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**ROBOTS, ARTIFICIAL INTELLIGENCE AND SERVICE AUTOMATION IN
HOTELS**

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Abstract

Purpose

This paper presents a review of the current state and potential capabilities for application of robots, artificial intelligence and automated services (RAISA) in hotel companies.

Design/methodology/approach

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A two-step approach was applied in this study. First, the authors make a theoretical overview of the robots, artificial intelligence and service automation (RAISA) in hotels. Second, the authors make a detailed overview of various case studies from global hotel practice.

Findings

The application of RAISA in hotel companies is examined in connection with the impact that technology has on guest experience during each of the five stages of the guest cycle: pre-arrival, arrival, stay, departure, assessment. The role of RAISA in hotel management is not explicit.

Research implications

Its implications can be searched with respect to future research. It deals with topics such as how different generations (guests and employees) perceive RAISA in the hotel industry and what is the attitude of guests in different categories of hotels (luxury and economy) towards the use of RAISA. It also shows what is the attitude of different types of tourists (holiday, business, health, cultural, etc.) and what kinds of robots (androids or machines) are more appropriate for different types of hotel operations.

Practical implications

Its implications are related to the improvement of operations and operational management, marketing and sales, enhancement of customer experience and service innovation, training and management.

Originality/value

This research paper complements and expands research on the role of RAISA in the hotel industry and makes some projections about the use of technologies in the future.

Introduction

Hospitality is a century-old tradition activity, which has developed very dynamically since the beginning of the 21st century. At present stage, a number of quantitative and qualitative changes occur as a result of the aggregate influence of different socioeconomic factors. The trend that the hotel superstructure significantly exceeds the volume and the growth of tourism demand imposes as a dominant one (Dabeva & Lukanova, 2017). The formed overcapacity greatly exacerbates the competition in hospitality and leads to relatively high standards of basic services and products. Therefore, the efforts of the hotel organizations are less focused on what they offer (because in most cases the provided services and goods have similar characteristics for the same types and categories of hotels), and more on how they offer it (Lukanova, 2014). Modern tourists are orientated towards offers, for which they are sure, that the services in the destination, the experiences both outdoors and indoors and the hospitality of

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the local community are on high quality level, and are worth the price (Marinov, 2015). That is why in today's highly competitive environment, innovation can be defined as the most important component of the corporate strategy of a hotel company, because it gives direction to its evolution (German & Muralidharan, 2001). The application of new technologies such as robots, artificial intelligence and service automation (RAISA), leads to unprecedented changes in the way hotels cater to their guests. RAISA open in front of hotel companies big opportunities to improve operations, increase productivity and ensure a consistent level of quality (Ivanov, Webster & Berezina, 2017).

In the framework of this study, we focus on the application of RAISA in hotel services. These technologies are based on automation, which in a broader sense can be seen as a physical substitution of human labor. Today, automated technologies are widely used in both manufacturing and service industries. By service automation we mean the process of using machines to perform a certain sequence of operations when providing a particular service (Collier, 1983). From the service provider's perspective, service automation saves costs and improves operations and management (Kattara & El Said, 2014; Ivanov, Webster & Berezina, 2017). At the same time, service automation is the basis of self-service technologies through which part of the process of producing and delivering the service is transferred to the customer. Self-service technologies can be defined as service delivery method, which allow the customer to become a producer/coproducer of the service without the need for mediation of service staff (Beatson, Coote & Rudd, 2006; Beatson, Lee & Coote, 2007; Bitner, Brown & Meuter, 2000; Bitner, Ostrom & Meuter, 2002; Burke, 2002; Curran & Meuter, 2005; Salomann, Kolbe & Brenner, 2006; Girman, Keusch & Kmec, 2009). A modern example of such technologies are mobile applications, virtual reality, digital kiosks and others.

Artificial intelligence is associated with the ability of machines to understand and use human language and then continue to work on their own. Modern AI is applied in many spheres of public life for various purposes such as reasoning, knowledge, learning, communication, perception, planning, etc. (Hill, Ford & Farreras, 2015; Barra, 2013; Bollier, 2017). AI is an essential component of robotic technology.

In the specialized literature, robots are defined as "intelligent physical devices" (Chen & Hu, 2013, p. 161) with a certain degree of autonomy, mobility, and sensory capabilities that allow them to perform intended tasks (International Organization for Standardization, 2012; Murphy et al., 2017; Qureshi & Sajjad, 2017; Tan, Mohan, & Watanabe, 2016; Ruocco, 2013). In general, robots can be classified into two main types: industrial robots and service robots (International Organization for Standardization, 2012). Industrial robots can be fixed or mobile

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and perform a variety of industrial operations (Thrun, 2004; Colestock, 2005; Pires, 2007; Vaussard et al., 2014), including in the military (Szegedi, Koronváry, Békési, 2017). Service robots, as the name suggests, are designed to perform useful tasks, which are people-oriented, through physical and social interactions (Ivanov, Webster & Berezina, 2017). For its part, service robots are divided into personal – “for non-commercial use by individuals (domestic servant robot, automated wheelchair, personal mobility assist robot, and pet exercising robot) and professional - used for commercial purposes by companies (cleaning robot for public places, delivery robot in offices or hospitals, fire-fighting robot, rehabilitation robot and surgery robot in hospitals” (Ivanov, Webster & Berezina, 2017: 1503).

1. Guest experience, guest cycle and RAISA

Research in the field of hospitality and technology defines the improved guest experience as one of the main advantages of hotel technology applications (Brewer, Kim, Schrier, & Farrish, 2008; Law, Buhalis, & Cobanoglu, 2014; Bilgihan, Smith, Ricci, Bujisic, 2016). The management of customer experience focuses on operations and processes orientated to the needs of the individual customers. Its aim is to turn satisfied hotel customers into loyal ones and then from loyal customers to hotel advocates (Gentile, Spiller & Noci, 2007; Verhoef, Lemonb, Parasuraman, Roggeveen, Tsiros & Schlesinger, 2009; Botha & Rensburg, 2010; Klaus & Maklan, 2013). Although consumer experience has been discussed since the mid-1980s, in its present form the guest experience is conceptualized by Pine and Gilmore (1999) in their book “Experience Economy”. The authors present experiences as a new economic "supply", the next step after goods and services, which they call "development of economic value". Researchers' views on the content aspects of consumer experience vary. For example, Pine and Gilmore (1999) systematize customer experiences in four categories: entertainment, knowledge, aesthetics and escape (of reality), which combine differently according to the nature of the products. Schmitt (2003) deduces five elements:

- sensitivity which satisfies the need for aesthetics;
- feelings which are associated with perceptions of fun and pleasure;
- thinking which satisfies the desire to expand knowledge and learn new things;
- action which is associated with the lifestyle;
- interrelations which satisfy the necessity of affiliation to a certain social group or community.

It is obvious, that each of the content elements of the guest experience can be seriously influenced positively or negatively by the use of RAISA in hospitality.

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According to Meyer & Schwager (2007) customer experience includes all the aspects that a company is offering — advertising, packaging, product and service features, the quality of service, ease of use, and reliability. Therefore, the formation of guest experience is a complex process which is accomplished by any direct or indirect interaction of the customer with the hotel organization before, during and after his stay at the hotel (Figure 1).

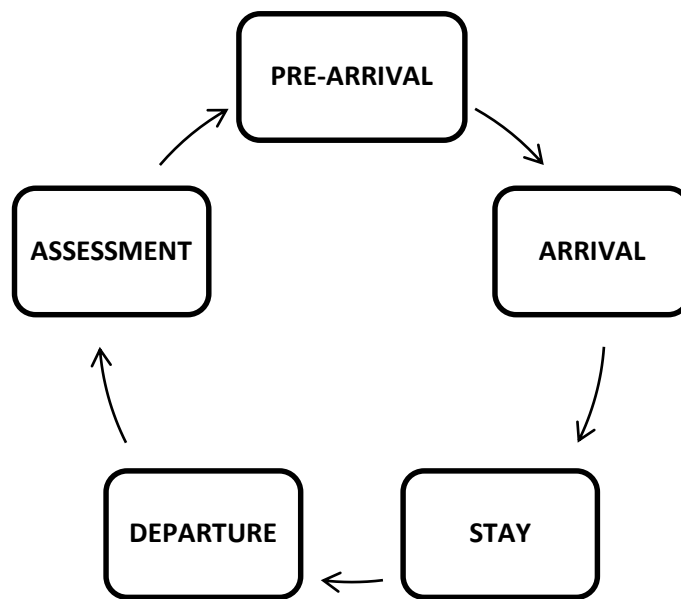


Fig. 1 Guest cycle

The term "guest cycle" was first introduced by Michael Kasavanna in 1978 (Jones, Paul, 1995). It structurally identifies the totality of all relations and interactions between the guest and the staff, related to the guest's stay at the hotel. The "Guest Cycle" model has four stages: "pre-arrival", "arrival", "stay", "departure". During each stage, different operations and procedures are performed in order to provide main and additional services to the guest. These operations form the technological process of tourist service in the hotel. For example, during the first stage - „pre-arrival” - two main operations are carried out: information and booking. The second stage includes welcoming the guest, registration and room assignment. The main focus of the third stage – “stay”, is to provide main and additional services and to meet the guests' expectations. The fourth and final stage includes checkout and settlement of the guest's account. Subsequently, the "Guest Cycle" model is further developed, adding a fifth stage – assessment. It is not directly related to hotel operations, since it takes place after the departure of the guest from the hotel. During this stage, the customer assesses all aspects of his stay. A higher degree of satisfaction leads to higher probability of re-visiting the hotel, or in other

words, the re-visiting of the hotel is strongly connected with the net result of the good guest experiences minus the bad ones. (Meyer, Schwager, 2007).

One of the first scenarios for automation of hotel services has been developed over 40 years ago (Borsenik, 1974; Lewis, 1982; Powers, 1984). The publications reflect both the possibilities of applying self-service technologies in the hotel industry and the attitude of hotel guests to their use (Connolly, 2005; Beldona & Cobanoglu, 2007; Lema, 2009; Kattara & El-Said, 2014). At a later stage, research focuses on the application of robotic systems in hospitality (Andrew, 1984; Graf & Weckesser, 1998; Weizer, 1991). Even in some of the first publications, researchers emphasize that for application of robotics system in the hospitality industry to be successful, acceptance, appropriate design of the work environment are required (Prokopenko, 1987), as well as acceptable system costs and new management skills. Over the last decade, researches have become more in-depth with regard to automation of services and the use of robots and artificial intelligence in the hospitality industry (Collins et al., 2017). Researches explore the possibilities of using robots for certain hotel operations. (López et al., 2013; Zalama, 2014; Kuo et al., 2016; Pinillos et al., 2016; Ivanov, Webster & Berezina, 2017; Murphy, Gretzel & Hofacker, 2017), the role of robots in innovating services in hospitality (Primawati, 2018), as well as for fully automated and robotized hotels (Northfield, 2015; Miljanić & Nikolić, 2016; Osawa et al., 2017). The focus of the discussions also includes the effects and consequences of the introduction of robots in the hospitality industry (Papathanassis, 2017; Tung & Law, 2017; Mishraa, Goyal, & Sharma, 2018), and cost-benefit analysis (Ivanov & Webster, 2018). The attitude of hotel guests to social robots in service is examined in greater detail (Pan et al., 2013; Pieska et al., 2013; Rodriguez-Lizundia et al., 2015; Ivanov, Webster, & Garenko, 2018; Ivanov, Webster & Seyyedi, 2018; Tussyadiah & Park, 2018), as well as the attitude of the hotel staff to RAISA in the hospitality (Osawa et al., 2017; Tanizaki, Shimmura & Fujii, 2017; Yu, 2018). Ethical issues related to the use of robots and humanoids in the provision of services are considered as well (Korstanje & Seraphin, 2018; Ozturkcan & Merdin, 2018).

Based on the literature review of the RAISA in Hospitality, we can summarize the possibilities for their practical use in the service delivery process in the hospitality. Table 1 presents some basic examples of RAISA application in hotel companies that define the scope of the research presented and are further elaborated in the text.

Table 1

Main examples of RAISA adoption in hotel companies

	Robots	Artificial intelligence	Service automation
Pre-arrival		AI search platform Chatbots	Virtual reality Mobile check-in
Arrival	Porter robots		Digital kiosks Smartphone Room Keys/Non-stop check-in
Stay	Front desk robots Concierge robots Delivery robots Vacuum cleaning robots Room assistant robots	Interactive Social Hubs Chatbots	In-room smart technologies
Departure	Porter robots	Travel assistant	Express Checkout Digital kiosks
Assessment		AI platform	

Source: own construction

2. Application of RAISA during the guest cycle

2.1. Application of RAISA at the Pre-arrival stage

In the Pre-Arrival stage, two main operations are carried out by the potential customer - gathering information and booking (Shostack, 1985; Armistead, 1989; Jones & Paul, 1995; Lukanova, 2017). The potential customer initially searches for information about the accommodation options in the destination that interests her/him. He examines different hotel types, compares services, amenities and prices. Based on the collected information, the customer selects a specific hotel and makes a reservation, i.e. makes a purchase. That is why at this point, it is of significant importance for the hotel to be as visible as possible for the potential customer. Mobile technologies, virtual reality and virtual assistants are modern examples of technologies used in hospitality that are powerful marketing tools for increasing customer loyalty, enhancing customer interactions and customer experience (Adukaite et al., 2013; Wang & Fesenmaier, 2013; Dickinson et al., 2014; Barragáns-Martínez & Costa-Montenegro, 2015; Howell & Hadwick, 2017).

Mobile technologies

Mobile accessibility (via smartphones and tablets) allows the potential customer to find the most suitable hotel among many in a particular destination. The customer may examine in advance not only the different types of rooms, but also the dining and SPA facilities, and other departments for auxiliary services in the hotel. In other words, mobile technologies are transforming the intangible hotel services into tangible.

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Pioneers in the creation and application of mobile applications are some of the largest international hotel companies such as Hilton (Hilton HHonors App), Marriott, Starwood Hotels & Resorts (Starwood Preferred Guest), AccorHotels Group etc. The mobile applications have unquestionable advantages for customers. The potential customer has the opportunity in a very short time to view a large number of hotels from the respective hotel company, no matter where these hotels are located. After choosing a specific hotel, the customer can make a reservation immediately. If the customer wants, she or he can view the layout of the hotel's rooms and choose a specific room. Furthermore, using the app, the potential guest can inform the hotel about her/his preferences for setting up the room. She/he can also order a variety of additional services such as food and beverages, extra pillows and so on, which will be available in his room upon arrival. Besides booking, mobile apps allow a number of operations to be made before the arrival of the guest at the hotel. For example, by using the application, a guest can check-in in advance and contact the service staff at any time. The guest has the opportunity to receive advance information about special offers, weather forecasts, sights and so on.

Since the implementation of its mobile app, Hilton conducted a number of studies covering more than 40 million members of Hilton HHonors. The results are unambiguous and clearly indicate that customers want to have greater choice and control. Nearly 90% of the guests of the hotel company express a positive attitude and like the possibility to choose the room in which they will be accommodated (Hilton, 2014).

New opportunities in the field of pre-arrival stage are provided by the largest European international chain AccorHotels Group. Since the spring of 2017 AccorHotels.com has introduced an innovative technology called MoodMatch. This is AI platform, which is entirely based on moods and experiences of the tourists. Based on an analysis of more than 100 million reviews of tourists and experts in the field of tourism, the AI platform systematizes 34 key features that are essential to potential customers when choosing a hotel. For each hotel worldwide, the platform defines a unique set of attributes, therefore it is known as Hotel DNA content platform. When the potential customer searches for a hotel through MoodMatch, he could choose between four categories, depending on his particular preferences: „In the mood for“, „Preferred style“, „Close to“ and „Anything else“. The search engine shows these hotels, which unique set of attributes most closely corresponds to the category selected by the customer (Accor Hotels, 2017).

In most cases, the cost of implementation and use of innovative technologies can be significant (Ivanov & Webster, 2017). That is why it is perfectly logical that such new technologies are primarily available for large hotel companies. Increasingly, however,

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considering the importance and role of the innovative technologies for the modern development of hotels, independent hotels are also starting to invest in them to improve their guests' experience. For example, hotel Schani Wien (Austria) allows its guests to choose a floor, a view, a size of the room and other features via a mobile application (Hotel Schani, 2017). It also allows guests to communicate directly with the hotel, get information about Vienna, weather forecast, unlock the room and with one click to order an airport transfer and check-in for the flight. Since May, 2015 Hotel Schani Wien has expanded its role as a pioneering hotel of the future and was the first hotel in the German-speaking region that accepted bitcoins as a payment method.

Virtual reality

Virtual reality (VR) is a new technology that creates a non-physical reality through information and communication systems (Gutiérrez, Vexo & Thalmann, 2008, Guttentag, 2010; McNeal & Newyear, 2013). Image design can be done not only on a monitor, but also through stereoscopic glasses. According to a study by "Eye for travel", 36% of Britons, 49% of Germans and 74% of Americans believe that virtual reality will be very helpful in planning a tourist trip (Howell, 2017). Best Western is the first big hotel chain, which sets a new standard for the way VR technology can be used to improve and facilitate the planning of tourist trips. The chain has a YouTube channel – BestwesternTV, where potential customers can see every room in the selected hotel, the lobby and all amenities long before they arrive at the hotel through VR technology (Best Western, 2016). Similarly the Spanish Cotton House hotel, part of the Marriott International's Autograph Collection Hotels creates a series of VR experience films (Hospitalitynet, 2017). VR enhances the customer experience by giving guests the opportunity not just to "look before they book" but fully to experience a property, room, suite or destination before making a booking.

Chatbots

Also known as virtual agents, instant messaging bots and artificial conversational entities, chatbots are computer programs that can respond to text or verbal commands and questions, providing advice in the place of a human staff member (Allison, 2012; Lasek & Jessa, 2013; Shum, He & Li, 2018). Artificial Intelligence (AI) is dramatically changing business, and chatbots, fueled by AI, are becoming an important customer service channel. Intelligent support bots can interact with the customers on every channel, from mobile websites to apps, and from desktops to social media. (Smith, 2017).

Since 2016, *Hilton* has taken steps to differentiate its strategy by adding artificial intelligence to its digital concierge services (Clancy, 2016). The idea is to convince more guests

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and travelers to use Hilton's online reservation options on its website, rather than using travel sites like Hotels.com. As the customer is browsing, there will be a chat box to assist him and help him according to his specific needs.

The main advantage of the support bots is that they can simultaneously handle thousands of bookings and inquiries. With customer service bot the hoteliers could be able to get in touch with the customer at a much earlier stage in the process - in the dreaming phase.

2.2. Application of RAISA at the Arrival stage

The second stage of Guest Cycle includes the procedures welcoming the guest, registration and room assignment. In the global hospitality, innovative technologies such as digital kiosks, mobile check-in and smartphone room keys increasingly have been applied to facilitate the guest upon his arrival and to save him time and waiting (Beatson, 2010; Kasavana, 2008)

Digital kiosks

Digital kiosks are a modern approach to efficient hotel service that can be a successful addition to each hotel's strategy (Makarem, Mudambi & Podoshen, 2009; Ostrowski, 2010; Lui & Piccoli, 2010; Shaw, 2014). By implementing digital kiosks, hotels provide guests the opportunity to register themselves, eliminating the waiting time at the reception. For check-in, the hotel guests could select between several languages (some of them will most likely not be spoken by reception staff). The self-service application shows the guest several room types according to his requirements and gives opportunity to upgrade. The guest reviews hotel check-in and stay policies, fills in the required information and confirms with fingerprint. Once the check-in procedures have been performed, the kiosk issues a guest keycard. The self-service application also gives the guest the opportunity to pay his bill by checkout. This way, digital kiosks provide full automation of check-in and checkout operations in hotel services.

Software companies such as IBM, NCR and Clock work together with some of the largest hotel chains like Hilton, Marriott, Sheraton, Hyatt and others that have hundreds of sites all over the world, where digital kiosks are installed. Hilton goes further by installing a digital kiosk even at the airport's baggage claim area. This way Hilton Hawaiian Village Beach Resort & Spa guests can check in also at the airport, long before they arrive at the hotel (Self-Service in Hotels and Motels, 2018 (Avery, 2008).

To optimize the use of hotel kiosks new features are added to self-service apps, which are not available at the reception. Such feature is airline web check-in. Self-service technology may include a software module with interactive maps through which guests can locate different sites near the hotel or get directions how to get to their room and other amenities at the hotel.

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Digital kiosks used in hospitality contribute to improving the guest experience by increasing customer choice and convenience, reducing waiting times and increasing guests control over the arrival and departure process. For hotels, the implementation of digital kiosks provides a potential opportunity to increase revenue through upselling and one-to-one marketing offers of additional services.

Mobile check-in

The mobile check-in/checkout is another unit in the evolution of innovative technologies in the hospitality (Kim, Park & Morrison, 2008; Wang & Wang, 2010; Chen, Hsu & Wu, 2012). Mobile and web check-in is implemented to enhance guest possibilities and the overall experience by reducing queuing times and allowing guests to interact with the hotel at a time and place convenient to them. Upon arrival at the hotel, the guest could quickly collect his key from a key dispenser at the reception and gain access to his room.

For the first time, mobile check-in application was implemented in 2008 from the hotel company Omni Hotels, an American based chain of 60 luxury hotels in the US, Canada and Mexico (Baker, 2014). Soon that example was quickly followed by some of the world's largest hotel chains like Marriott (Marriott Mobile Application for Marriott Rewards members), Hilton Worldwide (Hilton HHonors members), B&B Hotels, Choice Hotels, Scandic, Mövenpick, Park Inn, Radisson Blu, Louvre Hotels Group and others.

The mobile check-in allows hotel guests to finalize personally their registration procedure at a convenient time. In this sense, we can assert that the provision of self-check-in option to hotel guests contributes to their convenience, improves their arrival experience and increases the level of customer satisfaction. The application of mobile check-in frees employees from some routine operations and thereby provides them more time and opportunity to make a good first impression by focusing on „value-added face-to-face services that are more impressive than handing out a registration card and a key“ (Clock Software, 2016).

Smartphone Room Keys/Non-stop check-in (NSCI)

From the mentioned above, it becomes clear that digital kiosks and mobile check-in enable the guest registration process to be done virtually and waiting time at the reception to be avoided. However, this does not prevent the fact that the guests have to stop at the hotel reception to pick up a key. Present days there are several innovative technologies such as NFC (Near Field Communication), RFID (Radio-frequency identification), acoustic, Bluetooth, PIN-code (Personal Identification Number) and biometrics, whose applications in hotels enable the guest to go straight to the room without stopping (Pesonen & Horster, 2012; Gruen, 2014; Keymolen, 2018). Table 2 summarizes the characteristics of the listed NSCI technologies:

Table 2

Key Features of NSCI Technologies in Hospitality

NSCI technology	Functions	Disadvantages
› Smartphone with app	The guest registers with the appropriate app before arrival; and then at arrival uses the app to activate a signal (via Bluetooth or RFID) to unlock the hotel room door.	All members of the family (including the kids) need to have their own smartphone; the main registered guest must find a secure way to transfer the virtual key to other members of the family; this solution fails if the phone's battery is dead
› Traditional mobile phone	The hotel sends SMS to the guest before arrival; at arrival, the guest transmits an acoustic signal in front of the hotel room's door.	Expensive solution, because the hotel needs to send many SMSs, and if they are to international destinations they could be too expensive. Also the reliability of the cellular reception is outside the hotel's control; fails to work if the phone's battery is dead
› PIN code	The guest receives a PIN code prior arrival via SMS or email. When he gets to his hotel door, he types in the code and opens the door.	None essential.
› 2D Barcode	The hotel guest receives 2D barcode prior arrival; at arrival he scans the smartphone or the printout of the code at the door.	2D barcode scanners are relatively expensive and consume a lot of energy.
› Biometrics	Access to the hotel room is controlled by fingerprint scans or retina scanning devices	Expensive scanning devices.

Source: own construction

Keyless entry system is a brand new technology, first introduced in 2014 by the hotel company The Starwood Hotels & Resorts Worldwide through the mobile app Starwood Preferred Guest (Mangla, 2014). The mobile app enables full automation of check-in and checkout procedures as the guest automatically receives his hotel bill on his email.

Another leading hotel company in terms of application of Keyless entry system is Hilton Worldwide. Members of its loyalty program Hilton HHonors can benefit from the mobile-enabled room key technology not only to get access to their hotel rooms, but also to access other areas of each property that requires a room key, such as the fitness center, executive floors, elevators, parking facilities and so on.

Digital technologies are really setting new standards for hotel services. According to the American Hotel & Lodging Association, by 2016 65% of hotel owners in the US had introduced mobile check-in for their guests (American Hotel & Lodging Association, 2016). Using the self-service technology in terms of automated check-in, room selection, checkout, secure payment etc. eliminates much of the administrative work for the service staff and thus gives

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more opportunity for human interactions, increases the accuracy of routine operations, reduces costs and improves the guest experience altogether. The digitalization of hotels also includes the development of analytical and security systems and extensive digital marketing. Modern tourists are well-versed in all digital things, they try to remain connected to the Internet, use their mobile devices and keep easy access to information (Filipova, Kadieva, 2017). As a result, digital has become the “channel-of-choice” for communication between hotels and their clients.

2.3. Application of RAISA during the Occupancy stage

In the occupancy stage guests are offered a variety of services and various operations are carried out which provide a wide range for implementation and application of RAISA. High-speed internet, smart TV, digital entertainment devices are now considered as regular services and are not enough to create a unique and memorable experience (Bartelds, 2014; Margarido, 2015). Therefore hospitality companies that aim to improve the user experience do not stop developing RAISA at all levels of operational performance - both in front office operations that are visible to the customer and are with or without his participation and in back office operations, which take place outside the customer's eyes.

Interactive Social Hubs

The user experience can be greatly influenced by social media (Chan & Denizci Guillet, 2011; Lee & Wicks, 2010; Noone, McGuire, & Rohlf, 2011; Xiang & Gretzel, 2010; Leung, Law, Van Hoof & Buhalis, 2013). Realizing the role of the user-generated content, more and more hotel organizations are starting to convert their hotel public areas into social hubs. A social hub is a digital property of the hotel organization that collects what the hotel or its guests post on various social networks and displays it together. The social hub may or may not contain user-generated content. Social hubs enable hotel organizations to unite the tremendous amount of information in a more synthesized presentation that can be displayed on any marketing channel (Chiba, 2013).

Social hubs find application in hospitality in different forms: digital screen in the hotel lobby or in the hotel room, social wall of the hotel site, mobile application for hotel customers. In 2013, Marriott introduced the use of a social hub, which is a combination of a mobile application, a digital screen incorporated in the hotel lobby and a LED table that interacts with people sitting on it. Social application Six Degrees aims to connect like-minded people who have similar professional or personal interests and are also staying at the same Marriott hotel. To use it a guest has just to download the app and syncs it with his or her LinkedIn network. The information is also available to the hotel's management team, which, based on the specific combination of guests at the moment, can organize various events, such as wine tasting. The

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digital screen in the lobby can display photos, events and successful meetings between people. The interactive LED table has an interesting function. When a guest puts his/her phone on it, LED lights glow to indicate if the guest has something in common with the others seated at the table. Other hotel companies such as Hyatt and Caesar's Palace have also followed this modern approach by setting up digital lobby space in some of their hotels.

Besides contributing to the increase of customer satisfaction by providing new experiences for guests, social hubs/walls can also bring benefits to the hotel organization in several other aspects (Noone, McGuire, & Rohlf, 2011; Wiste & Li, 2016; Hudson & Hudson, 2017):

- free advertising, and eventually attracting new customers by promoting guest experience images, made by hotel guests themselves and uploaded to various social media. Often, hotels encourage guests to be active in uploading pictures from their stay at the hotel, by providing the best of them some prize (for example complimentary night);

- hotel companies can offer social walls to hosts of events as an additional service during conferences, corporate meetings, parties, weddings and other official or private events. The benefit of the hotel consists of generating direct revenue from the additional service;

- hotel companies can sell advertising space on their social wall where they display sponsored content and promote events from the local community - local entertainment, dining, cultural and sports events, etc.;

- hotel companies can take advantage of social hubs/walls and incorporate them into their own site. Summarizing positive social publications about hotel product elements by using authentic user-generated content could increase sales and attract new hotel customers.

In-room smart technologies

In their effort to provide personalized customer experience, more and more hotels are experimenting in this direction (DeMicco & Cobanoglu, 2009; Bilgihan, Cobanoglu, Cihan & Miller, 2010; Brochado, Rita & Margarido, 2016). Some hotel companies such as The Peninsula Hotels, use for this purpose in-room tablet technology (USA Today, 2016). Through the tablet, guests can control room temperature, lighting, set a wake-up alarm, turn on the TV, pull the curtains, make a room service order, request spa services, and so on. The main problem with this technology is that the hardware is expensive and requires constant updating (Wroten, 2017).

Another innovative solution tested by hotel companies is voice-control technology, through which guests can order room service, request a housekeeping visit, or adjust room controls (thermostat, blinds, lights, etc.). Devices with voice activation are still in the initial stage of implementation in the hospitality. For example, Marriott International plans to

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introduce Alexa for Hospitality, developed by Amazon in some hotels such as Marriott Hotels, Westin Hotels & Resorts, St. Regis Hotels & Resorts, Aloft Hotels, and Autograph Collection Hotels (Welch, 2018).

One of the most cited in the specialized literature example is the joint project of the hotel company Accor and the software company Microsoft, called Room 3120 in Novotel Paris Vaugirard Montparnasse (Hotelmarketing, 2011; Hospitalitynet, 2011; Margarido, 2015). The project, implemented in 2011, is an innovative concept for the hotel room based entirely on innovative technology solutions like decompression chamber, Xbox 360 console, multimedia digital table and interactive mirror. The technologies provide the guest with access to a variety of digital entertainment such as music, HD movies, games and information. They work with gestures and voice control, creating a unique guest experience.

Hotel companies like Marriott Hotels, Aloft Hotels and Four Seasons have designed a new generation of smart rooms. They not only provide an opportunity for guests to control temperature, lighting and other devices, but by combining innovative technology with artificial intelligence they can help hotel management learn about the individual preferences of the guests and offer them personalized offers. In addition to increasing guest experience by providing exceptional service, smart rooms also increase revenue and operational efficiency. For example, as a result of these activities, the Four Seasons Hotel Los Angeles at Beverly Hills indicates a 41% increase in room service revenue per occupied room (Eftekari, 2014). However, this technology also causes problems. For example, such a system is more susceptible to hacker attacks, which would lead to increased security costs.

Chatbots

In addition to the pre-arrival stage, chatbot technology such as chatbot concierge, virtual concierge, Bebot, Eva etc is also applicable during the stay of the guest at the hotel. It is extremely suitable for guests who like automated communication, want quick access to information, and do not want to waste time by contacting an employee and waiting for his answer. For the hotel industry, chatbots are still a relatively new technology and is mostly applied by major hotel companies like Novotel, Marriott, Holiday Inn and Hyatt. Independent and smaller hotels are still working with human-maintained instant messaging systems, which for them are a financially more affordable alternative.

The application of chatbots can be done through various customer service channels - on a touchscreen placed in the hotel lobby, as a mobile app or on a tablet that guests receive at their arrival. Guests can request the same services and amenities a human concierge would offer. Through chatbot technology guests can discover information related to the brand, the

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hotel and the attractions and restaurants near the hotel, the weather forecast, the flight schedule, and so on. The combination with AI, allows chatbot to recognize guests' messaging style and to best suit their needs and personal preferences.

One of the most significant advantages of the chatbot is that it helps to enhance guest experience when corresponding with the hotel. The chatbot is available 24/7 and as a multilingual application can serve guests from different nationalities. At the same time, this contributes to reducing the staff workload. As the guest communicates with chatbot throughout his stay at the hotel, this could help the hotel to collect and study his behavioral trends and thus to refine its services and offerings. This in turn would help to build brand loyalty (Dickinson, 2017).

At the same time, chatbots have some disadvantages, which may be due to the initial stage of their use in the hospitality industry (Dickinson, 2017). Chatbots cannot always meet the expectations of guests. . Often an automated response to a more complicated request can lead to a negative effect. Complexity of language can also be a barrier to the use of chatbots, as in human language words have different meanings depending on the situation, the context or the intonation. It is necessary that guests take into consideration that they have to make simple and precise requests in order to gain maximum benefit from chatbots. Last but not least, the cost of building chatbots needs to be taken into account. It is considered that the cost can vary between \$30,000 and \$150,000 (Dickinson, 2017), which explains the implementation of conversational bots mostly by major international hotel companies.

Robots

As recent publications show, robots can find applications in different departments of the hotel, both in the front office and in the back office (Ivanov, Webster, Berezina, 2017; Murison, 2016; Pullen, 2017; López, Pérez, Zalama and Gómez-García-Bermejo, 2013). In the specialized literature, robots are defined as “intelligent physical devices” (Chen & Hu, 2013, p. 161). According to the International Organization for Standardization, robots are actuated programmable mechanisms with a degree of autonomy that is determined by their ability to perform intended tasks without human intervention (International Organization for Standardization, 2012). Having in mind the classification of Murphy, Hofacker and Gretzel (2017), according to which the robots are divided into three categories - industrial robots, professional service robots and personal service robots, we can assert that all three types could find application in hospitality. For example, industrial robots and professional service robots can be applied to back office operations such as preparing food in the hotel restaurant or

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cleaning rooms, while personal service robots are more likely to be used in front office operations such as concierge services, room service and entertainment.

One of the most cited examples in the specialized literature is the Japanese Henn-na Hotel. The hotel is part of Huis Ten Bosch theme park in Sasebo, Nagasaki. It opened in 2015 and is the first in the world, whose service staff is made up of robots (Rajesh, 2015). Work positions performed by robots include front desk agents, concierge, porters, in-room assistants, vacuum cleaners, and a robotic arm operating the luggage storage room. The doors of the hotel rooms are opened using face recognition software.

In recent years, many hotel companies have started using robots, mostly for concierge and room service, room cleaning and entertainment. The technology company Savioke is a pioneer in developing autonomous indoor service robots for hospitality. Its butler robots are designed to be able to deliver various items ordered by guests to their hotel rooms (Martin, 2016; Savioke, 2017). The manufactured name of the robot is Relay, but each hotel company gives him a different name. For example, for Residence Inn it is Wally, for Crowne Plaza (Intercontinental) it is Dash, for Aloft (Starwood) it is Botlr. Hotel Jen is the first international hotel brand in Asia that uses autonomous Relay robots. Named Jeno and Jena, the Relay robots can be seen in its two properties in Singapore. M Social Hotel in Singapore has the first guest-facing butler robot, named AURA (Joseph, 2017). In order to accomplish its functions, the butler robot has a closed compartment where the items ordered by the guest are placed - most often foods and beverages, toothpaste, towels, etc. The number of the room for delivery is dialed on a small display at the top of the robot. The robot navigates around the property using Wi-Fi, 3-D cameras and sensors. The robot charges its batteries at the reception desk when not in use. In addition to deliveries to guest rooms, butler robots can be used to charge household supplies, serve coffee and other drinks at organized events and business meetings (Ward, 2016).

Concierge is another department in the hotel industry where robots are starting to be used. Hilton Worldwide works with Connie – a concierge robot powered by Watson artificial intelligence from IBM, Marriott in Belgium has a concierge robot, named Mario (Chestler, 2016; Friedlander, 2016), Mandarin Oriental Hotel in Las Vegas has Pepper, Japanese hotels use Toshiba's ChiHiraKanae (Logan, 2016). Concierge robots help guests to check-in, provide information about hotel services, local attractions, dining facilities, weather forecasts, and more (Tussyadiah, Park, 2018). The artificially intelligent concierge robots learn and extend their knowledge with every interaction with guests. which helps them provide more complete and more accurate information.

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Besides performing operations such as delivery of items and giving various information, butler robots and concierge robots perform one additional feature – they themselves serve as an attraction. Often guests order small items, not because they really need them, but just to take a selfie with the butler robot. Other concierge robots, like Pepper, can dance, talk, tell stories and pose for a photo. An important function that hotel robots can perform is data collection. In the process of interacting with guests, robots can collect a variety of information about guest preferences, satisfaction, purchase patterns and other behaviors. This would help hoteliers to gather valuable information and use it to design an extremely personalized service and thus increase the number of their loyal customers.

Proof that the use of robots is becoming more and more popular is the new San Gabriel Hotel, from the hotel chain Sheraton in Los Angeles that will open in 2018. While most hotels have only one or two robots, this hotel will have eight robots, developed by Aethon, a provider of autonomous mobile robots (Aethon, 2017). One of them, serving as a bellboy robot, will take guests to destinations on the first floor, the remaining seven robots will perform butler operations. These examples show that more and more hotel companies are starting to use robots not only in back office operations, but also in front office operations to reduce operating costs, increase productivity and enhance customer experience.

2.4. Application of RAISA during the Departure stage

The operations that take place during the Departure stage are related to the payment of the guest's bill, the vacancy of the room and checkout. At this stage, service automation helps hotel guests save time and effort, thereby reinforcing their positive impressions of the hotel and enhancing their customer experience (Kim & Qu, 2014; Berezina, 2015; Hertzfeld, 2016; Schaap, 2017).

Travel assistant

Often departure stage operations can be quite stressful for guests, especially if they are in a hurry for a flight or are worried about traffic. Travel assistants such as Google Home can significantly facilitate the guests at their checkout. They can check the status of flights, set an alarm, order help for the luggage, have someone bring their car in front of the hotel, call an Uber driver, and receive real-time traffic data. Besides helping the leaving guests to reach a destination on time with minimum hassle, travel assistants provide customers good experience when checking-out and help them to remain with positive impressions.

Express Checkout

More and more hotel companies offer their guests the opportunity to use a mobile application through which they can checkout and skip waiting at reception. Usually for this

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purpose, the guests could use the same mobile app with which they check-in. Once the guest leaves the hotel, the hotel finalizes the guest's bill and sends it to her/his email. As an examples could be mentioned the names of major hotel companies like Marriott (Marriott Mobile Application for Marriott Rewards members), Hilton Worldwide (Hilton HHonors members) and so on.

Digital kiosks

The other options are the self-service kiosks, used for check-in that can also serve as self-service terminals that allow guests to checkout promptly. The kiosks are located in the hotel lobby and are available at any time. At a convenient for them time, guests can check out by entering their room number and credit card on the digital screen. Thus, guests receive access to their folios, can review them and settle their accounts.

2.5. Application of RAISA during the Assessment stage

The Assessment stage takes place after the guest leaves the hotel. During this stage, the guests have the opportunity to share their opinion about their experience in the hotel (Barreda, & Bilgihan, 2013). Thanks to the new technologies today, guests are able to share information and give feedback through numerous channels (Neuhofer, & Buhalis, 2012). However, this is also the stage in which the hotel has the ability to understand the preferences and opinions of its guests, to take advantage of the gathered information and to use it to turn these guests into its loyal customers (Berezina, 2015). Artificial intelligence offers great opportunities in the field of data analysis. AI platforms could track numerous guest reviews from different channels - bookings, transactions, satisfaction surveys, third parties and so on. Hotel companies could use this information to enhance guest experience in all stages of the guest cycle by providing personalized services, communications and promotional offers. As an example in this respect can be mentioned the AI Metis platform, used by the luxury hotel portfolio Dorchester Collection, which handles thousands of customer reviews in different languages and systematizes their wishes and preferences as well as the strengths of the hotel company by comparing the results with those of its competitors (Hosea, 2016). As

3. Conclusions

This chapter examines the possibilities for applying RAISA to hotel companies in terms of the impact that technologies have on guest experience during each of the five stages of the guest cycle: pre-arrival, arrival, stay, departure, assessment. As the review of the literature and the various case studies from global hospitality practice show, the subject is highly controversial and the opinions of experts and researchers are not unambiguous. The application of RAISA in the hotel industry has both advantages and disadvantages and depends on many factors.

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First, it is necessary to take into account how tourists perceive the application of RAISA in sectors with high human interaction, such as hospitality. At this stage of development of the hotel industry, RAISA still has a relatively low, sporadic application and the hotel guests perceive it more as an attraction. However, maybe the guests would have a completely different attitude, if they are constantly served by robots and communicate with electronic devices during their stay at the hotel. In 2016, the Travelzoo media company conducted the first global survey among more than 6,200 travelers in Brazil, Canada, China, France, Germany, Japan, Spain, the United Kingdom and the United States, exploring consumer acceptance of robots in the travel and tourism industry. The results show that more than half of respondents believe that robots will improve hotel service but at the same time more than half of them would accept robots at the hotel reception only if they are combined with human staff (Singer, 2016). Another factor to consider is the value of investments in RAISA. According to a recent study by Ivanov & Webster (2017), costs may vary considerably, both in financial and non-financial terms and managers should carefully evaluate and compare them with benefits before deciding to invest.

An important fact that needs to be considered is how employees react to new technologies. The introduction of RAISA will require a number of changes in planning, organization, and control of operational activities. It is completely normal that employees are afraid of these changes and consider RAISA as a threat to their jobs (Ivanov & Webster 2017; Murphy, Hofacker, and Gretzel, 2017; Freifer, 2017). In many departments in the hotel industry, automation of operations and application of artificial intelligence will replace human employees. On the other hand, research shows that some hotels that already use butler robots have hired additional staff due to increased occupancy (Hospitalitytech, 2017).

Practical implications

There are several implications in terms of improving customer experience by using RAISA in hotels before, during and after the stay of the guest. AI search platforms and virtual reality stimulate the purchase by making the hotel as visible as possible to potential customers. Virtual reality can be used to "test" the service, which is otherwise not possible (Dabeva, 2000; Lukanova, 2017). The application of AI to consumer research has unlimited opportunities and at the same time is cost effective (Li, 2007; Wierenga, 2010). This allows hotel companies to design customized products and services by offering their customers services that best meet their requirements and expectations. Self-service technologies save the guests time and give them the opportunity to consume the service when it is comfortable for them. This helps to increase the efficiency and effectiveness of operations and services (Lukanova, 2017; Tussyadiah & Park, 2018; Ivanov & Webster, 2018).

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Innovative technologies such as interactive social hubs, chatbots, in-room smart technologies and robots that can be applied during the stay create a unique customer experience by providing the guests opportunity to receive a variety of useful information and entertainment, saving them time and being at their disposal 24/7. Furthermore, the application of AI in the service process allows the elimination of the language barrier, which facilitates the service. For hotel guests, innovative technology solutions are not only useful but also entertaining. Often, guests can use a service that includes a robot only because they are interested in seeing how it works (Ivanov & Webster, 2018). For the hotel company, innovative technologies are a source of advertising, growth in sales, and cost savings.

Pedagogical implications

Nowadays, the development of theory and practice in the field of new technologies and their application in tourism and hospitality is extremely dynamic. This claim is confirmed both by the described practical examples and by the survey of the researches in this field that have greatly increased in number and scope over the last five years. This objectively requires the necessity for specialized modules for hotel technology to be included in the curricula of undergraduate and graduate programmes in tourism and hospitality. tourism specialties at colleges and universities

Research implications

The academic research on the application of RAISA in hotels is still rather limited which provides various opportunities for future research, such as how different generations (guests and employees) perceive RAISA in the hotel industry and what is the attitude of guests in different categories of hotels (luxury and economy) towards the use of RAISA. It also helps to reveal the attitude of different types of tourists (holiday, business, health, cultural, etc.) and what kinds of robots (androids or machines) are more appropriate for different types of hotel operations.

In closing, the development of innovative technologies is an inconvertible process. With regard to future development we consider that their implementation in the hospitality industry will continue and will find its place in all stages of the guest cycle, as long as it does not contradict morality and law. Service robots that work in housekeeping provide guests and staff with a variety of information and recommendations, deliver to the guests various items, entertain children and adults, would be found at the hotels more and more often. In some departments of the hotel such as housekeeping, maintenance and security, extensive use of robots and artificial intelligence can lead to a significant increase in productivity, efficiency and reduce operational costs. In other departments, such as front desk, where contact with guests is

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intensive, robots and artificial intelligence will be combined with human staff to enhance customer satisfaction and guest experience.

We also believe that the different technologies will enter the hospitality industry at different rates based on whether they are really necessary and not how attractive they are. Perhaps in the hotel industry mobile technologies, virtual reality, artificial intelligence, voice enabled technologies and 3-D printing will be applied more intensively. At this stage of development, robots in hospitality are perceived by customers and employees as an attraction rather than as a necessity, so they may have a slower application.

Innovative technologies add value and personalize the stay, but overtaking them can destroy the human relationships that guests are looking for and appreciate (Kazandzhieva, 2016). Ultimately, the human touch can never be replaced by RAISA and this is very important in order for the hospitality sector to remain “hospitable”.

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