

## Tourism Digitization Using the Main Components of Industry 4.0

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### Abstract.

This paper shows and discusses the core information system applications in the tourism industry business, that are used to improve operational excellence (operational business processes) and decision making, such as Enterprise resource systems, Systems for knowledge management, E-commerce applications and Business intelligence systems. This study aims to discuss the extent of digitalization on the tourism industry. It will present what will change in future in order to find out the likely advantages of digitization in the tourism industry.

Cyber-physical systems, cloud computing, and cognitive-based processing, along with advanced computing paradigms like Horizontal and vertical integration, big data analytics, mobile and social technologies, IoT (Internet of Things) and IIoT (Industrial Internet of things) are some of the key components of the fourth industrial revolution. The merger of recent technologies and the experience connected with the Industry 4.0 and IoT can be used as a basis for solving the problems caused by ineffective operational excellence and decision making in tourism companies. Four areas where researched where the most effective influence of information system applications in the tourism industry business was felt. They include ERP system, ecommerce development, KMS and Decision support Systems.

**Keywords:** Digitization, Enterprise Information system, E-Commerce, Knowledge Based management, Data analytics, Cloud computing, Mobile, Internet of Things, Tourism industry.

### Introduction

The Fourth Industrial Revolution builds on the Digital Revolution, representing new ways in which technology becomes embedded within societies and even the human body [1]. The Fourth Industrial Revolution is marked by emerging technology breakthroughs in a number of fields, including robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, Internet of Things (IoT), 3D printing and autonomous vehicles.

In an article [2] the Fourth Industrial Revolution was described as the creative connection between technology and the market in all industries based on IT, that is, the creative and open combination of technology and the market through open innovation, or growth based on the open business model [3]. However, the characteristics of the Fourth Industrial Revolution can be completely defined only when technical innovation is combined with institutional innovation as in the Second Industrial Revolution.

Technology is not only shaping the future of production, but also the future of the tourism industry. Industry 4.0 is the leading trend for automation and data sharing in the tourism industry and hospitality management. In a study [4], the authors examined that the potential of digitization in the tourism industry. Their study of the potential of digitization in tourism reveals six hypotheses that influence the potential of digitization in the tourism industry.

They found out that that determining factors such as “sales increase”, “sharing economy”, “personalized offers”, and “social media” had a positive impact on the potential of digitization in the tourism industry. This shows largely the importance of digitization in the tourism industry. The determining factors are supported by various technologies including cyber-physical systems, the Internet of Things, cloud and mobile technologies, large data analysis.

The effect and impact on the economy of this industrial revolution cannot be overemphasized. Operational efficiency and profitability can be increased in the tourism industry by increasing the use of new tools, techniques and the development of entirely new business models, services and products.

Digitalization in tourism has not yet reached its full potential but it is expected to do just that as it becomes more important for business.

According to Schwab [5], Industry 4.0 is characterized by the following principles namely: Flexibility, Reduction of execution time like, improved decision making capabilities; Customization - customization for customers like in terms of planning and production; More efficient processes and services as a result of large data evaluation; and Flexible and adaptable organization, like the integration of a work organization.

Nevertheless, other technologies like cloud and mobile technologies enable companies and users to gain access to applications on demand and this is as a result of industry 4.0.

Industry 4.0 can be characterized by four major sectors namely: cyber - physical systems (connections between the real and virtual world), the IoT, the IoS, and the smart factory [6], [7].

With the current transformation of systems that are not specifically products and this is because of Industry 4.0., a lot of cyber physical systems examples can be seen. This systems combine communications, IT, data and physical elements integrating a number of core technologies: Sensor networks (receptors), Internet communication infrastructure (IP), Intelligent real-time processing and event management (CPUs) , Actors for mechanical activities , Embedded Software for logic , Big Data and Data Provisioning , Automated operations and management of system activities , Advanced Robotics, Virtual Reality and 3D/4D Printing.

Various industries are going through a transformation and the Digitization of Industries creates opportunities and challenges. The digitization of products, big data and cloud computing make it easier to understand and meet individual customer needs more accurately [8].

The Increasing capacities and joining the data transfer, computation and storage capacities and the extent to which digital technologies penetrate the economy lead to a transformation phase, based on Internet of Things (IoT). According to a report by the International Union (ITU) and Cisco Systems, the current IoT technology is rooted in their potential to solve some of the world's most pressing problems. Now, Information and Communication Technologies (ICT) such as Mobile Units, Internet and Big Data have greatly increased their contribution to global development projects by improving end-to-end performance and service delivery [9].

In the tourism business sector, enterprise application systems are classified by different spheres based on the need of the company. These enterprise application systems are reviewed and are noted on their value to the tourism business. The most important enterprise system for the tourism business is the enterprise resource planning system (ERP). Furthermore, according to a paper by [10] says that we have recently entered the dawn of the fourth industrial evolution, in which it differs in speed, scale, complexity, and transformative power compared to previous revolutions. Therefore, in order for the tourist industry to grow in profitability; competition, higher customer satisfaction, continuous improvement and improved decision making, it must embrace the Industry 4.0 digital technologies including the Internet of Things, Big Data & Analytics, Artificial Intelligence, smart technologies for tourism destinations. These should be used as them as a stepping-stone into the future by the creation of smart tourism ([11], [27]), mobile tourism and virtual tourism [12].

### **The contemporary enterprise system in the tourism industry**

In the tourism industry today, there is an increased competition between the established and the new markets, between firms within a destination, and between destinations domestically. This competition has evolved because of globalisation of services and the development of new technologies. The further our knowledge increases about the effects of tourism, the greater the capacity of tourism operators to develop strategies to achieve competitive advantage of their companies. Therefore, to achieve competitive advantage, tourism managers must have a clear understanding of the change in tourism business trends and its implication for the business [19].

The Tourism industry is one, which is depended on integrated information network that plays a critical role in enhancing business success relationship. The forces of change brought about by information technology have transformed the way business is done in the tourism and hospitality industry [13].

In this direction of achieving competitive advantage, the ERP software came to be used in the tourism industry and tourism services. The ERP technology solutions can help tourism enterprises reduce costs, increase operational efficiency, increase customer loyalty, and coordinate supply chains. In addition, ERP systems in the tourism industry integrate the diverse aspects of its rapidly growing business operations, streamline business processes and complete integration of front, mid and back office with the help of ERP systems. The integrated solution enables a tight financial control and reduced losses due to inefficient reconciliation, duplication of work, and possible delays [14].

For example, there has been considerable growth in the implementation of new information technologies and the development of new commercial formats such as ERP software in online travel agencies.

The Tourism companies are under pressure to reduce waste, control costs, optimize business processes, and consolidate operations. To make it possible there is a need for an Enterprise resource planning (ERP) system that will provide information across all function and location within the organization. Enterprise resource planning systems (ERPs) have been in the limelight because of their integrated approach and their ability to solve the fragmentation of information in organizations [15].

The rapid growth of the Tourism and hospitality industry requires sophisticated Enterprise resource planning (ERP) systems for managing the increasing volume and quality of tourism traffic. Modern travelers demand more high quality travel services, products, information, and value for their money ([16], [17], and

[18]). The emergence of new tourism services and products, coupled with a rapid increase in tourism demand, has driven the wide-scale adoption of enterprise resource planning (ERP) system.

Categorically, for a business strategy to be executed properly for a company, in order to be more consistent and depended than the competition, an ERP is used because it supports a centralized database that provides information as required, by functional channels to supervisors of a business company. To ensure proper consolidation from all the departments of the business company, an ERP must be implemented. Data is consolidated from business processes of the business company, which are accessed by personnel of the company. Therefore, it is necessary that for a tourist company to share its data, the enterprise system should be capable of supporting the major functional parts of the company. The benefit of implementing such a system in the tourist industry will help the company optimize and automate its business processes taken from industry-wide best practices [24] instead of having to do everything physically.

According to Laudon [20] enterprise, applications also take advantage of new technologies like open source software and cloud computing, Web 2.0 services and all these technologies are becoming part of the enterprise software on Social CRM and Business Intelligence systems. Furthermore, an increase in the use of social media medium such as Facebook, LinkedIn, and Twitter has occurred over the last few years, thus giving companies a better way to reach out to customers. Therefore, new technologies should integrate this new medium. This new technology should help in identifying customers and sales realization and to create new marketing strategies in the tourism industry.

Conclusive, an ERP in the tourism industry, could be used to manage every task of the traveling service chain, including management of finance, human resource, service, maintenance, projects, stocking, investment, risk, decision-making, payoff analyzing, region planning, region business, and intelligent traffic.

### **Contemporary E-commerce in the tourism industry**

Digitization is the process, which is caused by the adoption of digital technologies and the application systems that build upon them. Digitization can be defined according to different levels of intensity: from the pure presentation and information (website), the sales channel function (e-commerce), business process integration (E-Business) to new business models with virtual products or services [21]. Taking e-commerce into account in the tourism industry means that more and more products are being sold online. In order to increase customer satisfaction, it has become a common practice for online merchants to allow their customers to express opinions [23] about the products they have purchased [22]. E-commerce has made clients and suppliers to learn how to use all the new technologies to gather information about a company's products or services and compare them to the competition.

According to a paper [26] Tourism is an information-based business, the product is a "confidence good," and an a priori comprehensive assessment of its qualities is impossible. Tourists must leave their daily environment to consume the product. At the moment of decision making, only an abstract model of the product is available, based on information acquired through multiple channels, such as television, brochures, word-of-mouth, or the Web.

Contemporary technologies today, give access to tourism companies to act local by displaying advertisements targeted directly at consumers almost on a one-on-one basis. Video advertisements rather than static print advertisements are becoming the favored way to connect with clients.

In addition to ecommerce, the role of mobile commerce in the tourism business and contemporary mobile applications that bring value to a business are very important. Mobile phones are the tools used by customers to search for information and make orders and purchases. The internet has become a mechanism for ecommerce because of its structure and open standards. It is less expensive and relatively easy to use it as a channel for connecting clients, suppliers, and staff of a company.

Internet allows big businesses to act like small ones and small businesses to act big. The challenge to businesses is to make transactions not just cheaper and easier for themselves but also easier and more convenient for customers and suppliers. Ecommerce application use new technologies to make it easier for customers to use them and allow business to attract clients [20].

Therefore, through the digitalization of the tourism industry using the internet, has given digital firms the chance to develop new business models or reshape their current model by using one or more of the unique features of e-commerce: global reach, ubiquity, universal standards, interactivity, richness, information density, personalization/customization, and social technology.

Ecommerce also helps the tourist industry in creating value generating strategies such as Value extraction, Value capture, Value addition and Value creation. This strategies assist in process changing, design of new services, customisation and configuration of products. Customization describes the process of individualizing products or services based on IT enabled mass customization [26].

Benefits of e-commerce to the tourism industry include creating and sustaining suitable tourism products, in the form of accommodation, catering, guiding, handicraft production and cultural encounters such as displays, shows, lectures. Such a product may be regarded as a tool for natural and cultural resource conservation and community development and it is closely associated with ecotourism, sometimes referred to as community-based ecotourism [25]. This is referred to as community-based tourism. Other benefits are the creation of tourism business and revenue models for e-commerce.

The role of mobile commerce and e-commerce in the tourism industry is important because other types of business are embracing services available through the technology. Mobile phones are not just for making phone calls anymore. Now they take photos, send text messages, are used as tracking devices, to book tourist destinations and pay for such services by mobile applications. The benefits of mobile commerce to business in the tourism industry include faster purchases, improved clients experience and direct connection to clients.

Conclusively, the tourism industry has shown how e-commerce has changed the structure of this type of industry, and in this process, develop new business opportunities. The creation of additional specialized services, products, flexible network configurations, and further consumer integration will lead to smart tourism marketplaces that integrate all stakeholders [28].

### **The contemporary knowledge management systems in the tourism industry**

The management of knowledge in the tourism business firms is an important strategic asset that has to be organized in such a way, that it has to be acquired, stored, distributed, and applied effectively and efficiently, and also enable the firm maintain a sustainable competitive advantage and support innovation [29].

The tourism industry is developing into a highly knowledge-based industry because of recent advancements in information processing that allow for an extensive use of knowledge transfer, knowledge reuse, storage and production of knowledge [31]. To gain a competitive advantage, the companies in the tourism industry need to invest in KMS that would assist them to make products and services that are better, less expensive to produce, and more desirable than those of competitors.

Therefore, to reduce costs, gain competitive advantage and ensure employees receive the right training at the right time, tourism business must invest in a KMS management systems and web based multimedia systems. Knowledge network systems provide the needed tools for delivering, tracking, and assessing employee learning. Additional application tools for collaboration help the tourism business develop knowledge repositories that staffs, suppliers, clients, and business partners can access through knowledge networks.

In addition, it can be said that Information and knowledge management systems are important business assets that have to be well taken care of, protected, developed, and organized for the benefit of the entire business. These modern systems develop and manage knowledge using computer-aided design systems, virtual reality systems, augmented reality [34], and Virtual Reality Modelling Language. Such KMS can also support procurement decisions [33] by the management of tourism companies.

Some of the advantages of using intelligent methods for knowledge management include the use of technological tools to acquire knowledge. Such tools assist in organizational staff to find patterns, categories, and behavior models in massive amounts of data.

An example is the design and development of framework of knowledge management for tourism crisis management. This framework is an autonomous software system, and is capable of collaborate in extraction and dissemination of knowledge in all stages of crisis. The combinations of artificial intelligence and web-based technologies are applied in the framework that can collect, sort, store, and share the information throughout the organizations [30].

Another benefit using a KMS to improving of the internal and external knowledge in the business of a tourist company, and its overall corporate performances is to use the balanced scorecard, as a broader concept of performance measuring, which highlights the non-financial performance and synchronizes the business activities with the company's vision and strategy [32].

Artificial intelligence also provides tools for capturing, storing, and disseminating human knowledge and intelligence. The reason why business are interested in artificial intelligence is to preserve the intelligence and knowledge of their staffs and use it to their competitive advantage.

Conclusively, the reason why tourism business are interested in artificial intelligence is to preserve the intelligence and knowledge of their staffs and use it to their competitive advantage. Technology transfer through KMS is absolutely important and beneficial to the tourism industry, since the trend of globalization and digitalization of the world economy has increased.

### **The contemporary decision-making management systems and their benefits to the tourism industry**

The businesses in the tourism industry are using technology to automate operations in order to reach out to customers. The inability of managers making efficient decisions is because they do not use their data judiciously. Therefore, to improve decision-making, the company's managers should data mine through their raw data more efficiently by the use of technology.

In times of crises, tourism business can apply the fsQCA tool [42]. This would help to understand the influential factors of decision-making in tourism and hospitality, like changing market dynamics, the formulation of supply and demand, and operational flexibility and adaptability in new environments.

Therefore, in order for managers to carry out their duties successfully and motivate the employees as well, all employees of a company at various levels of business operations and management that make decisions must collect raw data from the various levels of the organization and process it by an appropriate Decision support management system. They must do this to achieve the overall objective of the company.

Decision support systems assist managers in making decisions as they themselves assume the roles of interpersonal, informational and decisional. Any designed decision support system must support these roles in order to function properly and output the required results in accordance to the organizational objective. Such a system is the Tourism Management Information System. A tourism Management Information System also supports decision making in a tourism business. Tourism Management Information System is the electronic delivery of market research information and decision support tools for the tourism management. It is a platform for tourism associations to exchange data/ information/ knowledge [35]. Such decision support systems should promote and market the businesses products and services.

Other systems that help decision making in the tourism business are the Business intelligence systems.

Business intelligence systems that support analytics also help management in transforming the raw organizational data collected from customers, suppliers, employees, business partners, and the external business environment, thus supporting decision making in the organization.

Business intelligence describes how businesses collect, store, clean, and disseminate useful information to executives, managers, and employees.

Business analytics, on the other hand, are the tools and techniques businesses use to analyze and understand the data in a meaningful way. Business analytic tools, such as data mining, statistics, online analytical processing, and models help managers to locate any hidden pattern or information in large datasets amongst others.

For example, tourism companies researched with data mining and business intelligence over the big data, which are stored by tourist web sites. Using business intelligence has helped tourism business managers to discover and describe the hidden pattern in tourist buyer's behaviors [36,37]. Thus, the crises faced in the tourism industry because of converting the traditional ways to modern ways is eliminated. Tourists plan, manage and book their travel trips online without any intervention, receiving all the necessary information that they need on the Internet.

In this regard, the traditional role played by the tourist agencies has limited in a great deal, because online agencies have come to the forefront to assist and help the client in all stages of the search for directions before buying tickets and issuing visas[43].

Information systems play an important role in assisting employees working in a group make decision more efficiently. The different management levels in company use different types of information systems to make decisions. At the operational and middle management, information is received from the transaction processing systems as well as the company's management information system.

Senior management and Directors in the tourism industry use various information, along with their experience, knowledge, education, and understanding of the organization and the business environment as a whole, to make their decisions.

Due to the categorization into teams and group, tourist organization build up the group decision-support systems. A group decision-support systems in an organizations can be an advantage because it possible to increase meeting size while still providing a level of productivity. [38]Wöber (2001) suggested that the identification of tourism destinations competing for the same market can be assisted by a Group Decision Support System (GDSS). And in this way, decision-makers can include their subjective and objective views for analysis like the traditional forms of competitive analysis.

GDSS (Group Decision Support System) software provides a structured method for organizing and evaluating ideas. The information gathered during the meeting is preserved for later use and for those who were unable to attend.

Inaccurate Decisions are made due to the fact that browsing of multiple websites lead to too much travel information and choices [39] and this gets a user confused.

Another way to make decisions is to use a *recommender system*. It provides assistance in the social process of indicating or receiving indications about what options are better suited in a specific case for specific individuals (Gretzel, Mitsche, Hwang, & Fesenmaier, 2004; Resnick & Varian, 1997). Ricci (2002) further stated that a recommender system could provide valuable information to assist consumers' decision-making

process. A recommender system can support travellers in a complex decision-making process by identifying better customer requirements and by correlating those to other consumers and their preferences (Fesenmaier, Werthner, & Wöber, 2003; Ricci & Werthner (2002), Ricci & Werthner (2006)).

Various specific information systems exist in the tourism industry for specific information. Like the Spatial Decision Support System which helps in allowing multiple participants from various sectors to designate land parcels appropriate for tourism-related development or for a competing land use. this type of information system (SDSS) can offer policy makers concerned with contentious tourism-related planning and management decisions[40]

Also[41], the adaption of Marketing Decision Support Systems by tourism managers helps in supporting organizations in collecting, storing, processing, and disseminating information, and in the decision-making process by providing forecasts and decision models (Little 1979) Although It has generally been accepted that corporate decisions

should be based on information because it reduces the uncertainty prevailing in decision processes (Murdick and Munson 1986) and, therefore, becomes a critical success factor for companies that are facing growing competition and dynamic markets (Glazer 1991).

The Fuzzy-set qualitative comparative analysis method may also be applied in an increasingly unstable tourism business environment. Implementation of fsQCA, as an innovative tool in tourism studies and; specifically in the service sector, will help to further comprehend the influential factors of decision-making, like changing market dynamics, the formulation of supply and demand, and operational flexibility and adaptability in new environments. fsQCA will also provide the ability to generate multiple solutions expressing different business interests and desirable enterprising strategies can assist hoteliers to take better decisions by improving their insight in an increasingly unstable business environment. fsQCA can provide the grounds for further understanding of decision-making by both tourists and stakeholders [42].

Finally, to reap the benefits of using DSS, business in the tourism industry must apply various decision support systems to help them to make decisions in times of crises, forecasting, productivity and various company objectives.

Various business intelligence systems, Group decision-support systems, methods and techniques comprised of hardware, software, and people, help streamline group meetings and communications by removing obstacles and using technology to increase the effectiveness of decision making in the tourism business.

## Conclusion

In this paper, we have looked at the four different aspects of information systems and their impact in the tourism industry and also, play a major part in the tourist business companies.

Through the assistance of enterprise information systems, e-commerce applications, knowledge management systems and decision support systems, businesses in the tourist industry can achieve their strategic goals, oversee competitiveness and create profitability.

Achieving a benefit in the competitive situation involves adopting new management models as well as changing business processes to reflect the realities of digital technology.

Digital technologies use the synergy effect of integration. In isolation technologies such as mobile devices, tablets, large data and social media are not that powerful. The interconnections between digital technologies in the tourism industry are the driving force of innovation today by creating new digital products, services, tools, applications, models for decision-making. The realization of this paragon requires the creation of analogous relations within the tourism industry businesses as well.

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