robots will have on the number of jobs in the hospitality industry, it is highly likely AI will significantly alter the nature of work by automating some jobs out of existence and generating other new jobs in a way that that makes them more effective and/or efficient. Robots are being used to perform a variety of tasks in both FOH/BOH operations. Key value propositions that address many stakeholder groups in hotels and restaurants are improvements in productivity, profits, and customer service experiences.
More sophisticated implementation models capable of easing the uncertainty to AI driven technology framework as a means to determine the various types of work that can be automated may be useful for implementation purposes. Effective technology adoption frameworks include a focus on two main factors; (1) work complexity and (2) data complexity. The Bataller and Harris, (2016) framework analysis posits four primary types of activity models:

Figure 3. Artificial intelligence implementation models



In the lower quadrant of figure 3, efficiency technological value describes the most routine activities in the daily work load that have well defined rules, procedures and outlined criteria. The primary goal of which is to deliver consistent low-cost performance. The technology solution itself can comprehend the necessary procedure or policy and acts accordingly.

Human interface is required to monitor accuracy and make decision as to the evolution of the changing business conditions. Over time, machine learning capabilities will increasingly improve such rules. The best example of the efficiency model can be seen in automated decision-making capabilities that can now be embedded into the normal flow of work: e.g., systems sense online data or conditions, apply codified knowledge or logic, and make decisions.

In the opposite lower quadrant of figure 3, the expert technology system value propositions are capable of searching large data files and making interpretations and recommendations based on the acquired system knowledge. A key difference and important distinction among these expert technology solutions is whether the system is functioning as a primarily autonomous system or whether it is providing input to human judgment. For instance, based on a person's travel preferences and activities, certain destinations may be recommended and over time updated to include a wider selection of destinations.

In the first upper quadrant of figure 3, effectiveness value is considered a companion to the improvement of workers and or organizations to produce. Their outcomes are highly dependent on harmonization and communication and of interconnected activities including but not limited to; (1) general administration, (2) sales and marketing with the technology interfaces acting as agents or personal assistants to the human capital resources. For instance, AI helps humans be better at what they do. Virtual agents, whether consumer or corporate, are excellent examples of
AI technology solutions within the effectiveness model using verbal and textual instructions to search data repositories and formulate answers back to the end users.

In the last quadrant depicted in figure 3, AI technology solutions are adopted to boost innovation and creative thinking of human capital resources. In this case, humans make key decisions to act upon while AI applications identify alternatives and optimize the best recommendations.

4.2 Disruptive nature of AI

Considering the potential positivistic social and economic impacts of AI to advance adoption rates of robotics and other technologies in the hotel and restaurant space, careful navigation with various stakeholder groups is imminent. For instance, job losses will be an obvious consequence as robots perform more tasks being currently performed by humans. This will present HR professionals with a number of unique challenges, including how to combine AI and human capital resources in ways that make their organizations more competitive while dealing with a substantial number of job losses and or workplace reorganizations.

Currently, BOH hotel operations where robots need not interact with hotel guests may be an easier disruption. The potential job losses and work shifts caused by automation will certainly cause angst and labor strife with respect to current hospitality workers. Potential ramifications are beginning to surface with the adoption of FOH voice-based technologies interfacing with guests at check-in and or in-room virtual assistants.
Consequently, unionized hospitality workers are increasingly securing contract concessions from major hotel brands. These concessions stipulate advance notification of potential technologies that may impact their jobs and allow for negotiated mitigation efforts.

4.3 Managerial Implications and Conclusion

This narrative literature review paper investigated the technological automations (robots, artificial intelligence and augmented reality) in the hospitality sector for the purpose of gaining the attention of operations managers, hotel chains and academics alike.
This paper is intended to guide hospitality practitioners into new lines of inquiry, and to facilitate the direction of academic research by determining what needs to be done by defining how technological advancement can best be approached. Guiding those through lines of inquiry can begin with; (1) facilitating the development of best practice guidelines, (2) strengthening advocacy capacity from internal stakeholder groups, and (3) enhancing professional development activities between technology pioneers, academics and industry first-adaptors.

Other key areas of disruption to the hotel and restaurant workplace include training programs. It will be necessary to design and implement new types of training for the jobs that are augmented by robots (e.g., housekeeper jobs that are augmented by vacuuming robots). This may require more time spent on training. However, some of the training might be performed by the very robots that augment the work performed by their human counterparts.

Higher-order tasks involving robots that augment jobs (e.g., perform some but not all of the job tasks) may enable the job holders to perform higher-order tasks, thereby making the jobs more satisfying. The new job design components will have to be developed in a cost-effective manner.
Productivity and profits will be a major value proposition for hotel and restaurant operators because robots do not get tired, do not get bored, don't need a break or a vacation, do not require benefits and do not require a salary. They can operate 24-hours-per-day, 7-days-per-week (with no overtime). On top of that, they are often

able to perform tasks faster than humans and with greater accuracy and consistency. In short, robots are more productive than humans, which reduces labor costs and increases profitability.
With respect to service improvements, robots should enable faster, better service. Consider, for example, how robot chefs and a squad of delivery robots could provide faster room service. Or, how robots that are equipped with facial recognition capabilities can learn and remember the wants and needs of repeat guests and provide those guests with personalized services. Or, how robots with vast memory banks will be able to do a better job of answering questions and offering suggestions.
Still, questions remain as to the adoption and efficacy of introducing robots and other advanced technologies into the traditional service driven enterprise. Customer acceptance issues may stand in the way of hotel guests accepting the expanded or extensive use of robots in hotels, particularly with regard to robots that involve human-robot interactions. More human-robot interactions have the potential to make a hotel feel colder and less welcoming because of the robots limited ability to express warmth, friendliness, and empathy. Another possible reason why guests may object to more robots is the social backlash resulting from the robot-driven loss of jobs in large swaths of society.

5. Limitations

This study as with any study has limitations to its generalizability to the hotel and restaurant industry. Given the narrative literature review paper format arguments can be made as to the interpretive nature of the results. Although not empirical in nature, an integrative literature review (ILRP) can be considered, in and of itself, a form of research that can stand alone (Yorks, 2008). Moreover, the articles reviewed are more independently causation related than correlated to one another. Meaning service system design, artificial intelligence and augmented reality are disparate subjects. In this case further research may be needed to better understand the relationship and application of these topics in the context of hotel and restaurant practice.

To move towards more tangible, evidence-based research to address the unanswered questions surrounding robots and technology adoption, future studies could further examine the impacts of robotics, artificial intelligence and augmented reality in the hotel and restaurant industry through empirical based research. Survey instrumentation designed to ascertain perceptions pertaining to adoption, job loss and customer perceptions among and between the various stakeholder groups identified in this paper would be recommended.

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