CONTEMPORARY ICT CONCEPTS IN TOURISM ORGANIZATIONS

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Abstract

The application of new ICT technologies in the tourism sector enables preferable management of the tourism sector. As consequence of modern business processes, terms such as smart business, smart cities, smart tourism, etc. appear. Given systems generate or collect large amounts of data, store and transfer data, which are managed using a set of harmonized artificial intelligence systems, Big Data systems, IoT and Cloud platforms. Big Data system, as well as the artificial intelligence system, interact with IoT technology and Cloud systems. Big Data concept enables the analysis of the business environment in order to offer a higher quality tourist product. AI and Big Data systems, IoT and Cloud are becoming an integral part of the business. Given movements result enables the customer to use better services of a travel company. By applying given technologies, both the company and the tourist services customer benefit, and the productivity and efficiency of business of tourist systems increases.

Key Words: *Artificial Intelligence, Big Data, Cloud Systems, ICT, IoT, smart tourism*
JEL classification: *D83, M15, Z32*

Introduction

International tourist arrivals (overnight stays) increased by 3.8% in 2019 compared to the previous year, according to data reported by destination. 2019 was the tenth consecutive year of sustainable growth since 2009. UNWTO estimates that around 1.5 billion arrivals in 2019 were circulating through destinations worldwide, approximately 54 million more than the

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previous year. This represents a consolidation of growth of 6% recorded in 2018, but at a slower pace and below the annual average of 5% in the last ten years (2009-2019). The growth of international tourist arrivals continued, which surpassed the world economy (+ 3.8% vs + 3.0%). In recent years, tourism has become a key economic sector that has a positive impact on economic development (UNWTO, 2020).

The importance of the computerization of the tourism sector, as well as following the latest developments in the field of information technologies, can be seen in the fact of increasing the share of this industry in the global GDP (Pažun & Langović, 2019).

The terms "smart tourism" and "sustainable tourism" interact strongly. Each country has formulated a specific strategy for the development of smart tourism that affects the development of sustainable tourism. Smart tourism is in the function of using ICT technology, i.e. it uses Big Data systems, artificial intelligence, as well as IoT and Cloud technology due to managing data, that is, generating knowledge used for business purposes.

Contemporary IT concepts

Modern IT concepts that enable successful business are artificial intelligence, Big Data, iot, Cloud systems. These systems form a platform for processing a large amount of data that generates knowledge on the basis of which companies belonging to the tourism sector can strategically position themselves in the market.

Artificial intelligence

The feature of artificial intelligence is task performing that traditionally requires human cognitive function. The given concept defines its use in the tourism industry, due to costs reduction and increasing system security. Artificial intelligence can be used to improve the personalization of a tourist product.

One example in this area is the Cerebras system with the mission to create the new classes of computer systems that are able nowadays to bring highest quality artificial intelligence systems upgrades of several orders of magnitude. For hotels and other companies in the tourism industry, one of the promising applications of artificial intelligence is to provide assistance to customers online. An example of application is in the form of bots on

social media platforms, as well as in the form of instant messaging applications. In this case AI is able to answer questions and provide useful information to customers. Applications of AI in the tourism industry are not limited to this form of customer service. Another important application is about collection and processing or data analysis in order to define conclusions about the business processes of tourism companies, and thus define business practices. An important feature of artificial intelligence in this domain is the ability to quickly and accurately process huge amounts of data or information. Hotel Dorchester Collection has used AI to process user information to create a real-time image of user requirements. Robotics is the next application of AI through interaction between users and artificially intelligent robots. Connie, a welcome robot at Hilton hotels, uses AI and speech recognition to provide clients with tourist information. The quality of communication between the user and the robot develops gradually because the robot has the ability to learn through interaction with users (USAToday, 2016).

Big Data technology

The systems present in the Big Data infrastructure are following: traditional relational database management systems (RDBMS), NoSQL systems, Hadoop, MapReduce.

Traditional RDBMS systems have long been the standard in terms of database management. Databases are organized on the principle of large structure following a relational data model. Nowadays, however, RDBMS is generally not considered a sufficiently scalable solution for Big Data. NoSQL databases are efficient because they are unstructured, therefore reduce data consistency requirements, as well as increase speed and agility.

Hadoop is an Apache project and represents a flexible architecture for computing and data processing in cluster networks. Given system provides a development framework for distributed storage and processing using the MapReduce software model.

HDFS (Hadoop Distributed File System) is a distributed, scalable and portable file system used to store and process large amounts of data stored on large server clusters. A distributed file system can store large amounts of data and provide access to a large number of distributed users.

MapReduce is a software model that provides processing and generation of large amounts of data by dividing jobs into independent processes and parallel execution of given processes on the cluster. At a higher level, each MapReduce program transforms the list of input data elements into a list of output data elements. In order to take advantage of the parallel processing provided by Hadoop, it is necessary to form a query in the form of a MapReduce procedure. Big Data analytics is a complex process of analyzing large and diverse data sets in order to reveal hidden patterns, unknown correlations or market trends, in order to define appropriate business decisions by companies (Langović & Pažun, 2016).

Cloud concept

Cloud Computing was created as a result of the economy's need for new information system capabilities on existing platforms without large investments. Cloud Computing has enabled companies to take advantage of new features using a Web browser. The essence of the concept of Cloud Computing technology is based on how to access applications hosted in the Cloud. Given IT concept is a model by which certain business services are made available to users, through an existing ICT environment. Large companies have discovered the advantages of a given Cloud technology.

According to Gartner, Cloud Computing is a type of computing in which resilient IT resources are distributed as a service, to external users using Internet technologies (Gartner, 2019).

The term Cloud is a metaphor for the Internet, and with sufficient accuracy it can be said that this is a process of developing services that are available via the Internet. Virtualization is the basis for the development of a given technology. Virtualization technology enables the functioning of multiple virtual machines on a single physical machine, thus achieving better utilization of physical resources. Scientific applications, then Big Data systems, IoT technologies, financial engineering, video game industries, social networking systems, artificial intelligence systems can be found on Cloud Computing. It brings something that is an advantage in the exploitation process in the form of adding new opportunities in a short time, without additional investments in infrastructure and new staff. The only requirements of the users of the given service are a Web browser, internet connection.

Cloud computing can be divided into certain categories with sufficient accuracy depending on the economic and technological aspects. There are four types of Cloud Computing development models, which are represented in following Table 1. The Private Cloud - Internal Cloud represents a term for computer architecture within a company, owned by the company and some departments, teams, etc. In the case of the public Cloud, the required resources are dynamically allocated in the form of Web services via the Internet. The Public or external Cloud represents Cloud Computing in the true sense. It is owned by the provider - the service provider (Amazon, Google, Microsoft, Windows Azure, etc.) and the user pays for the service. Hybrid Cloud is a combination of public and private Cloud. It represents the hybrid model where part of the services is in the Cloud (resources are outside the company, ie. with the provider of the service provided) and part is with the owner/user. The shared Cloud corresponds to the Cloud infrastructure which is shared between the organization and service providers with common interests.

Table 1: *Cloud types vs. infrastructure feature*

	manages infrastructure	**owned infrastructure**	**located infrastructure**	**available infrastructure (it can be used)**
private	organization	organization or service provider	in or outside the facilities of the organization	authorized users
public	service provider	service provider	outside of facilities of the organization	non-authorized users
hybrid	organization and service provider	organization and service provider	in and outside the facilities of the organization	authorized and non-authorized users
shared	service provider	organization or service provider	in or outside the facilities of the organization	authorized users

Source: *Authors' research*

Based on the second category, where the technological aspect dominates, the following division is distinguished: IaaS (Infrastructure as a Service) - infrastructure as a service, PaaS (Platform as a Services) - platform as a service and SaaS (Software as a Services) - software as a service. The following development trends are currently available: Green Cloud Computing, Edge Computing, Cloud Criptographs, Load Balancing, Cloud Analytics, Mobile Cloud Computing Big Data, Cloud Deployment Model.

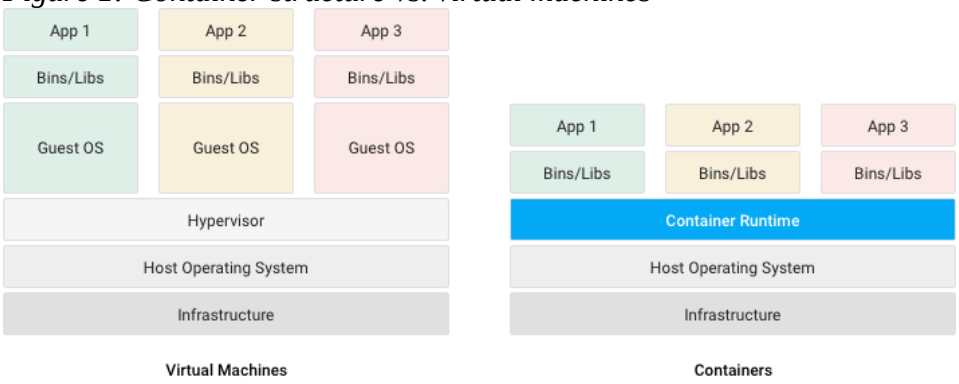
For example, Green Cloud Computing saves energy, while in Edge Computing, data is processed at the edge of the network instead of in the data warehouse. Edge Computing is a new field that also optimizes resource utilization and improves system security. Cryptography can convey content with sufficient security. Cloud analytics is a combination of data analytics and Cloud computing technologies. Cloud analytics is useful for both small and large organizations. Analysis has a broad scope, because there are many areas that require research. Cloud analytics consists of business intelligence tools, analytics management, risk management.

Many organizations define the combination of public and private Cloud as the best business solution. In a survey of nearly 800 companies in 2019, 94% used some form of Cloud. Many businesses are still in the early stages of implementing Cloud, deploying around 20% of their applications on a given platform. Gartner predicts that more than half of Cloud-based companies today will move all their resources to the Cloud by 2021. The worldwide public Cloud service market will reach 228 billion in 2019, growing 15.8% over 2018 in US dollars. Software as a service will remain the largest segment, reaching over 170 billion dollars in 2023. Further, due to revenue, IBM and Oracle are corporations that have a significant role in the Cloud computing world, compared to, for example, Google and Alibaba (Pažun, 2018). Comparing to 2017 when the estimated revenue of the world's largest Cloud-based companies, according to Gartner, Microsoft Commercial Cloud (Azure, Office365, Microsoft365), when was 21,2, in 2019 was 44.5 (in billions of dollars), as well as Google Cloud Platform, G Suite from 4,0 in 2017 has increased in 2019 with 8.9. Estimated revenue of Amazon AWS has been increased as well, from 20.4 in 2017, to 35 billion of dollars in 2019 (Gartner, 2019).

VMware. The technologies for the realization of Cloud computing are system VMs (several operating systems can exist on the same computer and they are all isolated from each other; a virtual machine can provide a set of instructions that is different from the host computer). During the 1980s and 1990s, virtualization was generally abandoned and replaced by cheap x86 servers and desktops. Instead of sharing the resources of a single mainframe computer, organizations turned to cheap distributed systems. The advent of Linux and the adoption of Windows during the 1990s set x86 servers as the industry standard. This approach has brought a number of problems due to poor resource utilization. Research shows that the utilization ranges from 10-15%. The solution for decreasing both infrastructure and labor costs was offered by VMware.

Containers. The goal of the container is complete standardization, meaning containers connected to the host use specially defined interfaces for any task. The container application should not depend on the resources or architecture of the host system, which simplifies the development of the working environment. Service-oriented design in combination with container applications provides easy scalability. The containers are isolated at the process level and share the host kernel, allowing simple starting. In this way, a large number of given workstation systems can be started. The key fact to recognize about Cloud containers is that they are designed to virtualize a single application. Containers create an isolation limit at the application level, not at the server level.

Figure 1: Container structure vs. virtual machines



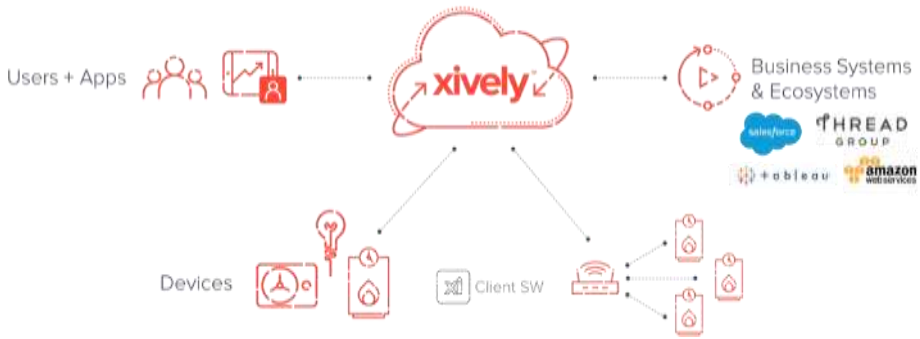
Source: *TechTarget, https://searchCloudsecurity.techtarget.com/feature/Cloud-containers-what-they-are-and-how-they-work/, (10 April 2020).*

Internet of Things concept

Internet of intelligent devices and sensor networks are the basis for the development of smart environments. One of the solutions for the development of IoT systems is Cloud computing Xively. The given platform manages a large amount of data sent from different platforms.

Carriots represents development and hosting platform, specially developed for smart device internet projects and M2M communication, which enables data management and creation of applications based on Groovy code. The ThingWorx platform provides IoT application development. It is mainly intended for industry, but can also be used in other environments.

Figure 2: *Xively sistem*



Source: *Xively, https://xively.com/, (20 April 2020).*

The following diagram shows the conceptual architecture for a connected product solution. Aneka represents a platform that offers its capabilities in the form of software as a service (SaaS) and in the form of infrastructure as a service (IaaS).

Figure 3: *Aneka system architecture*

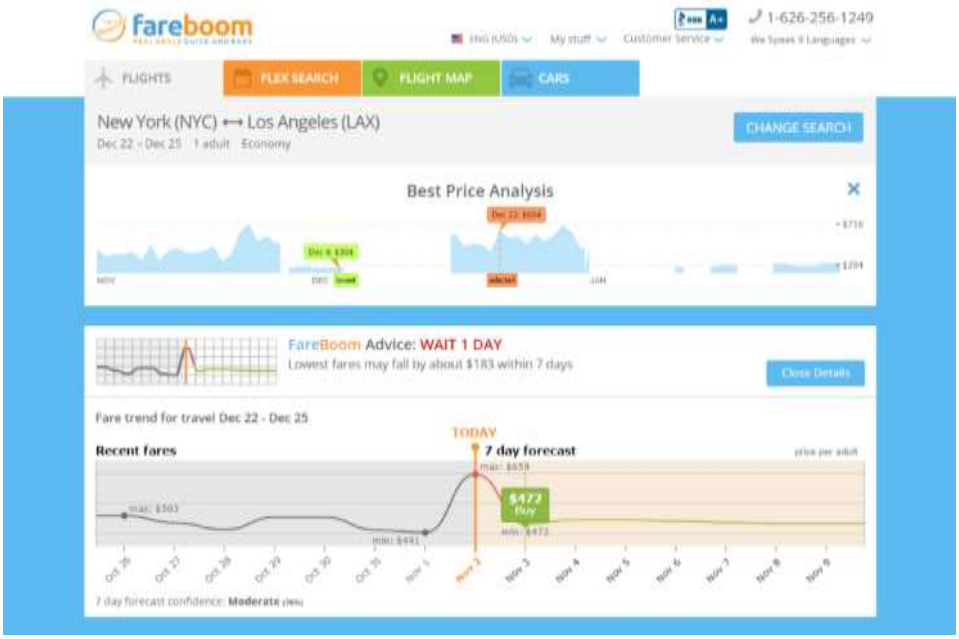
Source: *TechRepublic, https://www.techrepublic.com/resource-library/whitepapers/aneka-as-paas-cloud-computing/, (20 April 2020).*

Aneka is a usage system that enables Cloud integration and application development. It provides a runtime environment and a set of Application Program Interfaces (APIs) that allow developers to build. NET applications that are used in the public or private Cloud. Aneka enables computer systems to connect and form a strong infrastructure. Smart device management is defined in the Cloud, through Cloud Manager.

IT concepts and the tourism sector

Many Big Data issues generally relate to the tourism sector. One of them is the difficulty in sharing information between sources. Organizations generally do not have a standard way of collecting data. However, UNWTO is already working to create a standard statistical framework. Many cities do not have a Big Data strategy. The report of the company Skift from 2017 calls the Big Data in tourism "unfinished work". Iot systems are also an important part of hotel or tourism systems that are used in energy conservation, security, providing location information, as well as enabling the system maintenance process. It is necessary to mention the cloud, which is a platform on which the components of the overall information system are located. A complete information system with applied data science, as well as artificial intelligence systems enables the automation of tourist systems. The user of tourist services can plan a trip using a smartphone and a computer, in other words, the computer allows the reservation of plane tickets, hotel room reservations, destination overview, etc.

Figure 4: *Application of short term forecast*



Source: *Fareboom, https://www.fareboom.com/, (25 April 2020).*

Furthermore, one of the applications is presentes in the flight forecast for airline tickets and hotel prices. The scientific research team AltekSoft has built an innovative tool for predicting the price of travel for global online travel agency, Fareboom.com (Fareboom, 2014; AltekSoft). By working on its core product, the travel booking website, one can access and collect historical data on millions of searches over the past few years. Possessing given information, a self-learning algorithm was created that is able to predict future price movements based on a number of factors, such as seasonal trends, demand growth, airline special offers and supply. With an average confidence rate of 75 percent, the tool can make short-term (several days) as well as long-term (several months) forecasts.

Hopper is a company that uses data science, ie. using applied predictive analytics through certain tools that help users in booking airline tickets at the optimal price (Travelport, 2019).

The next example is the Intelligent Travel Assistant. Smart reception services, powered by artificial intelligence, are gaining in importance in various industries. Travel reservations are just one of the areas that are highly automated by algorithms. Intelligent programs trained to perform a specific task at the request of the user are usually called "bots" or "chats" (Bulanov, 2018; Altexsoft, 2018).
For example, Hiatt, a world leader in hospitality, has been using social platforms to connect with its customers since 2009 (Conversocial, 2016).

Using the system Facebook, Slack, Skype and other, virtual travel assistants are trained to search for optimal offers or book flights and hotels, to plan the trip in its entirety. They can be useful for enhancing the overall travel experience through useful information, for example, useful suggestions for popular tourist destinations, as well as for places to eat or local attractions. Using Slack, the latest flight options can be received, including prices. These are the most common ways to use AI bots.

Optimized interrupt management assisting users with problems that may occur during the trip, can be automated. It is mainly applied to business trips. Interrupt management is always a time-sensitive task, the risk of travel disruption is quite high. For example, there are thousands of delays and several hundred canceled flights per day. In a business trip, this can result in significant losses and have serious consequences for the company.

With advances in technology, it has become possible to anticipate such disruptions and effectively mitigate losses for both the passenger and the carrier. The 4site tool was developed by Cornerstone Information Systems, which allows increasing the efficiency of travel for legal entities through a set of functions for managing travel interruptions in real time (Cornestone IS, 2017).

Amadeus, one of the leading global distribution systems (GDS), has implemented a scheduling recovery system, with the aim of helping airlines mitigate the risks of travel disruptions. Qantas, Australia's largest airline, was the first to implement a business improvement system applying the interrupt control system.

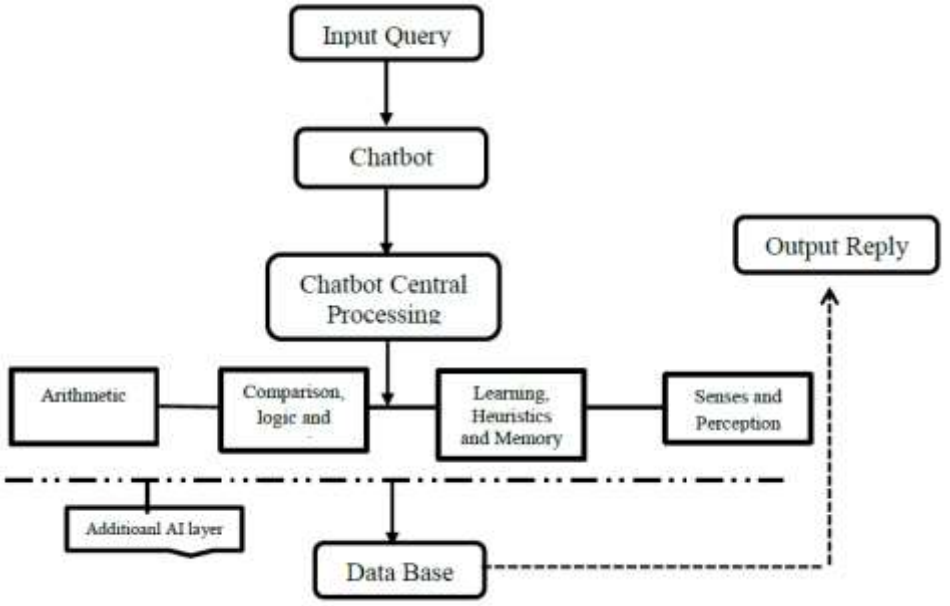
Unlike personal travel assistants and intelligent interference management, airlines can use the power of artificial intelligence to automate the customer support process. It is important especially now, when almost half of all consumers agree that the speed of response to a query is the most important component of a successful service. Based on an experiment conducted by Qantas to test the efficiency of a travel jamming system, what an experienced professional takes about 15-20 minutes, can be done by the algorithm in less than a minute. Combining virtual assistants and human assistants can also help optimize business performance (Fox, 2015)

As far as personalization in airlines is concerned, certain solutions are oriented towards personalization. For example, United Airlines has been analyzing the use of its website since 2014. The company monitors user behavior, through 150 variables, i.e. through individual and general historical data. This large set of data is used to analyze users and customize pages in real time depending on the category to which a particular user belongs. According to the defined user group, the airline's website processes the data very quickly and thus adapts the segments of the website by increasing the quality of communication with users. This form of personalization increases revenues from year to year by about 15 percent (Noyes, 2014)

When it comes to a stay experience, AI solutions can automate hotel processes, as well. With virtual assistants that enable voice in the rooms, guests can set the room temperature, adjust the lighting, turn the TV on and off. In addition to face recognition, hotels can automate check-in. Such hotel product features exist in many hotels around the world. More and more hotels use chatbots or even have robot assistants. Virtual voice

assistants appear more often in hotels. According to a report by Oracle Hotel 2025, 78 percent of hotels will upgrade suites with voice-controlled devices, and 68 percent will use robots to log in and out by 2025 (Oracle Hospitality, 2017). Wynn Las Vegas has equipped all of its rooms with an Amazon Echo speaker, Safeco Field Suits are used in the rooms, as an aid, and can provide assistance during the stay of the guest in the city. The Radisson Blu Edwardian Hotel in London uses a chatbot called Edward, as well as the Las Vegas Hotel uses Rose, a virtual porter who answers all questions and helps guests 24 hours a day. Clarion Hotel Amaranten in Stockholm also uses a chatbot based on Alex (Businesswire, 2016; Cision, 2016; Mariners, 2017; May, 2018; Tkaczyk, 2017).

Figure 5: *Conceptual framework of tourism bot*



Source: *Ukpabi, D. C., Aslam, B., & Karjaluoto, H. (2019). Chatbot adoption in tourism services: A conceptual exploration. Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality, Emerald Publishing Limited, 105-121.*

With face recognition technology, the hotel experience becomes much safer. For example, the Lemon Tree Hotel in Deli has installed a facial recognition system (Goel, 2015). This system captures facial images from a CCTV camera and compares them with existing images in the database.

The Japanese Henn at the Hotelis completely controlled by robots (Guardian, 2015).

At Henn at the Hotel, the receptionists are robots, the porter is a robot as well, and instead of issuing electronic keys, guests need to register face pictures upon check-in.

Smart tourism can be confused with e-tourism, because information and communication technologies, i.e. information systems, and social media concepts are common elements.

E-tourism has improved due to the widespread use of social media and the propensity for mobile tourism. Smart tourism is based on a greater degree of integration with the environment and better processing of information in terms of quality and quality.

Other segments in which smart tourism differs from e-tourism are: sphere, basic technology, travel phase, life force, paradigm, structure and exchange (Gretzel et al., 2015). These differences between e-tourism and smart tourism are shown in Table 2.

Table 2: *Differences between e-tourism and smart toursm*

	smart tourism	**e-tourism**
structure	ecosystem	value chain intermediaries
sphere	bridging digital and physical	digital
core technology	sensors and smartphones	websites
life force	Big Data	information
paradigm	tech mediated cocreation	interactivity
exchange	public-private-consumer collaboration	B2B, B2C, C2C
travel phase	during trip	pre- and post-travel

Source: *Gretzel, U., Sigala, M., Xiang, Z., Koo, C. (2015). Smart tourism: foundations and developments, Electron Markets, Vol. 25, 179–188.*

Conclusion

The constant use of innovations in ICT is becoming the most important part of the tourism industry. The importance of IT in tourism is clearly seen and defined. Hotels use technology to make customers book online. Airlines

use IT for almost all aspects of their operations, from flight planning to analyzing the application of the Big Data, Cloud, AI, etc. in defining business solutions. Due to the travel company positioning on the market, considering both the company itself and the business environment remains necessary. The analysis of the market by applying modern technologies gives the possibility of creating a hotel or tourist product that contains enough regular characteristics.

In order to use given technologies with sufficient quality, it is necessary for the tourism sector experts to be sufficiently educated at faculty institutions, regarding the application of ICT technology and general professional and expert knowledge of applied mathematics. The organizational skills of given managers have to be constantly developed both through schooling and through experience and training in the company itself.

There are terms smart tourism, smart destination, terms that occur as a consequence of the process, allowing us to make substantial changes in the organization itself, by applying the given technologies.

It is necessary to create a framework of constant modifications through staff education, as well as to form organizations capable of continuous learning, i.e. innovation and awareness, in order to make the changes necessary for the application of modern technologies. The development of ICT technologies enables the realization of business ideas in the tourism sector that enable business automation, data analysis and business forecasting, as well as advanced generation of a tourist product that meets the needs of a user.

This paper has tried to provide insight into the concept of application of modern technologies in tourism which is developing rapidly due to the application and investment in technologies. The benefits of introducing technology and the Internet into traditional business models are numerous. With the help of concept Big Data, Internet of Things, AI, a platform can be set up that can improve the functioning. If appropriate measures are taken, the idea of smart tourism can bring large benefits to both participants on the supply side and tourists themselves.

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