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Svetovanje in izobraževanje, dr. Andrej Raspor, s. p.
Dolga Poljana 57
5271 Vipava
Slovenija

Glavni kontakt

E-pošta: zalozba.perfectus@gmail.com

Glavni urednik

Darko Lacmanović, Črna gora

Odgovorna urednika

Bojan Macuh
Pedja Ašanin Gole

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RAZLIČNI NAČINI UPORABE IKT V HOTELSKI INDUSTRIJI

Sonja Seferović  <https://orcid.org/0000-0002-6034-2104>¹

Nikola Vukčević  <https://orcid.org/0000-0002-5971-5129>²

Povzetek: Razvoj informacijskih in komunikacijskih tehnologij je pripeljal do prave revolucije v razvoju in načinu poslovanja v turizmu in hotelirstvu. Uporaba IKT je omogočila uvedbo različnih tehnoloških sistemov, kot so centralni rezervacijski sistemi in globalni distribucijski sistemi, kar je omogočilo učinkovitejše poslovanje, neposredno interakcijo med turističnimi organizacijami, hoteli in strankami, hkrati pa znižalo stroške in povečalo produktivnost. V hotelski industriji se znatna vlaganja v IKT rešitve uporabljajo pri oblikovanju storitev in izdelkov ter izboljšanju celotnega poslovanja sodobnih hotelskih sistemov. Z naraščajočimi trendi uporabe IKT na vseh področjih poslovanja postaja IKT pomemben vir trajnostne konkurenčne prednosti ter strateško orožje, na katerega se v svetu močne konkurence na trgu zanašajo hotelska podjetja. V okviru raziskave je bila osrednja tema identifikacija različnih IKT rešitev v hotelski praksi, v smislu iskanja optimalne kombinacije za oblikovanje najboljše možne IKT strategije, zaradi boljšega tržnega položaja in poslovnih rezultatov. Prizadevali smo si prispevati k boljšemu razumevanju različnih kombinacij uporabe sodobnih IKT rešitev za povečanje znanja na tem področju. Predmet raziskovanja je informacijska in komunikacijska tehnologija ter njena uporaba v hotelirstvu. Raziskane so sodobne IKT rešitve, ki se uporabljajo v hotelih v poslovnem kontekstu, torej možnosti in načini njihove uporabe v vsakdanjem delu. Glavni cilj teoretične raziskave je bil identificirati različne IKT rešitve, ki so našle svojo uporabo v hotelirstvu, ter njihove možne kombinacije v zvezi s strateškimi vprašanji upravljanja sodobnih kompleksnih hotelskih sistemov. Ta raziskava ima pomemben prispevek v akademski sferi, saj zapolnjuje vrzel v delu teoretičnega raziskovanja o uporabi različnih IKT rešitev v sodobni hotelski praksi.

Ključne besede: hotelska industrija, IKT rešitve, hotelski sistemi, konkurenčna prednost, hotelska praksa.

DIFFERENT WAYS OF ICT APPLICATION IN THE HOTEL INDUSTRY

Expanded abstract: The development of Information and Communication Technologies has led to a real revolution in the development and way of doing business in the tourism and hotel industry. The application of ICT has enabled the introduction of various technological systems such as central reservation systems and global distribution systems, which has enabled more efficient and effective business, direct interaction between tourism organizations, hotels and customers, while reducing costs and increasing productivity. In the hotel industry, significant investments in ICT solutions are used in the design of services and products as well as to improve the overall business of modern hotel systems. With growing trends in the use of ICT in all areas of business, ICT is gaining importance and is becoming a major source of sustainable competitive advantage and a strategic weapon on which hotel businesses rely in a world of strong market competition.

Purpose: Within the research, the main issue was the identification of different ICT solutions in hotel practice, in terms of finding the optimal combination to formulate the highest quality ICT strategy, due to better market position and business results.

Design/Methodology/Approach: The subject of research is information and communication technology and its application in the hotel industry. Modern ICT solutions used in hotels in a business context have been researched, i.e., the possibilities and ways of their application in everyday work.

Findings/Results and Conclusions: Efforts were made to contribute to a better understanding of different combinations of application of modern ICT solutions in order to increase knowledge in this field.

Research limitations/Implications: The results of this theoretical research could be applied to other large hotel companies in Montenegro and the region in terms of strategic planning of ICT solutions. In addition, future research could be empirical in nature and focused on analyzing the possible link between the application of ICT solutions and hotel performance. This could provide a better insight into the business practice of hotel associations in Montenegro and the region.

Practical and/or social implications: The main goal of the theoretical research was to identify various ICT solutions that have found their application in the hotel industry, as well as their possible combinations in relation to strategic issues of management of modern complex hotel systems.

Originality/Value: This research has a significant contribution in the academic sphere, filling the gap in the part of theoretical research on the application of various ICT solutions in modern hotel practice.

Keywords: hotel industry, ICT solutions, hotel systems, competitive advantage, hotel practice.

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¹ Msc, Faculty for Mediterranean business studies Tivat, Luke Tomanovića br.1, 85320 Tivat, Montenegro, sonja.perovic.dls@gmail.com

² Assist. Prof., Faculty for Mediterranean business studies Tivat, Luke Tomanovića br.1, 85320 Tivat, Montenegro, nikolafms@gmail.com

Application of ICT solutions in the hotel industry

In the hospitality industry, technology is considered important for sustainable competitive advantage and strategic weapons (Bethapudi, 2013). As already pointed out, various studies have found that the hotel industry has always had a need to apply and implement ICT in conducting various business activities (Paryani, Masoudi, Cudney, 2010; Chevers, 2015). The reason for the application and implementation of ICT tools and applications in the hotel industry is that they need a wide range of information that basically encouraged them to apply technology, as well as the widespread use of tools and applications, the development of online presence among many companies. Most authors and researchers suggest that the Internet is an ideal way to sell hotel services and products (Connolly, Olsen & Moore, 1998; O'Connor, 2003; Christou, 2011). The basic services provided by hotels can be used to categorize ICT systems (Sigala, 2003). Hotel information system is the most typical ICT solution in hotel facilities. HIS can be divided into four main categories as follows: front-office ICT systems, back-office ICT systems, room-sharing ICT systems, and room-based ICT systems (Ham, Kim, Jeong, 2005).

Some of the most important applications of modern ICT solutions in hotels are: Electronic Data Processing (EDP), Asset Management System (PMS), Central Reservation System (CRS), Global Distribution System (GDS), Revenue Management (YM). In order to understand how ICT can influence business processes and communication related to strategic issues in the hotel industry, this research focuses on various ICT solutions that have found their application in the hotel industry, i.e., on the possibilities of hotel companies and the way they perceive conceptualization of technology. Some authors view technology in isolation, as part of one enterprise function, or focus on the technology itself rather than how it fits into the overall business system (Namasivayam, Enz, Siguaw, 2000). Some authors who have analyzed the impact of ICT in hotels consider only broader business issues and how ICT affects them (Sigala, Lockwood, Jones, 2001; Luck, Lancaster, 2003) while others examine staff roles and the social context of technology (Brotherton, Turner, 2001). Usually, the problems that may arise when applying different ICT solutions are seen through the prism of training and not as a possible symptom of the underlying conflict between ICT and what is being achieved. It seems that it is not accepted that the application of ICT is wrong or that they are poorly implemented or integrated, but it seems to be a common opinion that people should change their fields of action in order to respond to the demands of technology. Certain research, as a solution to this problem, suggests adapting technology to companies by additional training of staff. On the other hand, where technology responds well to the task, lack of knowledge will mean that technology is not used well (Lam, Cho, Qu, 2007).

Historically, the first steps in the application and implementation of ICT applications were taken by airlines that used the "computer reservation system" (CRS) in the 1950s. However, the use of ICT in hospitality began only in the late 1970s (Collins, Cobanoglu, 2003). In the 1980s, hotels began to use global distribution systems (GDS), hotel asset management systems (PMS) and hotel central reservation systems (CRS) to improve interoperability and interconnectivity. Since then, the study of the impact of different ICT solutions on the hotel industry has increased exponentially. Certain authors emphasize that the ICT revolution has led to unprecedented developments in the hotel and hospitality industry (Ip, Leung, Law, 2011). By synthesizing the column literature, it can be concluded that there are different relationships between ICT and effects (Mihalič, Praničević, Arnerić, 2015). There is an opinion that different ICT systems are significant resources of competitive advantage (Karadag, Dumanoglu, 2009). Most proponents of this view believe that the impact of ICT systems on competitiveness can be direct and indirect (indirect) and recognize investing in ICT as the ability to reduce costs and increase productivity. In contrast, some researchers argue that ICT investments do not have a significant impact on the value or effect of an enterprise and its competitive advantage, generally supporting ICT paradox theory (Brynjolfsson, 1993; Van Riel, Zhang, McGinnis, Nejad, Bujisic & Phillips, 2019). Third, a rather older opinion believes that ICT negatively affects business performance by suggesting that in the period after the implementation of ICT companies regularly experience a decline in competition either in market share or profit (Kettinger, Grover, Guha, Segars, 1994).

Nevertheless, most research emphasizes the exceptional importance of different ICT solutions for the tourism and hotel industry. ICTs have a very important application in tourism, travel and catering, but the tourism and hotel industry also have an impact on the development of ICT applications in the field of tourism and hospitality (Mihalič, Praničević, Arnerić, 2015; Seng, 2015). Globally, the rapid development of ICT has also rapidly changed the structures of the tourism industry (Reino, Lamsfus, Salas, Torices, Alzua-sorzabal, 2013). It can be argued with certainty that today the hotel and catering industry is one of the industries most associated with the progress and implementation of state-of-the-art ICT solutions. In recent decades, ICT is seen as a strategic resource and one of the basic tools for achieving a leading market position in the hospitality industry. The technological development of ICT is increasingly recognized as a key component of the hotel company's strategic plan (Bethapudi, 2013). Certain research on the impact of ICT investments on hotel performance suggests that such investments may continue to increase hotel performance and productivity (Sirirak, Islam, Khang, 2011). ICT has also been recognized as a strategic asset in hotel and hospitality companies to improve their strategic competitiveness (Wang, Qualls, 2007). Other authors emphasize that business performance in the hospitality sector is positively associated with early adoption of ICT. That is, that the success of companies in the hospitality industry is positively influenced by the application of successful innovation strategies, as well as the early adoption of new ICT solutions in business communication (Gray, Matear, Matheson, 2000). We believe that precisely because of all the above, it is necessary to conduct additional research that would further explore the link between the adoption of ICT and hotel performance. It is evident that the connection between modern ICT solutions and the

performance of hotel systems is very complex precisely because of the different analytical approaches and management practices in the hospitality industry. Four areas were identified when examining decisions related to the adoption of ICT in hotels: coherence between business strategy and IT decision, types of IT applications, anticipated benefits of IT decisions and decision-making style (Bilgihan, Okumus, Kwun, 2011). For example, hotels in the US and Europe have embraced ICT and effectively integrated systems such as customer relationship management (CRM), computer reservation system (CRS), supply chain management, hotel resource planning, project management system, office automation system, knowledge management systems and that the application of these systems has had an impact on hotel management recognizing their benefits (Li, 2012).

Hotel front-office systems (HFOS)

One of the most prominent departments in the hotel is the front-office department, which aims to unify and support the progress of guest services and transactions from the time before their arrival to their departure. Currently, front-office operations in Europe and the world are mainly performed using an electronic system (Ansah, Blankson, Kontoh, 2012). These systems are known as hotel front-office systems (HFOS). HFOS are central systems that can operate 24 hours a day, 36 days a year. Hotel employees should manage HFOS at the point of contact with the customer. This HFOS system provides a variety of information to first-line employees and supports fast and secure transaction time with the intention of reducing time spent in the system (Aziz, Bakhtiar, Syaquif, Kamaruddin & Ahmad, 2012). The results of some research indicate that HFOS is usually designed using easy-to-understand language and technology (Kim, Jin-Sun, Kim, 2008). One of The basic HFOS that supports the hospitality business is PMS - asset management system (Reino, 2009). Generally speaking, the PMS system is a computerized system that facilitates asset management (such as hotels) by supporting day-to-day core business. PMS also centralizes the interconnection between other ICT systems within the main system. This use of interconnection in the front-office supports the exchange of information throughout the hotel. In each hotel there are a number of standard operations in which PMS packages can be incorporated, whether the hotel is small, which offers basic facilities, or large with a wide portfolio of additional facilities. These functions may include: booking, registration, invoices, report generation, household maintenance, and basic marketing analysis. Thus, PMS has the ability to support productivity and reduce costs by improving internal control and communication in the hotel (Kim, Lee, Law, 2008). However, PMS is perhaps the most expensive investment that hotels incur in terms of financial and human resources. Decisions on the functionality, system administration, and interconnectedness of PMS rely on business capabilities and needs. These decisions should include choices to determine which business activities should be supported by PMS, the amount/i.e. number and type, computer locations where PMS should be installed, as well as the level of connectivity between software and other ICT systems. In addition, hotels should decide whether to adopt their own asset management software or outsource this function to application service providers (ASPs). ASP here refers to those software applications in which files are located in a different location from where they are accessed. The availability of ICT skills and knowledge of hotel staff will determine whether PMS will be used in the hotel or supported by the ASP system. Depending on the ASP, the responsibility for maintaining the PMS will be transferred to this ASP.

As far as PMS administration is concerned, there is a wide range of options, depending on the size of the hotel and the dynamics of its business environment. PMS can be run in small hotels using a single standalone computer. However, if the PMS is to be accessed from several workstations, the hotel will need a server to store all software files, and then all other workstations (terminals) will join this server via a local area network (LAN). A LAN is a computer network that operates in a geographically limited area using wired and/or wireless technology. If the hotel is independent of PMS files and the PMS database will usually be located at the asset level, unless the asset management is with an application service provider, then the files will be located at the software vendor's location. However, if the hotel belongs to a chain the headquarters will accept information about reservations or the client. In this case, there are two alternative ways to place the PMS and the connection between the asset system and the seat level. The first way is to install an asset management system in the headquarters office and provide access to individual software to the PMS system via a virtual private network (VPN). Another way is to install PMS at each asset level, and then connect everyone to the asset management system in the headquarters office through two-way communication using VPN or ASP. Most common PMS solutions on the market are usually offered in modules that support most front-office operations. However, aspects of PMS and its boundaries are not consistent for both suppliers and end-user companies (Pucciani, Murphy, 2011). End-user companies may adopt additional functions in PMS depending on their specific requirements. These functions can be obtained through additional modules integrated into PMS to facilitate the flow of information across departments (Avinal, 2006).

However, if the hotel needs more advanced features, then the hotel must adopt additional non-modular software solutions. These software solutions can work independently or can be connected by one-way or two-way connection to PMS. Examples of these non-modular solutions are additional systems that support hotel management (e.g., energy management systems and electronic door locking) in addition to guest service systems (such as electronic minibar, room phone and in-room entertainment). This type of software and the communication between them can provide improvements in internal communication, business control, cost tracking and employee productivity, which also reduces operating costs. In addition, PMS can be connected to electronic distribution systems to allow automatic updating of room availability. Many hotels use additional facilities (i.e., restaurants, bars, conference and/or time-

sharing facilities) to generate additional revenue. These facilities require specific ICT systems to operate efficiently. Therefore, the hotel industry can set up these types of ICT systems as stand-alone systems or can seamlessly integrate them with PMS to support the exchange of information in front and back-office areas. To support entertainment facilities, hotel management may implement a "leisure management system" or "activity planner for billing and scheduling operations". Leisure management systems can be fully integrated into the PMS so guests can schedule appointments, book and/or close accounts at the front desk. When these systems are integrated with Maestro PMS, guests can develop promotional packages that include some of these leisure activities. Further, these systems can store guest preference data and event information for future direct marketing opportunities. ICTs are used in hotel front-office operations to create accounts, to check in and check out guests, to track reservations, to record guest costs and to exchange information within and across the hotel. Using ICT, customers can communicate with front-office staff over the Internet or by phone to make and confirm reservations, staying in the comfort of their private places and homes. Customers can make payments online to facilitate booking, which reduces queues and saves time in the front office. Therefore, debit and credit card payments have become an essential part of front-office work using appropriate hardware and software. Hence, as computerization becomes very important for efficient front-office operations, there are many software packages that cover almost every front-office function of visitors, from reservations, memorizing the history of guest visits, allocating rooms to general ledger accounting. Therefore, research on different types of ICT systems in front office operations in luxury hotels in Montenegro and their impact on market effects are important for hotel decision makers, all in order to effectively choose the right set of ICT systems.

ICT hotel reservation systems

As efficient distribution of hotel service activities is very important for hotel companies, since their "production" cannot be delayed or "stored", the development of such systems is one of the most studied topics in ICT research in the hospitality and hotel industry. According to some authors, the reservation system can be seen as a specific system that allows a sufficient amount of information to be provided to the right people at the right time in the right place (O'Connor, Frew, 2002). The development of computer reservation systems (CRS) began in the 1970s, and global distribution systems (GDS) in the 1980s. The advent of the Internet in the 1990s developed operational sales practices in the hospitality industry (Scaglione, Schegg, 2015). Using the Internet as a booking method can be valuable for both hospitality firms and customers by providing real-time information sharing as well as cost reduction for both parties (Kim, Kim, 2004; Schegg, Scaglione, 2013). In small individual hotels, the system of "updating" hotel rooms can be implemented and accessed by the basic booking module offered by any PMS software. This booking module can visualize hotel room inventory and can support booking entry, saving and retrieval. This type of module is at the property level. Conversely, chain hotels may have inventory at the corporate level. These hotels tend to centralize booking activities to headquarters or central booking offices. Therefore, chain hotels must provide this headquarters and offices with specific software solutions in order to manage reservations. An example of these software solutions is the Central Reservation System (CRS), a tool for accessing global distribution systems (GDS) and Internet distribution systems from a single system. CRS supports hotels in their sales and online marketing, and also allows the hotel management to announce its prices and the availability of rooms that will be used by sales channels that use CRS, e.g. tourist agencies. CRS is primarily used to exchange information such as available rooms and prices among hotels in the chain. Connecting with CRS is considered one of the significant benefits of joining any hotel franchise (Knowles, 1998). Since most hotel chains still typically make asset-level reservations, inventory databases must be synchronized between the asset-level reservation system and the CRS hosted at headquarters or central reservation offices. CRS networking improves cost-effectiveness, enables faster communication, efficient data management, and efficient information exchange (Ansah, Blankson & Kontoh, 2012). Therefore, most software solutions are designed to keep and update status and availability in one place and provide seamless communication between headquarters level and asset level to increase reservation (Reino, 2009). In addition to a sophisticated CRS hotel chain, it provides individual hotels in the chain with the technique of improving bookings, improving search services, maximizing sales, increasing market opportunities and applying revenue management (Ansah, Blankson & Kontoh, 2012). The CRS system is crucial for the survival of hotels, although they may face unprecedented operational challenges in terms of downtime in the guest service system (Knowles, 1998). As far as distribution channels are concerned, hotels can maximize their capabilities by enabling direct bookings while allowing seamless connection of hotel inventory with one or more distribution channels that hotels can use. Currently, almost all hotel companies in the world are exposed to ICT systems directly or indirectly (Ansah, Blankson & Kontoh, 2012). Increasing market share and exposure is one of the reasons why hotel managers use multiple network channels. One of these distribution channels is GDS such as: Galileo, Amadeus, SABER and Worldspan. These systems include not only hotels but also airlines, car rentals and other travel resources and are commonly used by professional travel agencies (Rowe and Ogle, 2008).

The second distribution channel is the "alternative distribution system" (ADS), which refers to those travel agents whose core activities are performed online, such as: Expedia, BookDirect, Orbitz, Travelocity, HotelFactory, RezView, iHotelier and ResExpress (Thakran, Verma, 2013). The third possible distribution channel that hotels can use is Central Reservation Systems, run by external partners, including Best Western or Reserve America. In addition, hotels can also use their own website as a possible distribution channel. Booking rooms through a hotel website can reduce distribution costs (Phelan, Christodoulidou, Countryman, Kistner, 2011) and reduce hotel dependence on intermediaries (Samanta, 2009). Therefore, several hotel chains are trying to raise direct distribution through their

own websites by offering lower prices. However, developing such interfaces can become very expensive. If the hotel management cannot set up a direct interface for each of the CSAs and GDSs, the hotel management may hire alternative companies to provide access to distribution channels and support communication between PMS and GDSs and/or CSAs. In this case, reservations (instant computer message) from the GDS or website will be transferred to the hotel reservation system to request room availability. After the reservation is checked and confirmed, the data will be sent back to the applicant. However, if there is no connection between PMS and GDS/ADS, hotels will try to gain access to these distribution systems and then manually allocate rooms to the systems. Another option for small hotels with limited technology is Destination Management Systems (DMS), also known as Destination Information Systems (DIS). The mentioned DMS is based on the same type of technology of companies that deal with switching, but it is managed by a regional tourist organization. Therefore, hotels can improve revenue generation by selling rooms through a diverse range of GDS, ADS and DMS systems. Furthermore, when automatic communication between PMS and these electronic distribution systems is enabled, communication with external partners will be improved, as well as the response to market changes, leading to increased revenue generation. Online booking systems need to highlight some factors such as convenience, price and security in order to attract first time users. It is also necessary to include functions such as searching for information and transactions in order to retain previously accessed users (Kim, Lee, Law, 2008).

ICT systems of business administration

As for the applications of business administration systems, they can be interconnected in PMS or they can be managed as stand-alone systems. Some of the PMS vendors offer certain modules that are combined into their PMS solutions or offer connectivity with other software solutions (Abukhalifeh, Pratt, 2022). The benefits of integrating systems into front and back office applications are mainly related to increased internal accuracy of information and productivity by sharing the same database among hotel sectors. This category includes solutions for accounting, procurement and human resources (Gulmez, Ajanovic, & Karayun, 2014). In addition, there are various modules that can be adopted by the PMS system such as work order or maintenance modules. These modules are designed to support the generation of fault reports and give them priority that the maintenance sector can visualize, act accordingly, close the order when maintenance is completed, and notify the sectors involved (Murphy, 2013). This type of plant is focused on increasing productivity, internal communication and improved control. As part of back-office applications, e-procurement solutions make it possible to take advantage of business automation and electronic distribution channels (Kothari, Hu, Roehl, 2007). In institutions with a large volume of business and with extensive buying and selling activity, these applications enable an automated purchase process. They are particularly relevant for hotel sectors where purchases are made in large quantities and are usually integrated into restaurant, catering or banquet management systems, in addition to work order / maintenance systems. This system identifies on a daily basis which items must be sold or retained, as well as handling operations such as ordering, receiving, inventory control, recipe management, inventory depletion and re-ordering (Moraitis, 2018). Certain authors point out that this type of application improves communication with suppliers, decision-making and internal communication, which in turn can translate into improved control and productivity (Croom, Brandon-Jones, 2007). Systems that support accounting activities improve control and decision-making. For accounting, both the Receivables/Sales Book and General Ledger module can be obtained as a modular solution that complements PMS, supporting comprehensive accounting, financial reporting and analysis, as well as guest invoice management, enabling posting with several account systems, tax advance refunds trade with integrated official forms, customer analysis, replication, currency exchange reservation, data import and export. However, some PMS only provide a receivables module, and a different software package needs to be installed for general ledger accounting, which can be connected for one-way or two-way communication with the receivables module or can be done independently. On the other hand, various modules may be available for claims, including a module for paying commissions for travel agencies and a module for accounting of owners. Special modules or software packages can be purchased to support human resource management. Especially large hotels or those belonging to the chain deal with a large amount of information related to their human resources, requiring special ICT applications to manage this information and set up staff rotation. ICT enables hotels to keep records of employees in the human resources management sector, support payroll and pre-treatment, generate staffing schedules at the sector level, provide access through EPOS, support information on holidays, sick leave and other earnings, generate reports on planned versus actual labor costs and facilitating employee reviews and assessments. These systems are by default connected to PMS when they are a modular solution. However, once an additional package is purchased, they can be linked to PMS. In addition, they can also connect to service devices such as computers or electronic outlets for login purposes. These types of systems are mainly aimed at improving rotation and scheduling controls.

ICT systems of business intelligence in the hotel industry

Hotel and hospitality companies can use intelligent information systems that transform large amounts of unstructured raw data into meaningful and useful information for the purpose of designing ICT systems (Nam, Dutt, Chathoth, Daghfous, Khan, 2021). These systems help hotels to identify and develop new opportunities and make appropriate investments (Law, Leung, Buhalis, 2009) which translates into a competitive advantage in the market and long-term stability. One type of these systems that hotels can use is the

"Revenue Management System" which allows hotels to establish special booking arrangements, including occupancy rates for selected dates that will be automatically displayed in the booking phase (Reino, 2019). Revenue management is a key instrument for controlling supply and demand (Fernandez, Gerrikagoitia and Alzua-Sorzabal, 2015). The basic branch of revenue management is "revenue management", which here refers to the strategy of variable prices, which depends on understanding, anticipating and motivating consumer behavior in order to maximize profits or revenue from hotel room reservations. Revenue management functionality can be included by default in many PMS or as a modular function to maximize revenue generated from the sale of hotel services. However, hotel chains looking to optimize their sales can adopt advanced ASP revenue management solutions and link those solutions to PMS. This allows hotels to extract relevant forecast sales and consumer behavior patterns from their databases. According to these patterns and predictions, hotels can optimize rooms and set their occupancy rate to a higher level. Some authors point out that another important system for hotels is the customer relationship management (CRM) system, which refers to modern ICT solutions that can be used to enter, store, search and analyze various information obtained by users in the function of marketing and other service activities (Law, Leung, Buhalis, 2009). As hotel visitors become more loyal to the brand, more sophisticated and price-sensitive, it is evident that CRM is a strategic requirement to attract and increase customer support. There is currently a widespread view that the successful implementation of customer relationship management should effectively adapt and combine ICT functionality with business processes. Hotel CRM systems can be interconnected with PMS and other systems. An effective e-marketing strategy requires integration and coordination between CRM systems, website features and promotion techniques.

ICT systems for guest services

Another additional system that hotels can establish are "visitor service systems". These are devices specially designed to provide additional services in the room. Visitor service systems can also be used to increase customer satisfaction and/or to generate additional revenue. Their importance to assets and the required level of interrelationship with PMS is determined by the size of the assets, resources, type of customer, level of services offered and revenue generation strategies. This group may include: electronic door lock, electronic advertising in the room without interference/room cleaning, telephone in the room, entertainment in the room, electronic minibar, Internet access, in-room printing, energy management systems and/or power switches. Electronic locking systems can be set up as stand-alone or in a network system with connection to PMS and/or restaurant, catering and leisure or any other management system that supports hotel facilities. Traditionally, special wiring would be required to connect individual access control units to a central workstation. However, wireless networking solutions are now available. These devices can be managed from standalone devices or can be connected to any facility management software system, including PMS, restaurant management, etc. enabling further functionalities for the card, such as their use to post costs to the guest room. Key readers and printers can have stand-alone and networked system settings. Key cards can also be provided to access limited areas of the hotel – such as car parks, swimming pools, etc. Some service providers have also introduced cashless vending solutions, which allow visitors to use a key card to purchase products and post costs to the guest room via a wireless PMS connection. Currently, there are additional systems that have developed in the industry according to biometric automated locking systems, eliminating the need to carry a visitor's card. Electronic advertising Do-Not-Disturb - Make-Up-Room/Cleaning of the room that allows staff to recognize the status of "Do not disturb" or clean the room from the hallway. With these systems, the guest from the room can operate simple touch sensor systems or a small motion sensor. These systems can be managed independently or integrated with PMS for centralized management of basic activities in hotels. "Energy Management Systems" (EMS) allow hotels to reduce unnecessary energy consumption, usually associated with lighting and/or heating. EMS applies to both switches and software, and includes a wide range of devices and operates in several service segments in hotels. However, they are mainly focused on managing the energy of the guest room.

The most common example of this system is the electrical switch, which is triggered only when the hotel room lock/unlock card is inserted, ensuring that all systems are switched off when no one is in the room. These types of solutions are usually installed individually at the guest room level. However, further functions are enabled by integrating stand-alone devices into a centrally controlled system. This can be run from the hotel's PC terminal which can be connected to the PMS and offer additional functions.

The system may include a thermostat that allows the room temperature to decrease/increase when it is unoccupied and controls the temperature control of the guest when the room is used. The infrared motion sensor has the task of turning off when the room is not used for a long time, and it also provides improved lighting and climate control devices. The advanced feature offered by some hotels allows guests to adjust the temperature range by several degrees and contribute to energy savings. Energy control is delivered through a centralized version, which connects the system to PMS and provides additional features such as automatic room lighting when registering a guest, to create a welcoming atmosphere. The in-room telephone can fulfill a dual functionality, associated with guest service and room maintenance support. They are based on a "private automated voice messaging" ICT system that allows external direct dialing from and to the guest room. Its basic use involves keeping call accounting, enabling its performance to track phone calls and record them to the account of hotel visitors. Additional features include waking up calls, receiving voicemail, setting alarms via email, identifying callers from reception, disconnecting the calling system from the room when this is busy and/or tracking any phone calls

from hotel staff. An advanced feature of the telephone management system is call logging, which allows cleaners to update room status information via the handset, which can be especially useful for large hotels that require fast work and hotels that require frequent household updates. In addition, this system allows monitoring locations of employees, and controllers of keeping records and evaluating the work of housekeepers in hotels. When the hotel is interested in providing more advanced functions to the customer, "Guestroom Digital Assistant" can be adopted, which integrates not only telephone access, call billing and household records, but also enables energy management of elements such as heating, lighting, alarm clocks, digital radio, displays of information and communication about guest services, automated CRM tracking and voice advertising. In-Room Entertainment Systems (I-RES) refer to advanced television-based services that offer customization by the hotel and digital on-demand services individually or in combination. Customization can range from hospitable messages in guest language, broadcasting evacuation information, displaying phone information and messages about special promotions, as well as additional services at the hotel, reading billing information, and even the check-out process. As for digital services on demand, they may include access to electronic games/movies, etc. Electronic minibars can be a significant source of hotel revenue. In hotels where you want to provide services quickly, where customers demand urgent payment, the cleaners cannot permanently check the items spent from the electronic minibar. In this case, electronic mini bars can be connected to PMS systems, recognizing the removal of items from the minibar, automatically posting costs to the guests' account. Because guests tend to move items and then return them without consuming them, these devices usually allow them to be reversed and not charged (Reino, 2009). In-room Internet access can be provided directly to the computer that records them or via a television system. Depending on the business model of the hotel, as well as whether in-room internet access is proposed only for customer satisfaction or as income support, it can be charged per use or be free. Hotels offer free internet up to a certain speed. The Internet usage service is charged for speeds higher than the set ones and the interfaces with PMS will enable the posting of costs to the guest's account. Institutions where a significant number of guests travel for business purposes are expected to offer in-room printing. This service can be provided in a room or in a hotel business center, or through network partners, allowing guests to upload their file to a special website tailored to the hotel and download a document from the hotel printer (this device can work seamlessly with wireless network and with existing printers, connecting the solution to the printer and intranet). Guest service systems mainly exist to increase customer satisfaction, however, when these systems are delivered for an additional fee, they can become a key source of revenue for catering facilities. Communication between these systems and PMS supports productivity, internal communication, and improved control by allowing access to billing information through a single system. Therefore, there is a wide range of general business and hotel-specific applications, which can run independently or be integrated into a networked system environment to support accommodation operations, contribute to business performance, improve productivity, support decision-making, reduce operating costs, improve internal communication, communicate with partners, communicating with suppliers, increasing revenue, increasing customer satisfaction and improving control.

Hardware and general network infrastructure in the hotel industry

Establishment dynamics combined with the type of customers served by hardware and general network infrastructure can create a demand for different types of interfaces. Therefore, traditional fixed computers and electronic cash registers are being replaced or supplemented by alternative devices. This is the case with electronic points of sale (EPOS). EPOS refers to hardware systems that support bar and restaurant business services. Designed as a solution for "electronic cash registers", enabling wider functions in hotels with a large volume of operations, including tracking orders for drinks and food, electronic transfer of orders to production staff, automatic sending of fees to/from PMS invoices. However, in restaurants, they are usually associated with restaurant management systems (RMS). Some of the main requirements that modern EPOS must meet include constant high speed, ease of use, reliability, rich functionality and remote support (Ansah, Blankson, Kontoh, 2012). Depending on the size and dynamics of the hotel as a catering facility, operators may consider adopting handheld devices that allow waiters to receive and send orders in real time to the kitchen, such as the Digital Dining case. They can include other functions, such as integrated credit card payment devices, and depending on the software solution, they can provide the ability to send orders directly to the kitchen, split bills or intentionally keep orders without automatically sending orders. As far as staff registration is concerned, this can be made possible by using an ID card, fingerprint or entering an ID number. The efficient point-of-sale and table reservation system provided by Northwind, for example, includes a dynamic setting that allows staff to track customer movements from table to table. They can be managed independently or connected to a restaurant/catering management system, which in turn can be linked to PMS. Hotel ICT solutions can be networked to share information and resources over a local area network (LAN) or wide area network (WAN). The LAN helps to exchange information in the hotel from the front office to the restaurant, and the WAN helps to exchange information from one hotel to another within the same chain in different geographical areas. Computers can connect to these networks to use content from another hotel or location. This integration of ICT systems provides a powerful tool that brings an advantage in strengthening and promoting the hotel and hospitality industry (Mathur, 2015). However, networking remains one of the main issues in ICT (Ansah, Blankson, Kontoh, 2012). The application of various ICT solutions in the hotel industry is crucial for the success of hotel companies. The strategic goal of most hotel managers is to integrate ICT with tourism in an attempt to support accessibility, availability of a wide variety of services and products, visibility of information, and thus create customer satisfaction (Bethapudi, 2013). This trend includes the use of computer software, hardware and telecommunications devices to store, manipulate, translate, protect, send and receive data, and the growth of ICT integration is one of

the most significant time management events in the hotel industry (Ansah, Blankson, Kontoh, 2012). An alternative to the traditional check-in and check-out processes at the hotel reception is offered through kiosks, which are integrated into most PMS systems (Cline, 1999; Jaremen, Jędrasiak & Rapacz, 2016). Similarly, laptops can be used to support check-in operations when the main visitor check-in point is busy. In addition, handheld devices enable connection via a TCP IP-based network environment, wireless internet or "global mobile communication system" (GSM) for restaurants and/or bars. Finally, video display systems are also used in high standard hotels with a large number of visitors/guests to display constantly updated data and announcements. Some types of these video displays can be interconnected with PMS. The main areas for setting up a video display system are the lobby, hotel halls, conference centers or any other center of hotel activity. In general, many researchers have seen that the development of certain business functions in hotels is strongly intertwined with ICT issues (Brady, Fellenz, Brookes, 2008) and that the most efficient business function in tourism is the so-called ICT revolution (O'Connor, Frew, 2002). However, there are several studies that have examined the impact of ICT on market effects in the context of service industries. On the other hand, according to other research, the degree of ICT use is significantly related to the performance of a marketing function (Noh, Fitzsimmons, 1999). In addition, the same research confirmed that databases and networking are the most important ICT categories. The second study used an empirical analysis of 61 German hotel and business hotel companies and found that ICT influences visitor trust and commitment, supporting the argument that there are obvious marketing benefits from investing in ICT (Ryssel, Ritter, Gemünden, 2004). Hotel managers can use ICT solutions to attract more guests, improve service quality, provide exceptional guest satisfaction, and increase market share and revenue (Kapiki, Fu, 2015). Hotel facilities are progressively using ICT to reach potential customers in the fastest and most efficient way (Leong, 2001). However, in addition to all the above advantages of ICT in hospitality, there should be budget allocations for the procurement of hardware and network devices, software and installation, staff training on system use, security, routine maintenance and system administration, although these procedures may have negative implications for hotel managers and owners (Ansah, Blankson, Kontoh, 2012). Some impacts of the ICT system may have dysfunctional consequences for users, which may interrupt the main goal of adopting a new ICT system. Positive effects of the application of modern ICT solutions in the hotel industry include reduction of stress, quality of working life, job satisfaction and other work-related results with significant consequences on business efficiency and productivity (Mathur, 2015). The challenge for every hotel company is to adopt new ICT solutions and learn how to use them to create a better system. At the same time, it is difficult to choose the most important business segment in which to implement ICT (Aziz, Bakhtiar, Syaquif, Kamaruddin & Ahmad, 2012). Adopting an ICT system can restructure the work environment and change the efficiency of work in a hotel business. Lack of training is one of the main obstacles to the full exploitation of ICT. Some hotel administrators are reluctant to adopt ICT due to technophobia (Siguaw, Enz, Namasivayam, 2000). Due to the above, perhaps, the application of modern ICT solutions is not as intensive as in other sectors.

Conclusion

We are witnessing a revolution in the tourism and hospitality market, which ICT, as the most important challenge, is implementing the design of new scientific paradigms for the development of tourism based on modern e-technologies. The results of theoretical research of different ICT solutions applied in the hotel industry indicate that the intensity of their application is high, but that there are also many different combinations of their application. As the hotel sector is a central part of the tourism economy of many countries that are strategically oriented towards tourism, the application of various ICT solutions in hotels can have a significant impact on the overall tourist attractiveness of a country as a tourist destination. The hotel and hospitality industry in the world is becoming highly competitive and it is necessary that hotels use different ICT solutions to improve their activities and overall business performance. The success of modern business systems, such as hotels, increasingly depends on the optimal combination of ICT solutions that would meet the increasingly specific needs of tourists as users of their services. This leads to the belief that it is necessary to find the optimal combination of different ICT solutions that are widespread in the hotel industry today. This research is relevant to the requirements of the hotel industry because it helps to deepen the problem of understanding the various ICT technical solutions applied in the hotel industry by managers to be able to achieve better business results through their application. In addition, a better understanding of this issue can help to better formulate a strategy for the use of ICT in order to improve performance and market position. This research seeks to help modern hotel systems and managers in the field of tourism and hospitality to improve their knowledge in the field of application of various ICT solutions in their business activities in order to achieve better business results. The focus of the research is on the most modern ICT solutions used in the hotel industry today. However, most previous research in this area has focused on ICT in general or on commonly accepted ICT solutions, e.g., Internet. Therefore, this research focuses on assessing the availability of a wide range of ICT applications, as well as the integrated level of these systems. In addition, the research filled the gap regarding the requirements related to the implementation of various ICT solutions in the hotel industry that must be taken into account in order to maximize the benefits of ICT at all management levels. Analyzing the various modern ICT systems represented in the modern hotel industry, this research contributes to the practice of choosing the right ICT investment to improve the overall performance of the hotel system. Certainly, this research found that different ICT technology solutions are potential elements for direct improvement of hotel performance, which may encourage managers in the hotel sector to more intensively explore different combinations of ICT solutions or find new ways to ICT investments that can lead to changes in the tourism industry in terms of restructuring ICT strategies in the hotel

industry. The research results also contributed to the development of an approach to the analysis of different ICT solutions. Further research can be moderate to empirical research on the effects of different combinations of ICT solutions on specific examples in the hotel industry, both from the point of view of managers and from the point of view of customers or employees. This would help more in researching the relationship between different ICT solutions and business results or overall hotel performance. Another study could test the relationship between ICT and internal marketing (i.e. productivity and performance of service innovation) based on employee perspectives. Research could also be conducted to measure the satisfaction of external customers with the adoption of ICT from a customer perspective. Future research may also be moderate on the interdependence of the application of different combinations of ICT solutions and the marketing effects of hotel operations.

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